



Joy DeMarco
Executive Director



Construction Documents

Edison State Community College
Board of Education

Convocation Center Expansion

1973 Edison Drive
Piqua, Ohio 45653
Project No. ESC-230006/223193.00

22 February 2024

PROJECT TITLE PAGE

EDISON STATE COMMUNITY COLLEGE
CONVOCATION CENTER EXPANSION
1973 EDISON DRIVE
PIQUA, OHIO 45653

Architects/Engineers

Direct Questions and Substitutions Concerning This Project To:

Fanning/Howey Associates, Inc.
4930 Bradenton Avenue
Dublin, OH 43017
Phone No. 614/764-4661
FAX No. 614/764-7894

Structural Consultant

Jezerinac Geers & Associates, Inc.
5640 Frantz Road
Dublin, OH 43017

Surveying and Civil Engineering Consultant

Access Engineering Solutions
1200 Irmischer Blvd., Suite B
Celina, OH 45822

Plumbing Consultant

Prater Engineering
6130 Wilcox Road
Dublin, OH 43016

SET NO. _____

END OF PROJECT TITLE PAGE

CERTIFICATIONS PAGE

TITLE AND LOCATION OF THE WORK

Edison State Community College
Convocation Center Expansion
1973 Edison Drive
Piqua, OH 45653

NAME AND ADDRESS OF OWNER(S)

Edison State Community College
1973 Edison Drive
Piqua, OH 45653

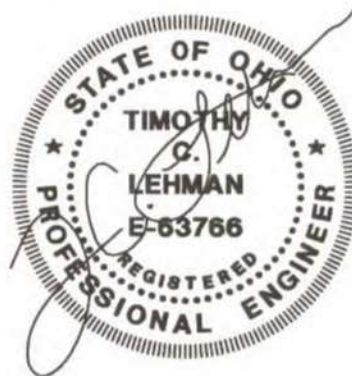
Ohio Facilities Construction Commission
William Green Building
30 West Spring Street, 4th Floor
Columbus, OH 43215

NAME AND ADDRESS OF ARCHITECTS/ENGINEERS

Fanning/Howey Associates, Inc.
128 West Market Street
Celina, OH 45822

I hereby certify that the Project Drawings and the Project Manual were prepared by me or under my direct supervision and that I am a duly registered Architect/Engineer under the Laws of the State of Ohio.

FANNING/HOWEY ASSOCIATES, INC.
ARCHITECTS/ENGINEERS



Timothy C. Lehman, License No. E-63766
Expiration Date: 12/31/2025

Date: February 22, 2024

©Fanning/Howey Associates, Inc. 2024, All Rights Reserved. No portion of these drawings, specifications or contract documents may be reproduced, transformed, recast, or otherwise copied – specifically including scanning or other digitizing means – without the prior written consent of Fanning/Howey Associates, Inc. These drawings, specifications, or contract documents may be used only in connection with the construction project identified thereon and then only in accordance with the architectural and building contracts then in force. No other use of these drawings, specifications, or contract documents may be made without the prior written consent of Fanning/Howey Associates, Inc.

END OF CERTIFICATION PAGE

Document 00 01 10 - Table of Contents (General Contracting Project)

State of Ohio Standard Requirements for Public Facility Construction

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

Division 00 – Procurement and Contracting Requirements

Introductory Information

- 00 01 01 Project Title Page
- 00 01 05 Certifications Page
- 00 01 10 Table of Contents

Procurement Requirements

- 00 10 00 Solicitation
- 00 21 13 Instructions to Bidders
- 00 21 15 Substitution Request Form
- 00 31 00 Available Project Information
- 00 31 01 Edison Community College – Roofing Installer’s Warranty
- 00 31 32 Geotechnical Data
- 00 41 13 Bid Form
- 00 43 13 Bid Security Form
- 00 45 13 Bidder’s Qualifications
- 00 45 39 EDGE Affidavit

Contracting Requirements

- 00 52 00 Agreement Form
 - 00 52 14 Subcontract Form (OAC 153:1-03-02)
 - 00 53 14 Public Authority Contract
 - 00 61 13 Performance and Payment Bond Form
 - 00 61 13.19 Acknowledgement of Surety
 - 00 62 43 Certified Payroll Report
 - 00 62 46 Contractor’s Personal Property Tax Affidavit
-
- 00 71 00 Contracting Definitions
 - 00 72 13 General Conditions
 - 00 73 00 Supplementary Conditions
-
- 00 73 43 Wage Rate Requirements

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

DIVISION 01: GENERAL REQUIREMENTS

- 01 10 00 Summary
- 01 10 00.01 No Smoking Sign
- 01 21 00 Allowances
- 01 23 00 Alternates
- 01 32 00.00 Construction Progress Documentation
- 01 32 16 Construction Progress Schedule
- 01 33 00.00 Submittal Procedures
- 01 33 13.01 Steel Fabricator Certification (OFCC)
- 01 33 13.02 Contractor Certification (OFCC)
- 01 40 00 Quality Requirements
- 01 42 00 References
- 01 50 00.00 Temporary Facilities and Controls
- 01 50 00.01 OFCC Construction Sign Sample
- 01 60 00.00 Product Requirements
- 01 73 00 Execution

01 73 29	Cutting and Patching
01 74 00	Progress Cleaning
01 77 00	Closeout Procedures
01 78 23	Operation and Maintenance Data
01 78 39	Project Record Documents
01 79 00	Demonstration and Training

FACILITY CONSTRUCTION SUBGROUP

DIVISION 02: EXISTING CONDITIONS

02 41 19	Selective Demolition
----------	----------------------

DIVISION 03: CONCRETE

03 06 30.01	Concrete Schedule
03 06 30.03	Concrete Mix Design Submittal
03 30 00	Cast-in-Place Concrete

DIVISION 04: MASONRY

04 20 00	Unit Masonry
----------	--------------

DIVISION 05: METALS

05 12 00	Structural Steel Framing
05 21 00	Steel Joist Framing
05 31 00	Steel Decking
05 40 00	Cold-Formed Metal Framing
05 50 00	Metal Fabrications
05 52 13	Pipe and Tube Railings

DIVISION 06: CARPENTRY

06 10 53	Miscellaneous Rough Carpentry
06 16 00	Sheathing
06 41 16	Plastic-Laminate-Faced Architectural Cabinets

DIVISION 07: THERMAL AND MOISTURE PROTECTION

07 21 53	Miscellaneous Thermal Insulation
07 25 00	Weather Barriers
07 27 23	Boardstock Air Barrier
07 42 13.23	Metal Composite Material Wall Panels
07 54 00	Thermoplastic Membrane Roofing (PVC and KEE)
07 62 00	Sheet Metal Flashing and Trim
07 71 00	Roof Specialties
07 72 00	Roof Accessories
07 84 13	Penetration Firestopping
07 91 00	Preformed Joint Seals
07 92 00	Joint Sealants
07 92 19	Acoustical Joint Sealants

DIVISION 08: OPENINGS

08 12 13	Hollow Metal Frames
08 13 16.13	Aluminum Doors
08 14 16	Flush Wood Doors
08 31 13	Access Doors and Frames
08 43 13	Aluminum-Framed Storefronts
08 71 00	Door Hardware
08 80 00	Glazing
08 87 33	Architectural Window Film

DIVISION 09: FINISHES

09 05 61.13	Moisture Vapor Emission Control
09 21 16.00	Gypsum Board Assemblies
09 30 00	Tiling
09 51 13	Acoustical Panel Ceilings
09 65 13	Resilient Base and Accessories
09 67 23	Decorative Resinous Flooring
09 68 13	Tile Carpeting
09 91 13.00	Exterior Painting
09 91 23.00	Interior Painting
09 96 00	High Performance Coatings
09 96 63	Interior Finish System

DIVISION 10: SPECIALTIES

10 11 00	Visual Display Units
10 14 23.16	Interior Panel Signage
10 14 33	Illuminated Exterior Panel Signage
10 21 13.13	Metal Toilet Compartments
10 21 13.19	Solid Polymer Toilet Compartments
10 28 00	Toilet, Bath, and Laundry Accessories
10 44 13	Fire Extinguisher Cabinets
10 44 16	Fire Extinguishers
10 51 13	Metal Lockers

DIVISION 11: EQUIPMENT

11 05 13	Common Motor Requirements for Equipment
11 23 00	Commercial Laundry Equipment

DIVISION 12: FURNISHINGS

12 24 13	Roller Window Shades
12 32 16	Manufactured Plastic Laminate-Faced (Educational) Casework
12 93 00	Site Furnishings and Amenities

DIVISION 13 AND 14 – NOT USED**FACILITY SERVICES SUBGROUP**DIVISION 21 AND 22 – SPECIFICATIONS – REFER TO DRAWINGS

DIVISION 23: HEATING, VENTILATING, AND AIR CONDITIONING

23 05 00	Common Work Results
23 05 53	Identification
23 05 93	Testing & Balancing
23 07 00	Insulation
23 09 00	Control Instrumentation
23 09 93	Operational Sequences
23 09 93p	Control Point Lists
23 31 13	Rigid Duct
23 33 00	Air Systems Accessories
23 34 23	Powered Ventilators
23 37 13	Diffusers Registers & Grilles
23 74 13	Packaged Air Handlers
23 82 39	Unit Heaters

DIVISION 26: ELECTRICAL

26 00 05	Electrical Demolition
26 00 50	General Electrical Requirements
26 05 05	Electrical Testing
26 05 19	Low-Voltage Electrical Power Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33	Conduit and Boxes for Electrical Systems
26 05 43	Underground Ducts and Raceways for Electrical Systems
26 05 53	Identification for Electrical Systems
26 22 00	Low-Voltage Transformers
26 24 16	Panelboards
26 27 26	Wiring Devices
26 28 13	Fuses
26 28 16	Enclosed Switches and Circuit Breakers
26 51 00	Interior Lighting

DIVISION 27: COMMUNICATIONS

27 01 00	Operation and Maintenance of Communications Systems
27 01 11	Demonstration, Training and Warranty of Communications Systems
27 05 00	Common Work Results for Communications
27 05 26	Grounding and Bonding for Communications Systems
27 05 28	Pathways for Communications Systems
27 05 53	Identification for Communications Systems
27 11 00	Communications Equipment Room Fittings
27 13 23	Communications Fiber Optical Backbone Cabling
27 15 15	Communications Copper Horizontal Cabling (Category 6)
27 15 53	Misc. Communications Audio/Video Cabling
27 41 12	Communications Audio-Video Mounts
27 41 43	Integrated A/V Equipment (Televisions)
27 51 23	Intercommunications and Program Systems
27 53 15	Synchronous Wireless Clock Systems

DIVISION 28: ELECTRONIC SAFETY AND SECURITY

28 05 10	Common Work Results for Electronic Safety and Security
28 05 23	Conductors and Cables for Electronic Safety and Security
28 13 10	Access Control
28 23 11	IP Video Surveillance
28 31 11	Digital, Addressable Fire-Alarm System

SITE AND INFRASTRUCTURE SUBGROUP

DIVISION 31: EARTHWORK

- 31 10 00 Site Clearing
- 31 20 00 Earth Moving

DIVISION 32: EXTERIOR IMPROVEMENTS

- 32 12 16 Asphalt Paving
- 32 13 13 Concrete Paving
- 32 13 73 Concrete Paving Joint Sealants
- 32 92 00 Turf and Grasses

DIVISION 33: UTILITIES

- 33 05 00 Common Work Results for Utilities
- 33 05 10 Utilities Services
- 33 46 00 Subdrainage

END OF DOCUMENT

Document 00 10 00 - Solicitation (General Contracting / Electronic Bid) State of Ohio Standard Requirements for Public Facility Construction

Electronic bids will be received by:

Ohio Facilities Construction Commission
<https://bidexpress.com>

for the following Project:

Project No. ESC-230006
Convocation Center Expansion
Edison State Community College
Piqua, Miami County

in accordance with the Contract Documents prepared by:

Fanning/Howey Associates, Inc.
128 West Market Street
Celina, OH 45822
Phone No. (419)586-7771
FAX No. (419)586-2141
Rodney D. Wiford
rwiford@fhai.com
<https://fhai.com>

In compliance with Section 153.08 of the Ohio Revised Code and Section 153:1-8-01 of the Ohio Administrative Code, Bids for this Project are being received, opened, and published through electronic means using the State's electronic bidding service.

To access this Project through the electronic bidding service, you must first register at <https://bidexpress.com> by clicking on the "REGISTER FOR FREE" button and following the instructions. In order to bid, you must create and enable a digital ID within the service. This process requires the submission of notarized paperwork and may take up to five business days to complete. There are no fees to register, create and enable a digital ID, or to download bid documents. There is a small expense on a monthly or per bid basis to submit a bid. The electronic bidding service offers customer support that may be reached at 888.352.2439 or via email at support@bidexpress.com.

Bidders may submit requests for consideration of a proposed Substitution for a specified product, equipment, or service to the Architect/Engineer ("A/E") no later than 10 days prior to the bid opening. Additional products, equipment, and services may be accepted as approved Substitutions only by written Addendum.

From time to time, the Commission issues new editions of the "State of Ohio Standard Requirements for Public Facility Construction" and may issue interim changes. Bidders must submit Bids that comply with the version of the Standard Requirements included in the Contract Documents.

Prevailing Wage rates and Equal Employment Opportunity requirements are applicable to this Project.

This Project is subject to the State of Ohio's Encouraging Diversity, Growth, and Equity ("EDGE") Business Development Program. A Bidder is required to submit with its Bid and with its Bidder's Qualifications form, certain information about the certified EDGE Business Enterprise(s) participating on the Project with the Bidder. Refer to **Section 6.1.10** of the **Instructions to Bidders**.

The EDGE Participation Goal for the Project is **«5.0» percent**.

The percentage is determined by the contracted value of goods, services, materials, and labor that are provided by EDGE-certified business(es). The participation is calculated on the total amount of each awarded contract. For more information about EDGE, contact the Business Certification Compliance Manager at Stacy.Cornett@development.ohio.gov, or at 77 South High Street, 28th Floor, Columbus, Ohio 43215; or by telephone at (614) 728-0088.

The Bidder may be subject to a Pre-Award Affirmative Action Compliance Review in accordance with Section 123:2-5-01 of the Ohio Administrative Code including a review of the Bidder's employment records and an on-site review.

The Bidder must indicate on the electronic Bid Form, the locations where its services will be performed in the spaces provided or by attachment in accordance with the requirements of Executive Order 2019-12D related to providing services only within the United States and the requirements of Executive Order 2022-02D prohibiting purchases from or investment in any Russian institution or company. Failure to do so may cause the Bid to be rejected as non-responsive.

DOMESTIC STEEL USE REQUIREMENTS AS SPECIFIED IN OHIO REVISED CODE SECTION 153.011 APPLY TO THIS PROJECT. COPIES OF OHIO REVISED CODE SECTION 153.011 CAN BE OBTAINED FROM ANY OF THE OFFICES OF THE OHIO FACILITIES CONSTRUCTION COMMISSION.

Bidders are encouraged to be enrolled in and to be in good standing in a Drug-Free Safety Program (“DFSP”) approved by the Ohio Bureau of Workers' Compensation (“OBWC”) prior to submitting a Bid and provide, on the Electronic Bid Form with its Bid, certain information relative to their enrollment in such a program; and, if awarded a Contract, shall comply with other DFSP criteria described in **Section 1.6** of the **General Conditions**.

Electronic bids will be received for:

<u>Trade</u>	<u>Estimate</u>
General Contract	\$1,573,676.00
Alternate No. 1 – Training Room	\$ 160,255.00
Alternate No. 2 – Built-In Casework	\$ 9,680.00
Alternate No. 3 – Loose Furnishings	\$ 39,751.00
Alternate No. 4 – Plastic Toilet Compartment	\$ 1,954.00
Alternate No. 5 – Moisture Vapor Emission Control	\$ 7,924.00
Alternate No. 6 – Parking Lot Cameras	\$ 10,000.00

until **May 1, 2024**, at 2:00 pm., when all Bids will be electronically opened. Bid tabulations will be posted no later than 5:00 p.m. on the day Bids are opened.

All Bidders are strongly encouraged to attend the Pre-Bid Meeting on **April 22, 2024**, at **10:00 am.** at the following location: Edison State Community College, North Hall, 1973 Edison Drive, Piqua, OH 45356

The Contractor is responsible for scheduling the Project, coordinating the Subcontractors, and providing other services identified in the Contract Documents.

The Contract Documents may be downloaded as electronic PDF files from the State’s electronic bidding service at <https://bidexpress.com> at no charge.

END OF DOCUMENT

**Document 00 21 13 - Instructions to Bidders (General Contracting / Electronic Bid)
State of Ohio Standard Requirements for Public Facility Construction**

TABLE OF CONTENTS

ARTICLE 1 - GENERAL INSTRUCTIONS1
ARTICLE 2 - BIDDING PROCEDURES1
ARTICLE 3 - BID OPENING AND EVALUATION.....5
ARTICLE 4 - WITHDRAWAL OF BID8
ARTICLE 5 - BID GUARANTY AND BOND.....9
ARTICLE 6 - CONTRACT AWARD AND EXECUTION.....10
KEYWORD INDEX.....12

ARTICLE 1 - GENERAL INSTRUCTIONS

1.1 Applicable Law and Forum

1.1.1 The rights of any Bidder or any party to a subsequent Contract shall be governed by the laws of the state of Ohio and only Ohio courts shall have jurisdiction over any action or proceeding related to the Bid or any subsequent Contract. The Bidder irrevocably consents to such jurisdiction.

1.2 Project Scheduling and Coordination

1.2.1 When the Contract Documents refer to a period of time by a number of days, it excludes the first day and includes the last day of the period. If the last day of the period falls on a Saturday, Sunday, or a legal holiday, that day shall be omitted and the period shall end on the next day which is not a Saturday, Sunday, or legal holiday.

1.2.2 The time for completion of the Project indicated on the electronic **Bid Form** is the time for Substantial Completion of all Work applicable to the Bidder.

1.2.3 The State may assign all or any portion of its interest in a Contract with one or more of the successful Bidders to another successful Bidder as an agreed condition for an award of the Contract for the respective Bid. The assignment may include, without limitation, the duty to schedule, coordinate, and administer the Contract.

1.2.4 The Contractor is responsible for scheduling the Project, coordinating the Subcontractors, and providing other services identified in the Contract Documents.

1.2.5 By submitting its Bid, the Bidder indicates its understanding that the Contract Sum, based on its Bid and as amended by Change Orders, includes all costs that the Contracting Authority owes the Bidder.

1.3 Written Notice

1.3.1 Notice under the Contract Documents shall be validly given if:

1.3.1.1 delivered personally to a member of the organization for whom the notice is intended;

1.3.1.2 delivered, or sent by registered or certified mail, to the last known business address of the organization; or

1.3.1.3 sent by facsimile, email, or web-based project management software, provided the original signed document is delivered within 3 business days after the date of the electronic transmission.

1.3.2 Notices provided to one Project Participant from another shall be simultaneously copied to the prospective Bidders, the Owner, the Contracting Authority, and the A/E.

1.4 Use of the State’s Electronic Bidding Software

1.4.1 The Bidder shall use the State’s Electronic Bidding Software to submit its Bid for this Project. Paper Bids will not be accepted.

1.4.2 Bidders, Subcontractors, and Material Suppliers may download the Contract Documents as PDF files from the State’s Electronic Bidding Software at no charge by registering and associating with a company at <https://bidexpress.com>.

1.4.3 Bidders are encouraged to create and obtain approval of their Digital ID well in advance of the bid deadline. Approval may take up to seven business days.

1.4.4 Bidders are also encouraged to click the “Select for Bidding” link on the electronic **Bid Form** to be listed on the electronic Plan Holder’s list and submit payment to receive notifications regarding Addenda and other announcements.

1.4.5 Subcontractors and Material Suppliers may view the electronic Plan Holder’s list to determine potential Bidders.

1.4.6 Bidders, Subcontractors, and Material Suppliers are encouraged to attend a contractor webinar or contact the vendor’s help desk through the means identified at <https://bidexpress.com> to increase their knowledge of using the State’s Electronic Bidding Software.

ARTICLE 2 - BIDDING PROCEDURES

2.1 Examination of Contract Documents and the Site

2.1.1 Before submitting a Bid, the Bidder shall examine all Contract Documents, including, but not limited to, the Drawings, Specifications, and Addenda for all divisions of Work for the Project, noting in particular all requirements that may affect its Work in any way.

2.1.2 The Bidder’s failure to become acquainted with the extent and nature of Work required to complete any portion of the Work in conformity with the requirements of the Contract Documents, shall not be a basis for additional compensation.

2.1.3 Before submitting a Bid, the Bidder should not only examine and evaluate the Site and related Project conditions where the Work will be performed, but shall also consider when the Work will be performed including, but not limited to, the following:

- 2.1.3.1** the condition, layout, and nature of the Site and surrounding area;
- 2.1.3.2** the availability and cost of labor;
- 2.1.3.3** the availability and cost of materials, supplies, and equipment;
- 2.1.3.4** the cost of temporary utilities required in the Bid;
- 2.1.3.5** the cost of any permit or license required by a local or regional authority having jurisdiction over the Project;
- 2.1.3.6** the usual weather conditions of the Project location;
- 2.1.3.7** conditions bearing upon transportation, disposal, handling, and storage of equipment, materials, and waste; and
- 2.1.3.8** subsurface and concealed physical conditions and related information provided in the Contract Documents.

2.2 Pre-Bid Meeting

2.2.1 The Bidder is encouraged to attend the pre-bid meeting, where the A/E, the Contracting Authority, and the Owner will receive questions regarding the Contract Documents. If not given in **Document 00 10 00 - Solicitation**, the A/E shall issue notice of the time and place of any pre-bid meeting to each registered Plan Holder.

2.2.2 The A/E shall prepare minutes of the pre-bid meeting for the Project record. If questions raised by the prospective Bidders require changes to, or clarifications of, the Contract Documents, the A/E shall issue the changes by written Addendum, along with a list of pre-bid meeting attendees.

2.2.3 Additional compensation shall not be based upon the Bidder’s failure to attend the pre-bid meeting, which results in the Bidder’s incomplete knowledge and familiarity of the Project requirements.

2.3 Request for Interpretation

2.3.1 If the Bidder finds any perceived ambiguity, conflict, error, omission, or discrepancy within the Contract Documents, including the Drawings, Specifications, and Addenda, or between any of the Contract Documents and Applicable Law, the Bidder shall submit a written Request for Interpretation (“RFI”) to the A/E for an interpretation or clarification.

2.3.1.1 The Bidder is responsible for prompt delivery of the RFI.

2.3.1.2 The A/E shall respond to RFIs received more than 7 days before the bid opening.

2.3.2 The A/E shall issue Addenda in response to RFIs that modify or clarify the Contract Documents. Any Addenda issued within 72 hours before any bid opening (excluding Saturdays, Sundays, and legal holidays) shall extend the bid opening date by 7 days pursuant to **Section 3.3.1**.

2.3.2.1 The Addenda may be delivered via the State's State's Electronic Bidding Software, facsimile or e-mail, posted to a web or FTP site, or otherwise furnished to each registered Plan Holder.

2.3.3 Any interpretation or clarification of the Contract Documents made by any Person other than the A/E, in any manner other than a written Addendum, shall not be binding, and the Bidder shall not rely upon the interpretation or clarification.

2.3.4 The successful Bidder shall not be compensated for a claim alleging insufficient data, incomplete, ambiguous, conflicting, or erroneous Contract Documents or proposed Contract Documents, or assumed conditions regarding the nature, extent, or character of the Work, if the Bidder did not submit a related RFI prior to the bid opening.

2.4 Basis of Design and Acceptable Components

2.4.1 The Contract Documents may list components produced by specific manufacturers to denote kind, quality, or performance requirements.

2.4.2 The component listed first is the Basis of Design Component.

2.4.3 Other listed components are Acceptable Components.

2.4.3.1 If the Bidder includes an Acceptable Component in its Bid, the Bidder is responsible for the costs of coordination and modification required.

2.5 Substitutions Prior to Bid Opening

2.5.1 If the Bidder proposes to use an article, device, material, equipment, form of construction, fixture, or item other than the Basis of Design or Acceptable Components named in the Specifications, the Bidder shall certify that the proposed item is equal in quality and all aspects of performance and appearance, to the item specified.

2.5.1.1 If approval of a Substitution requires changes to the Contract Documents or affects the work of other trades, the Bidder is responsible for the additional costs, including, but not limited to, changes to the design by the A/E.

2.5.2 The Bidder shall submit its request for Substitution to the A/E no later than 10 days prior to the bid opening, which must include:

2.5.2.1 the name and complete description of the proposed Substitution, including Drawings, performance and test data, and other information necessary for a complete evaluation; and

2.5.2.2 a statement setting forth any changes that the Proposed Substitution will require in the Contract Documents or the Project.

2.5.3 If the A/E approves the Proposed Substitution, the A/E shall issue an Addendum.

2.5.4 If the A/E does not approve the Proposed Substitution, the A/E shall inform the Bidder of its decision, which is final. The A/E may reject a proposed Substitution because the Bidder failed to provide sufficient information to enable the A/E to completely evaluate the Proposed Substitution without causing a delay in the bid deadline.

2.5.5 Proposed Substitutions received by the A/E less than 10 days prior to the bid deadline shall not be considered.

2.6 Electronic Bid Form

2.6.1 Each Bid shall be submitted on the electronic **Bid Form** through the State's Electronic Bidding Software.

2.6.1.1 All sections of the electronic **Bid Form**, including a completed "Bidder Affirmation and Disclosure" section acknowledging that the Bidder affirms, understands, and will abide by the requirements of Executive Order 2019-12D related to providing services only within the United States and Executive Order 2022-02D prohibiting purchases from or investment in any Russian institution or company, and a completed "Commitment to Participate in the EDGE Business Assistance Program" page, shall be submitted with the Bid. Failure to do so may cause the Bid to be rejected as non-responsive.

.1 If the names, locations, and service locations of Subcontractors are not known at the time of the Bid deadline, the Bidder must provide the information requested with its **Subcontractor and Material Supplier Declaration**.

2.6.1.2 Unless the Bidder withdraws the Bid as provided in **Article 4**, the Bidder is required to comply with all requirements of the Contract Documents, regardless of whether the Bidder had actual knowledge of the requirements and regardless of any statement or omission made by the Bidder that might indicate a contrary intention.

2.6.2 The Bidder shall fill in all relevant spaces on the electronic **Bid Form**. The State's Electronic Bidding Software will identify any incomplete required fields.

2.6.3 If the Bidder is a corporation, partnership, or sole proprietorship, an officer, partner or principal of the Bidder shall enter the legal name of the Bidder in the space provided on the electronic **Bid Form**. If the Bidder is a joint venture, an officer, partner or principal, as applicable, of each member of the joint venture shall enter the legal name of the applicable member in the space provided.

2.7 Allowances

2.7.1 If Allowances are provided on the electronic **Bid Form**, the amount of each Allowance shall be included in the Base Bid amount. Allowances shall be used solely for the purpose of determining the adjustment to the Contract Sum for the difference between the amount of the Allowance and the actual cost of the related Work provided. Allowances shall not include the Contractor's Fee.

2.8 Unit Prices

2.8.1 If Unit Prices are requested on the electronic **Bid Form**, the amount of the scheduled quantities shall be included in the Base Bid amount. Unit prices shall be used solely for the purpose of determining the adjustment to the Contract Sum for the difference between the estimated quantities on the electronic **Bid Form** and the actual quantities provided.

2.8.2 Unit Prices shall include all materials, equipment, labor, delivery, installation, and any other cost or expense, in connection with, or incidental to, the performance of that portion of the Work. Unit Prices shall not include the Contractor's Fee on account of the associated Unit Price Work. The Bidder shall submit Unit Prices for all items listed.

2.9 Alternates

2.9.1 If an Alternate is listed on the electronic **Bid Form**, the Bidder shall fill in the applicable space with a positive or negative bid amount as applicable. The Contracting Authority reserves the right to accept or reject any or all bid amounts for Alternates, in whole or in part, and in any order.

2.9.1.1 If no change in the bid amount is required, indicate "\$0."

2.9.1.2 Failure to make an entry on any Alternate shall cause the Bid to be rejected as non-responsive if that Alternate is selected.

2.9.1.3 Failure to indicate a negative number will indicate the Bidder's intent to increase the Base Bid by the amount entered in the applicable space.

2.9.1.4 If an Alternate is not selected, an entry as listed in **Section 2.9.1.2** on that Alternate shall not, by itself, render a Bid non-responsive.

2.10 Submittals with Electronic Bid Form

2.10.1 The Contracting Authority shall reject a Bid as non-responsive if the Bidder fails to submit the following with the Bid:

2.10.1.1 An electronic facsimile of the Bid Guaranty as provided in **Article 5**, meeting the requirements of Ohio Revised Code ("ORC") Sections 153.54 and 153.571.

2.10.1.2 The original unaltered Bid Guaranty shall be delivered to the Contracting Authority within 3 business days after the public bid opening as provided in Ohio Administrative Code ("OAC") Section 153:1-8-01(H).

2.10.2 If the apparent low Bidder does not submit a valid Power of Attorney of the agent signing for the Surety with its Bid, the Contracting Authority shall direct the apparent low Bidder to deliver a valid and appropriate Power of Attorney to the Contracting Authority within a period determined by the Contracting Authority. The Contracting Authority shall not enter into a Contract without a valid Power of Attorney.

2.10.3 The Bidder is encouraged to submit background information with its Bid using the **Bidder's Qualifications** form and including, but not limited to, the information listed in this **Section 2.10**. If the apparent low Bidder does not submit the **Bidder's Qualifications** form and related information attached to the electronic **Bid Form**, the Bidder shall provide it upon request in accordance with **Section 3.5.4**, including, but not limited to:

2.10.3.1 the overall experience of the Bidder, including number of years in business under present and former business names;

2.10.3.2 a complete listing of all the Bidder's ongoing construction projects and a listing of construction projects which are similar in cost and type to the Project completed by the Bidder in the last 5 years. Include information of

the scope of work and value of each contract, a description of Encouraging Diversity Growth and Equity (“EDGE”) participation and performance, and a project name/contact Person/address/phone number for the owner and the architect or engineer for each project;

2.10.3.3 a Certificate of Compliance with Affirmative Action Programs, issued pursuant to ORC Section 9.47, by the Equal Opportunity Coordinator of the Department of Administrative Services;

2.10.3.4 a complete listing of Affirmative Action and EDGE program violations in the last 5 years;

2.10.3.5 a complete listing of Prevailing Wage, EPA, OSHA, or other regulatory entity issues or violations in the last 5 years;

2.10.3.6 a complete listing of judgments, claims, arbitration proceedings or suits pending or outstanding in the last 5 years;

2.10.3.7 a complete listing of Drug-Free Workplace Program and Drug-Free Safety Program (“DFSP”) violations in the last 5 years;

2.10.3.8 upon request of the Contracting Authority, the apparent low Bidder shall submit the following information, which is not a public record under ORC Section 149.43; and shall remain confidential, except under proper order of a court:

- .1** an annual financial statement prepared within the 12 months prior to the bid opening by an independent licensed accounting firm; and the name, address, contact Person, and phone number of the bank normally used by the Bidder for its primary banking; or
- .2** a financial report generated within 30 days prior to the bid opening from Standard and Poor, Dun and Bradstreet or a similar company acceptable to the Contracting Authority documenting the financial condition of the Bidder; and the name, address, contact Person, and phone number of the bank normally used by the Bidder for its primary banking.

2.10.3.9 a description of the Bidder’s relevant facilities and major equipment, whether leased or owned;

2.10.3.10 a description of the management experience of the Bidder’s project manager(s) and superintendent(s) and a comprehensive resume for each;

2.10.3.11 a description of the EDGE-certified Business Enterprises the Bidder proposes as Subcontractors for this Project by attaching a fully completed **EDGE Affidavit** form for each EDGE-certified Business Enterprise;

2.10.3.12 to support a Bond, a current and signed Certificate of Compliance issued by the Ohio Department of Insurance, showing the Surety is licensed to do business as a surety in Ohio;

2.10.3.13 a current Ohio Workers’ Compensation Certificate;

2.10.3.14 if the Bidder is a foreign corporation not incorporated under the laws of Ohio, a Certificate of Good Standing from the Ohio Secretary of State; or, if the Bidder is a foreign person or partnership, evidence that the Bidder filed, with the Ohio Secretary of State, a Power of Attorney designating the Ohio Secretary of State as the Bidder’s agent for the purpose of accepting service of summons in any action brought under ORC Section 153.05 or under ORC Sections 4123.01 to 4123.94, inclusive;

2.10.3.15 evidence that the Bidder is enrolled in, and in good standing in, a DFSP approved by the Ohio Bureau of Workers’ Compensation (“OBWC”); and

2.10.3.16 any other data or information which the A/E may request concerning the responsibility of the Bidder, including a complete list of major Subcontractors with an estimated contract value of \$200,000 or more, which the Bidder proposes to employ on the Project.

2.11 Changes in the Bid Amount

2.11.1 Any change to a previously submitted Bid shall be resubmitted through the State’s Electronic Bidding Software prior to the deadline for submission of Bids.

ARTICLE 3 - BID OPENING AND EVALUATION

3.1 Delivery of Bid

3.1.1 The Bidder shall submit its Bid to the Contracting Authority prior to the time of the bid deadline.

3.1.2 Bids that are submitted after the time of the bid deadline shall not be considered.

3.2 Bid Opening

3.2.1 Electronic Bids shall be received until the time stated when all Bids shall be electronically opened and the Bid tabulation made public by posting on the State's Electronic Bidding Software.

3.2.2 The posting of Bid tabulations is for informational purposes only and is not to be construed as an acceptance or rejection of any Bid submitted.

3.2.3 The contents of the electronic **Bid Form** and its attachments are public records and shall be available for inspection, upon request, at any time after the bid deadline, except for any information that is not defined as a public record under Ohio law.

3.3 Bid Deadline Extension

3.3.1 If an Addendum is issued within 72 hours prior to the published time for the bid deadline, excluding Saturdays, Sundays and legal holidays, the bid deadline shall be extended 7 days. If the Contracting Authority approves, the bid deadline may be extended for more than 7 days, and consideration for additional advertising may be recommended.

3.3.2 As part of issuing any Addendum earlier than 72 hours prior to the published time for the bid deadline, excluding Saturdays, Sundays and legal holidays, only the Contracting Authority may approve a revised bid deadline or additional advertising.

3.4 Bid Evaluation Criteria

3.4.1 The Contracting Authority reserves the right to accept or reject any or all Bids, in whole or in part, and reserves the right to award the Contract to any remaining Bidder the Contracting Authority determines, in its sole discretion, to have submitted the lowest responsive and responsible Bid.

3.4.2 The Contracting Authority reserves the right to accept or reject any or all Alternates. Alternates may be accepted or rejected in any order.

3.4.3 If any Bidder has engaged in collusive bidding, the Contracting Authority shall reject that Bidder's Bid as non-responsive for the Contract. A collusive bidder may also be debarred from future State Contracts.

3.4.4 The Contracting Authority reserves the right to waive, or to allow any Bidder a reasonable opportunity to cure a minor irregularity or technical deficiency in a Bid, provided the irregularity or deficiency does not affect the bid amount, or otherwise give the Bidder a competitive advantage. Noncompliance with any material requirements of the Contract Documents shall cause a Bid to be rejected as non-responsive.

3.4.5 If, in the opinion of the Owner, the award of the Contract to the lowest Bidder is not in the best interest of the State, with the written consent of the Contracting Authority, the Owner may accept, in its discretion, another Bid so opened, or the Contracting Authority may reject all Bids and advertise for other Bids. The advertisement shall be for the period, in the form, and in the publications directed by the Contracting Authority.

3.5 Bid Evaluation Procedure

3.5.1 The Contract shall be awarded to the lowest responsive and responsible Bidder as determined in the discretion of the Contracting Authority, or all Bids may be rejected in accordance with Applicable Law.

3.5.1.1 In determining which Bid is the lowest, the Contracting Authority shall consider the Base Bid and the bid amounts for any Alternate, or Alternates, which the Owner decides, in its sole discretion, to accept.

3.5.1.2 The total of the bid amounts for the accepted Alternate(s) shall be added to, or deducted from, the Base Bid, as applicable, for determining the lowest Bidder.

3.5.1.3 If two Bidders submit the same bid amount and both are determined to be responsive and responsible, the Contracting Authority may select one Bidder by the flip of a coin, which shall be conducted in the presence of both Bidders and shall be final.

.1 If one of the Bidders refuses to participate in, or fails to be present at, the flip of a coin, the remaining Bidder shall be selected.

3.5.2 A Bidder for a Contract shall be considered responsive if the Bidder's Bid responds to the Contract Documents in all material respects and contains no irregularities or deviations from the Contract Documents that would affect the amount of the Bid or otherwise give the Bidder a competitive advantage.

3.5.2.1 A Bid shall be rejected as non-responsive if the Bid contains a Bid Guaranty executed by a Surety not licensed in Ohio or a Bid Guaranty that is otherwise determined to be insufficient by the Contracting Authority.

3.5.2.2 The Bidder may be subject to a Pre-Award Affirmative Action Compliance Review pursuant to OAC Section 123:2-5-01 including a review of the Bidder's employment records and an on-site review.

- .1 The Bidder must submit the information requested no later than 10 days after receipt of the request. Failure to timely respond to this request for records may result in the Bidder being found non-responsive.

3.5.2.3 If the lowest Bidder is non-responsive, the Bidder shall be notified according to **Section 3.6**.

3.5.3 In determining whether a Bidder is responsible, factors to be considered include, without limitation:

3.5.3.1 preferences required by law, where applicable;

3.5.3.2 the experience of the Bidder;

3.5.3.3 the financial condition of the Bidder;

3.5.3.4 the conduct and performance of the Bidder on previous Contracts, including compliance with Equal Employment Opportunity in the Construction Industry Administrative Rules, OSHA and Prevailing Wage laws, and demonstration of good faith effort to participate in the EDGE Business Development program, or actual participation in the EDGE Business Development program, or both, as indicated in the ORC and the Ohio Administrative Code;

3.5.3.5 the facilities of the Bidder;

3.5.3.6 the management skills of the Bidder, including the capability of the Bidder to construct and manage the entire Project, including but not limited to the plumbing, fire protection, heating, ventilating and air conditioning, and electrical branches or classes of the Work; and

3.5.3.7 the Bidder's ability to execute the Contract properly, including past performance of the Bidder and the Subcontractors that the Bidder proposes to use on the Project.

3.5.4 The A/E shall obtain from the lowest responsive Bidder any information the Contracting Authority determines appropriate to consideration of factors showing responsibility. If the lowest responsive Bidder is responsible, the Contract shall be awarded to that Bidder, unless all Bids are rejected. The Bidder shall provide all requested information within 3 days of a request from the A/E, or a longer period, if the Contracting Authority consents in writing.

3.5.5 If the lowest responsive Bidder is not responsible, the Contracting Authority shall evaluate the next lowest Bidder according to the procedures set forth in this **Section 3.5** until the Contract is awarded, all Bids are rejected, or all responsive Bidders are determined to be not responsible.

3.6 Rejection of Bid

3.6.1 If the lowest Bidder is not responsive or responsible, the Contracting Authority shall reject the Bid and notify the Bidder in writing by Certified Mail of the finding and the reasons for the finding.

3.6.2 Ten Percent Rule.

3.6.2.1 If the lowest responsive and responsible Bid for the Contract, including the Base Bid and accepted Alternates if any, exceeds an amount 10 percent greater than the published Estimated Construction Cost for the Contract, the Contracting Authority shall reject all Bids.

3.6.3 A Bidder notified in accordance with **Section 3.6.1** may object to its rejection by filing a written protest, which must be received by the Contracting Authority within 5 days of the notification provided pursuant to **Section 3.6.1**.

3.6.4 Upon receipt of a timely protest, the Contracting Authority shall meet with the protesting Bidder to hear its objections. ORC Chapter 119 administrative hearing requirements are not applicable to the bid protest meeting.

3.6.4.1 No Contract award shall become final until after the Contracting Authority has met with all Bidders who have timely filed protests and the award of the Contract is affirmed by the Contracting Authority.

3.6.4.2 If all protests are rejected, the Contract shall be awarded to the lowest responsive and responsible Bidder, or all Bids shall be rejected.

3.7 Notice of Intent to Award

3.7.1 The Contracting Authority shall notify the apparent successful Bidder that upon satisfactory compliance with all conditions precedent for execution of the Contract, within the time specified, the Bidder shall be awarded the Contract.

3.7.2 The Contracting Authority reserves the right to rescind any Notice of Intent to Award if the Contracting Authority determines it issued the Notice of Intent to Award in error, or if the conditions precedent for execution of Contract set forth in **Article 6** are not met.

ARTICLE 4 - WITHDRAWAL OF BID**4.1 Withdrawal prior to Bid Opening**

4.1.1 A Bidder may withdraw a Bid after submitting the Bid through the State's Electronic Bidding Software, provided the Bidder submits its request through the State's Electronic Bidding Software prior to the bid deadline.

4.2 Withdrawal after Bid Opening

4.2.1 The Bid shall remain valid and open for acceptance for a period of 60 days after the bid opening; provided, however, a Bidder may withdraw a Bid from consideration after the bid opening if the bid amount was substantially lower than the amounts of other Bids, providing the Bid was submitted in good faith, and the reason for the bid amount being substantially lower was a clerical mistake, as opposed to a judgment mistake, and was actually due to an unintentional and substantial arithmetic error or an unintentional omission of a substantial quantity of Work, labor, or material made directly in the compilation of the bid amount.

4.2.1.1 Notice of a request to withdraw a Bid shall be made in writing filed with the Contracting Authority within 2 business days after the bid opening. The Contracting Authority reserves the right to request the Bidder to submit evidence substantiating the Bidder's request to withdraw the Bid.

4.2.1.2 No Bid may be withdrawn under **Section 4.2.1** which would result in awarding a Contract involving the same item on another Bid to the same Bidder.

4.2.2 If a Bidder withdraws its Bid under **Section 4.2.1**, the Contracting Authority may award the Contract to the next lowest responsive and responsible Bidder, or reject all Bids and advertise for other Bids. In the event the Contracting Authority advertises for other Bids, the withdrawing Bidder shall pay the costs, in connection with the re-bidding, of printing new Contract Documents, required advertising, and printing and mailing of notices to prospective Bidders, if the Contracting Authority finds that these costs would not have been incurred but for the withdrawal.

4.2.3 A Bidder may withdraw the Bidder's Bid at any time after the 60-day period described in **Section 4.2.1** by giving written notice to the Contracting Authority.

4.3 Refusal to Accept Withdrawal

4.3.1 If the Contracting Authority contests the right of a Bidder to withdraw a Bid pursuant to **Section 4.2.1**, a hearing shall be held within 10 days after the bid opening and the Contracting Authority shall issue an order allowing or denying the claim of this right within 5 days after the hearing is concluded. The Contracting Authority shall give the withdrawing Bidder timely notice of the time and place of the hearing.

4.3.1.1 The Contracting Authority shall make a stenographic record of all testimony, other evidence, and rulings on the admissibility of evidence presented at the hearing. The Bidder shall pay the costs of the hearing.

4.3.1.2 Pursuant to ORC Section 119.12, the Bidder may appeal the order of the Contracting Authority required by **Section 4.3.1**.

4.4 Refusal to Perform

4.4.1 In the event the Contracting Authority denies the request for withdrawal and the Bidder refuses to perform the Contract, the Contracting Authority may reject all Bids or award the Contract to the next lowest responsive and responsible Bidder.

4.5 Effect of Withdrawal

4.5.1 A Bidder, who is permitted to withdraw a Bid under **Section 4.2.1**, shall not supply material or labor to, or perform a subcontract or other work for, the Person to whom the Contract is awarded; or otherwise benefit, directly or indirectly, from the performance of the Project for which the withdrawn Bid was submitted; without the Contracting Authority's prior written consent.

ARTICLE 5 - BID GUARANTY AND BOND**5.1 Bid Guaranty**

5.1.1 The Bidder shall submit a Bid Guaranty with the Bidder's Bid, payable to the Contracting Authority, in the form of either:

5.1.1.1 the signed **Document 00 43 13 - Bid Security Form** contained in the Contract Documents for the amount of the Base Bid plus all additive Alternates; or

5.1.1.2 a certified check, cashier's check, or letter of credit, for 10 percent of the Base Bid, plus all additive Alternates – a letter of credit shall expressly provide that it is revocable only by the Contracting Authority.

5.1.2 The Bid Guaranty shall be in form and substance satisfactory to the Contracting Authority and shall serve as an assurance that upon acceptance of the Bid, the Bidder shall comply with all conditions precedent for Contract execution, within the time specified by the Contracting Authority.

5.1.3 If the blank line on the **Bid Security Form** is not filled in, the penal sum shall be the full amount of the Base Bid plus all additive Alternates. If the blank line is filled in, the amount shall not be less than the full amount of the Base Bid plus all additive Alternates, stated in dollars and cents. A percentage is not acceptable. In the event the blank line is filled in for an amount less than the full amount of the Base Bid plus all additive alternates, the Bid shall be rejected as non-responsive.

5.1.4 An authorized agent must sign the **Bid Security Form**, and the Bidder shall provide a Power of Attorney from the Surety. A Surety authorized by the Ohio Department of Insurance to transact business in Ohio must issue the **Bid Security Form**.

5.1.5 The requirements of ORC Section 3901.86 may be applicable requiring an Ohio resident agent countersign the **Bid Security Form**. The Bidder shall determine the applicability of this provision.

5.1.6 Bid Guaranties in the form of a certified check, cashier's check, or letter of credit shall be returned to unsuccessful Bidders 60 days after the bid opening. Bid Guaranties in the form of a certified check, cashier's check, or letter of credit shall be returned to the successful Bidder upon providing **Document 00 61 13 - Performance and Payment Bond Form** from a Surety satisfactory to the Contracting Authority.

5.2 Forfeiture of Bid Guaranty

5.2.1 If for any reason, other than as authorized by **Section 4.2.1** or **Section 5.3**, the Bidder fails to execute the Agreement, and the Contracting Authority awards the Contract to another Bidder, which the Contracting Authority determines is the lowest responsive and responsible Bidder:

5.2.1.1 The Bidder who failed to execute the Agreement is liable to the State for the difference between its Bid and the Bid of the next lowest responsive and responsible Bidder, or for a penal sum not to exceed ten percent of the bid amount, whichever is less.

5.2.2 If the Contracting Authority then awards a Contract to another Bidder, which the Contracting Authority determines is the lowest responsive and responsible Bidder and that Bidder fails or refuses to execute the Agreement:

5.2.2.1 The liability of the lowest responsive and responsible Bidder shall be the difference between the bid amount of the lowest responsive and responsible Bidder and another Bidder which the Contracting Authority determines is the lowest responsive and responsible Bidder, except as provided in **Section 5.3**, but not in excess of the liability specified in **Section 4.2.2**.

5.2.2.2 The liability on account of an award to the lowest responsive and responsible Bidder beyond the third lowest responsive and responsible Bidder shall be determined in like manner.

5.2.3 If the Contracting Authority does not award the Contract to another Bidder under **Section 5.2.2**, but submits the Project for re-bidding:

5.2.3.1 The Bidder failing or refusing to execute the Agreement is liable to the State for a penal sum not to exceed 10 percent of the Bidder's bid amount or the costs in connection with the resubmission of printing new Contract Documents, required advertising, and printing and mailing notices to prospective Bidders, whichever is less, except as provided in **Section 5.3**.

5.3 Exception to Forfeiture

5.3.1 A Bidder for a Contract with the State costing less than \$500,000 may withdraw its Bid from consideration if its Bid for another Contract with the State for less than \$500,000 has already been accepted if:

5.3.1.1 the Bidder certifies in good faith that the total amount of its current contracts is less than \$500,000; and

5.3.1.2 the Bidder's Surety certifies in good faith that the Bidder is unable to perform the subsequent Contract because such performance would exceed the Bidder's bonding capacity.

5.3.2 If a Bid is withdrawn pursuant to **Section 5.3.1**:

5.3.2.1 the Contracting Authority may award the Contract to another Bidder which the Contracting Authority determines is the lowest responsive and responsible Bidder or reject all Bids and submit the Project for re-bidding; and

5.3.2.2 neither the withdrawing Bidder nor the Bidder's Surety shall be liable for the difference between the Bidder's Bid and that of the next lowest responsive and responsible Bidder for a penal sum, or for the costs of printing new Contract Documents, required advertising, and printing and mailing notices to prospective Bidders.

5.4 Bond

5.4.1 Prior to signing the Agreement, the Bidder shall provide the Bond required by law in form and substance satisfactory to the Contracting Authority, and from a Surety licensed to do business in the state of Ohio and satisfactory to the Contracting Authority.

5.4.1.1 If the Bidder provided **Document 00 43 13 - Bid Security Form**, described in **Section 5.1.1.1**, as its Bid Guaranty then that form shall be the Bond.

5.4.1.2 If the Bidder provided another form of Bid Guaranty, described in **Section 5.1.1.2**, then **Document 00 61 13 - Performance and Payment Bond Form**, described in **Section 5.1.6**, shall be the Bond.

5.4.1.3 The Bidder shall not be required to provide both forms described above.

5.4.2 The Bond must be in the full amount of the Contract to indemnify the State against all direct and consequential damages suffered by failure of the Contractor to perform according to the provisions of the Contract and in accordance with the Plans, Specifications, details, and bills of material therefore and pay all lawful claims of Subcontractors, Material Suppliers, and laborers for labor performed or materials furnished in performing and completing the Contract.

ARTICLE 6 - CONTRACT AWARD AND EXECUTION

6.1 Conditions Precedent for Execution of Contract

6.1.1 The successful Bidder must submit the items in this **Section 6.1** to the Contracting Authority before executing the Agreement.

6.1.2 Bond, and to support the Bond, a Certificate of Compliance issued by the Ohio Department of Insurance, showing the Surety is licensed to do business in the state of Ohio.

6.1.3 Ohio Workers' Compensation Certificate

6.1.4 Certificate of Compliance with Affirmative Action Programs, issued by the Equal Opportunity Coordinator. The form must be submitted through the Ohio Business Gateway: <http://business.ohio.gov/efiling/>.

6.1.5 Certificate of Insurance (ACORD form is acceptable) and copy of additional insured or loss payee endorsement. The Contracting Authority reserves the right to request and receive a certified copy of the Contractor's insurance policies.

6.1.6 If a Bidder is a foreign corporation (e.g., not incorporated under the laws of Ohio) it must submit a Certificate of Good Standing from the Ohio Secretary of State showing the right of the Bidder to do business in the state of Ohio.

6.1.7 If a Bidder is an individual or partnership, nonresident of the State, it must submit a Power of Attorney designating the Ohio Secretary of State as the Bidder's agent for accepting service of summons in any action brought under ORC Section 153.05 or under ORC Sections 4123.01 to 4123.94, inclusive.

6.1.8 Evidence that the Bidder is enrolled in, and in good standing in, a DFSP approved by the OBWC.

6.1.9 Required Notice of Unresolved Findings for Recovery.

6.1.9.1 By submitting its Bid, the Bidder warrants that it is not subject to an unresolved findings for recovery under ORC Section 9.24. ORC Section 9.24 prohibits the State from awarding a Contract to any Bidder against whom the Auditor of State has issued a finding for recovery if the finding for recovery is unresolved at the time of award. If the Contract is awarded to a Bidder subject to an unresolved finding for recovery under ORC Section 9.24, the Contract is void on its face and the Contractor shall immediately repay to the Owner any funds paid under the Contract.

6.1.10 EDGE Program – Supporting Documentation Required.

6.1.10.1 The Bidder shall provide evidence acceptable to the Contracting Authority of the Bidder's participation in the EDGE Program by contracting with EDGE-certified Business Enterprise(s) for the Project by submitting a fully completed EDGE Affidavit for each EDGE-certified Business Enterprise, by requesting a waiver or partial waiver of the advertised EDGE Program participation goal for the Project on the Bidder's company letterhead including full documentation of the Bidder's good faith effort to contract with EDGE-certified Business Enterprise(s) for this Project, or both.

6.1.11 If the Bidder is a joint venture, it must submit the executed agreement between the joint venturers describing the division of services/work and percentage of contract for each company, and a Power of Attorney which authorizes one or more individuals to bind the joint venture and each individual joint venturer to Contract Modifications.

6.2 Non-compliance with Conditions Precedent

6.2.1 The award of the Contract and execution of the Agreement require the Contractor to comply with:

6.2.1.1 all conditions precedent for execution of the Contract within 10 days of the date of the Notice of Intent to Award; and

6.2.1.2 the **Bidder's Qualifications** form, including a fully completed **EDGE Affidavit** for each EDGE-certified Business Enterprise, not previously provided within 3 business days of receiving the Contracting Authority's request.

6.2.2 Non-compliance with the conditions precedent for execution of the Contract as stated in **Section 6.1** within the timelines stated in **Section 6.2.1** following the date of the Notice of Intent to Award shall be sufficient cause to permit the Contracting Authority to cancel the Notice of Intent to Award, for the Bidder's lack of responsibility and award the Contract to another Bidder, which the Contracting Authority determines is the lowest responsive and responsible Bidder; or the Contracting Authority may re-bid the Work at its sole discretion.

6.2.3 The Contracting Authority may extend the time for complying with the conditions precedent for execution of the Contract for good cause. The extension is not a waiver of the conditions precedent for execution of the Contract.

6.3 Time Limits

6.3.1 The Contracting Authority's failure to award the Contract and execute the Agreement within 60 days of the bid opening invalidates the entire bid process and all Bids submitted, unless the time is extended by written consent of the apparent lowest responsive and responsible Bidder and the Contracting Authority.

6.3.1.1 If the Contracting Authority awards the Contract within 60 days of the bid opening, increases in material, labor, and subcontract costs shall be borne by the Bidder.

6.3.1.2 If failure to execute the Contract within 60 days of the bid opening is due to matters for which the State is solely responsible, the Contractor is entitled to a Change Order authorizing payment of verifiable increased costs in materials, labor, or subcontracts. This increase shall not exceed the difference in price between the successful Bidder and the price of the next lowest responsive and responsible Bidder.

6.3.1.3 If failure to execute the Contract within 60 days of the bid opening is due to matters for which the Contractor is responsible, the Contracting Authority shall not grant a request for increased costs.

6.4 Notice to Proceed

6.4.1 The Contracting Authority shall issue a Notice to Proceed to the Contractor, which establishes the date for commencement and the calendar days allocated for Substantial Completion of all Work. Within 10 days of the date of the Notice to Proceed, or other period as mutually agreed by the Contractor and the Contracting Authority, the Contractor shall furnish the following submittals to the A/E:

6.4.1.1 Schedule of Values;

6.4.1.2 preliminary schedule of Shop Drawings and other Submittals;

6.4.1.3 Subcontractor and Material Supplier Declaration form, with completed “Bidder Affirmation and Disclosure” forms acknowledging that the Contractor affirms, understands, and will abide by the requirements of Executive Order 2019-12D and Executive Order 2022-02D for Subcontractors that were not identified in the electronic **Bid Form**;

6.4.1.4 qualifications of proposed project manager(s) and superintendent(s) and a comprehensive resume of each; and

6.4.1.5 evidence that an authorization agreement for automatic deposit of state warrants has been submitted to Ohio Shared Services using the electronic funds transfer form provided on the Internet at <http://supplier.ohio.gov>.

6.5 Prevailing Wage Rates

6.5.1 The Bidder shall base its Bid upon the prevailing rates of wages as ascertained by the Ohio Department of Commerce, Wage and Hour Bureau for the Project as provided in ORC Sections 4115.03 through 4115.14. Refer to **Document 00 73 43 - Wage Rate Requirements** for related information and the Project’s prevailing rates of wages with an appropriate ratio of registered apprentices.

6.5.2 The Bidder shall not be entitled to an increase in the Contract Sum on account of an increase in prevailing wage rates, except as otherwise provided by Applicable Law. The Bidder is responsible for compliance of its Subcontractors with prevailing wage requirements.

6.5.3 Within 10 days of the date of the Notice to Proceed, the Contractor shall provide the Contracting Authority’s Prevailing Wage Coordinator with a schedule of dates during the term of the Contract when the Contractor shall pay wages to its employees for the Project.

KEYWORD INDEX

A

Acceptable Components, 3
 Addenda, 2, 3
 Addendum, 2, 3, 6
 Affirmative Action, 5, 6, 10
 Agreement, 9, 10, 11
 Allowances, 4
 Alternate, 4, 6, 7
 Applicable Law, 2, 6, 12
 award of the Contract, 1, 6, 7, 11

B

Base Bid, 4, 6, 7, 9
 Basis of Design Component, 3
 Bid, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
 Bid Form, 1, 2, 3, 4, 6
 Bid Guaranty, 4, 6, 9, 10
 Bidder, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
 Bond, 5, 10

C

Change Order, 1, 11
 Contract, 1, 4, 6, 7, 8, 9, 10, 11, 12
 Contract Documents, 1, 2, 3, 6, 8, 9, 10
 Contract Sum, 1, 4

D

Drawings, 2, 3
 Drug-Free Safety Program (“DFSP”), 5, 10

E

Encouraging Diversity Growth and Equity (“EDGE”), 3, 4, 5, 7, 11
 Equal Employment Opportunity, 7
 Equal Opportunity Coordinator, 5, 10
 Estimated Construction Cost, 7

I

insurance, 10

J

joint venture, 4, 11

N

Notice of Intent to Award, 7, 11
 Notice to Proceed, 11, 12

O

Ohio Bureau of Workers’ Compensation (“OBWC”), 5, 10

Ohio Department of Commerce, 12
Ohio Department of Insurance, 5, 9, 10
Ohio Secretary of State, 5, 10

P

Plan Holder, 2, 3
Prevailing Wage Rates, 12

R

Request for Interpretation, 2

S

Schedule of Values, 11
Shop Drawings, 12
Specifications, 2, 3, 10
State, 1, 6, 9, 10, 11

State's Electronic Bidding Software, 1, 2, 3, 5, 8
Subcontractor, 1, 2, 3, 5, 7, 10, 12
Substantial Completion, 1, 11
Substitutions, 3
Surety, 4, 5, 6, 9, 10

T

Ten Percent Rule, 7

U

Unit Price, 4
unresolved findings for recovery, 11

W

Wage and Hour Bureau, 12

END OF DOCUMENT

DOCUMENT 00 21 15 - SUBSTITUTION REQUEST FORM
(During Bidding/Procurement Phase)

To: OhioBidQuestions@fhai.com

Date: _____

Project Convocation Center Expansion, Edison State Community College

We hereby submit for your consideration the following product instead of the specified item(s) for the above project:

<u>Section</u>	<u>Article/Paragraph (Page)</u>	<u>Specified Item</u>
----------------	---------------------------------	-----------------------

Proposed
Substitution: _____ Model: _____

Manufacturer: _____ Phone: _____

Attach complete technical data including laboratory tests if applicable.

Include complete information changes to Drawings and/or Specifications which proposed substitution require for proper installation.

Fill in Blanks Below, use additional sheets if necessary:

A. Does the substitution affect dimensions shown on Drawings?

B. Will the undersigned pay for changes to building design, including engineering and detailing costs caused by substitution, if any?

C. What effect does substitution have on other trades? _____

D. Differences between proposed substitution and specified item?

E. Manufacturer's guarantees of proposed and specified items are:
_____ Same _____ Different (explain on attachment)

The undersigned certifies that the function, appearance and quality are equivalent or superior to the specified item.

Submitted By:

Signature

Firm _____

Address _____

Telephone _____

Fax _____

Email _____

For Use by Design Consultant:
Accepted _____ Accepted as Noted _____
Not Accepted _____ Received too Late _____
PM _____
Specifier _____
Date _____
Remarks _____
Telephone _____

END OF DOCUMENT 00 21 15

DOCUMENT 00 31 00 - AVAILABLE PROJECT INFORMATION

1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting (Bidding) Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidder's convenience and information. This Document and its attachments are not part of the Contract Documents.
- B. Because subsurface conditions indicated by the soils borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the A/E, the A/E's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.
- C. The Soils Exploration Report and Soil Boring Logs were prepared for the Owner by CTL Engineering, 102 Commerce Drive, P.O. Box 44, Wapakoneta, Ohio 45895, phone no. 419-738-1447 for use in design. The following Subsurface Investigation Report is not a part of the construction Contract Documents and is enclosed within this document for informational use only.
1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer.
 2. The enclosed report and Log of Borings, and any interpolations of conditions between test borings is not a warrant or guarantee by the Owner or Architect/Engineer of subsurface conditions.
 3. The Contractor should visit the site and acquaint himself with all existing conditions. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to the site and subsurface conditions, but such subsurface investigations shall be performed only under the time schedules and arrangements approved in advance by the Owner. Any additional information, needed by the Contractor, shall be obtained by the Contractor at no cost to the Owner.
 4. Structural design has been based on the report and assumes that existing soils are clean and can be compacted and will achieve the densities specified in the earthwork section. It shall be the Contractor's responsibility to determine for himself existing Site and or soil conditions.
- D. Existing Site Survey Information: A Site survey can be found within the construction drawings. It is not however, part of the Construction Contract Documents and is for informational use only. Information found is not a warrant or guarantee by the Owner or Project Consultant. The Contractor should visit the Site and acquaint himself with all existing conditions.
- E. Existing Drawings: Existing drawings, provided by the Owner, are not part of the Construction Documents and have been provided for informational use only. We, the Project Consultant, do not accept responsibility for the information contained in the report.
1. The Contractor should visit the site and acquaint themselves with all existing conditions. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to the conditions, but such investigations shall be performed only under the time schedules and arrangements approved in advance by the Owner. Any additional information, needed by the Contractor, shall be obtained by the Contractor at no cost to the Owner.
- F. Roofing Installer's Warranty from The Enterprise Roofing & Sheet Metal Company.

END OF DOCUMENT 00 31 00

Document 00 31 01
Roofing Installer's Warranty

(Document enclosed hereinafter)

3.9 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS STEVE M. HEMMELGARN of THE ENTERPRISE ROOFING & SHEET METAL COMPANY, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: EDISON COMMUNITY COLLEGE
 2. Address: 1973 EDISON DRIVE, PIQUA OH 45356
 3. Building Name/Type: COLLEGE
 4. Address: 1973 EDISON DRIVE, PIQUA, OHIO 45356
 5. Area 250 SQUARES of 2.5 ISO Work:
ADHERED - STORA 250 SQUARES; FLASHING SPEC TW-31, TB-20, TB-20
INSULATION; NRG3 NRG3 / SHEET METAL
 6. Acceptance Date: JUNE 13, 2007
 7. Warranty Period: Two years.
 8. Expiration Date: JUNE 13, 2009
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding 90 mph;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this 2ND day of JULY 2007

1. Authorized Signature: 
2. Name: STEVE M. HEMMELGARN
3. Title: VICE PRESIDENT

END OF SECTION 07 5400



Johns Manville

A Berkshire Hathaway Company

DATE _____
APPVD. _____
Job No. of ALL _____
EXTEN. _____
ENT'D _____
DATE PD _____
CHK " _____

10100 W. Ute. Ave. (80127)
P.O. Box 625001
Littleton, CO 80162 5001
303 978 2000
303 978 2808 Fax

Dear Building Owner:

Attached to this letter is the Peak Advantage Roofing Systems Guarantee for the new roof recently installed on your building. We believe your building is now protected by one of the finest commercial roofing systems available on the market today. We appreciate the opportunity to provide you with a level of protection unmatched in the industry.

There are some things you should be aware of before you file this document away in a safe place:

1. This is NOT a maintenance agreement nor an insurance policy. Johns Manville liability is strictly governed by the terms of the Guarantee. If you have any questions about this Guarantee, contact Johns Manville Guarantee Services at the appropriate number given below.
2. You are required to perform routine maintenance on the roofing system to keep the coverage to the Guarantee intact. For your convenience, a list of maintenance items is printed on the back of the Guarantee.

We hope that you never experience any difficulty with your roofing system. If you do have a problem, you should contact Johns Manville Guarantee Services at the appropriate numbers provided. Please have the Guarantee on hand so that we may more efficiently handle your inquiry.

Our Technical Services Department is staffed by some of the most experienced roofing professionals in the roofing industry. Please call on them for any questions you might have about commercial and industrial roofing and Johns Manville products.

Sincerely,

Randy Wrights
Technical Specialist, Guarantee Services
Johns Manville Roofing Systems Group

Eastern Region	800/345-9603
Western Region	800/922-5922
www.jm.com	gsu@jm.com



Peak Advantage Guarantee

Building Owner

Edison Community College
Piqua, OH 45356

Building Name

Edison State College Regional Ctr of Excellence
1973 Edison Dr.

Piqua, OH 45356

Approved Roofing Contractor

The Enterprise Rfg. & Sheet Metal Co
P. O. Box 545

Dayton, OH 45419

Guarantee Number: ANT121050828

Date of Completion: 3/10/2007

Terms & Maximum Monetary Obligation to Maintain a Watertight Roofing System.

Years 20 **\$**
No Dollar Limit

Coverage

The components of the Roofing System covered by this Guarantee are:

- Membrane Spec. and Type** : Adhered-ST6RA
- Insulation Type** : NRG3 NRG3
- Accessories (Type and Quantity)** :

Total Squares: 250
TPO

These Johns Manville Guaranteed components are referred to below as the "Roofing System" and ALL OTHER COMPONENTS OF THE OWNER'S BUILDING ARE EXCLUDED FROM THE TERMS OF THIS GUARANTEE.

Johns Manville* guarantees to the original Building Owner that during the Term commencing with the Date of Completion, JM will pay for the materials and labor required to promptly repair the Roofing System to return it to a watertight condition if leaks occur due to: ordinary wear and tear, or deficiencies in any or all of the component materials of the Roofing System, or workmanship deficiencies in the application of the Roofing System.

WHAT TO DO IF YOUR ROOF LEAKS

If you should have a roof leak please refer to directions on the reverse side.

LIMITATIONS AND EXCLUSIONS

This Guarantee is not a maintenance agreement or an insurance policy; therefore, routine inspections and maintenance are the Building Owner's responsibility (see reverse side of this document). Failure to follow the Maintenance Program on the reverse side of this document will void the Guarantee. This Guarantee does not obligate JM to repair the Roofing System, or any part of the Roofing System, for leaks resulting from (a) natural disasters including but not limited to the direct or indirect effect of lightning, flood, hail storm, earthquake, tornados, hurricanes or other extraordinary natural occurrence and/or wind speeds in excess of 72 miles per hour, (b) misuse, abuse or negligence, (c) installation or material failures other than those involving the component materials expressly defined above the Roofing System or exposure of the Roofing System components to damaging substances such as oil or solvents or to damaging conditions such as vermin, (d) changes to the Roofing System or the Building's usage that are not pre-approved in writing by JM, or (e) failure of the Building substrate (mechanical, structural, or otherwise and whether resulting from Building movement, design defects or other causes) or improper drainage. JM is not responsible for leaks and damage resulting from water entry from any portion of the Building structure not a part of the Roofing System.

This Guarantee becomes effective when (1) it is delivered to Owner; and (2) all bills for installation, materials, and services have been paid in full to the Approved Roofing contractor and to JM. Until that time, this Guarantee is not in force and has no effect.

The Parties agree that any controversy or claims relating to this Guarantee shall be first submitted to mediation under the construction Industry Arbitration and Mediation Rules of the American Arbitration Association (Regular Track Procedures) or to such other mediation arrangement as the parties mutually agree. No court or other tribunal shall have jurisdiction until the mediation is completed.

TO THE FULLEST EXTENT PERMITTED BY LAW, JM DISCLAIMS ANY IMPLIED WARRANTY, INCLUDING THE WARRANTY OF MERCHANTABILITY AND THE WARRANTY OF FITNESS FOR A PARTICULAR PUPOSE, AND LIMITS SUCH WARRANTY TO THE DURATION AND TO THE EXTENT OF THE EXPRESS WARRANTY CONTAINED IN TIES GUARANTEE.

THE EXCLUSIVE RESPONSIBILITY AND LIABILITY OF JM UNDER THIS GUARANTEE IS TO MAKE REPAIRS NECESSARY TO MAINTAIN THE ROOFING SYSTEM IN A WATERTIGHT CONDITION IN ACCORDANCE WITH THE OBLIGATIONS OF JM UNDER TIES GUARANTEE.

JM AND ITS AFFILIATES WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES TO THE BUILDING STRUCTURE (UPON WHICH THE ROOFING SYSTEM IS AFFIXED) OR IT'S CONTENTS, LOSS UP TIME OR PROFITS OR ANY INCONVENIENCE. JM AND ITS AFFILIATES SHALL NOT BE LIABLE FOR ANY DAMAGES WHICH ARE BASED UPON NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILITY OR ANY OTHER THEORY OF LIABILITY OTHER THAN THE EXCLUSIVE LIABILITY SET FORTH IN THIS GUARANTEE.

No one is authorized to change, alter, or modify the provision of this Guarantee other than the Manager, Guarantee Services Unit or authorized delegate. JM's delay or failure in enforcing the terms and conditions contained in this Guarantee shall not operate as a waiver of such terms and conditions. This Guarantee is solely for the benefit of the Building Owner identified above and Building Owner's rights hereunder are not assignable. Upon sale or other transfer of the Building, Building Owner may request transfer of this Guarantee to the new owner, and JM may transfer this Guarantee, in its sole discretion only after receiving satisfactory information and payment of a transfer fee, which must be paid no later than 30 days after the date of Building ownership transfer.

In the event JM pays for repairs which are required due to the acts or emissions of others, JM shall be subrogated to all rights of recovery of the Building Owner to the extent of the amount of the repairs.

Because JM does not practice Engineering or Architecture, neither the issuance of this Guarantee nor any review of the Building's construction or inspection of roof plans (or the Building's roof deck) by JM representatives shall constitute any warranty by JM of such plans, specifications, and construction or in any way constitute an extension of the terms and conditions of this Guarantee. Any roof inspections are solely for the benefit of JM.

JM does not supervise nor is it responsible for a roofing contractor's work except to the extent stated herein, and roofing contractors are not agents of JM.

*JOHNS MANVILLE ("JM") is a Delaware corporation with its principal mailing address at P.O. Box 5108, Denver, Colorado 80217-5108.



1. Building Owner must notify JM Guarantee Services Unit (see below) immediately upon discovery of the leak and in no event later than 30 days after discovery of the leak.
2. In response to this notice, JM will arrange to inspect the Roofing System, and
 - (i) if the leaks are the responsibility of JM under this Guarantee (see Limitations and Exclusions), JM will take prompt appropriate action to return the Roofing system to a watertight condition, or
 - (ii) if the leaks are not the responsibility of JM under this Guarantee, advise the Building Owner within a reasonable time of the minimum repairs that JM believes are required to return the Roofing System to a watertight condition. If the building Owner, at his expense, promptly makes such repairs to the Roofing System this Guarantee will remain in effect for the unexpired portion of its Term. Failure to make these repairs in a timely and reasonable fashion will void any further obligation of JM under this Guarantee as to the damaged portion of the Roofing System.
3. In the event an emergency condition exists which requires immediate repair to avoid damage to the Building or its contents, then Building Owner may make essential temporary repairs. JM will reimburse Building Owner for those repair expenses that would have been the responsibility of JM under the Guarantee.

Maintenance Program

In order to continue the coverage of this Guarantee the following maintenance program must be implemented.

There are a number of items not covered by this Guarantee that are the responsibility of the owner. In order to ensure that your new roof will continue to perform its function, you must examine and maintain these items on a regular basis:

- Maintain a file for your records on this roof, including this Guarantee, invoices, and subsequent logs of all inspections performed and repairs that are made to the roof.
- Inspect your roof at least semiannually. This is best done in the Spring, after the roof has been exposed to the harsh winter conditions, and, in the Fall after a long hot summer. It is also a good idea to examine the roof for damage after severe weather conditions such as hailstorms, heavy rains, high winds, etc.
- Since these types of roofs typically have a low slope they are easily examined. However, care must be taken to prevent falling accidents.

When checking the roof:

- Remove any debris such as leaves, small branches, dirt, rocks, etc. that have accumulated.
- Clean gutters, down spouts, drains and the surrounding areas. Make certain they allow water to flow off the roof. Positive drainage is essential.
- Examine all metal flashings and valleys for rust and damage that may have been caused by wind or traffic on the roof, and make certain they are well attached and sealed. Any damaged, loose, or poorly sealed materials must be repaired by an Approved Roofing Contractor.
- Examine the areas that abut the roof. Damaged masonry, poorly mounted counterflashing, loose caulking, bad mortar joints, and any loose stone or tile coping can appear to be a membrane leak. Have these items repaired if found to be defective.
- Examine the edges of the roof. Wind damage often occurs in these areas. Materials that have been lifted by the wind need to be corrected by an Approved Roofing Contractor.
- Examine any roof top equipment such as air conditioners, evaporative coolers, antennas, etc. Make certain they do not move excessively or cause a roof problem by leaking materials onto the roof.
- Check the building exterior for settlement or movement. Structural movement can cause cracks and other problems which in turn may lead to leaks in your roofing system.
- Examine protective coatings; any cracked, flaking, or blistered areas must be recoated.

Protecting your investment:

- Avoid unnecessary roof top traffic.
- If you allow equipment servicemen to go onto the roof, advise them to be careful. Dropped tools, heavy equipment, etc. can damage the membrane. Log all such trips to the roof.
- Do not allow service personnel to make penetrations into the roof; these are to be made only by an Approved Roofing Contractor.

All the terms and conditions of this Guarantee shall be construed under the internal law of the state of Colorado without regard to its conflicts of law principles. Invalidity or unenforceability of any provisions herein shall not affect the validity or enforceability of any other provision which shall remain in full force and effect.

This form is not to be copied or reproduced in any manner. This Guarantee is valid only in the United States of America.

Guarantee Services Unit

Johns Manville, Guarantee Services Unit, 10100 West Ute Ave., Littleton, CO 80127 (shipping address)
Johns Manville, Guarantee Services Unit, P.O. Box 625005, Littleton, CO 80162-5005 (mailing address)

Guarantee Services Regional Phone Numbers

Document 00 31 32

Geotechnical Data

(Document enclosed hereinafter)

Document 00 41 13 - Bid Form (General Contract / Electronic Bid)

State of Ohio Standard Requirements for Public Facility Construction

THIS SAMPLE BID FORM IS PROVIDED WITH THE PROJECT MANUAL AS A PLACEHOLDER ONLY – SUBMIT YOUR BID USING THE ELECTRONIC BID FORM ON [HTTPS://BIDEXPRESS.COM](https://bidexpress.com)

General Info	Alt Total:	Bid Total:
Deadline «05/01/2024, Noon EDT/EST»		
Advertised «04/09/2024 04/16/2024 04/23/2024»	Description «Convocation Center Expansion, Piqua, Ohio A new locker room addition of approximately 3,000 square feet Adjacent to their existing gymnasium. »	
Number Project No. ESC-230006		
Business Name Ohio Facilities Construction Commission		

Procurement Documents

«Document 00 10 00 Solicitation »
 → Public Bid Advertisement

«Document 00 10 00 Solicitation»
 → Notice to Bidders

«Edison Convocation Center Expansion Project Manual
 → Procurement & Contracting Requirements and Specifications

«Edison Convocation Center Expansion Drawings»
 → Plans, elevations, sections, details, and schedules

«4» Attachments

Contract Times and Addenda

Contract Times

The time for Substantial Completion of all Work is «175 working days».

Acknowledgement of receipt of Addenda

Date Addendum #1 Received	Date Addendum #2 Received	Date Addendum #3 Received	Date Addendum #4 Received
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Allowance Instructions

Allowance amounts are fixed and no entry of data is required by the Bidder. Include each and every Allowance amount in the Base Bid. The Bidder's Fee (overhead and profit) and costs for unloading and handling on the Site, labor, installation costs, and other expenses contemplated for the Allowance must be included in the Base Bid and NOT in the Allowance amount.

■ Allowances (General Contract)			
Item	Description	Allowance Amount*	Extension
Allowance A-«1»	«Commercial Laundry Equipment»	«\$10,000.00»	«\$NN.NN»
«1» Item		Total:	

■ Base Bid Instructions

Enter the amount of the Base Bid for ALL LABOR AND MATERIALS to complete the scope of Work. Include the amount of each Allowance (if applicable) and the subtotal of each Unit Price Extension (if applicable) in the Base Bid amount. Failure to include Allowance or Unit Price Extensions in the Base Bid is the responsibility of the Bidder and will not be sufficient reason for adjustment of the Bid amount after the Bid deadline. Do not include Alternates (if applicable) in the Base Bid amount.

■ Base Bid (General Contract)			
Item	Description	Base Bid Amount*	Extension
Base Bid	All Labor and Materials (include Allowances and Unit Price Extensions above)	_____	
1 Item		Total:	

■ Alternate Instructions

Enter the amount of each and every Alternate to ADD TO or DEDUCT FROM the Base Bid. Indicate amounts to DEDUCT FROM the Base Bid by entering a minus sign (-) before the amount entered. Do not include Alternate amounts in the Base Bid.

■ Alternates (General Contract)			
Item	Description	Alternate Amount*	Extension
! Alternate: Owner-agency may award independently from entire bid.			
! Alternates are not included in bid total.			
Alternate «1»	«Training Room»	_____	
Alternate «2»	«Built-In Casework»	_____	
Alternate «3»	«Loose Furnishings»	_____	
Alternate «4»	«Plastic Toilet Compartments»	_____	
Alternate «5»	«Moisture Vapor Emission Control»	_____	
Alternate «6»	«Parking Lot Cameras»	_____	
«6» Items		Alternate Total:	Total:

■ Bidder Affirmation and Disclosure

The Bidder acknowledges that by submitting its Bid, the Bidder has read and understands the applicable Executive Orders regarding the prohibitions of performance of offshore services, locating State data offshore in any way, or purchasing from Russian institutions or companies. If awarded a Contract, the Bidder will become the Contractor and affirms that both the Contractor and its Subcontractors shall perform no services requested under this Contract outside of the United States.

The Bidder shall provide the locations where services under this Contract will be performed in the spaces provided below or by attachment. Failure to provide this information as part of its Bid may cause the Bidder to be deemed non-responsive and no further consideration will be given to its Bid. If the Bidder will not be using Subcontractors, indicate "Not Applicable" in the appropriate spaces.

1. Principal business location of Contractor:

Contractor Address*	City, State, and Zip*
<input type="text"/>	<input type="text"/>

Name / Principal business location of Subcontractor(s), if known at time of Bid deadline:

Subcontractor Name*	Address, City, State, and Zip*
<input type="text"/>	<input type="text"/>

2. Location(s) where services will be performed by Contractor (Project Sites):

Name*	Address, City, State, and Zip*
<input type="text"/>	<input type="text"/>

Name(s) / Location(s) where services will be performed by Subcontractors (Project Sites):

Subcontractor Name	Address, City, State, and Zip
<input type="text"/>	<input type="text"/>

3. Location(s) where State data will be located by Contractor:

Address*	City, State, and Zip*
<input type="text"/>	<input type="text"/>

Location(s) where State data will be located by Subcontractor(s), if known at time of Bid deadline:

Subcontractor Name	Address, City, State, and Zip
<input type="text"/>	<input type="text"/>

Bidder also affirms, understands and agrees that the Contractor and its Subcontractors are under a duty to disclose to the State any change or shift in location of services performed by the Contractor or its Subcontractors before, during and after execution of any Contract with the State. Bidder agrees it shall so notify the State immediately of any such change or shift in location of its services. The State has the right to immediately terminate the contract, unless a duly signed waiver from the State has been attained by the Contractor to perform the services outside the United States.

On behalf of the Bidder, I acknowledge that I am duly authorized to execute this electronic Bid Form including this Bidder Affirmation and Disclosure form and have read and understand that this form is a part of any Contract that Bidder may enter into with the State and is incorporated therein.

■ EDGE Program Commitment to Participate

Option A

The Bidder commits to meet or exceed the advertised EDGE Participation Goal of the Contract award amount, calculated as a portion of the Base Bid plus all accepted Alternates, by using EDGE-certified Business(es).

The Bidder agrees that if selected for consideration of the Contract, it shall provide (if not provided with the Bidder's Bid) to the Contracting Authority, at the location required and within 3 business days after receiving notice from the Contracting Authority, its fully completed Bidder's Qualification Form, including an EDGE Affidavit form for each EDGE-certified Business proposed for use by the Bidder if awarded the Contract for this Project.

Option B (indicate percentage of participation below)

The Bidder declares that it does not meet the advertised EDGE Participation Goal percentage, but, if awarded the Contract for this Project, commits to provide the percentage of the Contract award amount, indicated above, calculated as a portion of the Base Bid plus all accepted Alternates, by using EDGE-certified Business(es).

The Bidder acknowledges it understands the requirement for it to provide and agrees to provide to the Contracting Authority, if selected for consideration of the Contract, within 3 business days after notice from the Contracting Authority, a detailed Demonstration of Good Faith form describing its efforts undertaken prior to submitting its Bid to meet the advertised EDGE Participation Goal percentage for the Contract for this Project.

The Bidder commits to provide to the Contracting Authority at the location required, and within 3 days after receiving notice from the Contracting Authority, its fully completed Bidder's Qualifications Form, including an EDGE Affidavit form for each EDGE-certified Business proposed for use by the Bidder if awarded the Contract for this Project.

Option C

The Bidder declares that the Bidder is an EDGE-certified Business and that if awarded this Contract, the EDGE Participation percentage will be 100 percent of the Contract award amount.

Select EDGE option above*

Choices...

If option B selected, enter percentage

■ Certifications (State Prevailing Wages)

1. The Bidder has read and understands the proposed Contract Documents and agrees to comply with all requirements of the proposed Contract Documents, regardless of whether the Bidder has actual knowledge of the requirements and regardless of any statement or omission made by the Bidder, which might indicate a contrary intention.
2. The Bidder represents that the Bid is based upon the Basis of Design and Acceptable Components specified by the proposed Contract Documents.
3. The Bidder has visited the Site, become familiar with local conditions, and has correlated personal observations about the requirements of the proposed Contract Documents. The Bidder has no outstanding questions regarding the interpretation or clarification of the proposed Contract Documents.
4. The Bidder understands that the execution of the Project will require sequential, coordinated, and interrelated operations, which may involve interference, disruption, hindrance, or delay in the progress of the Bidder's Work. The Bidder agrees that the Contract Sum, as amended from time to time, shall cover all amounts due from the State resulting from interference, disruption, hindrance, or delay that is not caused by the State or its agents and employees. The Bidder agrees that any such interference, disruption, hindrance, or delay is within the contemplation of the Bidder and the State and that the Contractor's sole remedy from the State for any such interference, disruption, hindrance, or delay shall be an extension of time in accordance with the proposed Contract Documents.
5. During the performance of the Contract, the Bidder agrees to comply with Ohio Administrative Code ("OAC") Chapters 123:2-3 through 123:2-9 and agrees to incorporate the monthly reporting provisions of OAC Section 123:2-9-01 into all subcontracts on the Project, regardless of tier. The Bidder understands the State's Equal Opportunity Coordinator or the Contracting Authority may conduct pre-award and post-award compliance reviews to determine if the Bidder maintains nondiscriminatory employment practices, maintains an affirmative action program, and is exerting good faith efforts to accomplish the goals of the affirmative action program. For a full statement of the rules regarding Equal Employment Opportunity in the Construction Industry, see OAC Chapters 123:2-1 through 123:2-9.
6. The Bidder and each Person submitting a Bid on behalf of the Bidder certifies, and in the case of a Bid by a joint venture each member thereof certifies as to such member's entity, under penalty of perjury, that to the best of the undersigned's knowledge and belief: (a) the Base Bid, any Unit Prices, and any Alternate bid in the Bid have been arrived at independently without collusion, consultation, communication or agreement, for the purpose of restricting competition as to any matter relating to such Base Bid, Unit Prices or Alternate bid with any other Bidder; (b) unless otherwise required by law, the Base Bid, any Unit Prices and any Alternate bid in the Bid have not been knowingly disclosed by the Bidder and shall not knowingly be disclosed by the Bidder prior to the bid opening, directly or indirectly, to any other Bidder who would have any interest in the Base Bid, Unit Prices, or Alternate bid; (c) no attempt has been made or shall be made by the Bidder to induce any other Person to submit or not to submit a Bid for the purpose of restricting competition.
7. The Bidder shall execute the Agreement with the Contracting Authority, if a Contract is awarded on the basis of this Bid, and if the Bidder does not execute the Agreement for any reason, other than as authorized by law, the Bidder and the Bidder's Surety are liable to the State as provided in Article 5 of the Instructions to Bidders.
8. The Bidder certifies that the upon the award of a Contract, as the Contractor it shall make a good faith effort to ensure that all of the Contractor's employees, while working on the Site, shall not purchase, transfer, use, or possess illegal drugs or alcohol or abuse prescription drugs in any way.
9. The Bidder acknowledges that it read all of the Instructions to Bidders, and in particular, Section 2.10 - Submittals With Bid Form, and by submitting its Bid certifies that it has read the Instructions to Bidders and it understands and agrees to the terms and conditions stated in them.
10. The Bidder agrees to furnish any information requested by the Contracting Authority or the Architect/Engineer to evaluate the responsibility of the Bidder.
11. The Bidder agrees to furnish the submittals required by Section 6.1 of the Instructions to Bidders for execution of the Agreement within 10 days of the date of the Notice of Intent to Award.
12. When the Bidder is a corporation, partnership or sole proprietorship, an officer, partner or principal of the Bidder, as applicable, shall enter the legal name of the Bidder and the name of the officer, partner or principal of the Bidder (in lieu of signing the Bid Form) in the data fields provided.
13. When the Bidder is a joint venture, an officer, partner or principal, as applicable, of each member of the joint venture shall enter the legal name of the applicable member and the name of the officer, partner or principal (in lieu of signing the Bid Form) in the data fields provided.
14. The Bidder understands that the Contract is subject to all the provisions, duties, obligations, remedies and penalties of Ohio Revised Code Chapter 4115 and that the Bidder shall pay any wage increase in the locality during the term of the Contract.
15. The Bidder represents that the individual that is submitting and digitally signing the electronic Bid is legally authorized to do so.
16. Bidder acknowledges that by the act of submitting an electronic Bid that it is digitally signing the actual Bid, which shall serve as the Bidder's authorization for the further consideration and activity in the bidding and contract process.



The Bidder hereby acknowledges that the above representations in this Bid are material and not mere recitals.*

■ Procurement Forms

Document 00 43 13 - Bid Security Form

→ Upload below and provide original document within 3 days

Document 00 45 13 - Bidder's Qualifications

→ Upload below or provide within 3 days of request

Document 00 45 39 - EDGE Affidavit

→ Upload below or provide within 3 days of request

3 Attachments

■ Instructions for Providing Bid Submittals

Submission of Electronic Facsimile of Bid Guaranty with Electronic Bid

The Bidder SHALL UPLOAD and ATTACH TO ITS BID an ELECTRONIC FACSIMILE (scanned PDF document) OF ITS BID GUARANTY, payable to the Contracting Authority, in the form of either: (1) the signed and sealed Document 00 43 13 - "Bid Security Form" contained in the Contract Documents (and provided for the Bidder's convenience in the block above) for the amount of the Base Bid plus all additive Alternates; or (2) a certified check, cashier's check, or letter of credit, for 10 percent of the Base Bid, plus all additive Alternates – a letter of credit shall expressly provide that it is revocable only by the Contracting Authority. Refer to Sections 2.10.1.1 and 5.1 of Document 00 21 13 - "Instructions to Bidders."

Submission of Original Bid Guaranty

In addition to the Electronic Facsimile above, the Bidder SHALL DELIVER ITS ORIGINAL UNALTERED BID GUARANTY to the Project Coordinator at the address identified below WITHIN 3 BUSINESS DAYS AFTER THE BID DEADLINE as provided in Ohio Administrative Code Section 153:1-8-01(H). THIS REQUIREMENT APPLIES TO ALL BIDDERS. Refer to Section 2.10.1.2 of the Instructions to Bidders.

«Amber Cantrell, Project Coordinator»
 «Ohio Facilities Construction Commission»
 «30 West Spring Street, Fourth Floor»
 «Columbus, Ohio 43215»

Non-responsive Bid for Failure to Submit Bid Guaranty

Each Bidder MUST SUBMIT BOTH THE ELECTRONIC FACSIMILE AND THE ORIGINAL UNALTERED BID GUARANTY as described above. The Contracting Authority SHALL REJECT A BID AS NON-RESPONSIVE if the Bidder fails to submit BOTH elements of the Bid Guaranty. The checkboxes below are to identify that you have uploaded the other form of Bid Guaranty. DO NOT CHECK ALL BOXES. Refer to Section 2.10.1 of the Instructions to Bidders.

Submission of Bidder's Qualifications and EDGE Affidavit

The Bidder is encouraged to submit background information with its Bid using Document 00 45 13 - "Bidder's Qualifications" and Document 00 45 39 - "EDGE Affidavit" with the EDGE-certified Business(es) the Bidder proposes to use on the Project (forms provided for the Bidder's convenience in the block above). If the Bidder does not submit the Bidder's Qualifications form and/or the EDGE Affidavit form and related information attached to the electronic Bid Form, the Bidder shall provide it within 3 days of request. Refer to Sections 2.10.3 and 3.5.4 of the Instructions to Bidders.

■ Required Bid Guaranty Upload

Name	File*
Document 00 43 13 - Bid Security Form → Upload a scan of the fully executed Bid Security Form AND submit the original document to the Contracting Authority within 3 days of the bid deadline	<input type="button" value="Select file..."/> no file selected <input type="checkbox"/> I am NOT enclosing this document because the omission terms have been met. (Bidder submitted a Cashier's check below)
Power of Attorney → Upload a scan of the fully executed Power of Attorney AND submit the original document to the Contracting Authority within 3 days of the bid deadline	<input type="button" value="Select file..."/> no file selected <input type="checkbox"/> I am NOT enclosing this document because the omission terms have been met. (Bidder submitted a Cashier's check below OR included with the Bid Security Form above)
Cashier's Check for 10% of the Bid → Upload a scan of the Cashier's Check AND submit the original check to the Contracting Authority within 3 days of the bid deadline	<input type="button" value="Select file..."/> no file selected <input type="checkbox"/> I am NOT enclosing this document because the omission terms have been met. (Bidder submitted the Bid Security Form AND Power of Attorney above)
3 Required Documents	

Bidder's Qualifications and EDGE Affidavit Upload	
Name	File*
Document 00 45 13 - Bidder's Qualifications → Upload fully completed form and attachments	<input type="button" value="Select file..."/> no file selected <input type="checkbox"/> I am NOT enclosing this document because the omission terms have been met. (Must be submitted to the Contracting Authority within 3 days of request)
Document 00 45 39 - EDGE Affidavit → Upload a completed form for each EDGE business	<input type="button" value="Select file..."/> no file selected <input type="checkbox"/> I am NOT enclosing this document because the omission terms have been met. (Must be submitted to the Contracting Authority within 3 days of request)
2 Required Documents	

Bidder Signatory Information	
Bidder Signatory	
Name of Bidder's Authorized Signatory:*	Title of Authorized Signatory:*
<input type="text"/>	<input type="text"/>
All Bidders complete all information in this form. Duplicate and complete the block below for each Joint Venturer:	
Bidder Information	
Business Name:*	
<input type="text"/>	
Business Mailing Address, City, State, Zip:*	
<input type="text"/>	
Telephone Number:*	Facsimile Number:
<input type="text"/>	<input type="text"/>
Federal Tax ID Number:*	Email Address:*
<input type="text"/>	<input type="text"/>
Contact person for Contract processing:*	State of Incorporation (if applicable):
<input type="text"/>	<input type="text"/>
President or Chief Executive Officer's Name:*	Date enrolled in an OBWC-approved DFSP (month/date/year):
<input type="text"/>	<input type="text"/>
	President or Chief Executive Officer's Title:*
	<input type="text"/>

END OF DOCUMENT

Document 00 43 13 - Bid Security Form
State of Ohio Standard Requirements for Public Facility Construction

(Form of combined Bid Guaranty and Bond prescribed by Ohio Revised Code Section 153.571)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned _____,
_____, as Principal,
and _____ as Sureties,
are hereby held and firmly bound unto _____
_____ as Obligee(s), in the penal sum of the dollar amount of the Bid submitted by the Principal
to the Obligee on _____ (date) to undertake the Project known as:

Project Number: _____

Project Name: _____

Contract Description: _____
(e.g., General Contractor/Trades, Plumbing, HVAC, Electrical)

The penal sum, referred to herein, shall be the dollar amount of the Principal's Bid to the Obligee, incorporating any additive alternate Bids made by the Principal on the date referred to above to the Obligee, which are accepted by the Obligee. In no case shall the penal sum exceed the amount of dollars (\$ _____). (If the preceding line is left blank, the penal sum will be the full amount of the Principal's Bid, including add alternates. Alternatively, if completed, the amount stated shall not be less than the full amount of the Bid, including Alternates, in dollars and cents. A percentage is not acceptable.) For the payment of the penal sum well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that whereas the above-named Principal has submitted a Bid for the above referenced Project;

NOW, THEREFORE, if the Obligee accepts the Bid of the Principal, and the Principal fails to enter into a proper contract in accordance with the Bid, Plans, Specifications, details, and bills of material; and in the event the Principal pays to the Obligee the difference, not to exceed ten percent of the penal sum hereof between the amount specified in the Bid and such larger amount for which the Obligee may in good faith contract with the Bidder determined by the Obligee to be the next lowest responsive and responsible to perform the Work covered by the Bid; or in the event the Obligee does not award the Contract to such next lowest responsive and responsible Bidder and resubmits the Project for bidding, the Principal pays to the Obligee the difference not to exceed ten percent of the penal sum hereof between the amount specified in the Bid, or the costs, in connection with the resubmission, of printing new Contract Documents, required advertising and printing and mailing notices to prospective Bidders, whichever is less, then this obligation shall be null and void, otherwise to remain in full force and effect. If the Obligee accepts the Bid of the Principal, and the Principal, within 10 days after the awarding of the Contract, enters into a proper contract and executes the Agreement Form in accordance with the Contract Documents, including without limitation the Bid, Plans, Specifications, details, and bills of material, which said Contract is made a part of this Bond the same as though set forth herein; and

NOW ALSO, IF THE SAID Principal shall well and faithfully perform each and every condition of such Contract; and indemnify the Obligee against all damage suffered by failure to perform such Contract according to the provisions thereof and in accordance with the Contract Documents, including without limitation Plans, Specifications, details, and bills of material therefore; and shall pay all lawful claims of Subcontractors, Material Suppliers and laborers for labor performed and materials furnished in the carrying forward, performing or completing of said Contract; we, agreeing and assenting that this undertaking shall be for the benefit of any Subcontractor, Material Suppliers or laborer having a just claim, as well as for the Obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

THE SAID Surety hereby stipulates and agrees that no modifications, omissions or additions, in or to the terms of said Contract, the Work thereunder or the Contract Documents, including without limitation the Plans and Specifications, therefore, shall in any way affect the obligations of said Surety on its bond, and it does hereby waive notice of any such modifications, omissions or additions in or to the terms of the Contract, the Work, or the Contract Documents, including without limitation the Plans and Specifications.

SIGNED AND SEALED this _____ day of _____, _____.

PRINCIPAL:

SURETY:

Signature

Signature

By: _____
Name

By: _____
Attorney-in-Fact

Title

SURETY INFORMATION:

SURETY AGENT'S INFORMATION:

Name

Name

Address 1

Address 1

Address 2

Address 2

City State Zip

City State Zip

Telephone

Telephone

Email

Email

END OF DOCUMENT

Document 00 45 13 - Bidder's Qualifications
State of Ohio Standard Requirements for Public Facility Construction

Project Number: _____

Project Name: _____

1. Company Name: _____

Physical Address: _____
Street, Building, Unit

City, State, Zip

Mailing Address (if different): _____
P.O. Box

City, State, Zip

Telephone Number (w/ Area Code): (_____) _____

Fax Number (w/ Area Code): (_____) _____

Email address: _____

2. Overall Experience. Indicate Bidder's overall experience performing the trades bid, including the years in business performing the trade under present and former business names.

3. Financial. The apparent low Bidder shall submit, upon request of the Contracting Authority, either:

- a) An annual financial statement prepared within the 12 months prior to the bid opening by an independent licensed accounting firm; and the name, address, contact person and phone number of the bank normally used by the Bidder for its primary banking; or,
- b) A financial report generated within 30 days prior to the bid opening from Standard and Poor, Dun and Bradstreet or a similar company acceptable to the Contracting Authority documenting the financial condition of the Bidder; and the name, address, contact person and phone number of the bank normally used by the Bidder for its primary banking;

This information is not a public record under Ohio Revised Code Section 149.43; and shall remain confidential, except under proper order of a court.

e) EPA/OSHA violations

f) Liquidated damages and Statutory Delay Forfeiture assessed

g) Drug-Free Safety Program and Drug Free Workplace Program violations

7. **Management.** Identify individuals assigned to this Project.

Principal _____ Years with firm _____ Total Exp. _____

Project Manager _____ Years with firm _____ Total Exp. _____

Field Superintendent _____ Years with firm _____ Total Exp. _____

8. **EDGE Participation.** Identify EDGE-certified Business Enterprises proposed as Subcontractors and Material Suppliers for this Project. Attach a fully completed Document 00 45 39 - "EDGE Affidavit" for each EDGE-certified Business Enterprise.

9. **Certification.** I hereby certify that the information in this entire Bidder's Qualifications form, including all attachments and referenced information, is factual and complete.

Company Name _____

Authorized Official (please print or type) _____

Signature of Authorized Official _____ Date _____

END OF DOCUMENT

Document 00 45 39 - EDGE Affidavit
State of Ohio Standard Requirements for Public Facility Construction

EDGE PARTICIPATION

Certified Statement of Intent to Contract and Perform

Bidder or Proposer: Submit one fully completed form for each EDGE-certified Business

Project: _____

Project Name: _____

A. Bidder or Proposer's Company Name: _____

Mark all that apply:

Multi-Prime Contract General Contract CM at Risk Contract Design-Build Contract

B. EDGE-certified Business information (for contract at ANY tier)

Mark all that apply:

Subcontractor Material Supplier Professional Services Goods & Services

EDGE Business Name: _____

EDGE Business Address: _____

EDGE Certification Number: _____ E-mail: _____

Contact Person: _____ Phone: _____

Insert detailed description of materials, labor, services, supplies, etc. (may use industry codes – continue on separate page):

C. Certification of Intent

By signing below, the Bidder or Proposer certifies that it intends to contract with the EDGE-certified Business for the portion of the contract described above related to its Contract for this Project and for the estimated cost shown below. By signing below, the EDGE-certified Business certifies that it intends to contract with the Bidder or Proposer and intends to provide the portion of the contract described above related to the Contract for this Project for the estimated cost of:

_____ and _____ /100 dollars (\$ _____).

In the event the named Bidder or Proposer is NOT awarded a Contract, this Statement shall be null and void.

EDGE-certified Business

Bidder or Proposer

Authorized Signature

Authorized Signature

Name and Title

Name and Title

Date Signed

Date Signed

END OF DOCUMENT

Document 00 52 00 - Agreement Form

State of Ohio Standard Requirements for Public Facility Construction

This Agreement is made as of the date set forth below between the State of Ohio, acting by and through the Contracting Authority, and the Contractor in connection with the Project.

Project Number: ESC-230006/223193.00
Project Name: Convocation Center Expansion
Site Address: 1973 Edison Drive
Piqua, OH 45653»
Miami County

Owner: Edison State Community College
Owner's Representative: «Harold Hitchcock»
Address: 1973 Edison Drive
Piqua, OH 45653

Contracting Authority: Ohio Facilities Construction Commission
Project Manager: «Heather Brink»
Address: 30 West Spring Street, 4th Floor
Columbus, OH 43215

Contractor: «insert name»
Contractor's Principal Contact: «insert name»
Address: «insert street address»
«insert city, state zip code»

Architect/Engineer ("A/E"): Fanning/Howey Associates, Inc.
A/E's Principal Contact: Rodney D. Wiford
Address: 128 West Market Street
Celina, OH 45822

ARTICLE 1 - SCOPE OF WORK; EDGE COMMITMENT

- 1.1** The Contractor shall perform and provide all of the Work described in the Contract.
- 1.2** The project delivery method for this Project shall be «General Contracting».
- 1.3** The Contractor shall contract with EDGE-certified Business(es) for not less than «insert Contractor's EDGE commitment» percent of the Contract Sum.

ARTICLE 2 - COMPENSATION

2.1 The Owner shall pay the Contractor the Contract Sum for the Contractor's proper, timely, and complete performance of the Contract. The Contract Sum is \$«insert amount», subject to Modifications as provided in the Contract Documents. The Contract Sum is comprised of the following:

ARTICLE 3 - CONTRACT TIMES

3.1 The Contract Times are the periods established in the following table for the achievement of the associated Milestones:

Construction Stage Milestone(s) to which Liquidated Damages apply	Contract Time	Projected Date (as of the date of this Agreement)
Substantial Completion of all Work	«175» days	«»

3.1.1 The projected dates listed under "Projected Date (as of the date of this Agreement)" are provided only for convenient reference during consideration of the Agreement. The durations listed under "Contract Time" define the Contract Times and take precedence over the projected dates.

ARTICLE 4 - KEY PERSONNEL

4.1 The Contractor's key personnel for the Project are:

- 4.1.1 «insert name», Project Manager;
- 4.1.2 «insert name», Lead Scheduling Engineer;
- 4.1.3 «insert name», General Superintendent.

4.2 The Contractor's key personnel are authorized to act on the Contractor's behalf with respect to the Project and all matters concerning the Project.

ARTICLE 5 - GENERAL PROVISIONS

5.1 Effectiveness.

5.1.1 It is expressly understood by the Contractor that none of the rights, duties, and obligations described in the Contract Documents shall be valid and enforceable unless the Director of the Office of Budget and Management first certifies that there is a balance in the Owner's appropriation not already encumbered to pay existing obligations and until all relevant statutory provisions of the Ohio Revised Code, including ORC Section 126.07, have been complied with, and until such time as all necessary funds are available or encumbered and, when required, such expenditure of such funds is approved by the State Controlling Board, or other applicable approving body.

5.1.2 In addition, if federal funds are to be used to pay fees and expenses under this Agreement, none of the rights, duties, and obligations contained in this Agreement shall be binding on any party until the Owner gives the Contractor written notice that such funds are available from the Owner's funding source.

5.1.3 Subject to **Section 5.1.1**, the Contract shall become binding and effective upon execution by the Contracting Authority, Owner, Contractor, and Ohio Attorney General.

5.1.3.1 If the Contractor is a joint venture, **(1)** each individual joint venturer shall **(a)** sign the Agreement in its own name and **(b)** be a party to the Contract, and **(2)** the Contract and the Performance and Payment Bond shall be binding on and apply to all joint venturers jointly and severally.

5.1.3.2 If the Contractor is a limited liability company, which the Contracting Authority reasonably believes to be a special purpose or similar entity, the Contracting Authority may in its discretion require the limited liability company and each member of the limited liability company to **(1)** sign the Agreement in its own name and **(2)** be a party to the Contract. In that case, the Contract and the Performance and Payment Bond shall be binding on and apply to the limited liability company and to all of its members jointly and severally.

5.1.4 This Agreement may be executed in several counterparts, each of which shall constitute a complete original Agreement, which may be introduced in evidence or used for any other purpose without production of any other counterparts.

5.2 Representations.

5.2.1 The Contractor represents and warrants that it is not subject to an unresolved finding for recovery under ORC Section 9.24. If this representation and warranty is found to be false, the Contract is void, and the Contractor shall immediately repay to the Owner any funds paid under this Contract.

5.2.2 The Contractor hereby certifies that neither the Contractor nor any of the Contractor's partners, officers, directors, shareholders nor the spouses of any such person have made contributions in excess of the limitations specified in ORC Section 3517.13.

5.2.3 The Contractor, by signature on this Agreement, certifies that it is currently in compliance with, and will continue to adhere to, the requirements of Ohio ethics laws and conflict of interest laws and will take no action inconsistent with those laws.

5.2.4 The Contractor affirms to have read and understands Executive Order 2019-12D and shall abide by those requirements in the performance of this Contract. Notwithstanding any other terms of this Contract, the State reserves the right to recover any funds paid for services the Contractor performs outside of the United States for which it did not receive a waiver. The State does not waive any other rights and remedies provided the State in this Contract.

5.2.5 The Contractor affirms to have read and understands Executive Order 2022-02D regarding the prohibition of purchases from or investment in a Russian institution or company and shall abide by those requirements in the performance of this Contract. Notwithstanding any other terms of this Contract, the State reserves the right to recover any funds paid to the Contractor for purchases or investments in a Russian institution or company in violation of this paragraph. The provisions of this paragraph will expire when the applicable Executive Order is no longer effective.

5.2.6 During the performance of this Contract, if the Contractor changes the location(s) disclosed on the **Affirmation and Disclosure Form** (a page in its **Bid Form**), the Contractor must complete and submit a revised **Affirmation and Disclosure Form**.

5.2.7 Pursuant to ORC Section 9.76(B), the Contractor warrants that it is not boycotting any jurisdiction with whom the State of Ohio can enjoy open trade, including Israel, and will not do so during the term of this Contract.

ARTICLE 6 - Enumeration of Documents

6.1 The Contract Documents constitute the substance of the Contract, and include this Agreement, Drawings, Specifications, Addenda if any, **Contracting Definitions, General Conditions**, Supplementary Conditions if any, **Bid Form, Wage Rate Requirements, Bid Guaranty and Contract Bond or Performance and Payment Bond**, and Change Orders if any.

TREASURER’S CERTIFICATION

This signature certifies the amount required to meet the obligation in the fiscal year in which this Agreement is made has been lawfully appropriated for such purpose and is in the treasury or in process of collection to the credit of an appropriate fund free from any previous encumbrances.

Signature

Printed Name

Chief Financial Officer

SIGNATURES

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date set forth below:

«INSERT CONTRACTOR’S NAME»

STATE OF OHIO

Signature

Signature

Printed Name

Printed Name

Title

Title

OWNER’S CONCURRENCE
by «insert Owner’s name»

OHIO ATTORNEY GENERAL
Approval as to Form

Signature

Signature

Printed Name

Printed Name

Title

Title

Date

«INSERT CONTRACTOR'S NAME»
by «insert Joint Venturer/Member's name»

STATE OF OHIO
by «insert Contracting Authority's name»

Signature

Signature

Printed Name

Printed Name

Title

Title

by «insert Joint Venturer/Member's name»

OWNER'S CONCURRENCE
by «insert Owner's name»

Signature

Signature

Printed Name

Printed Name

Title

Title

OHIO ATTORNEY GENERAL
Approval as to Form

Signature

Printed Name

Title

Date

END OF DOCUMENT

Document 00 52 14 - State of Ohio Subcontract Form

State of Ohio Standard Requirements for Public Facility Construction

This Agreement is made as of the date set forth below between the Contractor and the Subcontractor in connection with the Project.

Project Number: ESC-230006/223193.00
Project Name: Convocation Center Expansion
Site Address: «1973 Edison Drive»
«Piqua, Miami County»

Contractor: «insert name»
Contractor's Principal Contact: «insert name»
Address: «insert street address»
«insert city, state zip code»

Subcontractor: «insert name»
Subcontractor's Principal Contact: «insert name»
Address: «insert street address»
«insert city, state zip code»

Public Authority: «Ohio Facilities Construction Commission»
Public Authority Contact: «Heather Brink»
Address: «William Green Building
30 West Spring Street, 4th Floor»
«Columbus, Ohio 43215»

ARTICLE 1 - NATURE OF SUBCONTRACT

1.1 The Subcontractor shall perform the entire Subcontract Work as specified in Exhibit «N» and described in the Contract Documents for the Project.

ARTICLE 2 - COMPENSATION

2.1 The Contractor agrees to pay for the performance of this Subcontract, subject to additions and deductions as provided in the Contract Documents, the Subcontract Sum of «insert Subcontract Sum», comprised of the following:

«insert Subcontract Sum component»\$«insert amount»
«insert Subcontract Sum component»\$«insert amount»
«insert Subcontract Sum component»\$«insert amount»
«insert Subcontract Sum component»\$«insert amount»

ARTICLE 3 - TIME OF PERFORMANCE

3.1 Time is of the essence. The Subcontractor shall diligently prosecute and complete all Subcontract Work in accordance with the construction progress schedule agreed between the parties.

ARTICLE 4 - CONTRACT DOCUMENTS

4.1 To the extent that the contract between the Public Authority and the Contractor applies to the Subcontract Work:

4.1.1 The Contractor and the Subcontractor agree to be mutually bound by the terms of the Contract Documents;

4.1.2 The Contractor assumes toward the Subcontractor the rights, remedies, obligations, and responsibilities that the Public Authority has and assumes toward the Contractor;

4.1.3 The Subcontractor assumes toward the Contractor the rights, remedies, obligations, and responsibilities that the Contractor assumes toward the Public Authority; and

4.1.4 The Subcontractor agrees to perform its portion of the Work in accordance with the Contract Documents.

4.2 The Subcontract and any modifications, amendments, or alterations thereto shall be governed, construed, and enforced by and under the laws of the State of Ohio.

4.3 If any term or provision of the Subcontract, or the application thereof to any Person or circumstance, is finally determined, to be invalid or unenforceable by a court of competent jurisdiction, the remainder of the Subcontract or the application of such term or provision to other Persons or circumstances, shall not be affected thereby, and each term and provision of the Subcontract shall be valid and enforced to the fullest extent permitted by law.

4.4 The Subcontract shall be binding on the Contractor and Subcontractor, their successors and assigns, in respect to all respective covenants and obligations contained in the Contract Documents, but the Subcontractor may not assign the Subcontract without the prior written consent of the Contractor and the Public Authority.

ARTICLE 5 - EFFECTIVENESS

5.1 The Subcontract shall become binding and effective upon execution by the Contractor.

5.2 This Subcontract has been executed in several counterparts, each of which shall constitute a complete original Subcontract, which may be introduced in evidence or used for any other purpose without production of any other counterparts.

5.3 Any signatory may deliver a copy of its counterpart signature page to this Subcontract via fax or e-mail. Each signatory shall be entitled to rely upon a signature of any other signatory delivered in such a manner as if such signature were an original.

ARTICLE 6 - REPRESENTATIONS

6.1 Contingent Assignment. The Contractor's contingent assignment of this Subcontract to the Public Authority, as provided in the Contract, is effective after termination of the Contractor by the Public Authority and the Public Authority's acceptance of the assignment in writing to the Subcontractor. The Subcontractor consents to the assignment and shall be bound at the same price and terms as in the Subcontract to the Public Authority. Unless the Public Authority takes assignment of the Subcontract, the Subcontractor will not have any contractual rights against the Public Authority.

6.2 Intended Third-Party Beneficiary. The Public Authority is an intended third party beneficiary of the Subcontract, entitled to enforce any rights thereunder for its benefit.

6.3 Insurance. The Subcontractor shall maintain insurance in accordance with the Contract Documents. Exhibit «N» sets forth the minimum limits of liability for the insurance required in the Contract Documents.

6.4 Right to Audit. The Subcontractor agrees that the Public Authority or any agents designated by the Public Authority have access to and the right to audit and the right to copy at the Public Authority's cost all of the Subcontractor's books, records, contracts, correspondence, instructions, drawings, receipts, vouchers, purchase orders, and memoranda relating to the Work for a period of not less than 3 years following completion of the Work consistent with Ohio Revised Code ("ORC") Section 149.43 with regard to the Public Authority's obligation to maintain confidentiality of trade secrets.

6.5 Indemnity. To the fullest extent permitted by law, the Subcontractor shall indemnify, defend, and hold harmless the Public Authority, the Contractor, their consultants and employees from all claims and expenses for bodily injury and property damage other than to the Work itself that may arise from the performance of the Subcontract Work, including reasonable attorneys' fees, costs and expenses, but only to the extent caused by the negligent acts or omissions of the Subcontractor or a person or entity for whom the Subcontractor may be liable. This Subcontract does not require a Subcontractor to waive its immunity under the Workers Compensation laws of Ohio from claims brought against the Subcontractor by the Subcontractor's employees.

6.6 Prompt Pay. The Contractor shall at a minimum make payments to the Subcontractor in accordance with Applicable Law, including ORC Section 4113.61. Progress payments to the Subcontractor for satisfactory performance of Subcontract Work shall be made no later than 10 days after receipt by the Contractor of payment from the Public Authority for Subcontract Work.

6.7 Retainage. Subcontractor retainage shall be at a rate equal to the percentage retained from the Contractor's payment by the Public Authority for the Subcontract Work, unless a lesser percentage is otherwise specified.

6.7.1 Labor Payments.

6.7.1.1 Partial payments to the Subcontractor for labor performed shall be made at the rate of 92 percent of the amount invoiced through the Subcontractor's request for payment that shows the Work of the Subcontractor is 50 percent complete.

6.7.1.2 After the Work of the Subcontractor is 50 percent complete, as evidenced by payments of at least 50 percent of the total amount due under the Subcontract, no additional funds shall be retained from payments for labor.

6.7.2 Material Payments.

6.7.2.1 The Contractor shall pay the Subcontractor at the rate of 100 percent of the scheduled value for materials incorporated into the Project.

6.7.2.2 The Contractor shall pay the Subcontractor at the rate of 92 percent of the invoice cost, not to exceed the scheduled value, for materials delivered to the Site, or other off-site storage location approved by the A/E, provided the Subcontractor provides the following information with its request for payment:

- .1 a list of the fabricated materials consigned to the Project, giving the place of storage, together with copies of invoices, in order to verify quantity and cost; and
- .2 a certification of materials stored off-site, prepared by the Subcontractor and signed by the A/E to evidence that the materials are in conformity with the Specifications and have been tagged with the Project name and number for delivery to the Project. The Subcontractor shall reimburse the A/E, through the Contractor, for all costs incurred to visit a storage site, other than the areas adjacent to the Project.
- .3 The Contractor shall pay the balance of the scheduled value when the materials are incorporated into and become a part of the Project.

6.8 Warranty. The Subcontractor fully warrants, for the benefit of the Public Authority, that all materials and equipment shall be new unless otherwise specified, of good quality, in conformance with the Contract Documents and free from defective workmanship or materials.

6.9 Non-Waiver of Lien Rights or Payment Bond Rights. This Subcontract shall not prohibit a Subcontractor from exercising its rights under ORC Chapter 1311 or under any Contractor-provided payment bond.

6.10 Non-Discrimination. The Subcontractor agrees to fully comply with Applicable Law regarding equal opportunity, including ORC Section 153.59 and, to the extent applicable, all Executive Orders issued by the Governor of the state of Ohio.

6.11 Dispute Resolution. The supplemental conditions to this Subcontract shall provide for a dispute resolution process comparable to the Contract's dispute resolution process in terms of timing, notice, substantiation, and informal dispute resolution efforts. The dispute resolution process provided in the supplemental conditions shall result in prompt access to the ultimate dispute resolution mechanism selected by the parties.

6.12 In the event that any supplemental conditions or other Subcontract terms conflict with the **State of Ohio Subcontract Form**, the **State of Ohio Subcontract Form** takes precedence and this Subcontract shall be read and enforced to include the provisions of the **State of Ohio Subcontract Form**.

6.13 The following exhibits are attached to and are a part of this Subcontract:

6.13.1 Exhibit A:

6.13.2 Exhibit B:

6.13.3 Exhibit C:

6.13.4 Exhibit D:

SIGNATURES

IN WITNESS WHEREOF, the parties have executed this Subcontract Form.

«INSERT SUBCONTRACTOR'S NAME»

«INSERT CONTRACTOR'S NAME»

Signature

Signature

Printed Name

Printed Name

Title

Title

Date

END OF DOCUMENT

Public Bid Advertisement (Electronic Bidding) State of Ohio Standard Forms and Documents

ESC-230006
Convocation Center Expansion
Edison State Community College
Piqua, Miami County

Bids Due: 2:00 pm local time, May 1, 2024, through the State's electronic bidding system at <https://bidexpress.com>

EDGE Participation Goal: 5.0% of contract

Domestic steel use is required per ORC 153.011.

<u>Contract</u>	<u>Estimated Cost</u>
General Contract	\$1,573,676.00
Alternate No. 1 – Training Room	\$ 160,255.00
Alternate No. 2 – Built-In Casework	\$ 9,680.00
Alternate No. 3 – Loose Furnishings	\$ 39,751.00
Alternate No. 4 – Plastic Toilet Compartment	\$ 1,954.00
Alternate No. 5 – Moisture Vapor Emission Control	\$ 7,924.00
Alternate No. 6 – Parking Lot Cameras	\$ 10,000.00

Pre-bid Meeting: April 22, 2024, 10:00 am, Edison State Community College, North Hall, 1973 Edison Drive, Piqua, OH 45356.

Bid Documents: FREE to download electronically at <https://bidexpress.com>. Registration is required.

More Info: A/E contact: Fanning Howey, Rodney Wiford, Phone: 419.586.7771, E-mail: rwiford@fhai.com

----- end of advertisement—do not publish this line -----

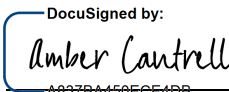
APPROVED FOR PUBLICATION

In: Dayton Daily News
On: April 9, 2024
April 16, 2024
April 23, 2024

Ohio Facilities Construction Commission

RECEIVED BY:

Type or print name of authorized representative

DocuSigned by:


Name
Project Coordinator

4/4/2024

Date

Signature

Date

Document 00 61 13 - Performance and Payment Bond Form
State of Ohio Standard Requirements for Public Facility Construction

(Form of Bond prescribed by Ohio Revised Code Section 153.57 - Not to be used as Bid Guaranty)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned _____,
_____, as Principal,
and _____ as Sureties,
are hereby held and firmly bound unto _____
_____ as Obligee(s), in the penal sum of _____ dollars,
for the payment of which well and truly to be made, we jointly and severally bind ourselves, our heirs, executors,
administrators, successors, and assigns.

SIGNED AND SEALED this _____ day of _____, _____.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that whereas the above-named Principal did on the
_____ day of _____, _____, enter into a Contract with the Obligee, which said Contract is
made a part of this Bond the same as though set forth herein and which is more fully described as:

Project Number: _____

Project Name: _____

Contract Description: _____
(e.g., General Trades, Plumbing, HVAC, Electrical)

NOW, THEREFORE, if the above-named Principal shall well and faithfully do and perform the things agreed by the
Obligee to be done and performed according to the terms of said Contract; and shall pay all lawful claims of Subcontractors,
Material Suppliers, and laborers, for labor performed and materials furnished in the carrying forward, performing, or
completing of said Contract; we agreeing and assenting that this undertaking shall be for the benefit of any Subcontractor,
Material Supplier or laborer having a just claim as well as for the Obligee herein; then this obligation shall be void; otherwise
the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the Sureties for
any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

THE SAID Surety hereby stipulates and agrees that no modifications, omissions, or additions, in or to the terms of
the said Contract or in or to the Plans and Specifications therefor shall in any wise affect the obligations of said Surety on its
bond, and it does hereby waive notice of any such modifications, omissions or additions in or to the terms of the Contract, the
Work or the Contract Documents, including without limitation the Plans and Specifications.

PRINCIPAL:

Principal Signature

By: _____

Title: _____

SURETY:

Surety Signature

By: _____
Attorney-in-Fact

SURETY INFORMATION:

Street

City State Zip

Telephone Number

SURETY AGENT'S INFORMATION:

Agency Name

Street

City State Zip

Telephone Number

Email Address

END OF DOCUMENT

Document 00 61 13.19 - Acknowledgement of Surety (General Contracting)
State of Ohio Standard Requirements for Public Facility Construction

Project Number: _____

Project Name: _____

Owner: _____

Contracting Authority: _____

Contractor: _____

Surety Name: _____

Performance & Payment Bond No.: _____

Original Penal Sum: _____

As required under the Contract between the State of Ohio, acting by and through the Contracting Authority, and the Contractor in connection with the Project, the Surety hereby acknowledges that the Penal Sum of the above-mentioned Bond has been increased to \$ _____ (*must be not less than 100% of the Contract Sum*).

SURETY:

SURETY INFORMATION:

Surety Signature

Street

By: _____
Attorney-in-Fact

City State Zip

Date

Telephone Number

SURETY AGENT'S INFORMATION:

Agency Name

Street

City State Zip

Telephone Number

END OF DOCUMENT

Certified Payroll Report (Prevailing Wage)

CHECK IF CORRECTED

State of Ohio Standard Forms for Public Facility Construction

EMPLOYER NAME AND ADDRESS			NAME OF GENERAL / PRIME CONTRACTOR				PROJECT NAME AND LOCATION (COUNTY)				CONTRACTING PUBLIC AUTHORITY / OWNER									
CHECK IF SUBCONTRACTOR ¹ <input type="checkbox"/>			WEEK ENDING _____				PAYROLL NUMBER _____ PAGE ² _____ of _____				PROJECT / CONTRACT NUMBER _____									
1. NAME, CURRENT ADDRESS, ³ AND LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER		2. WORK ⁴ CLASSIFICATION	3. RACE AND SEX	4. HOURS WORKED - DAY AND DATE				5. TOTAL PROJ HRS	6. BASE WAGE RATE	7. PROJ GROSS WAGES	8. FRINGES: CASH <input type="checkbox"/> APPROVED PLANS <input type="checkbox"/> CASH AND APPROVED PLANS <input type="checkbox"/>					9. TTL HRS ALL JOBS	10. TOTAL GROSS ALL JOBS	11. TAXES WITHHELD	12. OTHER DEDUCTIONS	13. NET WAGES PAID
										H&W	PENS	VAC	APP	OTHER						
			OT																	
			ST																	
			OT																	
			ST																	
			OT																	
			ST																	
			OT																	
			ST																	
			OT																	
			ST																	
			OT																	
			ST																	

My signature on this form signifies that (1) I pay, or supervise the payment of the employees shown above; (2) during the pay period reported on this form, all hours worked on this Project have been paid at the appropriate prevailing wage rate for the class of work done; (3) the fringe benefits have been paid as indicated above; (4) no rebates or deductions have been or will be made, directly or indirectly from the total wages earned, other than permissible deductions as defined in Ohio Revised Code Chapter 4115; and (5) apprentices are registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training. I understand that the willful falsification of any of the above statements may subject the Contractor or Subcontractor to civil action or possible criminal prosecution.

Type or Print Name and Title: _____ Signature: _____ Date: _____

CONTRACTOR'S PERSONAL PROPERTY TAX AFFIDAVIT
(O.R.C. § 5719.042)

State of Ohio
County of _____, ss:

_____, being first duly sworn, deposes and says that he/she is the
(Name)

_____ of _____
(Title) **(Name and Address of Contractor)**

_____ (the "Contractor") and
as its duly authorized representative, states that effective this ____ day of _____, 20____,
the Contractor:

() is charged with delinquent personal property taxes on the general list of personal property as set forth below:

<u>County</u>	<u>Amount</u> (include total amount penalties and interest thereon)
_____ County	\$ _____
_____ County	\$ _____
_____ County	\$ _____

() is not charged with delinquent personal property taxes on the general list of personal property in any Ohio county.

(Affiant)

Sworn to and subscribed before me by the above-named affiant this ____ day of _____, 20____.

(Notary Public)

My commission expires

_____, 20__

Document 00 71 00 - Contracting Definitions (General Contracting Project)

State of Ohio Standard Requirements for Public Facility Construction

Acceptable Component	A component listed in the Specifications after the Basis of Design Component.
Addenda or Addendum	Written or graphic instrument issued prior to the bid opening which modifies or interprets the proposed Contract Documents by additions, deletions, clarifications, or corrections. Addenda become part of the Contract Documents when the Agreement is executed.
ADR	See “Alternative Dispute Resolution.”
A/E	See “Architect/Engineer.”
Agreement	The form furnished by the Contracting Authority (including all of its exhibits) that, when completed and signed by the Contractor and Contracting Authority evidences entry into the Contract.
Allowance	A sum stipulated in the Contract Documents for a defined scope of the Work that may not be completely defined at the time of bidding. Allowance amounts do not include the Contractor’s Fee on account of the associated Work.
Alternate	A change in the proposed Project scope, which may include but is not limited to alternate materials or methods of construction, and an amount stated on the Bid form to be added to or deducted from the Base Bid if the corresponding Alternate is incorporated into the Contract.
Alternative Dispute Resolution	A voluntary and non-binding process for the administrative review, consideration, and attempted settlement of a dispute, without resort to judicial process, including but not limited to partnering, negotiation, mediation, impartial fact-finding, dispute review board, and mini-trials, but shall not include arbitration.
Applicable Law	All federal, state, and local codes, statutes, ordinances, and regulations that apply to the performance of the Work or the A/E’s Services on the Project.
Architect/Engineer	The Person responsible for providing professional design services and construction contract administration for the Project as provided in the Contract Documents. The A/E shall be a (1) registered architect holding a license and certificate of authorization issued by the Ohio Architects Board pursuant to ORC Chapter 4703, (2) landscape architect holding a license and certificate of authorization issued by the Ohio Landscape Architects Board pursuant to ORC Chapter 4703, or (3) professional engineer or professional surveyor holding a license and certificate of authorization issued by the Ohio Engineers and Surveyors Board pursuant to ORC Chapter 4733.
As-Built Documents	Documents, including but not limited to Drawings, Addenda, Specifications, Modifications, and other elements of the Contract Documents which the Contractor annotates and otherwise modifies to indicate changes made during the construction process, the location of concealed and buried items, and other information useful to the Owner throughout the life of the completed Project.
Base Bid	The amount stated in a Bid as the sum for which the Bidder offers to perform the Work in a particular trade or other category, which is described in the Contract Documents, excluding Alternates.
Basis of Design	A document that records the concepts, calculations, decisions, and product selections used to meet the Owner’s Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
Basis of Design Component	A component listed first in the Specifications.

Bid	A written proposal to perform a Contract, submitted on a completed Bid Form, accompanied by other required documents. The term Bid includes a proposal that has been digitally signed, encrypted, and submitted through the State's electronic bidding application pursuant to OAC Section 153:1-8-01.
Bidder	A Person that submitted a Bid.
BIM	See "Building Information Model."
Bid Form	A form furnished by the Contracting Authority with the proposed Contract Documents that is to be completed, signed, and submitted containing the Bidder's Bid.
Bid Guaranty	A bid bond or other instrument of security authorized by ORC Section 153.54 submitted with the Bid to provide assurance that the Bidder will execute the Agreement.
Bond	A performance and payment bond in the format specified by ORC Section 153.57 submitted by the Contractor to provide assurance that the Contractor will perform the Work of the Contract, including making required payments to Subcontractors and Materials Suppliers.
Building Information Model	A digital representation of physical and functional characteristics of a facility; a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle, which is defined as existing from earliest conception to demolition; electronic files used to design and coordinate the Project; and may be used to describe a single model or multiple models used in the aggregate.
Certificate of Contract Completion	A form used to document that the Contractor's achievement of Contract Completion. This form may also be used to document partial Contract Completion.
Certificate of Substantial Completion	A form used to document (1) that the Contractor has achieved Substantial Completion of the Work or a designated portion of the Work for which the Contracting Authority and the Owner have agreed to take Partial Occupancy, and (2) the date on which the associated Substantial Completion of the Work was achieved.
Change Directive	A written document prepared by the A/E and executed by the Contracting Authority that directs a change in the Work.
Change Order	A document recommended by the A/E and executed by the Contracting Authority and the Contractor that modifies the Contract.
Claim	A demand or assertion, initiated by written notice, certified by one of the parties to the Contract seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time, or other relief with respect to the terms of the Contract.
Commission	See "Ohio Facilities Construction Commission."
Commissioning Agent	The Person identified by the Contracting Authority who leads, plans, schedules, and coordinates the commissioning team to implement the Commissioning Process for the Project.
Commissioning Plan	A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.
Commissioning Process	A quality-focused process for enhancing the delivery of a project. The process focuses on verifying and documenting that the facility and all of its systems are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

Commissioning Report	A document that records the activities and results of the Commissioning Process. The Commissioning Report is developed from the final Commissioning Plan with its attached appendices.
Conformed Documents	Contract Documents with all Addenda items and accepted Alternates incorporated by the A/E, published, and issued to a successful Bidder for its use during performance of the Contract. The Conformed Documents are furnished solely for the Contractor's convenience. In the event of any conflict between the Contract Documents modified by Addenda and the Conformed Documents, the Contract Documents take precedence.
Construction Budget	The amount identified in the Agreement as adjusted by the Owner and Contracting Authority.
Construction Cost	The sum of the Contract Cost amounts for a phase of the Project.
Construction Progress Schedule	The critical path schedule for performance of the Contract; showing the time for completing the Work within the Contract Times; the planned sequence for performing the various components of the Work; the interrelationship between the activities of the Contractor, A/E, Contracting Authority, and Owner; and the Contractor's resource and cost loading information; as periodically updated during the performance of the Work.
Contract	The state of legal obligation entered into by the State and the Contractor, whereby they have agreed to an exchange of certain acts, materials, equipment, and services for certain monetary consideration, under all terms and conditions specified in the Contract Documents, which shall remain in full force and effect until such time as all obligations under the Contract have been lawfully and completely discharged, or the Contract is terminated under other conditions specified in the Contract Documents.
Contract Completion	The schedule Milestone in the progress of any Phase when the Work is completed in accordance with the terms of the Contract Documents and Contractor has satisfied all of its other obligations under the Contract Documents, including but not limited to (1) all governmental authorities have given final, written approval of the Work, (2) a final unconditional certificate of occupancy has been granted and issued to the Owner by the appropriate governmental authorities, (3) the Contractor's Work is 100 percent complete, and (4) all Punch List items have been completed or corrected, and (5) the Contractor has complied with conditions precedent to final payment and release of retained funds.
Contract Documents	Collectively, the documents that constitute the substance of the Contract including Drawings, Specifications, Addenda if any, General Conditions, Supplementary Conditions if any, Bid Form, Wage Rates; and the executed Agreement, Bid Guaranty and Contract Bond, and Modifications if any.
Contract Sum	The Contract Sum is the Contractor's entire compensation for the Contractor's proper, timely, and complete performance of the Work and is subject to adjustment as provided in the Contract.
Contract Times	The periods stipulated in the Agreement for the achievement of associated Milestones, in consecutive days, beginning on the date established by the Notice to Proceed, including adjustments authorized by executed Change Orders.
Contracting Authority	The party identified as such in the Agreement, which may be the Ohio Facilities Construction Commission; an agency of the state of Ohio; an Institution of Higher Education or division thereof; a School District Board; or the legislative body of a political subdivision.
Contractor	A firm, which is party to the Contract for the performance of Work on the Project in accordance with the Contract Documents.
Contractor's Documents	All Project-related documents, including those in electronic form, prepared by the Contractor and its Subcontractors.

Contractor's Fee	The portion of the Contract Sum attributable to the aggregate of the Contractor's profit and home-office overhead related to the Contractor's proper, timely, and complete performance of the Work.
Contractor Payment Request	The form furnished by the Commission that is to be used by the Contractor in requesting payments and which, when signed by the Contractor, shall serve as an affidavit that payments requested are in proportion to the Work completed as shown on the Schedule of Values.
Contractor's Punch List	A document prepared by the Contractor that consists of a list of items of Work to be completed or corrected by the Contractor as a condition precedent to Contract Completion.
Coordination Drawings	Drawings and Electronic Files prepared by the Contractor to demonstrate how multiple-system and interdisciplinary work will be coordinated. Clash reports generated by BIM authoring software may be included in the Coordination Drawing submittals if applicable.
Correction Period	A period of one year commencing on the date of Substantial Completion of the Work or a designated portion of the Work which the Contracting Authority and Owner have agreed to take Partial Occupancy.
CxA	See "Commissioning Agent."
Date of Commencement	The date established in a Notice to Proceed issued by the Contracting Authority to the Contractor to mark the start of the Work and the beginning of the running of the Contract Times.
day	A calendar day of 24 hours measured from midnight to midnight, unless otherwise expressly specified to mean a business day.
Defective Work	Work that does not conform to the Contract Documents; or does not meet the requirements of any applicable statute, rule or regulation, inspection, reference standard, test or approval; or has been damaged prior to the A/E's recommendation of final payment, unless responsibility for the protection thereof has been expressly assumed by the Owner; or that is not free from defects in workmanship, materials, or equipment during the period of any warranty or guarantee.
Differing Site Condition	Either (1) a subsurface or otherwise concealed physical condition encountered at the Site that differs materially from the conditions indicated in the Contract Documents or (2) an unknown physical condition of an unusual nature encountered at the Site that differs materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents.
Dispute Review Board	A form of Alternative Dispute Resolution that is typically comprised of three members, selected jointly by the Contractor and the Contracting Authority, to monitor the progress of construction and provide recommended resolutions to disputes that are brought before them.
Drawings	Graphic portions of the Contract Documents, showing the design, type of construction, location, dimension, and character of the Work to be provided by the Contractor, which generally includes plans, elevations, sections, details, schedules, diagrams, notes, and text.
Electronic File	Information maintained in a computer system or format that is intended to facilitate a Person's use and manipulation of the information including but not limited to Word, Excel, PDF, Primavera, CAD, and BIM files all in their native format.
Enclosure, Permanent	The condition in which the permanent exterior walls and roofs are in place, insulated and weathertight, and permanent windows and entrances are in place.
Enclosure, Temporary	The condition in which the permanent exterior walls and roofs are in place, insulated and weathertight, and windows and entrances are provided with suitable temporary enclosures.

Estimated Construction Cost	The sum of the Estimated Contract Cost amounts published in the Solicitation, as modified by Addenda, for a phase of the Project.
Estimated Contract Cost	The estimated amount for the Contract published in the Solicitation, including the Base Bid estimate and the estimates of selected Alternates, if any, as modified by Addenda.
Extra Materials	Materials required by the Contract Documents that are not incorporated into the Project but are given to the Owner to be used for future maintenance or repairs.
Fee	See "Contractor's Fee."
Final Inspection	The final review of the Work of the Contractor by the A/E to determine whether issuance of the Certificate of Contract Completion is appropriate.
furnish	Supply and deliver to the Site, or other specified location, ready for installation.
General Conditions	The State's Standard General Conditions in effect as of the date of the Agreement.
General Conditions Costs	General Conditions Costs include only the Contractor's costs to provide the general conditions Work including without limitation the costs of all of the following Site-related items: scheduling and coordinating the Work, telephone, telephone charges, facsimile, telegrams, postage, photos, photocopying, hand tools, simple scaffolds (one level high), tool breakage, tool repairs, tool replacement, tool blades, tool bits, and pre-approved travel, lodging, and parking costs. General Conditions Costs also include (1) Bond premiums and (2) premiums for builder's risk insurance if the Contractor purchases the builder's risk policy for the Project.
Hazardous Materials	Any material, substance, pollutant, or contaminant that is defined, regulated, referenced, or classified in the Comprehensive Environmental Response, Compensation and Liability Act, Federal Water Pollution Control Act, the Resource Conservation and Recovery Act, Clean Air Act, Hazardous Materials Transportation Uniform Safety Act, Toxic Substances Control Act, or any other Applicable Law relating to any hazardous, toxic, or dangerous waste, substance, or material. Any substance or material that, after release into the environment or upon exposure, ingestion, inhalation, or assimilation, either directly from the environment or directly by ingestion through food chains, will, or may reasonably be anticipated to, cause death, disease, behavior abnormalities, cancer or genetic abnormalities and specifically includes but is not limited to asbestos, polychlorinated biphenyls ("PCBs"), radioactive materials, including radon and naturally occurring radio nuclides, natural gas, natural gas liquids, liquefied natural gas, synthetic gas, oil, petroleum and petroleum-based derivatives and urea formaldehyde.
Indemnified Parties	The State, Contracting Authority, Owner, A/E, other Separate Consultants, and their respective officials, officers, consultants, agents, representatives, and employees, in both individual and official capacities.
install	Put into use or place in final position, complete and ready for intended service or use.
Institutional Designee	The party identified in the Agreement empowered with a level of authority similar to the Executive Director of the Commission, which may be the university architect or engineer, director of capital facilities, or an institution vice president.
Institution of Higher Education	Any state of Ohio university or college, community college, state of Ohio community college, technical college, university branch, community college district, technical college district, university branch district, and the applicable board of trustees or, in the case of a university branch district, any other managing authority.
Liquidated Damages	A sum established in the Contract Documents, pursuant to the statutory delay forfeiture authorized under ORC Section 153.19, to be paid to the Owner due to the Contractor's failure to complete the Work within the Contract Time for achievement of Substantial Completion, or any applicable portion of the Work on or prior to any Milestone date stated on the Agreement.

Material Supplier	A Person under a contract with the Contractor to furnish materials or supplies in furtherance of the Work, including all such Persons in any tier. Material Supplier does not include any Separate Contractor unless expressly assigned in writing to the Contractor by the Owner and accepted by the Contractor.
mediation	A voluntary process in which a neutral third party meets with the parties who have a disagreement or dispute and attempts to facilitate a mutually satisfactory resolution.
Milestone	A principal event specified in the Contract relating to a completion date or time.
Modification	A (1) written amendment to the Contract signed by both parties, (2) Change Order, (3) Change Directive, or (4) an order for a minor change in the Work.
negotiation	A form of Alternative Dispute Resolution in which all parties involved are represented by those invested with the authority to agree to a determination of an adjustment in the Contract Sum, Contract Times, or both.
Neutral Facilitator	A nonpartisan third-party without decision-making authority who is engaged to assist the Project's key stakeholders in developing cooperative relationships, achieving project objectives, avoiding or minimizing disputes, and nurturing a more-collaborative ethic characterized by trust, cooperation, and teamwork.
Notice of Commencement	A notice prepared by the Contracting Authority identifying the Project, the Contractors, the Surety for each Contractor, and the name of the Contracting Authority's representative upon whom a claim affidavit may be served.
Notice of Intent to Award	A written notice provided by the Contracting Authority to the apparent successful Bidder stating that upon satisfactory compliance with all conditions precedent for execution of a Contract within the time specified, the Contracting Authority intends to execute a Contract with the Bidder.
Notice to Proceed	A written notice provided by the Contracting Authority authorizing the Contractor to proceed with the Work and establishing the dates for commencement and completion of the Work.
OAC	Ohio Administrative Code
Ohio Facilities Construction Commission	The authorized contracting agent for public improvement projects in accordance with ORC Chapters 123 and 153, acting by and through its Executive Director.
ORC	Ohio Revised Code
Owner	The state of Ohio agency, Institution of Higher Education or division thereof, School District Board, or other instrumentality for whom the Project is being constructed.
Owner's Project Requirements	A written document that details the functional requirements of the Project and the expectations of how it will be used and operated. These requirements include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
Partial Occupancy	The condition that occurs when the Owner occupies or uses a portion of the Project prior to Contract Completion, partial occupancy is approved by authorities with jurisdiction over the Project and the insurer(s) providing the builders risk insurance, and items of Work cannot be completed until a subsequent date.
partnering	A voluntary dispute prevention process involving team building activities to help define common goals, improve communication, and foster a problem-solving attitude among a group of contracting parties that must work together throughout Contract performance to be less adversarial and more cooperative.
Payment Request	See "Contractor Payment Request."
Person	An individual, corporation, business trust, estate, partnership, association, or other public or private entity.

Phase	A separation in the Work of the Project by sequence or time intervals, which may include separate contractors for each Phase.
Plan Holder	A prospective Bidder that received a set of Contract Documents prior to the bid opening.
Product Data	Manufacturer's standard illustrations, schedules, diagrams, performance charts, instructions, and brochures that illustrate physical appearance, size, and other characteristics of materials and equipment.
Project	The public improvement, of which the Work performed under the Contract Documents may be the whole or a part.
Project Manager	A permanent employee of the Contracting Authority assigned to the Project and authorized to perform specific responsibilities.
Project Manual	That part of Construction Documents which consists of bound volume(s) of primarily written material which generally contain Division 00 - "Procurement and Contracting Requirements," and Divisions 01 through 49 - "Specifications," and other documents pertaining to the Project.
Proposal	The offer of a Contractor to perform the Work set forth in a Proposal Request.
Proposal Request	A document issued after execution of the Contract requesting a Proposal from the Contractor(s), which may initiate a Change Order to modify the Contract.
provide	Furnish and install, complete and ready for intended use.
Punch List	A document listing items of Work requiring correction or completion by the Contractor as a condition precedent to Contract Completion.
Punch List Milestone	The date 30 days after the achievement of Substantial Completion of all or a portion of the Work.
Record Documents	Electronic files and printed documents of all nature prepared by the A/E, which incorporate the information shown on the Contractor's As-Built Documents. They consist of the "Record Drawings" and "Record Project Manual," Certificate of Substantial Completion, Certificate of Contract Completion (as complete), Contractor's Warranty, Manufacturers' Warrantees, certificate(s) of occupancy, approved shop drawings and other action submittals, responses to Requests for Information, Addenda, Modifications, Balancing Reports, and the final version of the approved Construction Progress Schedule.
Record Drawings	The Drawings, which have been revised by the A/E to show the changes made during the construction process, conformed to represent the Work as executed by the Contractor.
Record Model	The Building Information Model, which has been revised by the A/E to show the changes made during the construction process, conformed to represent the Work as executed by the Contractor.
Record Project Manual	The Project Manual of the Contract Documents, which has been revised by the A/E to show the changes made during the construction process, based on the As-Built Project Manual furnished by the Contractor.
Request for Change Order	A written notice from the Contractor accompanied by a Proposal for a change in the Work.
Request for Information	A written request to the A/E seeking an interpretation or clarification of the Contract Documents.
RFI	See "Request for Information."
Samples	Physical examples, color selection items, field samples, and mock-ups furnished by the Contractor to illustrate functional and aesthetic characteristics of products, materials, equipment, or workmanship and establish criteria by which the Work shall be judged.

Schedule of Values	A full, accurate, and detailed statement furnished by the Contractor reflecting a defined breakdown of the Contract Sum.
School District	A local, exempted village, or city school district as defined in ORC Chapter 3311, or a joint vocational school established pursuant to ORC Section 3311.18, performing essential governmental functions of state government pursuant to ORC Sections 3318.01 to 3318.20.
School District Board	The board of education of a School District.
Separate Consultant	A Person engaged by the Owner or Contracting Authority to provide Project-related professional services other than the services under this Contract. The term includes the Separate Consultant's authorized representatives, successors, assigns, and subconsultants regardless of tier.
Separate Contract	The contract between the Owner or Contracting Authority and a Separate Consultant or a Separate Contractor.
Separate Contractor	A Person under contract with the Owner or Contracting Authority to provide Project-related work other than the Work under this Contract. The term includes the Separate Contractor's authorized representatives, successors, assigns, and subcontractors regardless of tier.
Shop Drawings	Drawings, diagrams, illustrations, and schedules specifically prepared for the Project provided by the Contractor or a Subcontractor to illustrate some portion of the Work. Shop Drawings are not Contract Documents. Shop Drawings on equipment shall include a written statement from the manufacturer of the equipment certifying the equipment is in compliance with the Contract Documents.
Site	The location designated for the Project.
Specifications	Those portions of the Contract Documents consisting of detailed written administrative, procedural, and technical requirements, included in Divisions 01 through 49, for the construction of the Work, whether physically on the Drawings or bound in separate volumes, including identification of acceptable materials, methods, equipment, quality, and workmanship.
Stage	A distinct period in the life cycle of a facility from concept through construction, to use and deconstruction or demolition. Typical Stages include Program Verification, Schematic Design, Design Development, Construction Documents, Bidding and Award stages; and the Construction Stage, which includes Construction and Closeout activities.
Standard Requirements	The brief name of the "State of Ohio Standard Requirements for Public Facility Construction," including but not limited to General Conditions, and other Division 00 Documents and Division 01 Sections; in effect as of date of the Agreement.
State	The government of Ohio, including any organized body, office, or agency established by the laws of this state for the exercise of any function of state government, or any state institution of higher education as defined in ORC Section 3345.011.
Subcontract	Any contract or agreement between the Contractor and a Subcontractor for performance of a portion of the Work.
Subcontract Form	The State of Ohio Subcontract Form prescribed by OAC Section 153:1-3-02 and required for use with the General Contracting method of project delivery.
Subcontractor	A Person who undertakes to perform any part of the Work on the Project under a contract with a Contractor or with any Person other than the State, including all such Persons in any tier. The term "Subcontractor" includes Material Suppliers, but does not include any Separate Contractor unless expressly assigned in writing to the Contractor by the Owner and accepted by the Contractor.

Substantial Completion	The stage in the progress of the Work when the Work (or designated portion of the Work for which the Contracting Authority and Owner have agreed to take Partial Occupancy) is sufficiently complete in accordance with the Contract that the Owner can utilize the Work for its intended use, as determined by the A/E. The issuance of a certificate of occupancy or partial certificate of occupancy (if applicable) is a condition precedent to the achievement of Substantial Completion.
Substantially Complete	See “Substantial Completion.”
Substitution	An article, device, material, equipment, form of construction, or other item, proposed by a prospective Bidder prior to the bid opening and approved by the A/E by Addendum, for incorporation or use in the Work as being functionally and qualitatively equivalent to essential attributes of a Basis of Design or Acceptable Component specified in the proposed Contract Documents.
Supplementary Conditions	Amendments to the General Conditions, issued as a separate document, which describe conditions of the Contract unique to a particular Owner or Project, which may include provisions regarding the assignment of responsibility for refuse removal, safety and security precautions and programs, temporary Project facilities and utilities, weather and fire protection, scaffolding and equipment, materials and services to be used commonly by the Contractor and Subcontractors and requiring the Contractor to provide assistance in the utilization of any applicable equipment system, preparation of operation and maintenance manuals, and training of Owner personnel for operation and maintenance of the Project. The General Conditions shall not be superseded or amended by Drawings and Specifications, unless so provided in Supplementary Conditions prepared by the Contracting Authority and approved by the Commission.
Supplementary Instructions	Amendments to the Instructions to Bidders, issued as a separate document, which describe instructions unique to a particular Owner or Project. The Instructions to Bidders shall not be superseded or amended by Drawings and Specifications, unless so provided in Supplementary Instructions prepared by the Contracting Authority and approved by the Commission.
Surety	A Person providing a Bid Guaranty or a Bond to a Bidder or a Contractor, as applicable, to indemnify the State against all direct and consequential damages suffered by failure of the Bidder to execute the Contract, or of the Contractor to perform the Contract and to pay all lawful claims of Subcontractors, Material Suppliers and laborers, as applicable.
Systems Manual	A system focused composite document that includes the operation manual, maintenance manual, and additional information of use to the Owner after they begin using the facility.
Unit Price	The cost of providing a unit of Work including labor, materials, services, and associated expenses. Unit Prices do not include the Contractor’s Fee on account of the associated Unit Price Work.
Work	The labor, materials, equipment, and services, individually or collectively which are required by the Contract Documents, to be performed or provided by the Contractor for the Project. The furnishing of all material, labor, detailing, layout, supplies, plants, tools, scaffolding, transportation, temporary construction, superintendence, demolition, and all other services, facilities and items reasonably necessary for the full and proper performance and completion of the requirements of the Project as set forth in the Contract Documents, and items reasonably inferable therefrom and consistent therewith for the proper execution and completion of the construction and other services required by the Contract Documents, whether provided or to be provided by the Contractor or a Subcontractor, or any other entity for whom the Contractor is responsible, and whether or not performed or located on or off of the Site.

END OF DOCUMENT

**Document 00 72 13 - General Conditions (General Contracting Project)
State of Ohio Standard Requirements for Public Facility Construction**

TABLE OF CONTENTS

ARTICLE 1 - CONTRACTOR’S RESPONSIBILITIES1
ARTICLE 2 - STATE’S RIGHTS AND RESPONSIBILITIES5
ARTICLE 3 - A/E’S RESPONSIBILITIES6
ARTICLE 4 - SUBCONTRACTORS7
ARTICLE 5 - PRECONSTRUCTION ACTIVITIES9
ARTICLE 6 - CONSTRUCTION AND CLOSEOUT10
ARTICLE 7 - MODIFICATIONS28
ARTICLE 8 - DISPUTE RESOLUTION35
ARTICLE 9 - COMPENSATION AND PAYMENT41
ARTICLE 10 - BONDS, INSURANCE, AND INDEMNIFICATION45
ARTICLE 11 - SUSPENSION AND TERMINATION52
ARTICLE 12 - GENERAL PROVISIONS55
KEYWORD INDEX59

ARTICLE 1 - CONTRACTOR’S RESPONSIBILITIES

1.1 Nondiscrimination

1.1.1 The Contractor shall comply with Applicable Law regarding equal employment opportunity, including ORC Section 153.59 and all Executive Orders issued by the Governor of the state of Ohio.

1.1.1.1 As required under ORC Section 153.59, the Contractor agrees to both of the following:

- .1** “in the hiring of employees for the performance of work under the contract or any subcontract, no contractor, subcontractor, or any person acting on a contractor’s or subcontractor’s behalf, by reason of race, creed, sex, disability or military status as defined in section 4112.01 of the Revised Code, or color, shall discriminate against any citizen of the state in the employment of labor or workers who is qualified and available to perform the work to which the employment relates;” and
- .2** “no contractor, subcontractor, or any person on a contractor’s or subcontractor’s behalf, in any manner, shall discriminate against or intimidate any employee hired for the performance of work under the contract on account of race, creed, sex, disability or military status as defined in section 4112.01 of the Revised Code, or color.”

1.1.1.2 The Contractor shall cooperate fully with the State’s Equal Opportunity Coordinator (“EOC”), with any other official or agency of the state or federal government that seeks to eliminate unlawful employment discrimination, and with all other state and federal efforts to assure equal employment practices under the Contract.

1.1.1.3 In the event the Contractor fails to comply with these nondiscrimination clauses, the Contracting Authority shall deduct from the amount payable to the Contractor a forfeiture of the statutory penalty pursuant to ORC 153.60 for each person who is discriminated against or intimidated in violation of this **Section 1.1.1**.

1.1.1.4 The Contract may be terminated or suspended in whole or in part by the Contracting Authority and all money to become due hereunder may be forfeited in the event of a subsequent violation of this **Section 1.1.1**.

1.1.2 Hiring Under State Public Improvement Contracts.

1.1.2.1 Any provision of a hiring hall contract or agreement which obligates the Contractor to hire, if available, only employees referred to the Contractor by a labor organization shall be void as against public policy and unenforceable with respect to employment under any public improvement contract unless at the date of execution of the hiring hall contract or agreement, or within 30 days thereafter, the labor organization has procedures in effect for referring qualified employees for hire without regard to race, color, religion, national origin, military status as defined in ORC Section 4112.01, or ancestry and unless the labor organization includes in its apprentice and

journeyman's membership, or otherwise has available for job referral without discrimination, qualified employees, both whites and non-whites (including African-Americans).

1.1.3 Affirmative Action.

1.1.3.1 The Contractor and Subcontractors shall comply with the State's Equal Employment Opportunity requirements described under OAC Sections 123:2-3 through 123:2-9 that include, without limitation, the requirements described under this **Section 1.1.3**.

1.1.3.2 The Contractor shall demonstrate its good-faith efforts to comply with the utilization goals currently established for minority and women employees and submit documentation to the EOC.

1.1.3.3 By the tenth day of each month, the Contractor and Subcontractors shall submit to the EOC via the internet a completed Ohio Construction Contract Information Report - Input Form 29 (I-29) for the preceding month. The form shall be submitted through the Ohio Business Gateway: <http://business.ohio.gov/efiling/>.

1.2 Prevailing Wages

1.2.1 The Contractor shall comply with the prevailing wage requirements described under ORC Chapter 4115 that include, without limitation, the requirements described under this **Section 1.2**.

1.2.2 If the Project is subject to payment of prevailing wage rates, the Contractor shall:

1.2.2.1 pay to laborers and mechanics performing Work on the Project the prevailing wage rates of the Project locality, as determined by the Ohio Department of Commerce, Wage and Hour Bureau;

1.2.2.2 post in a prominent place readily accessible by all workers on the Site, a legible listing of the current classifications of laborers, workers, and mechanics employed under this Contract;

1.2.2.3 ensure that the rates posted are current and remain posted in legible condition during the period of the Contract; and

1.2.2.4 not be entitled to an increase in the Contract Sum on account of an increase in prevailing wage rates, except as otherwise provided by Applicable Law.

1.2.3 The Contractor may access the Ohio Department of Commerce, Wage & Hour Bureau at its website, <http://198.234.41.198/w3/webwh.nsf/pages/PrevailingWageBid>, to obtain the current wage rates.

1.3 Royalties and Patents

1.3.1 The Contractor shall pay all royalties and license fees and assume all costs incident to the use, in the performance of the Work or the incorporation in the Work, of any invention, design, process, product, or device that is the subject of patent rights or copyrights held by others.

1.3.2 If the Contractor has reason to believe that use of the specified item is subject to patent or copyright protection, the Contractor shall immediately notify the Contracting Authority.

1.4 Assignment of Antitrust Claims

1.4.1 By signing the Agreement, the Contractor assigns, conveys and transfers to the Contracting Authority any right, title, and interest to any claims or causes of action it may have or acquire under state or federal antitrust laws relating to any goods, products, or services purchased, procured, or rendered to the State pursuant to the Contract.

1.5 Use of Domestic Steel

1.5.1 The Contractor is required by law to supply domestically produced steel products used for load bearing structural purposes on all projects funded in whole or in part with State funds.

1.5.2 The Contractor and Subcontractors shall comply with ORC Section 153.011 regarding the use of domestically produced steel products, and furnish the certifications required by **Section 6.19.8**. Copies of ORC Section 153.011 may be obtained from the Ohio Facilities Construction Commission or downloaded at <http://codes.ohio.gov/orc/153.011v1>.

1.6 Drug Free Safety Program Participation

1.6.1 Throughout the performance of the Work, the Contractor shall be enrolled in and remain in good standing in the Ohio Bureau of Workers' Compensation ("OBWC") Drug-Free Safety Program ("DFSP") or a comparable program approved by the OBWC that meets the requirements specified in ORC Section 153.03 ("OBWC-approved DFSP").

1.6.2 As required under ORC Section 153.03(E):

1.6.2.1 “Each contractor shall require all subcontractors with whom the contractor is in contract for the public improvement to be enrolled in and be in good standing in the Bureau of Workers’ Compensation’s Drug-Free Workplace Program or a comparable program approved by the Bureau that meets the requirements specified in section 153.03 of the Revised Code prior to a subcontractor providing labor at the project site of the public improvement.”

1.6.2.2 “Each subcontractor shall require all lower-tier subcontractors with whom the subcontractor is in contract for the public improvement to be enrolled in and be in good standing in the Bureau of Workers’ Compensation’s Drug-Free Workplace Program or a comparable program approved by the Bureau that meets the requirements specified in section 153.03 of the Revised Code prior to a lower-tier subcontractor providing labor at the project site of the public improvement.”

1.6.2.3 “Failure of a contractor to require a subcontractor to be enrolled in and be in good standing in the Bureau of Workers’ Compensation’s Drug-Free Workplace Program or a comparable program approved by the Bureau that meets the requirements specified in section 153.03 of the Revised Code prior to the time that the subcontractor provides labor at the project site will result in the contractor being found in breach of the contract and that breach shall be used in the responsibility analysis of that contractor or the subcontractor who was not enrolled in a program for future contracts with the State for five years after the date of the breach.”

1.6.2.4 “Failure of a subcontractor to require a lower-tier subcontractor to be enrolled in and be in good standing in the Bureau of Workers’ Compensation’s Drug-Free Workplace Program or a comparable program approved by the Bureau that meets the requirements specified in section 153.03 of the Revised Code prior to the time that the lower-tier subcontractor provides labor at the project site will result in the subcontractor being found in breach of the contract and that breach shall be used in the responsibility analysis of that subcontractor or the lower-tier subcontractor who was not enrolled in a program for future contracts with the State for five years after the date of the breach.”

1.6.3 Prior to authorizing a Subcontractor to commence Work on the Site, the Contractor shall obtain the Contracting Authority’s approval, and shall also submit to the A/E written confirmation of the Subcontractor’s enrollment on the **Subcontractor and Material Supplier Declaration** form.

1.6.4 In addition to OBWC-approved DFSP Basic requirements, the Contractor, each Subcontractor, and each Separate Contractor that provides labor on the Site shall participate in a pool that performs random drug testing of at least five percent of its employees who perform labor on the Site. The random drug testing percentage shall also include the on-site supervisors of the Contractor, Subcontractors, and Separate Contractors. Basic random drug testing shall otherwise comply with the same testing guidelines and criteria as required for OBWC-approved advanced testing. The Contractor and Subcontractor shall provide evidence of required testing to the Contracting Authority upon request.

1.7 Use of the State’s Web-based Project Management Software

1.7.1 If the Contracting Authority decides, in its sole discretion, to utilize the State’s web-based project management software for the Project, the Contractor shall use such software for all compatible services required under this Contract.

1.7.2 All costs for the Contractor’s use of the State’s web-based project management software for the Project shall be included in the Contract Sum. If the Contractor is unfamiliar with the proper use of such software, the Contractor shall provide its employees for training without additional compensation.

1.8 EDGE Participation and Reporting

1.8.1 The Contractor shall participate in the “Encouraging Diversity, Growth and Equity” (“EDGE”) Program by subcontracting with, and using one or more, businesses certified as an EDGE Business Enterprise (“EDGE-certified Business”) by the EOC.

1.8.1.1 If the Contractor is an EDGE-certified Business, the Contractor may include its own compensation under this Contract in the reporting.

1.8.1.2 The amount of EDGE participation cannot exceed 100 percent of the Contract Sum.

1.8.1.3 The Contractor shall include in the reporting only those expenditures to EDGE-certified Businesses that perform a commercially useful function as described in OAC Section 123:2-16-15.

1.8.2 The Contractor shall provide an EDGE Participation Report with each Contractor Payment Request.

1.8.2.1 The Contractor shall provide status reports, produced by the Contractor and each applicable EDGE-certified Business for the Contract, indicating:

- .1 the name of each EDGE-certified Business;
- .2 the federal tax identification number of each EDGE-certified Business;
- .3 the date of the EDGE-certified Business contract, Subcontract, or purchase order;
- .4 the projected and actual start and end dates of the EDGE-certified Business contract, Subcontract, or purchase order;
- .5 the original amount of the EDGE-certified Business contract, Subcontract, or purchase order with the Contractor;
- .6 the current amount of the EDGE-certified Business contract, Subcontract, or purchase order;
- .7 the amount invoiced to date;
- .8 the amount paid to date;
- .9 the status of the EDGE-certified Business contract, Subcontract, or purchase order (active, complete, or void); and
- .10 a statement describing any substantive product or performance deficiencies.

1.8.2.2 The Contractor shall provide reports for each EDGE-certified Business; however, the reports may be consolidated and submitted as one document.

1.8.3 The Contractor shall provide an EDGE Participation Final Report simultaneously with its final Contractor Payment Request.

1.8.3.1 The Contractor and each EDGE-certified Business shall provide in the report certification that the submitted document is a true and accurate accounting of the original contract amount paid to and, received by each EDGE-certified Business.

1.8.4 The Contractor shall provide the EDGE Participation Reports in detail and form acceptable to the Contracting Authority.

1.8.4.1 Failure to timely submit EDGE Participation Reports may result in withholding payment in accordance with **Section 9.8**.

1.8.5 The Contractor shall cooperate fully with requests for additional EDGE information and documentation from the EOC or Contracting Authority.

1.9 Owner Work Rules

1.9.1 The Contractor shall consult with the Owner to obtain full knowledge of the Owner's rules, regulations, or requirements affecting the Project.

1.10 Emergency

1.10.1 In the event of an emergency affecting the safety of the Project, other property, or individuals, the Contractor, without special instruction or authorization, shall act to prevent the threatened damage, injury, or loss.

1.10.2 If the Contractor believes that it is entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of its actions in response to an emergency, the Contractor may request a Modification by giving written notice under **Section 7.3.2**.

1.11 Contractor's Standard of Care

1.11.1 The Contractor shall perform the Work in a workmanlike manner, consistent with the standards of skill and care exercised by entities licensed to perform (where required under Applicable Law) and regularly performing comparable work in the same or similar locality under the same or similar circumstances.

1.12 Limit of Contractor's Responsibility

1.12.1 The Contractor is not responsible for the A/E's negligence or the A/E's failure to properly perform the A/E's contract.

1.13 Sustainability Requirements

1.13.1 This Project shall be designed and constructed in accordance with the requirements of Am. Sub. H.B. 251 of the 126th General Assembly and the resulting rules, policies, and procedures adopted by the Ohio Facilities Construction

Commission establishing Sustainability Requirements for Capital Improvements Projects, including but not limited to the applicable provisions of OAC 3318-3.

1.13.2 If the Project is designed and constructed under the Leadership in Energy and Environmental Design (“LEED”) Rating System developed by the U.S. Green Building Council or another rigorous rating system used to facilitate achievement of sustainability goals for the Project, the Contractor shall provide submittals certifying achievement of sustainable design rating system criteria for verification by the Green Building Certification Institute or other third party in accordance with the Contract Documents.

ARTICLE 2 - STATE’S RIGHTS AND RESPONSIBILITIES

2.1 Contracting Authority

2.1.1 The Contracting Authority shall designate a Project Manager for the Project. The Project Manager is authorized to act on behalf of the Contracting Authority to perform specific responsibilities under the Contract.

2.1.2 The Contracting Authority shall furnish information and services required of it in a timely manner.

2.1.3 The Contracting Authority shall have access to the Work at all times, whenever the Project is in preparation or progress.

2.1.4 The Ohio Facilities Construction Commission requires use of its forms where indicated in the Contract Documents. The party responsible for initiating forms shall utilize the latest edition obtained from the Commission’s website: <https://ofcc.ohio.gov>. The Commission may make modifications to its forms at any time.

2.1.4.1 The Contractor shall not modify any form provided by the Commission or Contracting Authority.

2.1.4.2 If the Project is administered using the State’s web-based project management software, the Contractor shall utilize the web-based forms and reports within the applicable business process. The State’s web-based project management software is sponsored by the Commission, and such web-based forms and reports are acceptable to the Commission in lieu of its paper forms.

2.1.5 The Contracting Authority is not responsible for construction means, methods, manners, techniques, sequences, procedures, or for safety precautions and programs in connection with the Work, or for the Contractor’s failure to carry out the Work in conformity with the Contract Documents.

2.2 Owner

2.2.1 The Owner shall designate a representative authorized to act on behalf of the Owner during the Project.

2.2.2 The Owner shall furnish information and services required of it in a timely manner.

2.2.3 The Owner shall have access to the Work at all times whenever the Project is in preparation or progress.

2.2.4 Upon issuance of the Notice to Proceed, the Owner shall provide the Site to the Contractor in a condition to permit the Contractor to perform the Work.

2.2.5 The Owner may request a change in the Work if the A/E recommends and the Contracting Authority approves the change.

2.2.6 The Owner shall communicate with the Contractor through the Contracting Authority.

2.2.7 The Owner is not responsible for construction means, methods, manners, techniques, sequences, procedures, or for safety precautions and programs in connection with the Work, or for the Contractor’s failure to carry out the Work in conformity with the Contract Documents.

2.3 Approval of Owner, Contracting Authority, and State

2.3.1 The Owner, Contracting Authority, or State’s review and approval of the Work and any information the Contractor submits to them is for the sole purpose of determining whether the Work and information are generally consistent with the Contract’s intent, and will not relieve the Contractor of its sole responsibility for the performance, preparation, completeness, and accuracy of the Work and information.

2.4 Neutral Facilitation

2.4.1 The Contracting Authority or Owner may engage a Neutral Facilitator for the purposes of **(1)** building cooperative relationships among the Project participants to achieve discrete objectives; **(2)** encouraging educated, productive, and

expedited attempts to avoid, minimize, and resolve disputes; and **(3)** maximizing the effectiveness of each participant's resources.

2.4.1.1 For example, a Neutral Facilitator may facilitate the organizational meeting, partnering session(s), and efforts to resolve disputes throughout the Project.

2.4.2 The Contracting Authority, Owner, and Contractor are entitled to interact with the Neutral Facilitator with the full expectation that **(1)** they may act, speak, and disclose information with complete candor and **(2)** all communication, whether oral or written, made in the course of facilitated sessions is confidential.

2.4.3 At any hearing or proceeding regarding any dispute arising out of or related to the Project **(1)** the Neutral Facilitator will not be competent to testify and shall not be called as a witness and **(2)** the Neutral Facilitator's testimony and work product will not be admissible.

2.4.4 The Neutral Facilitator will not **(1)** perform any services with respect to or bear any responsibility for any legal services, design-professional services, construction, or construction management associated with the Project or **(2)** have any liability whatsoever for any claims related to any legal services, design-professional services, construction, or construction management associated with the Project, including without limitation, claims for legal or design-professional errors or omissions, delays, cost overruns, faulty construction, or increased costs.

2.4.5 The Neutral Facilitator's participation in the Project will not relieve the Contracting Authority, Owner, and Contractor of any of their respective rights or obligations under the Contract.

2.5 Contractor Performance Evaluation

2.5.1 The Contracting Authority may evaluate the Contractor's performance during the progress of the Work, at completion of a phase of the Project, completion of the Project, or any of the foregoing. The Contracting Authority shall retain the evaluation(s).

2.5.1.1 The Contractor may request a copy of the completed evaluation(s). If the Contractor wishes to comment or take exception to any rating or remark, the Contractor must send a response in writing to the Contracting Authority within 30 days of receiving the evaluation(s).

2.5.1.2 The Contracting Authority may use the evaluation(s) in determining the responsibility of the Contractor for award of future contracts.

2.5.1.3 The Contracting Authority may request information from the Contractor for use in evaluating the A/E's performance. If information is requested, the Contractor must comply in a timely and responsive manner.

2.5.1.4 If a breach of the Contract is committed by the Contractor or is attributable to a Subcontractor, that breach will be used in the responsibility analysis of the Contractor and Subcontractor (where applicable) for future contracts with the State or subcontracts on State projects for five years after the date of the breach.

ARTICLE 3 - A/E'S RESPONSIBILITIES

3.1 The A/E's Contract Administration Duties

3.1.1 The A/E shall administer the Contract as provided in the Contract Documents and Architect/Engineer Agreement, including, but not limited to, performance of the functions described as follows:

3.1.1.1 The A/E shall attend and conduct progress meetings. The A/E shall prepare an agenda and produce a written report of each progress meeting, and distribute the report to the Contracting Authority, Owner, and Contractor within three business days after the meeting. The A/E shall not delegate the duty to prepare the agenda and written reports of any progress meeting.

3.1.1.2 The A/E may authorize minor changes or alterations in the Work that are consistent with the intent of the Contract Documents and do not involve adjustment of the Contract Sum or Contract Times, or both. The A/E has no authority to authorize the Contractor to perform additional or extra Work for which the Contractor may seek adjustment of the Contract Sum or Contract Times, or both.

3.1.1.3 The A/E shall review and recommend, certify, or approve applicable forms required under the Contract Documents.

3.1.1.4 The A/E shall render decisions in connection with the Contractor's responsibilities under the Contract Documents, and submit recommendations to the Contracting Authority for enforcement of the Contract as necessary.

3.1.2 The A/E is the initial interpreter of all requirements of the Contract Documents. All decisions of the A/E are subject to final determination by the Contracting Authority.

3.2 Site Visits and Observation

3.2.1 The A/E shall notify, advise, and consult with the Contracting Authority and Owner and protect the State against Defective Work throughout completion of the Project, which includes the Correction Period.

3.2.1.1 The A/E shall designate a field representative, subject to the Contracting Authority's approval, to attend to the Project, to observe and check the progress and quality of the Work, and to take action as necessary or appropriate to achieve conformity with the Contract Documents.

3.2.1.2 The A/E shall have its consultants attend to the Project at intervals required by its agreement or the Contracting Authority.

3.2.2 The A/E is authorized to disapprove or reject Defective Work. The A/E shall immediately notify the Contracting Authority any time the A/E disapproves or rejects an item of Work.

3.2.3 The A/E is not responsible for construction means, methods, manners, techniques, sequences, procedures, or for safety precautions and programs in connection with the Work, or for the Contractor's failure to carry out the Work in conformity with the Contract Documents.

3.3 Testing and Inspection Services

3.3.1 Unless otherwise specified in the Contract Documents, the A/E shall apply for, secure, and pay for the costs of structural testing and special inspections under Chapter 17 of the Ohio Building Code; testing including geotechnical analysis, environmental testing and analysis, concrete, masonry, structural steel, reinforcing steel, welding, bolts, steel connections, HVAC systems and controls, plumbing and piping, air and water balancing and testing, or other testing; or approval required by Applicable Law.

3.4 Approval of A/E

3.4.1 The A/E's review and approval of the Work and any information the Contractor submits to the A/E is for the sole purpose of determining whether the Work and information are generally consistent with the Contract's intent, and will not relieve the Contractor of its sole responsibility for the performance, preparation, completeness, and accuracy of the Work and information.

3.5 Limitation of A/E's Authority

3.5.1 Under no circumstances is the A/E authorized to:

3.5.1.1 bind the Owner or Contracting Authority to any authorizations under, modifications of, or amendments to any contract other than as expressly described under **Section 3.1.1.2**;

3.5.1.2 accept any defective or non-conforming services, Work, or vendor-furnished items;

3.5.1.3 make any settlements on behalf of the Owner or Contracting Authority; or

3.5.1.4 assume any responsibilities of the Contractor or Subcontractors.

ARTICLE 4 - SUBCONTRACTORS

4.1 Evaluation and Approval

4.1.1 Within ten days after the Notice to Proceed, or other period as mutually agreed by the Contractor and Contracting Authority, the Contractor shall submit to the A/E a **Subcontractor and Material Supplier Declaration** form through which the Contractor identifies its Subcontractors.

4.1.2 The Contractor's failure to timely submit the information regarding a proposed Subcontractor may result in withholding payment in accordance with **Section 9.8**.

4.1.3 After receiving the **Subcontractor and Material Supplier Declaration** form, the A/E shall verify that it is complete and deliver it to the Contracting Authority and Owner. If the A/E finds the form incomplete, the A/E shall return it to the Contractor and identify the incomplete information.

4.1.4 If the Contracting Authority rejects any proposed Subcontractor, the Contractor shall propose a replacement Subcontractor with no adjustment of the Contract Sum. The proposed replacement Subcontractor will be evaluated as described above.

4.1.5 No less than ten days before Work is to be performed by the Subcontractor, or within a shorter period as mutually agreed by the Contractor and Contracting Authority, the Contractor shall submit to the Contracting Authority a complete copy of the executed Subcontract between the Contractor and Subcontractor.

4.2 Form of Subcontract

4.2.1 All Subcontracts shall be on the **State of Ohio Subcontract Form** prescribed by OAC Section 153:1-03-02.

4.2.2 No less than ten days before Work is to be performed by a Subcontractor, or within a shorter period as mutually agreed by the Contractor and Contracting Authority, the Contractor shall submit to the Contracting Authority and A/E a complete copy of the executed Subcontract between the Contractor and Subcontractor. After receiving the Subcontract, the A/E shall verify that it is complete and deliver it to the Contracting Authority. If the A/E finds the Subcontract incomplete, the A/E shall return it to the Contractor and identify the incomplete information.

4.3 Replacement of Subcontractors

4.3.1 The Contractor shall not replace any Subcontractor after execution of the Subcontract without the prior written approval of the Contracting Authority.

4.4 Contractor's Responsibility

4.4.1 The Contractor is fully responsible for all acts and omissions of its Subcontractors and is responsible for scheduling and coordinating the Work of its Subcontractors.

4.4.1.1 The Contractor is fully responsible for any delay, interference, disruption, or hindrance attributable to the Contractor's Subcontractors.

4.4.1.2 The Contractor shall require that each of its Subcontractors have a competent supervisor at the Site whenever the Subcontractor is performing Work.

4.4.1.3 The Contractor shall bind its Subcontractors to the terms of the Contract Documents, so far as applicable to the Work of the Subcontractor.

4.4.1.4 The Contractor shall not agree to any provision, which seeks to bind the State to terms inconsistent with or at variance from the Contract Documents.

4.4.2 The Contractor will not be relieved of its full responsibility for Subcontractors and their performance of the Work by **(1)** the participation of the Owner, Contracting Authority, and A/E in the processes described under this **Article 4** or other related provisions of the Contract Documents or **(2)** the Contracting Authority's rejection of a Subcontractor or failure to reject a Subcontractor under **Section 4.1**.

4.5 Contingent Assignment of Subcontracts

4.5.1 The Contractor hereby assigns its agreement with each Subcontractor to the Contracting Authority provided that the assignment is effective only after termination of the Contract in whole or in part by the Contracting Authority and only for those agreements that the Contracting Authority accepts by notifying the Contractor and applicable Subcontractors in writing. The Contracting Authority may re-assign accepted agreements.

4.5.1.1 If the Contracting Authority terminates the Contract in part, the Contracting Authority may **(1)** take assignment of any entire Subcontract affected by the termination or **(2)** take partial assignment of only the portion of any Subcontract associated with the terminated part of the Contract.

4.6 Prompt Payment

4.6.1 The Contractor shall make payments to Subcontractors in accordance with Applicable Law, including ORC Section 4113.61.

4.6.2 The Contractor may reduce the amount paid to a Subcontractor pursuant to **Section 4.6.1** at a rate equal to the percentage retained from the Contractor and may withhold amounts necessary to **(1)** resolve disputed liens or claims involving the Work of the Subcontractor or **(2)** account for the failure of the Subcontractor to perform its obligations under its agreement with the Contractor.

ARTICLE 5 - PRECONSTRUCTION ACTIVITIES**5.1 Partnering**

5.1.1 The formation of a cohesive, mutually beneficial partnering arrangement among the Contractor, Contracting Authority, A/E, and Owner will accomplish the construction of the Project most effectively and efficiently. This arrangement draws on their collective strengths, skills, and knowledge to achieve a Project of the intended quality, within budget, and on schedule. To achieve that objective, participation in a partnering session is required for the following key stakeholders:

5.1.1.1 Contracting Authority: Project Manager

5.1.1.2 Owner: Primary representative

5.1.1.3 A/E: Principal-in-charge, project manager, field representative, major consultants

5.1.1.4 Contractor: Principal-in-charge, project manager, and superintendent

5.1.1.5 Major Subcontractors (e.g., plumbing, HVAC, electrical): Principal-in-charge, project manager or superintendent

5.1.1.6 CxA, if applicable

5.1.2 The purpose of the partnering arrangement is to build cooperative relationships between the Project's key stakeholders, avoid or minimize disputes, and nurture a more collaborative ethic characterized by trust, cooperation and teamwork. This arrangement is intended to produce a voluntary, non-binding, but formally structured agreement among the Project's key stakeholders, leading to an attitude that fosters risk sharing.

5.1.3 To create and implement the partnering arrangement, the Project's key stakeholders shall meet prior to the construction of the Project for developing a partnering agreement. The agreement should be comprehensive and focus on all issues necessary for successful completion of the Project, and shall identify common goals and objectives, develop a problem solution process, an Alternative Dispute Resolution ("ADR") strategy in accordance with **Section 8.13**, and an implementation plan for the partnering arrangement.

5.1.4 Formal contractual relations, responsibilities, and liabilities are not affected by any partnering arrangement. The cost associated with establishing this partnership, including but not limited to engaging the services of a Neutral Facilitator, shall be included in an allowance in the Contractor's bid. The Contractor shall include in its base bid the resources necessary to participate in the partnering session.

5.1.5 Partnering services may extend over the entire period of performance of the Contract and may include intervention or project realignment services to be utilized if serious disputes arise. The Project's key stakeholders should agree, during the initial partnering session, to the types of situations and circumstances in which intervention or realignment services shall be utilized.

5.2 Building and Trade Permits and Licenses**5.2.1 Plan Approval.**

5.2.1.1 The A/E shall secure the required structural, plumbing, HVAC, and electrical plan approvals.

5.2.1.2 The Contractor shall schedule and attend all intermediate and final inspections required for any permit applicable to the Work. The Contractor shall schedule the State Fire Marshal or local fire authority for the life safety inspection for occupancy permits. The Contractor shall give the A/E, Contracting Authority, and Owner reasonable notice of the dates and times arranged for inspections.

.1 The Contractor shall pay for any reinspections required as a result of the Contractor's failure to receive approval of its Work.

5.2.2 Trade Permits and Licenses.

5.2.2.1 The Contractor shall obtain, maintain, and pay for any permit, inspection, or license applicable to the Contractor's particular trade.

5.2.3 Local Permits.

5.2.3.1 The Contractor shall secure and pay the fees for any permits, inspections, licenses, capacity charges, or tap fees required by local authorities having jurisdiction over the Project. The Contractor shall give the A/E, Contracting Authority, and Owner reasonable notice of the date arranged for inspections.

5.2.4 National Pollutant Discharge Elimination System (“NPDES”) Storm Water General Permit.

5.2.4.1 The A/E shall secure the NPDES general permit by submitting a Notice of Intent (“NOI”) application form to the Ohio Environmental Protection Agency at least 45 days prior to the start of construction. The Contractor shall be a “co-permittee” if required under Applicable Law.

5.2.4.2 The A/E shall prepare and certify a storm water pollution prevention plan to provide sedimentation and erosion controls at the Project.

5.2.4.3 The A/E shall prepare and process the required Notice of Termination (“NOT”) prior to Contract Completion.

ARTICLE 6 - CONSTRUCTION AND CLOSEOUT**6.1 Commencement of Work on the Site**

6.1.1 Unless the Contracting Authority agrees otherwise in writing, the Construction Stage will commence with the Contracting Authority’s issuance of the Notice to Proceed and will terminate upon Contract Completion.

6.2 Responsibility of the Contractor

6.2.1 The Contractor shall complete portions of the Work in the sequence and time in the Construction Progress Schedule.

6.2.2 The Contractor shall supervise the Work.

6.2.3 The Contractor must perform the Work so as not to interfere with, disturb, hinder, or delay the services of Separate Consultants or the work of Separate Contractors. The Contractor must cooperate and coordinate fully with all Separate Consultants and Separate Contractors and must freely share all of the Contractor’s Project-related information with them to facilitate the timely and proper performance of the Work and of the services and work of the Separate Consultants and Separate Contractors.

6.2.4 The Contractor must afford every Separate Consultant and Separate Contractor proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of their services and work.

6.2.5 If the Contractor damages the property or work of any Separate Consultant or Separate Contractor, or by failure to perform the Work with due diligence, delays, interferes with, hinders, or disrupts the services of any Separate Consultant or the work of any Separate Contractor who suffers additional expense and damage as a result, the Contractor is responsible for that damage, injury, or expense.

6.2.6 The intent of **Sections 6.2.3** through **6.2.5** is to benefit the Separate Consultants and Separate Contractors, and to demonstrate that the Separate Consultants and Separate Contractors are intended third-party beneficiaries of the Contractor’s obligations under the Contract.

6.2.7 If the proper execution or results of any part of the Work depends upon work performed or services provided by the Owner, a Separate Consultant, or a Separate Contractor, the Contractor must inspect that other work and appropriate instruments of service, and promptly report to the Contracting Authority in writing any defects or deficiencies in that other work or services that render it unavailable or unsuitable for the proper execution and results of the Work. The Contractor’s failure to report before starting the affected part of its Work will constitute an acceptance of the other work and services as fit and proper for integration with the Contractor’s Work except for defects and deficiencies in the other work or services that were not reasonably discoverable at the time of the Contractor’s inspection.

6.2.8 The Contractor shall not delay the Work on account of any claim, dispute, or action between the Contractor and a Separate Consultant or Separate Contractor.

6.2.9 The Contractor shall develop and keep current the Construction Progress Schedule in accordance with **Section 6.5**, and prepare and keep current a schedule of submittals that is coordinated with the Construction Progress Schedule, for the A/E and Contracting Authority’s acceptance.

6.2.10 The Construction Progress Schedule shall not exceed the time limits current under the Contract Documents, shall provide for reasonable, efficient, and economical execution of the Project, and shall relate to the entire Project to the extent required by the Contract Documents.

6.2.11 The Contractor shall use the Construction Progress Schedule to plan, organize, and execute the Project, record and report actual performance and progress, and show how it plans to coordinate and complete all remaining work by Contract Completion.

6.2.12 The Contractor shall monitor the progress of the Work for conformance with the Construction Progress Schedule and shall initiate revisions as required by **Section 6.5.14**.

6.2.13 The Contractor shall establish the Project's regular working hours, subject to approval by the A/E and the Owner.

6.2.14 The Contractor shall coordinate the Work with the activities and responsibilities of the A/E, Owner, and Contracting Authority to complete the Project in accordance with the Contract Documents.

6.2.15 In the event of default of the Contractor, the Contractor shall cooperate with the A/E, Contracting Authority, and Contractor's Surety to achieve the Substantial Completion date and Contract Completion.

6.2.16 The Contractor shall remove all snow and ice as may be required for reasonably safe access to the Project including, but not limited to, building entries, driveways, parking lots, and sidewalks.

6.2.17 The Contractor shall keep a daily log containing a record of weather, number of workers on Site, identification of equipment, Work accomplished, problems encountered, and other similar relevant data.

6.3 Construction Procedures

6.3.1 The Contractor is solely responsible for and has control over all construction means, methods, manners, techniques, sequences, and procedures, for safety precautions and programs in connection with the Work, and for coordinating all portions of the Work.

6.3.1.1 If the Contract Documents give instructions that affect construction means, methods, manners, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety of them and, except as stated below, shall be fully and solely responsible for the jobsite safety of the means, methods, manners, techniques, sequences, or procedures.

6.3.1.2 If the Contractor determines that the means, methods, manners, techniques, sequences, or procedures specified in the Contract Documents may not be safe, the Contractor shall give timely written notice to the A/E, Owner, and Contracting Authority. The Contractor shall not proceed with that portion of the Work without further written instructions from the A/E. Any modification of the Contract shall be in accordance with **Article 7**.

6.3.2 The Contractor shall lay out and coordinate all lines, levels, elevations, and measurements for all of the Work, coordinate and verify existing conditions, and notify the A/E of discrepancies and conflicts before proceeding with installation or excavation.

6.3.3 The Contractor shall perform all cutting, fitting, or patching required for the Work and shall not endanger the Project by cutting, excavating, or otherwise altering the Project, or any part of it.

6.3.3.1 If the Contractor requires sleeves for the Work, the Contractor shall furnish and install the sleeves. The Contractor is responsible for the exact location and size of all holes and openings required to be formed or built for the Work.

6.3.3.2 The Contractor's patching shall match and blend with the existing or adjacent surface(s).

6.3.4 The Contractor shall comply with ORC Sections 3781.25 through 3781.32. In addition, before starting excavation or trenching, the Contractor shall determine the location of any underground utilities and notify any public authority or utility having jurisdiction over the Project and secure any required approval.

6.3.5 The Contractor shall install all Work in accordance with the Contract Documents and any installation recommendations of the manufacturer, including required temperature and humidity limits for installation of the various materials.

6.3.6 The Contractor shall comply with all requirements and conditions of the NPDES general permit, including, but not limited to, implementing and maintaining the sedimentation and erosion control measures specified in the storm water pollution prevention plan prepared by the A/E pursuant to **Section 5.2.4**, which are related to the Work, maintaining records of its construction activities, removing materials no longer required, and taking proper action if there is a reportable quantity spill.

6.3.7 The Contractor shall communicate with the Contracting Authority and Owner through the A/E.

6.4 Construction Supervision

6.4.1 Unless waived by the Contracting Authority in writing, the Contractor shall provide continuous supervision at the Site by a competent superintendent when any Work is being performed, and the Contractor's superintendent shall not be involved with any work other than the Project.

6.4.2 The Contractor's project manager and superintendent shall each have the responsibility and authority to act on behalf of the Contractor. All communications to the Contractor's project manager or superintendent shall be binding as if given directly to the Contractor.

6.4.3 The Contractor shall submit an outline of the qualifications and experience of the Contractor's proposed project manager and proposed superintendent, including references, to the Contracting Authority no less than ten days of the Notice to Proceed. For all Subcontracts in excess of \$200,000, and for all other Subcontracts on request from the Contracting Authority, the Contractor shall submit an outline of the qualifications and experience of the Subcontractor's proposed project manager and proposed superintendent, including references, to the Contracting Authority no less than ten days before the Subcontractor is scheduled to begin Work on the Site.

6.4.3.1 The Contracting Authority may reject the Contractor or Subcontractor's proposed project manager or proposed superintendent. If the Contracting Authority does not notify the Contractor of the rejection within 30 days after receiving the required information, it shall indicate that the Contracting Authority has no objection, but does not affect the Contracting Authority's rights under **Section 6.11.2** or any other provision relative to that project manager or superintendent.

6.4.3.2 If the Contracting Authority rejects the Contractor or Subcontractor's proposed project manager or proposed superintendent, the Contractor shall replace, or cause the Subcontractor to replace the project manager or superintendent (as appropriate) with someone acceptable to the Contracting Authority at no additional cost.

6.4.4 The Contractor and its Subcontractors shall not replace their respective project managers or superintendents without prior written approval of the Contracting Authority.

6.4.4.1 If the Contractor or a Subcontractor proposes to change its project manager or superintendent, the Contractor shall submit written justification to the Contracting Authority, along with the name and qualifications of the proposed replacement.

6.4.4.2 The procedure provided in **Section 6.4.3** shall be conducted to evaluate the Contractor or Subcontractor's (as applicable) proposed replacement project manager or superintendent.

6.5 Construction Progress Schedule

6.5.1 If the Estimated Construction Cost is less than \$500,000, the Contractor may provide a bar chart schedule with a logical sequence of events and sufficient detail to properly anticipate and monitor construction progress. If the Estimated Construction Cost for the Project is \$500,000 or more, the Contractor shall prepare and maintain a resource-loaded Construction Progress Schedule using the critical-path method of scheduling that provides the following information:

6.5.1.1 a graphic presentation of the sequence of the Work for the Project in the media and format required for the Project;

6.5.1.2 identification of each stage of the Work and any Milestone dates;

6.5.1.3 identification of activities and durations for review and approval of Shop Drawings and other action submittals, fabrication and review of mock-up Work, product review and procurement, fabrication, shop inspection, and delivery, including, but not limited to, lead time, coordination drawing delivery, Substantial Completion, Punch List, Punch List Correction, Project close-out requirements, occupancy requirements, and Contract Completion;

6.5.1.4 identification of disruptions and shutdowns due to other operations;

6.5.1.5 identification of the critical path of the Work;

6.5.1.6 identification of the crew size and total resource hours for each activity in the schedule; and

6.5.1.7 the Contractor's signature and date indicating approval.

6.5.2 The Contractor shall develop the Construction Progress Schedule using commercially available, personal computer software acceptable to the Contracting Authority and shall submit all baseline and updated schedules to the A/E in the schedules' native electronic format.

6.5.3 The Construction Progress Schedule shall not exceed the time limits current under the Contract Documents, shall provide for reasonable, efficient, and economical execution of the Project, and shall relate to the entire Project to the extent required by the Contract Documents.

6.5.4 The Contractor shall use the Construction Progress Schedule to plan, organize, and execute the Project, record and report actual performance and progress, and show how it plans to coordinate and complete all remaining Work within applicable Milestones. The Project participants shall use the Construction Progress Schedule as a tool for scheduling and reporting sequenced progress of the Work. The Contractor shall provide a clear graphics legend and other data including, but not limited to, Milestone dates, constraints, and other items required by the Project, A/E, Contracting Authority, and Owner. Each submission shall show the Contracting Authority's Project number and Project name, and provide a signature approval and date line for the Contractor.

6.5.5 The Contractor shall provide in each schedule: Activity identification and description for each activity broken down to a maximum duration that is appropriate for the activity, responsibility of the Contractor, Contractor's resources and crew size for each activity, provide early start, early finish, late start, late finish dates. Each schedule shall show predecessor activities and successor activities for each activity, entry free float, total float, and percentage of completion, and identify the appropriate predecessors and successors for all related activities.

6.5.6 The Construction Progress Schedule shall show all submittal dates, review and approval durations for coordination drawings, Shop Drawings, other action submittals, and mock-up Work.

6.5.7 Within 30 days of the date of the Notice to Proceed, the Contractor shall submit to the A/E a proposed Construction Progress Schedule approved by the Contractor. If the Project is \$4 million total construction cost or more, the Contractor may submit an intermediate Bar Chart Schedule for the first 120 days to the A/E within 30 days of the date of the Notice to Proceed; followed by the complete resource-loaded precedence or arrow diagram schedule within 90 days of the date of the Notice to Proceed.

6.5.7.1 The Contractor shall submit the initial and all updates of the Construction Progress Schedule in graphic and tabular form to the A/E. With each monthly schedule update, the Contractor shall include a list of all changes to the previously approved baseline schedule or monthly updated schedule.

6.5.7.2 After receiving the Construction Progress Schedule, the A/E shall review and submit a copy of the Construction Progress Schedule to the Contracting Authority and Owner for review and acceptance, or reject and return it to the Contractor with recommendations for revisions.

6.5.8 The Construction Progress Schedule shall be managed using early start dates and early finish dates. The Contractor must exhaust existing float before claiming additional time for a Change Order, or show that it is not possible to use float to cover the time requirements of the Change Order.

6.5.9 The Contractor's failure to timely submit and properly maintain an approved Construction Progress Schedule may result in withholding payment in accordance with **Section 9.8**.

6.5.10 For each progress meeting, the Contractor shall provide a two- to six-week look-ahead schedule, as appropriate for the Project.

6.5.11 On a weekly basis, the Contractor shall prepare and submit to the A/E a written report describing:

6.5.11.1 activities begun or finished during the preceding week;

6.5.11.2 activities in progress and expected completion;

6.5.11.3 activities to be started or finished in the upcoming two weeks, including but not limited to, the Contractor's workforce size and total resource hours associated with those activities; and

6.5.11.4 other information requested by the A/E.

6.5.12 The A/E shall attach the above information to the minutes of the weekly progress meetings.

6.5.13 The Contractor shall provide monthly Progress Status Reports to the Contracting Authority, A/E, and Owner, which shall include recommendations for adjusting the Construction Progress Schedule to meet Milestone dates and the Substantial Completion date.

6.5.13.1 If it is apparent to the A/E that the Contractor may be unable to meet critical path activities, Milestone completion dates, or the Substantial Completion date, the A/E shall direct the Contractor to submit within three days a recovery plan to avoid or minimize delay to the Project.

6.5.13.2 A recovery plan shall include, but is not limited to, adjustments to one or more of the following:

.1 workforce;

.2 hours per shift;

.3 shifts per workday;

.4 workdays per week;

- .5 equipment;
- .6 activity logic.

6.5.13.3 If the A/E approves the recovery plan, the Contractor shall prepare a revised Construction Progress Schedule approved in accordance with **Section 6.5.7**. If the A/E does not approve the recovery plan, the Contractor shall submit within three days an alternate recovery plan to the A/E in writing for review and approval in accordance with **Section 6.5.7**.

6.5.14 The Contractor shall update the Construction Progress Schedule on a monthly basis, or other interval approved by the Contracting Authority, in accordance with **Section 6.5.7**.

6.5.14.1 The updated Construction Progress Schedule approved by the Contractor shall serve as an affirmation that the Contractor can meet the requirements of the updated Construction Progress Schedule.

6.5.14.2 The Contractor shall submit a tabular copy showing all changes to the previously approved schedule including, but not limited to, logic, float, and actual start date of activities. The original or initially approved Construction Progress Schedule and all subsequent Construction Progress Schedules submitted by the Contractor, and accepted by the A/E, shall serve as an affirmation that the Contractor agrees to and can meet the applicable requirements of the updated Construction Progress Schedule.

6.5.14.3 The Contractor's failure to timely submit an approved, updated Construction Progress Schedule may result in withholding payment in accordance with **Section 9.8**.

6.6 Progress Meetings

6.6.1 The A/E shall schedule a weekly progress meeting for the Contractor and other Persons involved in the Project. The purpose of the progress meeting is to review progress on the Project during the previous week, discuss anticipated progress during the following weeks, review critical operations, and discuss critical problems.

6.6.2 The Contractor shall be represented at every progress meeting by a Person authorized with signature authority to make decisions regarding possible modification of the Contract Documents or Construction Progress Schedule.

6.6.2.1 The A/E shall notify the Contractor and other Persons involved in the Project of the time and place of the progress meeting that shall thereafter be the same day and hour of the week for the duration of the Project, unless the A/E notifies the Contractor and other Persons involved in the Project of a different day and hour at least two days in advance.

6.6.2.2 The Contractor shall have any of its Subcontractors attend the progress meeting as determined advisable by the Contractor, or as requested by the A/E.

6.6.3 The A/E shall prepare a written report of each progress meeting and distribute the report to the Contracting Authority, Owner, and Contractor. The A/E shall not delegate the duty to prepare a written report of any progress meeting.

6.6.3.1 If any Person in attendance objects to anything in a report of a progress meeting, the Person shall notify the A/E, Contracting Authority, and any other affected Person in writing explaining the objection within five days.

6.6.3.2 The report of each progress meeting shall reflect any objection made to the report of the previous progress meeting and any response.

6.7 Project Coordination

6.7.1 The Contractor shall prepare drawings ("Coordination Drawings") after the Contractor and appropriate Subcontractors ("Coordination Participants") **(1)** determine the sequence of the Project, **(2)** identify the areas requiring special attention ("Coordination Areas"), and **(3)** determine the need for a coordination drawing for any Coordination Area. The Contractor shall prepare the Coordination Drawings with Computer-Aided Design ("CAD") or Building Information Modeling ("BIM") software acceptable to the Contracting Authority. The Coordination Drawings shall show the sheet metal work with plan and elevation dimensions, which specifically locate all HVAC ductwork, HVAC equipment, and HVAC piping for each Coordination Area based upon the information, discussion, and resulting consensus of the Coordination Participants during the coordination meetings.

6.7.1.1 After the Contractor completes the Coordination Drawings, the Contractor shall forward a copy of the Coordination Drawings to the A/E, Contracting Authority, and Owner.

6.7.1.2 The A/E shall review the Coordination Drawings to determine whether the Coordination Participants achieved the goals listed in **Section 6.7.1**. The A/E shall report any concerns, in writing, to the Coordination Participants within 14 days after receiving the drawings.

6.8 Review of Contract Documents and Field Conditions

6.8.1 Before starting each portion of the Work, the Contractor shall carefully study and compare the various Contract Documents relative to that portion of the Work, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the Site affecting it.

6.8.2 If the Contractor finds any perceived ambiguity, conflict, error, omission, or discrepancy on or between any of the Contract Documents, or between any of the Contract Documents and any Applicable Law, the Contractor, before proceeding with the Work, shall promptly submit a Request for Information (“RFI”) to the A/E for an interpretation or clarification.

6.8.2.1 Before submitting any RFI to the A/E, the Contractor shall carefully review the Contract Documents to ensure that the Contract Documents do not answer the RFI.

6.8.2.2 The A/E shall respond to an RFI within three days of receiving the RFI.

6.8.2.3 Any interpretation or clarification of the Contract Documents made by any Person other than the A/E, or in any manner other than writing, shall not be binding and the Contractor shall not rely upon it.

6.8.3 If the Contractor believes that it is entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of clarifications or instructions issued by the A/E in response to a RFI, the Contractor may request a Change Order by giving written notice under **Section 7.3.2** within seven days of receiving the A/E’s RFI response.

6.8.4 If the Contractor does not notify the A/E per **Section 6.8.3**, the Contractor will have accepted the RFI response without an adjustment to the Contract Sum or Contract Times.

6.9 Protection of the Project

6.9.1 The Contractor shall protect the Work from weather and maintain the Work and all materials, apparatus, and fixtures free from injury or damage until Substantial Completion of the Work.

6.9.1.1 The Contractor shall at all times cover or protect the Work.

6.9.1.2 The Contractor, at its expense, shall remove, and replace with new, any Work damaged as a result of the Contractor’s failure to provide coverage or protection.

6.9.1.3 The Contractor, at its expense, shall repair or replace any adjacent property, including, but not limited to, roads, walks, shrubbery, plants, trees, or turf, damaged during performance of the Contract.

6.9.1.4 After the date of Substantial Completion of the Work, the Owner is responsible for protecting and maintaining all materials, apparatus, and fixtures for the occupied portion of the Project free from injury or damage.

6.9.2 The Contractor shall protect the Project and existing or adjacent property from damage at all times and shall erect and maintain necessary barriers, furnish and keep lighted necessary danger signals at night, and take reasonable precautions to prevent injury or damage to individuals or property.

6.9.3 The Contractor shall not load, or permit any part of the Project to be loaded, in any manner that endangers the Project, or any portion thereof. The Contractor shall not subject any part of the Project or existing or adjacent property to stress or pressure that endangers the Project or property.

6.9.4 The Contractor shall provide all temporary bracing, shoring, and other structural support required for safety and proper execution of the Work.

6.9.5 Vibration, Noise, and Dust Control.

6.9.5.1 The Contractor shall provide controls/barriers for vibrations, noise, and dust control in occupied buildings as required by the construction operations.

6.9.5.2 The Contractor will not be permitted to exhaust or release unfiltered air, dust, construction debris, or other undesirable products into the exterior atmosphere or into occupied areas of the building outside the Site. The Project Manager may limit or stop the Work if the Contractor does not maintain proper air-quality standards.

6.9.5.3 In certain occupied buildings, tasks might be of such a nature that noise and vibration cannot be tolerated. In such spaces, Work shall be scheduled for other than normal working hours. The Contractor is cautioned that weekend or overtime work, if required, shall be performed at no additional cost. The Contractor shall obtain the Contracting Authority’s written permission before working other than standard hours. Weekend and overtime Work shall be reflected in the Construction Progress Schedule.

6.9.5.4 The Contractor is responsible for vibration control and control of transmission of noise arising from the Work. Principal considerations that shall be given to noise and vibration control are:

- .1 Noise control in compliance with Occupational Safety and Health Administration (“OSHA”) requirements for the health and safety of building occupants; control shall be for all areas of the facility, including equipment rooms, boiler rooms, and fan rooms.
- .2 Vibration control to limit sound produced by construction equipment, and for protection of the equipment existing in a building and the building structure.
- .3 Vibration control to provide for maximum usefulness of the facility by keeping levels of vibration within ranges conducive to study and work or other uses for which the facility is designed.

6.10 Materials and Equipment

6.10.1 The Contractor shall provide new materials and equipment of the quality specified in the Contract Documents.

6.10.2 The Contractor shall bring to or store at the Site only the materials and equipment required in the Work. If possible, materials and equipment should be installed in their final positions when brought to the Site.

6.10.2.1 The Contractor shall properly store and protect all materials and equipment it provides to the Project.

6.10.2.2 The Contractor shall timely remove from the Site any materials or equipment no longer required for the Work.

6.10.3 The Contractor shall not allow materials or equipment to damage the Project or adjacent property, or to endanger any individual at or near the Site.

6.10.4 If the Contractor provides an Acceptable Component, the Contractor shall be solely responsible for the costs of coordination and modification required.

6.10.5 If the Contractor provides approved Substitutions that require changes to the Contract Documents, the Contractor shall be solely responsible for the additional costs incurred as a result, including, but not limited to, changes to the design by the A/E.

6.10.6 The A/E shall consider Requests for Substitutions after the bid opening only when the Contractor can conclusively demonstrate to the A/E the following conditions:

6.10.6.1 the specified Basis of Design Components, Acceptable Components, or previously-approved Substitutions, through no fault of the Contractor or a Subcontractor, are not available; or

6.10.6.2 the specified Basis of Design Components, Acceptable Components, or previously-approved Substitutions will not perform as designed or intended.

6.10.7 The Contractor’s incorporation of unapproved Substitutions in the Work is Defective Work.

6.11 Labor

6.11.1 The Contractor shall maintain a sufficient workforce and enforce good discipline and order among its employees and the employees of its Subcontractors. The Contractor shall not permit employment of individuals not skilled in tasks assigned to them.

6.11.2 The Contractor shall dismiss from the Project any individual employed by the Contractor, or a Subcontractor, who the Contracting Authority finds, in its sole discretion, to be incompetent, guilty of misconduct, or detrimental to the Project.

6.11.3 The Contractor shall employ all legal efforts to minimize the likelihood or effect of any strike, Work stoppage, or other labor disturbance. Informational pickets shall not justify any Work stoppage.

6.12 Safety Precautions

6.12.1 The Contractor shall take reasonable precautions to ensure the safety of individuals on the Project.

6.12.1.1 The Contractor is responsible for designing and implementing its own safety program, including compliance with OSHA regulations. The Contractor’s safety plans, such as fall protection, hazards, communications, competent person, etc., shall meet or exceed the Owner’s safety plan (if any).

6.12.2 The Contractor shall pay any fine or cost incurred because of the Contractor’s violation, or alleged violation, of Applicable Law.

6.12.3 Before starting any Work, the Contractor shall submit to the Contracting Authority a copy of the Contractor's site-specific safety plan and safety manuals.

6.12.4 The Contractor shall not introduce Hazardous Materials to the Project (other than as specified in the Contract Documents or customary construction materials or equipment) or burn any fires on the Site.

6.12.4.1 If the Contractor brings Hazardous Materials to the Project, the Contractor must take reasonable precautions to prevent the Hazardous Materials from causing bodily injury or death, property damage, or environmental damage.

6.12.4.2 The Contractor shall notify the Project Manager 24 hours before the start of non-routine or non-recurring hot-work. Use of sources of fire, flame or sparks and flammable materials shall be kept to an absolute minimum. At the beginning of the Project, the Contractor shall inform the Project Manager of its intent to use blowtorches, welding apparatus or similar exposed flame and sparking devices. The Contractor shall give similar notice in regard to the use of flammable liquids, adhesives, and cleaners.

6.12.4.3 The Contractor shall furnish an appropriate number of fire extinguishers (minimum of one), which shall be within the immediate areas where work is being done at all times. The extinguisher(s) shall be adequate and suitable for the class of fire likely to be caused by the Contractor's operations.

6.12.5 Work Stoppage Due to Hazardous Materials.

6.12.5.1 If the Contractor encounters material the Contractor reasonably believes to be or contain, a Hazardous Material that has not been rendered harmless, the Contractor shall immediately stop Work in the affected area and verbally report the condition to the Contracting Authority and A/E, and within one business day deliver written notice of the condition to the Contracting Authority and A/E.

6.12.5.2 The Contracting Authority will promptly determine the necessity of the Owner retaining a qualified environmental consultant to evaluate the suspected Hazardous Material and to issue a related written report. Where appropriate, the Owner will engage a licensed abatement contractor to remove the material or render it harmless as directed.

6.12.5.3 The Contractor shall resume Work in the affected area upon written notice from the A/E that **(1)** the suspect material was evaluated and found not to be or contain a Hazardous Material, or **(2)** the suspect material has been removed or rendered harmless.

6.12.5.4 If the Contractor knowingly or negligently proceeds with the Work in an area where a Hazardous Material exists and has not been rendered harmless, the Contractor shall be solely responsible for all related claims, damages, losses, and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from performing the Work in the affected area.

6.12.5.5 The term "rendered harmless" means that the level of exposure is less than any applicable exposure standards set forth in Applicable Law.

6.12.6 Safety Data Sheets.

6.12.6.1 The Contractor shall identify any material it uses at the Site with a Safety Data Sheet ("SDS") meeting the requirements of OSHA's Hazard Communication Standard.

6.12.6.2 The Contractor shall maintain a notebook containing all of its applicable SDSs. That notebook shall be kept at the Site for the duration of the Project.

6.13 Construction Facilities, Utilities, and Equipment

6.13.1 Facilities.

6.13.1.1 The Contractor shall provide and maintain clean and suitable temporary facilities, equipment, services, and enclosed storage for its use at the Site.

6.13.1.2 The Contractor shall provide and maintain in a clean condition:

- .1 suitable facilities, equipment, and services for use by the A/E and Contracting Authority;
- .2 adequate space, equipment, and furnishings to conduct progress meetings, and store approved documents and permits; and
- .3 adequate sanitary facilities for use by all Persons at the Site.

6.13.2 Environmental Controls.

6.13.2.1 The Contractor shall protect its Work and materials from weather and damage from heat, cold, and humidity.

6.13.2.2 Until the permanent HVAC system is complete and available for use:

- .1 the Contractor shall make arrangements and pay for installation and maintenance of temporary heating and ventilating systems; and
- .2 the Contractor shall pay the costs incurred in operating the temporary heating and ventilating systems.

6.13.2.3 When the permanent HVAC system is complete and available for use:

- .1 The Contractor shall start up and maintain operation of the permanent HVAC system, including filters, and promptly remove temporary heating and ventilating systems.
- .2 If the Project consists entirely of new construction, the Contractor shall pay the costs of energy consumed in operating the permanent HVAC system until Substantial Completion.
- .3 If the Project is a renovation of an existing building or structure, addition(s) to an existing building or structure, or any combination of new construction and renovation work that does not allow separate metering of utilities, the Owner shall pay the costs of energy consumed in operating the permanent HVAC system.

6.13.2.4 From the date of Substantial Completion, the Owner shall pay the cost of operating the permanent HVAC system for the occupied portion of the Project.

6.13.2.5 If the permanent HVAC system is used during construction, the Contractor shall furnish an extended warranty and service contract in effect until the expiration of the Correction Period.

6.13.3 Water and Drainage.

6.13.3.1 The Contractor shall provide water necessary for the Work until the permanent plumbing system is available for use.

6.13.3.2 The Contractor shall provide temporary drainage and dewatering necessary for the Work and shall employ pumps, trenches, drains, sumps, and other necessary elements required to provide satisfactory working conditions for the protection, execution, and completion of the Project.

6.13.3.3 The Contractor shall make arrangements and pay for installation and maintenance of temporary plumbing systems until the permanent plumbing system is available for use.

6.13.3.4 When the permanent plumbing system is complete and available for use:

- .1 The Contractor shall start up and maintain operation of the permanent plumbing systems, and make arrangements and pay for removal of temporary plumbing systems.
- .2 If the Project consists entirely of new construction, the Contractor shall pay the costs of water consumed and sewerage charges until Substantial Completion.
- .3 If the Project is a renovation of an existing building or structure, addition(s) to an existing building or structure, or any combination of new construction and renovation work that does not allow separate metering of utilities, the Owner shall pay the costs of water consumed and sewerage charges.

6.13.3.5 From the date of Substantial Completion, the Owner shall pay the costs of water consumed and sewerage charges for the occupied portion of the Project.

6.13.3.6 If the permanent plumbing system is used during construction, the Contractor shall furnish an extended warranty and service contract in effect until the expiration of the Correction Period.

6.13.4 Electric Service.

6.13.4.1 The Contractor shall provide temporary light and power; and pay the charges for temporary electric service installation, and removal if required.

6.13.4.2 If the Project consists entirely of new construction, the Contractor shall pay the cost of energy consumed until Substantial Completion.

6.13.4.3 If the Project is a renovation of an existing building or structure, addition(s) to an existing building or structure, or any combination of new construction and renovation work that does not allow separate metering of utilities, the Owner shall pay the cost of energy consumed.

6.13.4.4 From the date of Substantial Completion, the Owner shall pay the cost of energy consumed for the occupied portions of the Project.

6.13.4.5 If the permanent electrical system is used during construction, the Contractor shall furnish an extended warranty and service contract in effect until the expiration of the Correction Period.

6.13.5 Hoisting Facilities.

6.13.5.1 The Contractor shall erect and maintain any hoisting equipment required for its Work.

6.13.5.2 If the electric service requirements of hoisting facilities differ from that available at the Site, the Contractor shall provide and pay for all necessary connections.

6.13.5.3 If a permanent elevator is identified in the Contract Documents to be used for hoisting materials or personnel during construction, the Contractor shall furnish an extended warranty and service contract in effect until the expiration of the Correction Period.

6.14 Progress Cleaning

6.14.1 The Contractor shall remove all waste materials, rubbish, and mud attributable to the Work to an appropriate disposal location at, or near, the Site.

6.14.2 The Contractor shall perform weekly broom cleaning of hard flooring surfaces in the area of the Work.

6.14.3 The Contractor shall remove, once each working day or as appropriate for the Project, all waste materials and rubbish from the disposal location at, or near, the Site.

6.14.4 The Contractor shall remove, as appropriate for the Project or as the A/E or Owner directs, any waste materials or rubbish from areas adjacent to the Project.

6.14.4.1 The Contractor shall dispose of waste materials, rubbish, and construction debris in a lawful manner in approved recycling facilities or landfills.

6.14.5 If the Contractor fails to clean up during the progress of the Work, the Contracting Authority may clean up on behalf of the Contractor and at the Contractor's expense. If the Contractor fails to maintain the areas adjacent to the Project clean and free of waste materials and rubbish, the Contracting Authority may also direct the local jurisdiction responsible for the area to have the area cleaned to its satisfaction at the Contractor's expense.

6.14.5.1 The Contracting Authority may deduct the cleaning costs from payments then or thereafter due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to the Owner.

6.14.6 The Contractor shall remove excavated material and spoil to a suitable off-site location approved by the Contracting Authority.

6.14.6.1 If the Owner designates a location on its property for disposal or storage of clean topsoil and/or subsoil in the Contract Documents, the Contractor shall remove such materials to the designated location.

6.15 Use of Premises

6.15.1 The Contractor shall use corridors, stairs, and elevators as designated by the Contracting Authority. The Contractor shall exercise extreme care to not exceed the carrying capacity of elevators or damage the cab interior in any way.

6.15.2 Loitering or wandering through the interior of buildings or exterior grounds outside the limits of the Work will not be permitted.

6.15.3 The Contractor shall confine its apparatus, materials, and the operations of its workers to the limits indicated by Applicable Law and the directions of the A/E or Project Manager.

6.15.4 No signs or advertising of any kind will be permitted on or about the Site, except those appearing on trucks and trailers.

6.15.5 Site Logistics Plan.

6.15.5.1 The Contractor shall prepare a plan of the Site indicating how the Contractor intends to use the Site. The plan should illustrate, as an example, areas to be used for lay down of material and equipment; office and storage trailer locations; vehicular access gates with ingress and egress routes; locations of wheel wash and concrete truck wash out activities; and offloading and hoisting locations.

6.15.6 Smoking and Tobacco Products.

6.15.6.1 All State buildings are smoke free. Smoking will not be permitted in any indoor area. The ban on tobacco products will be observed in all indoor and outdoor areas and parking areas on all State-owned and leased property. The Contractor shall enforce these restrictions on any individual employed by the Contractor, or a Subcontractor.

6.16 Interruption of Existing Services

6.16.1 Whenever it becomes necessary to interrupt existing services in use by the Owner or its tenants, including but not limited to sewer, water, gas, and steam lines, electric, telephone, and cable service, the Contractor shall continue the associated Work on a non-stop 24-hour per day basis until that Work is completed and the service restored, or at an alternate time required by the Contracting Authority.

6.16.2 Before beginning that Work, the Contractor shall apply in writing to, and receive approval in writing from, the Owner, through the A/E, to establish a time when interruption of the service will cause a minimum of interference with the activities of the Owner and its tenants.

6.17 Explosives and Blasting

6.17.1 The Contractor shall not conduct blasting on, or bring explosives to, the Site without the prior written approval of the Contracting Authority, Owner, and other authorities with jurisdiction.

6.17.2 The Contractor shall perform all blasting, storing, and handling of explosives as required under Applicable Law.

6.17.2.1 The Contractor shall carry appropriate liability insurance coverage, as required by the Contract Documents, for its blasting and explosives storage and handling operations. Immediately upon request, the Contractor shall deliver evidence of that insurance to the Contracting Authority.

6.18 Building Commissioning

6.18.1 If the Project scope includes building commissioning, the Contractor shall participate in the Commissioning Process, as prescribed in the Contract Documents.

6.18.2 The Contractor shall permit the A/E, or a third-party Commissioning Agent (“CxA”) if applicable, access to commission performance based equipment, fixtures, and/or systems (e.g., HVAC, fire protection, smoke evacuation, fume hoods, emergency power, etc.), prior to Substantial Completion.

6.18.3 The A/E, or CxA if applicable, shall promptly notify the Contractor in writing of any deficiency identified during the Commissioning Process.

6.18.4 To facilitate the Commissioning Process, the Contractor shall submit four sets of Operation and Maintenance Manuals for dynamic and engineered systems to the A/E, and CxA if applicable, for approval. That submission shall occur within 30 days following approval of all related Contractor submittals required by the Contract Documents.

6.19 Action Submittals

6.19.1 Submittal Description. Shop Drawings, Product Data, Samples, and other submittals for the A/E’s review and action shall be provided by the Contractor for any item required by the Contract Documents but not fully described in the Contract Documents, unless waived by the A/E, and include, but are not limited to:

6.19.1.1 construction of the various parts, method of joinery, type of materials, grade, quality and thickness of materials, alloy of materials, profiles of all sections, reinforcement, method of hanging doors or installing windows, anchorage, and type and grade of finish;

6.19.1.2 capacities, types of materials and performance charts that are pertinent to the materials, and performance charts that are pertinent to the equipment item; and

6.19.1.3 wiring diagrams, control diagrams, schematic diagrams, working and erection dimensions, arrangement and specifications.

6.19.2 Form of Submittals. The Contractor shall provide a transmittal letter, review and stamp its approval, and transmit the submittals to the A/E in accordance with the submittal schedule established by the A/E and Contractor.

6.19.2.1 The Contractor shall submit a minimum of one reproducible and three copies of Shop Drawings, and a minimum of four copies of any other submittal, except when using the State’s web-based project management software.

6.19.2.2 The data shown on the Shop Drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to communicate to the A/E the materials and equipment that the Contractor proposes to provide.

6.19.2.3 Each Sample shall be identified clearly as to materials, supplier, pertinent data as catalog numbers, the intended use, and other uses as the A/E may require enabling the A/E to review the submittal.

6.19.3 Variation from Contract Documents. If the submittals show variations from the requirements of the Contract Documents, the Contractor shall specifically and clearly identify the variations in its letter of transmittal.

6.19.3.1 Variations that may affect the construction quality, cost or timeline shall be submitted by the A/E to the Contracting Authority for review, and if approved, shall be incorporated into the Work by Change Order.

6.19.3.2 The Contractor shall not be relieved of responsibility for deviations from the Contract Documents by the A/E's approval of submittals.

6.19.3.3 Submittals are not Contract Documents. In the event of conflicts between submittals and the Contract Documents, the Contract Documents take precedence and govern the Work.

6.19.4 Contractor's Submittal Review. The Contractor shall review and stamp "approved" all submittals before forwarding them to the A/E. If it is apparent to the A/E that the Contractor has not reviewed the submittals, or has conducted an incomplete review, the A/E may reject the submittals.

6.19.4.1 The Contractor shall field verify conditions as necessary and make corrections of dimensions, locations of various items, encroachments of work of Separate Contractors, or variations from the requirements of the Contract Documents.

6.19.4.2 If required by the Contract Documents or Applicable Law, the Contractor shall have Shop Drawings or other submittals prepared by Persons possessing expertise and experience in an appropriate trade or profession or by a registered architect, professional engineer, or other professional.

6.19.4.3 By approving and submitting submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements, and field construction criteria related to the associated Work, or shall do so, and has checked and coordinated the information contained within the submittals with the requirements of the Work and of the Contract Documents.

6.19.5 A/E's Submittal Review. The A/E shall review submittals for conformity with design intent within 14 days after receiving them or in accordance with the approved submittal schedule, or other period as mutually agreed by the A/E and Contractor. The A/E's review of submittals is to determine if the items covered by the submittals will, after installation and incorporation into the Work, conform to the Contract Documents and be compatible with the design concept of the Project as a functioning whole.

6.19.5.1 The Contractor shall make corrections required by the A/E and resubmit the required number of corrected copies of submittals until approved, which resubmission shall be acted upon by the A/E within 14 days after receiving them, or other period mutually agreed by the A/E and Contractor.

6.19.5.2 When resubmitting corrected submittals, the Contractor shall direct the A/E's attention to revisions made by noting revisions on the resubmittal.

6.19.5.3 The Contractor shall pay all reasonable costs of the A/E, Owner, and Contracting Authority for attendant delay, interference, hindrance, or disruption of the Project due to excessive resubmittals without fault of the A/E, Owner, or Contracting Authority. Resubmittals in excess of two without fault of the A/E, Owner, or Contracting Authority may be determined excessive by the Contracting Authority.

6.19.5.4 The A/E may hold Samples and other submittals used to coordinate finishes, colors, patterns, textures, or other characteristics until submittals for adjacent materials are available. Within seven days after receiving the submittal, the A/E shall issue a written notice to the Contractor stating that the submittal is being held.

6.19.5.5 If coordinating submittals are not received within the period required for action on previously received submittals that are held in accordance with **Section 6.19.5.4**, review of the previously received submittals may be delayed.

6.19.5.6 The A/E's review shall not extend to means, methods, manners, techniques, sequences, or procedures of construction, or to safety precautions or incident programs.

6.19.5.7 The review and approval of a separate item shall not indicate approval of the assembly in which the item functions.

6.19.6 Risk of Nonpayment. The Contractor shall not commence any portion of the Work requiring Shop Drawings, Product Data, Samples, or other submittals until the submittal has been approved by the A/E. If the Contractor starts Work before the A/E's final approval of the submittal, the Contractor does so at its own risk that payment may not be approved by the Contracting Authority or made by the Owner for the related Work.

6.19.7 Equipment Statement. Shop Drawings on equipment shall include the following written statement from the manufacturer of the equipment:

6.19.7.1 “This equipment submitted for approval shall perform as specified when installed in the arrangement shown on this drawing and in the Contract Documents and in conjunction with all other accessories as flues, breechings, piping, controls, and equipment not furnished by this manufacturer, but required as an accessory or supplement to this equipment, providing that the accessory or supplementary items perform as specified and are installed as shown in the Contract Documents.”

- .1 The Contractor will be deemed to have included the above statement as required even if the associated Shop Drawing does not actually contain the statement.

6.19.7.2 This equipment statement shall not be required for Samples, Product Data, and other standard submittals that are not created specifically for this Project.

6.19.8 Domestic Steel Certifications. The Contractor shall include the following written certifications on the front cover or initial sheet of each structural steel fabrication Shop Drawing, signed and dated prior to fabrication:

6.19.8.1 “Steel Fabricator Certification: The steel fabricator identified below certifies that for this project all load-bearing structural steel has been fabricated or produced, to the best of its knowledge, only from steel made in the United States in accordance with Ohio Revised Code Section 153.011. Further, the steel fabricator hereby certifies that it has read and understands that a monetary penalty for violations may be imposed under the authority of Ohio Revised Code Section 153.99.” This certification shall be followed by the name of the fabrication company, name of the company official signing the certification, the signature of that company official, and the date of that signature.

- .1 The Contractor will be deemed to have included the above certification as required even if the associated Shop Drawing does not actually contain the certification.

6.19.8.2 “Contractor Certification: The contractor identified below certifies that it has required as a condition of purchase, that for this project all load-bearing structural steel shall be fabricated and produced using, to the best of its knowledge, only steel made in the United States in accordance with Ohio Revised Code Section 153.011. Further, the contractor hereby certifies that it has read and understands that a monetary penalty for violations may be imposed under the authority of Ohio Revised Code Section 153.99.” This certification shall be followed by the name of the Contractor company, name of the company official signing the certification, the signature of that company official, and the date of that signature.

- .1 The Contractor will be deemed to have included the above certification as required even if the associated Shop Drawing does not actually contain the certification.

6.20 Warranty

6.20.1 The Contractor warrants to the Contracting Authority and Owner that all materials and equipment furnished under the Contract shall be new and of good quality unless otherwise required or permitted by the Contract Documents, that the Work shall be free from defects not inherent in the quality required or permitted, and that the Work shall conform to the requirements of the Contract Documents. Work not conforming to those requirements, including Substitutions not properly approved and authorized is Defective Work. If required by the A/E, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

6.20.2 If the Contractor or a Subcontractor recommends a particular product, material, system, or item of equipment for incorporation into the Project and the Owner accepts that recommendation, the above warranty includes a warranty from the Contractor to the Owner that the recommended product, material, system, or item of equipment is fit and appropriate for the associated purpose.

6.21 Additional Tests and Inspections

6.21.1 If before or after Substantial Completion the A/E or the Contracting Authority determines that any portion of the Work requires special inspection, testing, or approval not otherwise required under the Contract Documents, the A/E shall order such inspection, testing, or approval.

6.21.1.1 If the special inspection, testing, or approval reveals Defective Work, the Contractor shall pay all associated costs and will not be entitled to any related adjustment of the Contract Times. Those costs may include, but are not limited to:

- .1 the cost of the special inspection, testing, or approval;
- .2 the cost of conducting the special inspection, testing, or approval on similar Work regardless of whether the similar Work is also revealed as Defective Work;
- .3 the cost of additional special inspections, testing, or approvals to evaluate remedial Work;

- .4 the cost of correcting the Defective Work; and
- .5 all related Owner-incurred fees and charges of contractors, engineers, architects, attorneys, and other professionals.

6.21.1.2 The Contracting Authority may deduct the costs described under **Section 6.21.1.1** from payments then or thereafter due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to the Owner.

6.21.1.3 If the special inspection, testing, or approval reveals that the Work complies with the Contract Documents, and the Contractor believes that it is entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of the special inspection, testing, or approval, the Contractor may request a Change Order by giving written notice under **Section 7.3.2** within seven days after the special inspection, testing, or approval.

6.21.2 If the Contractor is aware of a need for inspection, testing, or approval, or of a need to have any inspection, testing, or approval completed by a particular time to avoid delay, then the Contractor shall timely communicate such information to the A/E and Contracting Authority.

6.21.3 Except as described under **Section 6.21.1**, the Owner shall pay for any inspection, testing, or approval that did not become a requirement until after it awarded the Contract.

6.21.4 The Contractor shall coordinate with and give the A/E, Contracting Authority, and Owner reasonable notice of the anticipated dates of all inspections, testing, or approvals.

6.21.5 Within five days after completion of an inspection, testing, or approval, the A/E shall provide an original report/certificate of the inspection, testing, or approval to the Contractor and Contracting Authority with a recommendation for or against acceptance of the results therein.

6.22 Uncovering the Work

6.22.1 If the Contractor covers Work contrary to the requirements of the Contract Documents or contrary to the written request of the Contracting Authority or A/E, the Contractor shall, if the Contracting Authority or A/E requests in writing, uncover that Work for observation, correct it if not in conformity with the Contract Documents, and recover it at the Contractor's expense without adjustment of the Contract Times.

6.22.2 If the Contractor covers Work in accordance with the Contract Documents and not contrary to a request from the A/E or Contracting Authority for an opportunity to observe the Work prior to covering, the Contractor shall, if the A/E requests in writing, uncover that Work.

6.22.2.1 If the uncovered Work is Defective Work, the Contractor shall pay the costs of uncovering, correcting, and recovering the Work and shall not be entitled to an adjustment of the Contract Times.

6.22.2.2 If the uncovered Work is not Defective Work and the Contractor believes that it is entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of the uncovering and recovering of the Work, the Contractor may request a Change Order by giving written notice under **Section 7.3.2** within seven days after the Contracting Authority or A/E observes the uncovered Work.

6.23 Correction of the Work

6.23.1 Before Substantial Completion.

6.23.1.1 If the Contractor provides Defective Work or fails or neglects to perform the Work in accordance with the Construction Progress Schedule, the Contracting Authority or A/E may issue a written notice to the Contractor and Contractor's Surety directing the Contractor to correct the Defective Work or recover schedule deficiencies. Unless otherwise specified in that written notice, the Contractor shall promptly commence and diligently pursue correction of the Defective Work and recovery of schedule deficiencies within no more than three days after the Contracting Authority issues the written notice ("72-Hour Notice").

6.23.1.2 If the Contractor fails to promptly commence and diligently pursue correction of the Defective Work and recovery of schedule deficiencies required under **Section 6.23.1.1**, the Owner may correct the Defective Work or take action to recover schedule deficiencies without giving further notice to the Contractor or Contractor's Surety.

6.23.2 After Substantial Completion.

6.23.2.1 In addition to the Contractor's other obligations under the Contract Documents, if any of the Work is found to be Defective Work after Substantial Completion, the Contractor shall correct it promptly after receipt of written notice from the A/E, Contracting Authority, or Owner to do so, unless the Contracting Authority and Owner have previously acknowledged and accepted the Defective Work in writing as described under **Section 6.24.1**. The A/E,

Contracting Authority, or Owner may send a copy of the written notice to the Contractor's Surety, but are not obligated to do so.

6.23.2.2 During the Correction Period. If the Contracting Authority or Owner issues a notice under **Section 6.23.2.1** during the Correction Period, the Owner may correct the Defective Work itself without giving further notice to the Contractor or Contractor's Surety if the Contractor fails to **(1)** notify the Owner in writing of the Contractor's intent to correct the Defective Work within seven days after the Contracting Authority or Owner issues the notice and **(2)** thereafter promptly commence and diligently pursue correction of Defective Work.

6.23.2.3 The Correction Period:

- .1 commences on the date of Substantial Completion of the Work or a designated portion of the Work which the Contracting Authority and Owner have agreed to take Partial Occupancy;
- .2 relates only to the Contractor's specific obligation and opportunity to correct the Work during the Correction Period;
- .3 does not establish a period of limitation with respect to any of the Contractor's other obligations under the Contract Documents;
- .4 has no relationship to the time within which the State or Owner may seek to enforce the Contract;
- .5 does not establish a period of limitation within respect to the commencement of litigation to establish the Contractor's liability under the Contract or otherwise; and
- .6 shall not be extended by corrective Work performed by the Contractor under this **Section 6.23.2**.

6.23.2.4 After the Correction Period. If the Owner issues notice under **Section 6.23.2.1** after expiration of the Correction Period, the Owner may correct the Defective Work without giving further notice to the Contractor or Contractor's Surety if the Contractor fails to **(1)** notify the Owner in writing of the Contractor's intent to correct the Defective Work within 14 days after the Owner issues the notice and **(2)** thereafter promptly commence and diligently pursue correction of Defective Work.

6.23.3 Emergency Correction of Defective Work.

6.23.3.1 Notwithstanding any other provision of the Contract to the contrary, if in the Contracting Authority's or Owner's opinion the Defective Work presents a threat of imminent harm or danger to people, property, or the environment, the Contracting Authority or Owner may order the Contractor to immediately correct Defective Work or the Owner may correct the Defective Work itself without any prior notice to the Contractor or Contractor's Surety.

6.23.4 Responsibility for Costs of Correction.

6.23.4.1 The Contractor shall pay all of the costs and damages associated with the correction of Defective Work and the recovery of schedule deficiencies under this **Section 6.23**. Those costs and damages may include, but are not limited to, the related fees and charges of contractors, engineers, architects, attorneys, and other professionals; and the cost of correcting or replacing adjacent work. The Contracting Authority may deduct those costs and damages from payments then or thereafter due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to the Owner.

6.24 Acceptance of Defective Work

6.24.1 Before final Contract Completion, the Owner may accept any Defective Work instead of requiring its removal or correction, in which case the Contract Sum must be equitably reduced as described under **Article 7**.

6.24.1.1 The Owner may only accept Defective Work through a deduct Change Order that makes explicit reference to this **Section 6.24**.

6.24.1.2 After final Contract Completion, the Owner may only accept Defective Work by giving written notice to the Contractor that the Owner is accepting the associated Defective Work.

6.24.2 None of the following will constitute **(1)** acceptance of Defective Work, **(2)** a release of the Contractor's obligation to perform the Work in accordance with the Contract, or **(3)** a waiver of any rights set forth in the Contract or otherwise provided by Applicable Law:

6.24.2.1 observations or inspections by the Owner, Contracting Authority, or A/E;

6.24.2.2 the making of any payment;

6.24.2.3 Substantial Completion or the issuance of a Certificate of Substantial Completion;

6.24.2.4 Partial Occupancy and the Owner's use or occupancy of the Work or any part of it;

- 6.24.2.5 Contract Completion or the issuance of a partial or final Certificate of Contract Completion;
- 6.24.2.6 any review or approval of a submittal;
- 6.24.2.7 any inspection, test, or approval by other Persons; or
- 6.24.2.8 any correction of Defective Work by the Owner.

6.25 Project Document Maintenance and Submittal

6.25.1 During Construction.

6.25.1.1 The Contractor shall maintain in good order at a secure location on the Site:

- .1 a complete copy of all Contract Documents; Shop Drawings, Product Data, Samples and similar required submittals; manufacturer operating and maintenance instructions; certificates; warranties; RFIs and responses thereto; and other Project-related documents, all marked currently and accurately to record field changes and selections made during construction and to show actual installation where installation varies from Work as originally shown, including the exact location and depth of underground utility lines; and
- .2 a set of Drawings and Specifications, approved in accordance with **Section 5.2.1.1**, and the records required by **Section 6.2.17**.

6.25.1.2 Before submitting each Contractor Payment Request, the Contractor shall record all changes on the Contract Documents, neatly in a contrasting color, noting new information not shown on the original Contract Documents. Failure to record all changes may cause payment to be withheld or delayed by the Contracting Authority.

6.25.1.3 The Contractor shall keep a record of changes made to the Specifications, noting particularly any approved variation from manufacturers' installation instructions and recommendations.

6.25.1.4 If the Contractor uses Shop Drawings to indicate as-built conditions, the Contractor shall cross-reference the Shop Drawing sheet numbers to the corresponding sheet numbers on the Contract Documents. The Contractor shall note related numbers where applicable.

6.25.1.5 The Contractor shall at all times permit access to the documents described in this **Section 6.25.1** to authorized representatives of the State, local authorities having jurisdiction, Contracting Authority, Owner, and A/E.

6.25.2 Before Contract Completion.

6.25.2.1 The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and final payment, shall organize the As-Built Documents into manageable sets, bind the sets with durable paper cover sheets, and deliver the As-Built Documents to the A/E.

6.25.2.2 The Contractor's As-Built Documents submission shall include, but is not limited to:

- .1 Certificate of Occupancy;
- .2 inspection certificates for pressure piping, elevator, boiler, electrical, plumbing or piping purification, etc.;
- .3 Letter of Approval from the local fire authority or State Fire Marshal for the fire suppression system;
- .4 Operation and Maintenance Manuals, organized into suitable sets of manageable size. Indexed data bound in individual binders, with pocket folders for folded sheet information and appropriate identification marked on the front and the spine of each binder;
- .5 neatly and accurately marked sets of As-Built Documents, and other Contract Documents reflecting the actual construction of the Project;
- .6 detailed Drawings reflecting the exact location of any concealed utilities, mechanical or electrical systems, and components;
- .7 assignment to the Owner of all warranties and guarantees, including the most-recent address and telephone number of any Subcontractors or manufacturers;
- .8 an affidavit to certify that all Subcontractors have been paid in full for all Work performed or materials furnished for the Project;
- .9 final certified payroll reports; and
- .10 an affidavit to certify that the Contractor and each of its Subcontractors, regardless of tier, have complied with all requirements of ORC Chapter 4115.

6.25.2.3 By submitting the As-Built Documents to the A/E, the Contractor certifies that its As-Built Documents are complete, correct, and accurate.

6.25.3 Record Documents.

6.25.3.1 The A/E shall revise the original Contract Documents and related electronic files with the information contained on the As-Built Documents. The A/E shall label the revised original Contract Documents and related electronic files as “Record Documents” and reflect the date of the A/E’s incorporation of the As-Built Documents.

6.25.3.2 The Owner may thereafter use the Record Documents for any purpose relating to the Project including, but not limited to, additions to or completion of the Project.

6.26 Final Cleaning

6.26.1 Before requesting the Substantial Completion inspection of the Work, the Contractor shall clean the Site, remove waste materials and rubbish attributable to the Project, and restore the property to its original condition so that upon Substantial Completion, the premises are ready for occupancy by the Owner.

6.26.2 If the Contractor performs any Work after final cleaning, the Contractor shall clean the affected area as provided above so that upon Substantial Completion, the premises are ready for occupancy by the Owner.

6.26.3 Final cleaning shall be done to the reasonable satisfaction of the A/E and Contracting Authority.

6.27 Substantial Completion**6.27.1 Contractor’s Punch List.**

6.27.1.1 When the Contractor considers the Work, or a designated portion thereof, Substantially Complete the Contractor shall inspect the Work and prepare a list of Defective Work and incomplete or unacceptable Work (“Contractor’s Punch List”). The Contractor shall list all items of Work not in compliance with the Contract Documents, including items the Contractor is requesting to be deferred.

- .1 The Contractor shall proceed to correct all items listed on the Contractor’s Punch List and certify that the incomplete items listed on the Contractor’s Punch List are to its knowledge an accurate and complete list by signing the Contractor’s Punch List.
- .2 The Contractor’s failure to include an item on the Contractor’s Punch List shall not alter the Contractor’s responsibility to complete the Work in accordance with the Contract Documents.
- .3 The Contractor shall submit the signed Contractor’s Punch List to the A/E, together with a request for the Substantial Completion inspection of the Work.

6.27.1.2 If the Project is administered using the State’s web-based project management software, the Contractor shall submit the Contractor’s Punch List, using the “Punch List” business process.

6.27.2 Substantial Completion Inspection.

6.27.2.1 Within three business days after receipt of the request for the Substantial Completion inspection of the Work, the A/E shall notify the Contractor of acceptance or rejection of the request, stating reasons for any rejection.

- .1 Within seven days after its acceptance of the Contractor’s request, the A/E shall conduct the Substantial Completion inspection to determine whether the Work, or designated portion, is in conformity with the Contract Documents and Substantially Complete. The A/E shall notify the Contractor, Contracting Authority, and Owner of the scheduled time of the inspection.
- .2 If the A/E determines that the Work is Substantially Complete, within three business days after the Substantial Completion inspection, the A/E shall prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion and include a list of Defective, incomplete, or unacceptable Work (“A/E’s Punch List”). The A/E’s Punch List shall include (1) the items on the Contractor’s Punch List that are not yet completed or corrected as of the date of the Substantial Completion inspection, and (2) comments from the Contracting Authority and Owner.
- .3 The A/E shall submit the Certificate of Substantial Completion to the Contracting Authority, Owner, and Contractor for their written acceptance. Upon their acceptance and consent of the Contractor’s Surety, and subject to the Owner’s right to withhold payment, the Owner shall release retainage as described under **Section 9.7.2**.
- .4 The A/E’s failure to include an item on the A/E’s Punch List shall not alter the Contractor’s responsibility to complete the Work in accordance with the Contract Documents.
- .5 If the A/E accepts the request and subsequently determines that the Work is not Substantially Complete, the A/E may request compensation for expenses related to excessive Punch List activities. The Contracting Authority may deduct that additional compensation to the A/E from payments then or thereafter due the

Contractor. If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to the Owner.

6.27.3 Completion of Punch List Items.

6.27.3.1 Before expiration of the Punch List Milestone and before the date of Final Contract Completion, the Contractor shall complete all items on the A/E's Punch List. After completing all items on the A/E's Punch List, the Contractor shall provide a written request for Final Inspection of the Work to the A/E.

- .1** If Work on the A/E's Punch List cannot be timely completed, the Contractor shall justify in writing to the reasonable satisfaction of the Contracting Authority and A/E, the reasons the items cannot be completed, and the Contractor may propose, for the Contracting Authority and A/E's approval, an adjustment of the Punch List Milestone for the associated Punch List items to establish a time when the Contractor shall complete those items.
- .2** Within three business days after receipt of the request for the Final Inspection of the Work, the A/E shall complete a Final Inspection of the Work for compliance with the Contract Documents.
- .3** If multiple inspections of items on the A/E's Punch List are required due to the Contractor's failure to properly and timely complete them, the Contractor shall pay any additional costs incurred by the A/E, Owner, and Contracting Authority resulting from any attendant delay. The Contracting Authority may deduct those additional costs from payments then or thereafter due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to the Owner.

6.28 Partial Occupancy

6.28.1 The Owner may occupy or use a portion of the Project prior to Substantial Completion of all Work if:

6.28.1.1 the building authority with jurisdiction over the Project issues a partial certificate of occupancy for the portion of the Project the Owner intends to occupy;

6.28.1.2 the Owner with the Contractor's and A/E's assistance has provided written notice of the Partial Occupancy to the insurers providing builder's risk property insurance for the Project; and

6.28.1.3 the Contracting Authority has received notice of the Partial Occupancy from the A/E and has consented to it.

6.28.2 Before the Owner commences Partial Occupancy, the Owner, Contracting Authority, A/E, and Contractor shall proceed as described under **Section 6.27** for the area designated for Partial Occupancy.

6.28.3 The Contractor shall be relieved of the obligation to maintain the area accepted for Partial Occupancy, but shall remain obligated to complete and correct the Work and to carry the insurance required by the Contract Documents during performance of any such Work.

6.29 Demonstration and Training, Operating Appurtenances

6.29.1 The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and final payment, shall perform demonstration and training of the Owner's maintenance personnel as specified in the Contract Documents.

6.29.2 The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and final payment, shall organize and submit operating appurtenances and loose items related to operation and maintenance of the completed Project to the Owner, including, but not limited to:

6.29.2.1 keys to door and window hardware, panels, and other devices not directly provided to the Owner from the manufacturer;

6.29.2.2 operating handles, levers, cranks, specialized wrenches or drivers, remote controls, and similar items; and

6.29.2.3 extra materials (e.g., attic stock).

6.30 Contract Completion

6.30.1 Partial Contract Completion.

6.30.1.1 When items of Work cannot be completed until a subsequent date, the A/E shall prepare a partial Certificate of Contract Completion that shall include a detailed list of the deferred Work and the date(s) by which the Contractor will complete that Work.

6.30.1.2 The A/E shall submit the partial Certificate of Contract Completion to the Contracting Authority, Owner, and Contractor for their written acceptance. Upon their acceptance of the partial Certificate of Contract Completion and consent of the Contractor's Surety, the Contracting Authority may release payment to the Contractor, as determined in the sole discretion of the Contracting Authority.

6.30.2 Final Contract Completion.

6.30.2.1 When all items on the A/E's Punch List have been completed to the satisfaction of the A/E, all requirements of the Contract Documents have been completed, and the provisions of **Sections 6.25** through **6.29** have been fulfilled, the A/E shall prepare and recommend execution of a final Certificate of Contract Completion.

6.30.2.2 The date that the Contracting Authority executes the final Certificate of Contract Completion is the date of Contract Completion.

ARTICLE 7 - MODIFICATIONS

7.1 General

7.1.1 Changes in the Work.

7.1.1.1 The Contracting Authority may order changes in the Work without invalidating the Contract. Subject to the limitations stated in this **Article 7** and elsewhere in the Contract Documents, a change in the Work may be accomplished by a Change Order, Change Directive, or order for a minor change in the Work.

- .1 The Contractor shall proportionately increase the amount of the Bond whenever the Contract Sum is increased.
- .2 If notice of any change affecting the Contract is required by the provision of any Bond, notice is the Contractor's responsibility, and the amount of each applicable Bond shall be adjusted accordingly.

7.1.1.2 The Contractor shall not proceed with any change in the Work without the Contracting Authority's prior written authorization except as provided under **Sections 1.10** and **7.5**.

7.1.1.3 Except as provided in **Section 1.10**, the Contractor's failure to obtain prior written authorization for a change in the Work constitutes a waiver by the Contractor of an adjustment to the Contract Sum or Contract Times, or both, for the related Work.

7.1.1.4 The Contractor shall perform all changes in the Work under the applicable provisions of the Contract Documents, and the Contractor shall proceed promptly with the change unless otherwise provided in the Change Order, Change Directive, or order for a minor change in the Work

7.1.2 Paperwork Consolidation.

7.1.2.1 Related Modifications, with the same or similar justification (e.g., Owner Request or field resolution), may be consolidated into the same Change Order.

7.1.2.2 Add and deduct Modifications, with the same or similar justification, may be included on the same Change Order.

7.1.2.3 Modifications resulting from errors or omissions shall not be combined with other modifications for which the A/E will receive a fee.

7.1.3 Modification Numbering.

7.1.3.1 The A/E shall assign a number to each Modification, which shall uniquely identify it.

7.1.3.2 The A/E shall not duplicate or reuse any number throughout the Project or reuse assigned numbers for Proposal Requests that are initiated but cancelled in process.

7.1.3.3 The number for each Change Order shall be coordinated with any associated Proposal Request or Change Directive.

7.1.4 Modification Log.

7.1.4.1 The A/E shall create and maintain a Modification Log for the Project, which shall contain the following minimum information:

- .1 number of the Modification;
- .2 a brief description of the Modification;
- .3 cost of the Modification;
- .4 schedule impact of the Modification; and

.5 dates sent to, and received from, the parties.

7.1.5 Reconciliation of Unit Price Items.

7.1.5.1 The Contracting Authority may increase, decrease, or delete entirely the scheduled quantities of Unit Price Work.

7.1.5.2 The A/E shall issue a Change Order to reconcile the difference between the scheduled and actual quantities of Unit Price Work performed and materials furnished.

7.1.5.3 If the actual quantity of a Unit Price item differs from the scheduled quantity by 20 percent or more, so that application of the Unit Price to the quantities of Work proposed would create an undue hardship on either the Owner or Contractor, the A/E shall issue a Proposal Request and subsequent Change Order to adjust the Unit Price.

.1 If a Unit Price is adjusted as described under **Section 7.1.5.3**, the new Unit Price will only apply to the units of Work performed that are **(1)** less than the 20 percent threshold if the Unit Price is changed on account of an over-estimation of the scheduled quantity of a Unit Price item involved in the Work or **(2)** in excess of the 20 percent threshold if the Unit Price is changed on account of an under-estimation of the scheduled quantity of a Unit Price item involved in the Work.

7.1.5.4 If the actual quantity of a Unit Price item exceeds the scheduled quantity by 20 percent or more, the Contractor shall immediately notify the A/E, who shall issue a Change Directive and subsequent Change Order to authorize an adjustment in the scheduled quantity.

7.1.6 Notice of Credits and Schedule Reductions.

7.1.6.1 Notwithstanding any other provision of the Contract to the contrary, the Contractor shall promptly notify the Contracting Authority, Owner, and A/E in writing whenever any change in the Project (including without limitation through an order for a minor change in the Work) may entitle the Owner to a credit from the Contractor or a reduction of the time for completion of the Project.

7.2 Change Order Procedure

7.2.1 A Change Order is a written instrument prepared by the A/E and executed by the Contracting Authority and Contractor, stating their agreement upon all of the following:

7.2.1.1 a change in the Work;

7.2.1.2 the amount of the adjustment of the Contract Sum, if any; and

7.2.1.3 the extent of the adjustment of the Contract Times, if any.

7.2.2 Except with the Contracting Authority's written consent as explicitly provided under **Section 7.4.8**, the Contractor is not entitled to reserve any rights or take other similar action with respect to a Change Order if the effect or intent of the reservation or action would be to accommodate a further adjustment of the Contract Sum or Contract Times, or both, after the Contractor signs the Change Order. By signing a Change Order, the Contractor irrevocably certifies that the elements of a Change Order described in **Section 7.2.1** are completely and fully satisfied, and waives all rights, if any, to seek further adjustment of the Contract Sum or Contract Times, or both, at a later date with respect to the associated change in the Work including without limitation on account of **(1)** the "cumulative impact" of the associated change in the Work in combination with one or more other changes in the Work; **(2)** all direct and indirect costs, including interest on those costs; and **(3)** any delays, inefficiencies, disruptions, suspensions, extended overhead, and acceleration.

7.2.3 The A/E shall prepare each Change Order form, attach the supporting documentation, and issue the Change Order to the Contractor for signature.

7.2.4 If the Contractor is in agreement with the Change Order under **Section 7.2.1**, the Contractor shall sign and return the Change Order to the A/E within three days after receiving it.

7.2.5 When the A/E receives the Change Order signed by the Contractor, the A/E will recommend approval by signing the form and transmitting the Change Order and the revised Change Order Log to the Owner.

7.2.6 When the Owner receives the Change Order, the Owner may sign the form accepting the Change Order, attach certification of funding, and transmit the Change Order to the Contracting Authority; or, if the Owner does not accept the Change Order, the Owner will reject and return it to the A/E.

7.2.7 When the Contracting Authority receives the Change Order, the Contracting Authority may sign the form approving the Change Order, and transmit the fully executed Change Order to all signers; or, if the Contracting Authority does not accept the Change Order, the Contracting Authority will reject and return it to the A/E.

7.2.8 When the Change Order is signed by the Contractor, A/E, Owner, and Contracting Authority, the fully executed Change Order modifies the Contract Documents and authorizes and directs the Contractor to proceed, and the Contractor shall promptly proceed with the associated change in the Work.

7.3 Initiation of Change Orders

7.3.1 Proposal Request.

7.3.1.1 The A/E shall prepare and issue a Proposal Request to the Contractor to obtain the Contractor's Proposal for the adjustment of the Contract Sum or the Contract Times, or both, associated with a contemplated Modification.

- .1 In any Proposal for an adjustment of the Contract Sum, the Contractor shall specifically identify the items set forth in **Section 7.7**.
- .2 In any Proposal for an adjustment of the Contract Times, the Contractor shall specifically identify the items set forth in **Section 7.8**.
- .3 The Contractor's cost of preparing and providing Proposals is included in the Contract Sum.

7.3.1.2 The Contractor shall respond with a Proposal to the A/E and Contracting Authority within 14 days after receiving the Proposal Request. The allowable time for the Contractor's response may be extended by written agreement of the Contractor and A/E.

7.3.1.3 The Contractor shall hold the Proposal valid and open for acceptance for at least 45 days. The acceptance period may be adjusted by mutual consent of the Contractor and Contracting Authority. The time limits described under this **Section 7.3.1.3** apply only to Proposals submitted in response to a Proposal Request.

7.3.1.4 A Proposal may be accepted by the Contracting Authority only through a Change Order. A Proposal Request does not authorize the Contractor to proceed with a change in the Work.

7.3.1.5 If the Contractor does not timely submit a Proposal within the time required in **Section 7.3.1.2**, the Contractor waives its right to an adjustment to the Contract Sum or Contract Times, or both, associated with the contemplated change in the Work.

7.3.2 Request for Change Order.

7.3.2.1 The Contractor may initiate a change in the Work by submitting written notice to the A/E accompanied by a Proposal meeting the requirements of **Section 7.3.1**.

7.4 Change Directives

7.4.1 A Change Directive is a written order prepared by the A/E and executed by the Contracting Authority directing a change in the Work and may, if necessary:

- 7.4.1.1** state a proposed basis for adjustment, if any, in the Contract Sum or Contract Times, or both; or
- 7.4.1.2** limit the scope of the change in the Work on a time and materials basis, not to exceed a fixed adjustment of the Contract Sum.

7.4.2 If a change in the Work must start immediately to avoid an imminent impact to the schedule of the Project, the A/E may prepare a Change Directive for the Contracting Authority's and the Owner's signatures pursuant to **Section 7.4.1**, authorizing the Contractor to proceed.

7.4.3 A Change Directive shall be used to direct a change in the Work in the absence of total agreement on the terms of a Change Order.

7.4.3.1 For the purposes of clarity, the Contract refers to a Change Directive as if it is only to be used in the absence of total agreement on the terms of a Change Order concerning the associated change of the Work. A Change Directive may also be used in the absence of agreement as to whether the subject of the Change Directive actually constitutes a change in the Work; such as the situation described under **Section 7.5.3**.

7.4.4 Upon receipt of a Change Directive, the Contractor shall promptly proceed with the change in the Work involved.

7.4.5 The Contractor may sign the Change Directive to accept the proposed basis for adjustment, if any, of the Contract Sum or Contract Times, or both. Thereafter, the A/E shall prepare and the A/E, Contracting Authority, Owner, and Contractor shall promptly execute an associated Change Order as described under **Section 7.2**.

7.4.6 Within 14 days after receiving the Change Directive, the Contractor shall respond with a Proposal meeting the requirements of **Section 7.3.1** to the A/E and Contracting Authority for adjustment of the Contract Sum or Contract Times, or both, on account of the change, unless the Change Directive is performed on a time and materials basis under

Section 7.4.1.2. If the Change Directive is performed on a time and materials basis, the Contractor shall submit its Proposal within seven days after completing the Work.

7.4.6.1 The Proposal for the adjustment of the Contract Sum, if any, shall include: **(1)** written documentation as described under **Section 7.7**; and **(2)** a written statement from the Contractor that the proposed adjustment is the entire adjustment in the Contract Sum associated with the change.

7.4.6.2 The Proposal for the change in the Contract Times, if any, shall include: **(1)** written documentation as described under **Section 7.8**; and **(2)** a written statement from the Contractor that the proposed adjustment is the entire adjustment of the Contract Times associated with the change.

7.4.7 If the Contractor does not respond to a Change Directive as required under **Section 7.4.5** or **Section 7.4.6**, the Contracting Authority shall determine the adjustments, if any, of the Contract Sum and Contract Times, and the A/E shall prepare a Change Order consistent with that determination. Notwithstanding any other provision of the Contract to the contrary, that Change Order will modify the Contract Documents when it is signed by the Owner and Contracting Authority. If the Contractor does not agree with the Contracting Authority's determination, the Contractor shall initiate a Claim under **Article 8** within ten days after the date that the Contracting Authority issues its determination, and the Contractor's failure to do so shall constitute an irrevocable waiver of the Claim.

7.4.8 Pending final determination of the total adjustment of the Contract Times on account of a Change Directive, the period of time not in dispute for that change in the Work may be included in the Construction Progress Schedule accompanied by a Change Order indicating the parties' agreement with part or all of the time adjustment.

7.4.9 If the Contracting Authority, Owner, and Contractor agree on the adjustments of the Contract Sum and Contract Times associated with a Change Directive, the A/E shall prepare an appropriate Change Order within seven days after receiving the Contractor's Proposal. The A/E, Contracting Authority, Owner, and Contractor shall promptly sign the Change Order as described under **Section 7.2**.

7.4.10 If the Contracting Authority, Owner, and Contractor do not agree on the adjustments of the Contract Sum and Contract Times associated with a Change Directive within 60 days after the Change Directive is issued, the Contracting Authority shall determine the adjustments, if any, of the Contract Sum and Contract Times, and the A/E shall prepare a Change Order consistent with that determination. Notwithstanding any other provision of the Contract to the contrary, that Change Order will modify the Contract Documents when it is signed by the Owner and Contracting Authority. If the Contractor does not agree with the Contracting Authority's determination, the Contractor shall initiate a Claim under **Article 8** within ten days after the date that the Contracting Authority issues its determination, and the Contractor's failure to do so shall constitute an irrevocable waiver of the Claim.

7.5 Minor Changes in the Work

7.5.1 The A/E may order minor changes in the Work not involving adjustment of the Contract Sum or extension of the Contract Times and not inconsistent with the intent of the Contract Documents. Those changes shall be effected by written order issued to the Contractor.

7.5.2 The Contractor shall promptly carry out each order for a minor change in the Work if the Contractor agrees that the order does not involve adjustment of the Contract Sum or Contract Times, or both.

7.5.3 If the Contractor reasonably believes that it would be entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of an order for a minor change in the Work, the Contractor, within three business days after receiving the order, shall give the Contracting Authority and A/E written notice of the Contractor's position, and not proceed with the subject Work without first receiving a Change Directive or Change Order related to it.

7.5.4 The Contractor waives its right to an adjustment of the Contract Sum or Contract Times on account of an order for a minor change in the Work by:

7.5.4.1 starting the Work that is the subject of the order for a minor change in the Work; or

7.5.4.2 failing to give the notice described under **Section 7.5.3** within three business days after receiving the order for a minor change in the Work.

7.6 Differing Site Conditions

7.6.1 If the Contractor encounters a Differing Site Condition, the Contractor shall stop Work on that Differing Site Condition and give immediate written notice of the condition to the A/E and Contracting Authority.

7.6.1.1 The Contractor's failure to give notice of the Differing Site Condition as required under this **Section 7.6.1** shall constitute an irrevocable waiver of any associated Claim.

7.6.1.2 The written notice of a Differing Site Condition under this **Section 7.6.1** shall be required before the notice of Claim under **Article 8**.

7.6.2 Promptly after receiving notice from the Contractor under **Section 7.6.1**, the A/E shall investigate to determine whether the Contractor has encountered a Differing Site Condition. The A/E shall give written notice of its determination to the Contracting Authority and Contractor within ten days after completing the investigation.

7.6.2.1 If the A/E determines that the Contractor has encountered a Differing Site Condition and the Contracting Authority agrees with the A/E's determination, the A/E shall process an appropriate Change Order.

7.6.2.2 If the A/E determines that the Contractor has encountered a Differing Site Condition but the Contracting Authority disagrees with the A/E's determination, the A/E shall process an appropriate Change Directive through which the Contracting Authority may convey its disagreement with the A/E's determination.

7.6.2.3 If the A/E determines that the Contractor has not encountered a Differing Site Condition and the Contractor does not agree with that determination, the Contractor must initiate a Claim under **Article 8** within ten days after the date that the A/E issues its determination.

7.7 Change Order Cost or Credit Determination

7.7.1 General.

7.7.1.1 The maximum cost or credit resulting from a change in the Work shall be determined as described below.

- .1 Proposals shall include the information required by **Section 7.7.1.4**.
- .2 A Unit Price Proposal shall only be valid when incorporated into the Contract by Change Order.
- .3 The maximum cost or credit includes all compensation for impact costs. Additional costs for impacts shall not be allowed.

7.7.1.2 The Contractor shall not assign any portion of the Work to another Person whereby the Contractor would benefit directly or indirectly from the double application of charges for overhead or profit.

Example: Assume that (1) the Contractor is or is capable of self-performing general trades Work and (2) the change in the Work includes both electrical trade Work and general trades Work. The Contractor may not assign the general trades Work to the Contractor's electrical Subcontractor and then perform that general trades Work as a sub-subcontractor to the Contractor's electrical Subcontractor.

7.7.1.3 The Contracting Authority may require notarized invoices for material costs and may audit the records of the Contractor and Subcontractors.

7.7.1.4 For each change in the Work, the Contractor shall furnish a detailed Proposal itemized on the **Proposal Worksheet Summary Form (Contractor)** published by the Ohio Facilities Construction Commission through which the Contractor shall document the related changes in the Contract Sum as described under **Section 7.7.2**. Any Subcontractor pricing shall be itemized on the appropriate **Proposal Worksheet Summary Form**.

7.7.1.5 **Section 7.7.2** establishes the exclusive and maximum amount that the Owner shall pay for any Change Order, including, but not limited to, all amounts for interference with, delay, hindrance, disruption of, or impact on the Work ("Pricing Criteria"). These Pricing Criteria also govern the value of deduct Change Orders and the Contractor's entitlement to additional compensation or damages through the Claims and dispute resolution processes on account of changes in the Work. In order to expedite the review and approval process, Proposals shall be prepared in the categories and order listed in **Section 7.7.2**.

7.7.2 Pricing Criteria.

7.7.2.1 Contractor Personnel Costs. Any cost or credit arising from a change in the quantity of the Contractor's on-Site management (including supervision and administrative personnel) not subject to prevailing wage under ORC Chapter 4115 shall be calculated on an hourly basis according to the rates acceptable to the Contracting Authority.

- .1 In no event will the Contractor be entitled to an increase in the Contract Sum on account of Contractor Personnel Costs unless the Contractor actually incurs additional Contractor Personnel Costs solely on account of the associated change in the Work.
- .2 Under no conditions will the increase under this **Section 7.7.2.1** exceed those additional Contractor Personnel Costs the Contractor actually incurs.

7.7.2.2 Labor. Any cost or credit arising from a change in the quantity of field labor directly involved in the Work shall be based upon the actual rate of pay to the worker. If the Project is subject to payment of prevailing wage rates, field labor shall be paid according to the relevant classification of labor as established in the applicable prevailing

wage determination for the Project locality, as determined by the Ohio Department of Commerce, Wage and Hour Bureau.

- .1 In no event will the Contractor be entitled to an increase in the Contract Sum on account of labor costs unless the Contractor actually incurs additional labor costs solely on account of the associated change in the Work.
- .2 Under no conditions will the increase under this **Section 7.7.2.2** exceed those additional labor costs the Contractor actually incurs.
- .3 The cost for supervision above the level of working forepersons (such as general forepersons, superintendent, project manager, etc.) is included in the adjustment under **Section 7.7.2.1** for the Contractor and under **Section 7.7.2.10** for Subcontractors.

7.7.2.3 Fringes. Fringe benefit credit for labor provided under **Section 7.7.2.2** is only allowable for prevailing wage fringe benefits pursuant to ORC Chapter 4115, including, but not limited to, Health and Welfare, vacation, apprenticeship training, and certain types of pension plans. The parties shall defer to the Ohio Department of Commerce's policy on which benefits are granted fringe benefit credit. Each fringe benefit for which credit is requested shall be calculated on an hourly basis and listed as a separate line item. The Contractor shall submit documentation supporting the calculation of the amounts for each fringe benefit for each worker classification, including labor provided by Subcontractors.

7.7.2.4 Allowable Payroll Expenses. Allowable payroll expenses for labor provided under **Section 7.7.2.2** including payroll taxes as well as other benefits that are required by Applicable Law, such as federal and state Unemployment and Workers' Compensation shall each be a separate line item and shall not be credited for compliance with ORC Chapter 4115.

7.7.2.5 Equipment Rentals. Any cost or credit arising from a change in the quantity of non-owned heavy or specialized equipment shall be based on the documented rental cost, but shall not exceed 100 percent of that documented cost. No rental charges shall be allowed for hand tools, minor equipment, simple scaffolds, etc. Downtime due to repairs, maintenance, and weather delays shall not be allowed. Contractor shall submit copies of actual paid invoices to substantiate rental costs.

7.7.2.6 Owned Equipment. Any cost or credit arising from a change in the quantity of heavy or specialized equipment owned by the Contractor or Subcontractor performing the Work shall be based on the cost listed by the current edition of the Associated Equipment Distributors' *AED Green Book* heavy equipment rental rates, but shall not exceed 100 percent of that documented cost. No recovery shall be allowed for hand tools, minor equipment, simple scaffolds, etc. The longest period of time that the equipment is to be required for the Work shall be the basis for the pricing. Downtime due to repairs, maintenance, and weather delays shall not be allowed.

7.7.2.7 Trucking. Any cost or credit arising from a change in the quantity of trucking shall be based on a reasonable delivery charge or per-mile trucking charge for delivery of required materials or equipment. Charges for use of a pick-up truck shall not be allowed.

7.7.2.8 Materials. Any cost or credit arising from a change in the quantity of materials incorporated into the changed Work shall be based on the actual cost (including all discounts, rebates or related credits) of those materials. Documentation shall show costs, quantities, or Unit Prices of all items, as appropriate.

- .1 The cost or credit for reusable materials (e.g., concrete form lumber, shoring, or temporary enclosures) shall be limited to 33 percent of the material cost for each use.

7.7.2.9 Contractor's General Conditions Costs. Any cost or credit arising from a change in the quantity of the Contractor's General Conditions Costs shall be limited to the extent to which the change is attributable to an associated change in the Contract Time for achievement of Substantial Completion resulting from the change in the Work.

- .1 In no event shall the Contract Sum adjustment per day of Contract Time adjustment exceed an amount equal to **(1)** the sum of the General Conditions Costs line items in the Contractor's Schedule of Values approved by the Contracting Authority, **(2)** divided by the total number of days of the original Contract Time for achievement of Substantial Completion.
- .2 The Contractor shall **(1)** exclude the Bond premium from the Schedule of Values for the purposes of the calculation under **Section 7.7.2.9.1**, and **(2)** include the actual adjustment of the Bond premium attributable to an associated change in the Contract Sum.
- .3 If the Contractor purchases the builder's risk insurance for the Project, the Contractor shall **(1)** exclude the builder's risk insurance premium from the Schedule of Values for the purposes of the calculation under **Section 7.7.2.9.1**, and **(2)** include the actual adjustment of the builder's risk insurance premium attributable to an associated change in the Contract Sum.

7.7.2.10 Subcontractor Overhead and Profit. Any cost or credit arising from a change in Subcontractor-performed Work shall include the Subcontractor's aggregate overhead and profit allowance equal to 15 percent of the sum of the Subcontractor's costs described under **Sections 7.7.2.2 through 7.7.2.8** that are associated with that changed Work.

- .1 The allowance applies to each Subcontractor tier. The Contractor is not entitled to recover overhead and profit under **Section 7.7.2.10** on account of changes in Contractor self-performed Work or Work the Contractor performs as a Subcontractor at any tier.

Example: Assume that **(1)** the Contractor is self-performing general trades Work and **(2)** the change in the Work includes both \$25,000 of electrical trade Work and \$10,000 of general trades Work. Under this **Section 7.7.2.10**, **(1)** the Contractor's Subcontractor would be entitled to overhead and profit mark-up but **(2)** the Contractor would not be entitled to any mark-up. Under **Section 7.7.2.11**, the Contractor would be entitled to Contractor's Fee mark-up on its self-performed Work and on the electrical Work. The amount of the Change Order would be calculated as follows: Subcontractor Change Order = \$25,000 + (\$25,000 x 15%) = \$28,750; Contractor Change Order = \$10,000 + \$28,750 + ((\$10,000 + \$28,750) x 10%) = \$42,625.

- .2 The allowance covers: the costs required to schedule and coordinate the Work, telephone, telephone charges, facsimile, telegrams, postage, photos, photocopying, hand tools, simple scaffolds (one level high), tool breakage, tool repairs, tool replacement, tool blades, tool bits, home office estimating and expediting, home office clerical and accounting support, home office labor (management, supervision, engineering), all other home office expense, legal services, travel, and parking expenses.
- .3 An exception is allowed for shop or engineering labor on items in **Section 7.7.2.10.2**, which shall not be subject to Prevailing Wage rates for steel fabricators, sheet metal fabricators, and sprinkler system fabricators performing work off Site. Recovery for these matters shall be allowed on an hourly basis under items in **Sections 7.7.2.2, 7.7.2.3, and 7.7.2.4** of these Pricing Criteria.
- .4 An exception is allowed for field supervision labor on items in **Section 7.7.2.10.2**, for those portions of the Change Order Work that will be performed, or was performed, at times when the superintendent is not required to be on Site under **Section 6.4**, including but not limited to overtime hours due to acceleration and extensions of the Contract Times. Recovery for this matter will be allowed on an hourly basis under items in **Sections 7.7.2.2, 7.7.2.3, and 7.7.2.4** of these Pricing Criteria.

7.7.2.11 Contractor's Fee. Any cost or credit arising from a change in the Work shall include an allowance for the Contractor's Fee equal to **(1)** ten percent times **(2)** the sum of the costs described under **Sections 7.7.2.1 through 7.7.2.10** that are associated with that changed Work.

7.7.2.12 Miscellaneous. Any cost or credit arising from a change in Work may include the following costs with no allowance for Contractor's Fee under **Section 7.7.2.11** or Subcontractor overhead and profit under **Section 7.7.2.10**.

- .1 The premium portion only for approved overtime (labor and fringes). The straight time portion is included in items in **Sections 7.7.2.2, 7.7.2.3, and 7.7.2.4**.
- .2 State sales tax shall be allowed on items as defined by **Section 12.7**.

7.7.3 Costs that shall not be reimbursed for Change Order Work include the following:

- 7.7.3.1** Voluntary employee deductions including, but not limited to, deductions for charitable donations or U.S. savings bonds.
- 7.7.3.2** Employee profit sharing.

7.8 Time Extension

7.8.1 Every adjustment of the Contract Times associated with any change in the Work shall be determined as provided in this **Section 7.8**, which establishes the Contractor's maximum entitlement for any change in the Work, including without limitation all adjustments for interference, delay, hindrance, disruption of, or impact on the Work. This **Section 7.8** also governs time adjustments for deduct Change Orders and the Contractor's entitlement to additional time through the claims and dispute resolution processes on account of changes in the Work.

7.8.2 The Contractor shall substantiate all changes in the Contract Times with:

- 7.8.2.1** a written description of the nature of the interference, disruption, hindrance, or delay;
- 7.8.2.2** identification of Persons and events responsible for the interference, disruption, hindrance, or delay;
- 7.8.2.3** date or anticipated date of commencement of the interference, disruption, hindrance, or delay;

7.8.2.4 identification of activities by schedule activity number and name on the Construction Progress Schedule, which may be affected by the interference, disruption, hindrance, or delay, or new activities created by the interference, disruption, hindrance, or delay and the relationship with existing activities;

7.8.2.5 anticipated duration of the interference, disruption, hindrance, or delay and of any remobilization period;

7.8.2.6 specific number of days of extension requested and specific number of days for remobilization requested;

7.8.2.7 recommended action to avoid or minimize any future interference, disruption, hindrance, or delay; and

7.8.2.8 a detailed written proposal as described under **Section 7.7** for an increase in the Contract Sum which would fully compensate the Contractor for all costs of acceleration of the Work needed to completely overcome the associated delay, if any.

7.8.3 Critical Path. Time extensions shall depend upon the extent to which the Work on the critical path of the Construction Progress Schedule is affected, if applicable.

7.8.3.1 A Change Order granting a time extension may provide that the Contract Times shall be extended for only those specific elements so interfered with, disrupted, hindered, or delayed and related remobilization and that remaining Milestone dates shall not be altered and may further provide for adjustment of Liquidated Damages.

7.9 Examination and Audit of Contractor's Records

7.9.1 The Contracting Authority and Owner may examine all books, records, documents and other data of the Contractor and its Subcontractors related to the bidding, pricing, or performance of the Work for the purpose of evaluating any Contractor Payment Request, Proposal, Modification, or Claim.

7.9.2 The above referenced materials shall be made available at the office of the Contractor or Subcontractor, as applicable, at all reasonable times for inspection, audit, and reproduction until the expiration of six years after the date of Substantial Completion of all Work.

7.9.2.1 The Contractor shall maintain and require its Subcontractors to maintain complete and accurate business records at its principal place of business. If the principal place of business is greater than 50 miles from the Site, the Contractor shall timely make records available, and shall require its Subcontractors to timely make records available, at the office of the Contracting Authority or Owner upon request for the records.

7.9.3 To the extent that the Contractor or Subcontractor, as applicable, informs the Contracting Authority or Owner in writing that any documents provided to the Contracting Authority or Owner are trade secrets, the Contracting Authority or Owner shall treat those documents, to the extent permitted by law, as trade secrets of the Contractor or Subcontractor, as applicable.

7.9.3.1 If a dispute arises with any other Person about whether that Person should be given access to the documents, the Contractor or Subcontractor as applicable, shall indemnify the Contracting Authority and Owner against all costs, expenses, and damages, including but not limited to attorneys' fees, incurred or paid by reason of that dispute.

7.9.4 The right of inspection, audit, and reproduction extends to all documents necessary to permit adequate evaluation of the cost of pricing data submitted along with the computations and projections used therein.

7.9.5 If the Contract has been terminated in whole or in part, the records relating to the Work terminated shall be made available to the Contracting Authority or Owner for a period of six years from the date of any applicable final settlement or payment, as applicable.

7.9.6 Records that relate to disputes, litigation, or settlement of Claims arising out of the performance of the Work shall be made available until the dispute, litigation or Claims have been finally decided or settled.

ARTICLE 8 - DISPUTE RESOLUTION

8.1 Initiation of a Claim

8.1.1 Every Claim shall accrue upon the date of occurrence of the event giving rise to the Claim.

8.1.2 The Contractor shall initiate every Claim by giving written notice of the Claim to the A/E and Contracting Authority within ten days after occurrence of the event giving rise to the Claim, with the following exceptions:

8.1.2.1 The ten-day time limit on initiating a Claim arising from a determination of the Contracting Authority concerning a Change Directive begins to run on the date that the Contracting Authority issues its determination under **Section 7.4.7** or **Section 7.4.10**, as applicable.

8.1.2.2 The ten-day time limit on initiating a Claim arising from the response of the A/E to an RFI begins to run on the date that the A/E issues the A/E's response to the RFI.

8.1.2.3 The ten-day time limit on initiating a Claim arising from the A/E's determination concerning a Differing Site Condition begins to run on the date that the A/E issues the A/E's determination under **Section 7.6**.

8.1.3 The Contractor's written notice of a Claim shall provide the following information to permit timely and appropriate evaluation of the Claim, determination of responsibility, and opportunity for mitigation:

8.1.3.1 nature and anticipated amount of the impact, including all costs for any interference, disruption, hindrance, or delay, which shall be calculated in accordance with **Section 7.7** and be a fair and reasonably accurate assessment of the damages suffered or anticipated by the Contractor;

8.1.3.2 identification of the circumstances responsible for causing the impact, including, but not limited to, the date or anticipated date, of the commencement of any interference, disruption, hindrance, or delay;

8.1.3.3 identification of activities on the Construction Progress Schedule that will be affected by the impact or new activities that may be created and the relationship with existing activities;

8.1.3.4 anticipated impacts and anticipated duration of any interference, disruption, hindrance, delay, or impact, and any remobilization period;

8.1.3.5 the Contractor's planned actions to mitigate damages by avoiding interference, disruption, hindrance, delay, or impact; and

8.1.3.6 recommended action to avoid or minimize any interference, disruption, hindrance, delay, or impact.

8.1.4 The Contractor's failure to initiate a Claim as and when required under this **Section 8.1** shall constitute the Contractor's irrevocable waiver of the Claim.

8.1.5 The A/E, in consultation with the Contracting Authority, shall respond to the written notice of the Claim within a reasonable time of receipt, but not to exceed ten days.

8.2 Substantiation of Claims

8.2.1 Within 30 days after the initiation of a Claim, the Contractor shall submit four copies of all information and statements required to substantiate a Claim as provided in this **Article 8** and all other information that the Contractor believes substantiates the Claim. The Contractor shall file the four copies by delivery of one copy to the A/E, one copy to the Owner, and two copies to the Contracting Authority.

8.2.2 The Contractor shall substantiate all of its Claims by providing the following minimum information:

8.2.2.1 a narrative of the circumstances, which gave rise to the Claim, including without limitation the start date of the event or events and the actual or anticipated finish date;

8.2.2.2 detailed identification of the Work (e.g., activity codes from the Construction Progress Schedule) affected by the event giving rise to the Claim;

8.2.2.3 copies of the Contractor's daily log (**Section 6.2.17**) for each day of impact;

8.2.2.4 copies of relevant correspondence and other information regarding or supporting Contractor entitlement;

8.2.2.5 copies of the Contractor's most recent income statement, including segregated general and administrative expenses for the most recent reporting period, and for the period of the Contract, if available, and similar information for any Subcontractor claim included; and

8.2.2.6 the notarized certification described under **Section 8.5.1.1**.

8.2.3 The Contractor's failure to comply with the requirements of this **Section 8.2** shall constitute an irrevocable waiver of any related Claim.

8.3 Substantiation of Claims for Increase of the Contract Sum

8.3.1 The Contractor shall substantiate each Claim for an increase of the Contract Sum with:

8.3.1.1 written documentation as described under **Section 7.7** of the actual additional direct and indirect costs to the Contractor due to the event giving rise to the Claim;

8.3.1.2 a written statement from the Contractor that the increase requested is the entire increase in the Contract Sum associated with the Claim; and

8.3.1.3 the general substantiation documentation described under **Section 8.2**.

8.3.2 The Contractor's failure to comply with the requirements of this **Section 8.3** shall constitute an irrevocable waiver of any related Claim.

8.4 Substantiation of Claims for Extension of the Contract Times

8.4.1 The Contractor shall substantiate each Claim for an extension of the Contract Times with:

8.4.1.1 written documentation as described under **Section 7.8** of the actual delay to the critical path of the Construction Progress Schedule due to the event giving rise to the Claim;

8.4.1.2 a detailed written Proposal as described under **Section 7.7** for an increase in the Contract Sum that would fully compensate the Contractor for all costs of acceleration of the Work needed to completely overcome the associated delay together with a statement consistent with **Section 8.3.1.2**;

8.4.1.3 a written statement from the Contractor that the extension requested is the entire extension of the Contract Times associated with the Claim; and

8.4.1.4 the general substantiating documentation described under **Section 8.2**.

8.4.2 In addition to the requirements of **Section 8.4.1**, if adverse weather conditions are the basis for a Claim for additional time, the Contractor shall document the Claim with data substantiating that weather conditions were abnormal for the period, could not have been reasonably anticipated, and had an adverse effect on a critical element of the scheduled construction. The support for and evaluation of all adverse weather Claims shall be based upon average weather conditions during the five years immediately preceding the dates at issue in the Claim as those weather conditions were recorded at the government-controlled weather-recording facility nearest to the Site.

8.4.3 The Contractor's failure to comply with the requirements of this **Section 8.4** shall constitute an irrevocable waiver of any related Claim.

8.5 Certification of the Claim

8.5.1 The Contractor shall certify each Claim within 30 days after initiating the Claim under **Section 8.1** or before Contract Completion, whichever is earlier, by providing the notarized certification specified in **Section 8.5.1.1**, signed and dated by the Contractor:

8.5.1.1 "The undersigned Contractor certifies that the Claim is made in good faith; that the supporting data is accurate and complete to the best of the Contractor's knowledge and belief; that the amount of money, time, or both requested is a fair, reasonable, and necessary adjustment for which the Contractor believes the State is liable; that the amount of money, time, or both requested is the entire amount of money, time, or both to which the Contractor is entitled on account of the Claim and for which the Contractor believes the State is liable; and that the undersigned is duly authorized to certify the Claim on behalf of the Contractor."

8.5.2 The date that the Contractor's certified and fully substantiated Claim is received by the Contracting Authority, or the date that the Contractor is required to certify and fully substantiate a Claim pursuant to **Sections 8.2.1** and **8.5.1**, shall trigger the 120-day period for exhaustion of administrative remedies pursuant to ORC Section 153.16(B).

8.5.3 The Contractor's failure to comply with the requirements of this **Section 8.5** shall constitute an irrevocable waiver of any related Claim.

8.6 Delay and Delay Damage Limitations; Derivative Claims

8.6.1 Subject to other provisions of the Contract, the Contractor will be entitled only to an extension of the Contract Times on account of delay in the commencement or progress of Work on the critical path of the Construction Progress Schedule caused by acts of Nature or the public enemy, acts of the government not arising from the Contractor's failure to comply with Applicable Law, fires, floods, epidemics, weather, and labor disputes beyond the Contractor's control.

8.6.2 Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor shall not be entitled to an increase in the Contract Sum, or an extension of the Contract Times, or both:

8.6.2.1 on account of the impact of any normal adverse weather on any of the Work or on account of the impact of any abnormal adverse weather on Work not on the critical path;

8.6.2.2 to the extent that a delay occurs concurrently with a delay attributable to the Contractor; or

8.6.2.3 on account of the delay of any Work not on the critical path.

8.6.3 Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor shall not be entitled to an increase in the Contract Sum or any type of damages on account of a delay in the commencement or progress of

Work on the critical path unless (1) the delay is caused by the Owner and (2) the delay was not authorized or permitted under the Contract.

8.6.4 Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor shall not be entitled to an increase in the Contract Sum or any type of damages arising from a delay in the commencement or progress of any of the Work caused by the occurrence or non-occurrence of an event beyond the Owner’s control such as acts of Nature or the public enemy, acts of the government, fires, floods, epidemics, labor disputes, unusual delivery delays, weather, or damages caused by the Contractor.

8.6.5 Derivative Claims. Notwithstanding any other provision of the Contract to the contrary, if the Owner prosecutes a claim, suit, or appeal against a Separate Consultant or Separate Contractor to recover damages the Contractor suffers on account of the acts or neglects of a Separate Consultant or Separate Contractor or a person or entity for whom either is legally responsible, the Owner’s liability to the Contractor shall not exceed the amount the Owner actually recovers from the Separate Consultant or Separate Contractor on account of those damages less the costs the Owner incurs recovering them. The Owner is not obligated to prosecute any such claim, suit, or appeal.

8.7 Liquidated Damages

8.7.1 If the Contractor fails to achieve a Milestone within the associated Contract Time, it would be difficult, if not impossible, to determine the Owner’s resulting damages. Therefore, if the Contractor fails to achieve a Milestone within the associated Contract Time, the Contractor shall (at the Owner’s option) pay to or credit the Owner the Liquidated Damages per day sum determined according to the following schedule for each day that the Contractor fails to achieve a Milestone within the associated Contract Time. If the Project involves more than one Phase as explicitly identified in the Agreement, the Contract Sum in the below schedule refers to the total Contract Sum for each of the Phases individually as opposed to the aggregate Contract Sum for all Phases.

Contract Sum	Liquidated Damages per day for Milestones other than the Punch List Milestone	Liquidated Damages per day for the Punch List Milestone
Less than \$1,000,000	\$500	\$125
From \$1,000,000.01 to \$2,000,000	\$1,000	\$250
From \$2,000,000.01 to \$5,000,000	\$2,000	\$500
From \$5,000,000.01 to \$10,000,000	\$5,000	\$1,250
From \$10,000,000.01 to \$20,000,000	\$7,500	\$1,875
From \$20,000,000.01 to \$50,000,000	\$10,000	\$2,500
More than \$50,000,000	\$15,000	\$3,750

8.7.2 If the Contractor simultaneously fails to achieve two or more Milestones, the Owner shall be entitled to recover the sum of the associated Liquidated Damages per day rates.

8.7.3 The Liquidated Damages described in this Section 8.7 are only intended to compensate the Owner for the direct damages it incurs as a result of the Contractor’s failure to achieve the Milestones within their associated Contract Times.

8.7.4 The Liquidated Damages described in this Section 8.7 are not intended to compensate the Owner for any damages the Owner incurs on account of (1) any claims attributable to the Contractor that are brought by others including Separate Consultants and Separate Contractors or (2) any failure of the Contractor to timely, properly, and completely perform the Contract other than the failure to achieve the Milestones within their associated Contract Times.

8.7.5 The parties acknowledge that the above-listed Liquidated Damages per day sums are not penalties, and they each irrevocably waive the right (if any) to challenge the validity and enforceability of those Liquidated Damages per day sums. Notwithstanding any other provision of the Contract Documents to the contrary, if a court determines that the Liquidated Damages per day sums or their application are void and unenforceable, the Owner shall be entitled to recover the actual damages that it incurs on account of the Contractor’s failure to achieve one or more of the Milestones within the Contract Times.

8.7.6 In addition to other rights that the Owner may have relative to the Liquidated Damages, the Contracting Authority may deduct the Liquidated Damages from the Contract Sum as the damages accrue. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall immediately pay the amount of the insufficiency to the Owner.

8.8 Mutual Waiver of Consequential Damages

8.8.1 Except as provided under **Section 8.8.2**, the Owner and Contractor each waive against the other all Claims for consequential damages that may arise out of or relate to this Contract.

8.8.1.1 The Owner's waiver includes Claims for loss of use, income, profit, revenue, financing, cost of capital, business and reputation, management and employee productivity, and consequential damages arising from termination of the Contract or related to insolvency.

8.8.1.2 The Contractor's waiver includes Claims for unabsorbed home-office overhead; any other form of overhead in excess of that specifically provided for under **Section 7.7**; delay damages except as otherwise specifically provided for in **Section 8.6**; increased cost of funds for the Project; lost opportunity to work on other projects; losses of financing, business, and reputation; loss of profit except anticipated profit arising directly from properly performed Work; loss of bonding capacity; and consequential damages arising from termination of the Contract or related to insolvency.

8.8.2 Notwithstanding **Section 8.8.1**, this **Section 8.8**:

8.8.2.1 does not apply to any damages that would be covered by insurance provided in connection with the Project if the Contract did not include **Section 8.8.1**;

8.8.2.2 does not apply to the Contractor's indemnity obligations for third-party claims against the Indemnified Parties even if those claims are for damages that **Section 8.8.1** would otherwise preclude;

8.8.2.3 does not preclude the Owner's recovery of Liquidated Damages under **Section 8.7**; and

8.8.2.4 does not apply to Claims for damages arising from the Owner's or the Contractor's gross negligence or willful misconduct.

8.8.3 This **Section 8.8** shall survive termination of the Contract.

8.9 Review of the Claim

8.9.1 The A/E shall review the Claim and prepare a written analysis of its content, which shall include:

8.9.1.1 a narrative of the A/E's examination of the facts giving rise to the Claim;

8.9.1.2 identification of relevant Contract Documents and language;

8.9.1.3 an analysis of whether the Contractor complied with the requirements of the Contract Documents pertaining to Claim initiation and substantiation including, without limitation, the issues of entitlement to, and calculation of, adjustments of the Contract Sum, Contract Times, or both;

8.9.1.4 an analysis of claimed additional labor, materials, and equipment for the scope of the Work items described;

8.9.1.5 an analysis of any time extension for any interference, disruption, hindrance, impact, or delay claimed (to include the calculation of any concurrent delays affecting entitlement);

8.9.1.6 a concluding opinion regarding Contractor entitlement to, and the appropriateness and reasonableness of all, or any part of, the Claim; and

8.9.1.7 an appendix containing copies of contemporaneous documentation supporting the concluding opinion.

8.9.2 The A/E shall submit the written analysis to the Project Manager no more than 30 days after receiving the Contractor's substantiated and certified Claim.

8.10 Claim Decision

8.10.1 The Project Manager shall examine the Contractor's Claim and A/E's analysis.

8.10.2 The Project Manager shall approve or deny all, or any part, of the Contractor's Claim and forward a written decision to the Contractor, A/E, Owner, and Contracting Authority within 14 days after receiving the A/E's analysis. The Project Manager may employ independent resources to assist in its review, or refer evaluation of the Claim to a consultant.

8.10.3 If the Contractor and Owner agree with the Project Manager's decision, the decision shall be incorporated into a Change Order.

8.10.4 Any Claim remaining unresolved after completion of the process described under this **Section 8.10** shall be subject to Claim decision review as described under **Section 8.11**.

8.11 Claim Decision Review

8.11.1 The Contractor may request review of the Project Manager's decision by written notice delivered by certified mail within 14 days after the Project Manager's decision.

8.11.1.1 If the Project is administered by the Commission, jointly administered by the Commission and a public school district, or locally administered by authority granted to an agency of the state of Ohio by the Commission, the written notice shall be delivered to the Executive Director of the Commission.

8.11.1.2 If the Project is locally administered by an Institution of Higher Education under ORC Section 3345.50 or ORC Section 3345.51, the written notice shall be delivered to the Institutional Designee who will review the Project Manager's decision instead of the Commission.

8.11.2 The Commission or Institutional Designee, as applicable, shall schedule and conduct a meeting within 30 days after receiving the Contractor's request for review. The Commission or Institutional Designee may employ independent resources to assist in the meeting and review.

8.11.3 The Commission or Institutional Designee, as applicable, shall determine the final disposition of the Contractor's request for review and provide a written decision to the Contractor and Owner within 14 days after the meeting.

8.11.4 The decision of the Commission or Institutional Designee is the final administrative decision of the Contracting Authority as described under ORC Section 153.12(B).

8.11.5 If the Contractor and Owner agree with the Commission's or the Institutional Designee's decision, the decision shall be incorporated into a Change Order.

8.11.6 Any Claim remaining unresolved after completion of the process described under this **Section 8.11** shall be subject to litigation, which may be preceded by Alternative Dispute Resolution ("ADR") as described under **Section 8.13**.

8.12 Delegation

8.12.1 No provision of this **Article 8** shall prevent the Executive Director from delegating the duties or authorities of the Commission to any other person selected at the Executive Director's sole discretion.

8.13 Alternative Dispute Resolution

8.13.1 At any point in the Claims and dispute-resolution processes, the Project's key stakeholders may agree to enter into non-binding ADR including progressive negotiation, Dispute Review Board, mediation, or another non-binding ADR procedure accepted by all of the Project's key stakeholders.

8.14 Audit of the Claim

8.14.1 All Claims shall be subject to audit at any time following filing of the Claim, whether or not the Claim is part of a lawsuit.

8.14.2 The audit may be performed by employees of the Contracting Authority or by a consultant engaged by the Contracting Authority.

8.14.3 The audit may begin upon ten-days' notice to the affected Contractor or affected Subcontractor.

8.14.4 The Contractor shall cooperate with the request.

8.14.5 Failure of the Contractor or Subcontractor to produce sufficient records to allow the Contracting Authority to audit and verify a Claim shall constitute an irrevocable waiver of the Claim or portion of the Claim that could not be completely audited.

8.14.6 The Contractor shall make available to the Contracting Authority all Contractor and Subcontractor documents related to the Claim including, without limitation, the following documents:

8.14.6.1 daily time sheets and superintendent's daily reports;

8.14.6.2 union agreements, if any, and employer agreements;

8.14.6.3 insurance, welfare, fringes, and benefits records;

8.14.6.4 payroll register;

8.14.6.5 earnings records;

8.14.6.6 payroll tax returns;

- 8.14.6.7** material invoices, purchase orders, Subcontracts, and all material and supply acquisition contracts;
- 8.14.6.8** material cost distribution worksheets;
- 8.14.6.9** equipment records (list of Contractor equipment, rates, etc.);
- 8.14.6.10** vendor rental agreements and Subcontractor invoices;
- 8.14.6.11** Subcontractor payment certificates;
- 8.14.6.12** canceled checks (payroll and vendors);
- 8.14.6.13** job cost report;
- 8.14.6.14** job payroll ledger;
- 8.14.6.15** general ledger, general journal (if used), and all subsidiary ledgers and journals together with all supporting documentation pertinent to entries made in those ledgers and journals;
- 8.14.6.16** cash disbursements journal;
- 8.14.6.17** financial statements for all years reflecting operations on the Project;
- 8.14.6.18** income tax returns for all years reflecting operations on the Project;
- 8.14.6.19** depreciation records on all equipment utilized whether the records are maintained by the Contractor, its accountant, or others;
- 8.14.6.20** if a source other than depreciation records is used to develop costs for the Contractor's internal purposes in establishing the actual cost of owning and operating equipment, all other source documents;
- 8.14.6.21** all documents that reflect the Contractor's actual profit and overhead during the years the Project was being performed;
- 8.14.6.22** all documents related to the preparation of the Contractor's Bid(s), including the final calculations on which the Bid was based, unless the documents are placed in escrow under provisions of the Instructions to Bidders;
- 8.14.6.23** all documents that relate to the Claim together with all documents that support the amount of damages as to the Claim;
- 8.14.6.24** worksheets used to prepare the Claim establishing the cost components for items of the Claim including, but not limited to, labor, fringes, benefits and insurance, materials, equipment, Subcontractors, and all documents that establish the periods of time, individuals involved, the hours and rate of pay for the individuals; and
- 8.14.6.25** all other documents required by the Contracting Authority to reasonably review the Claim.

8.15 False Certification of the Claim

8.15.1 If the Contractor falsely certifies all or any part of a Claim, the portion of the Claim falsely certified shall be denied, and may be sufficient cause for the State to debar the Contractor from future State contracting opportunities as permitted by Applicable Law.

8.16 Performance and Payment

8.16.1 The Contractor shall proceed with the Work during any dispute resolution process, unless otherwise agreed by the Contractor and Contracting Authority in writing.

8.16.2 The Contracting Authority shall continue to make payment of any undisputed amounts in accordance with the Contract Documents pending final resolution of a Claim, unless otherwise agreed by the Contractor and Contracting Authority in writing.

ARTICLE 9 - COMPENSATION AND PAYMENT

9.1 Allowances

9.1.1 The Contract Sum includes the Allowances (if any) identified in the Contract.

9.1.2 All Allowances include the cost to the Contractor (less any applicable trade discounts) of materials and equipment required by the Allowances to be delivered at the Site, and all applicable taxes.

9.1.3 The Contractor's Fee and costs for unloading and handling on the Site, labor, installation costs, and other expenses contemplated for the Allowances are not in the stated Allowance amounts but are otherwise included in the Contract Sum.

9.1.4 Before final payment, an appropriate Change Order will be issued to reconcile the Contract Sum so that it reflects actual amounts due to the Contractor on account of Work covered by Allowances.

9.2 Unit Prices

9.2.1 Where the Contract provides that all or part of the Work is to be Unit Price Work, initially the Contract Sum will include for all Unit Price Work **(1)** an amount equal to the sum of the established Unit Prices for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Contract plus **(2)** the Contractor's Fee on that Unit Price Work.

9.2.2 The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Sum. The Contracting Authority will determine the actual quantities and classifications of Unit Price Work performed by Contractor.

9.2.3 The Contractor's Fee on account of Unit Price Work is not in the stated Unit Price amounts but are otherwise included in the Contract Sum.

9.2.4 Before final payment, an appropriate Change Order will be issued as described under **Section 7.1.5** to reconcile the Contract Sum so that it reflects actual amounts due to the Contractor on account of Unit Price Work actually performed.

9.3 Schedule of Values

9.3.1 Within ten days after receipt of the Notice to Proceed, or other period as mutually agreed by the Contractor and Contracting Authority, the Contractor shall submit to the A/E a Schedule of Values on a form published by the Commission, with separate amounts shown for labor and materials for each branch of Work, following the numbers and titles of the Construction Specifications Institute's *MasterFormat* for individual work results, or *UniFormat* for assemblies in place.

9.3.1.1 The Contractor shall clearly indicate on the Schedule of Values, the amount(s) allocated, including separate items for Contractor's Fee (overhead and profit), for each EDGE-certified Business used in the performance of the Work. The amount(s) shall indicate labor and materials, as appropriate.

9.3.2 The grand total shown on the Schedule of Values shall equal the total Contract Sum. The Contracting Authority may use the approved Schedule of Values to determine the cost or credit to the Owner resulting from any change in the Work.

9.3.2.1 The first items shall be a breakdown of General Conditions Costs.

9.3.2.2 The amounts for labor and materials shall accurately reflect the cost for each item. Separate items shall not be shown for Contractor's Fee, except when Work is performed or materials are supplied by an EDGE-certified Business, pursuant to **Section 9.3.1.1**. Contractor's Fee shall be included in the totals for labor and materials.

9.3.2.3 If the material allocation exceeds 55 percent of the Contract Sum, the Contractor shall provide, upon request, sufficient information to support the higher percentage.

9.3.2.4 Subcontract Work shall show amounts for labor and materials. Fringe benefits shall be shown as a part of labor costs.

9.3.2.5 When more than one major structure is included in the Work, the Contractor shall subdivide the Schedule of Values accordingly, with cost details for each structure shown separately.

9.3.2.6 The line items shall be coordinated with line items in the Project Schedule, which may require division of items of Work by area of the Project by floor, phase, or other appropriate area.

9.3.2.7 Mechanical and electrical Work shall be included in separate line items for all major pieces of equipment, and group smaller equipment items by type.

9.3.2.8 Line items shall be included for each Allowance, Coordination Drawings, Punch List Work, Project Record Document Submittals, delivery of attic stock, and specified demonstrations and training.

9.3.3 The A/E may return the Schedule of Values to the Contractor for re-submittal if it does not meet the requirements or contains insufficient items or details of the Work, or approve the Schedule of Values if the A/E determines that it conforms to this **Section 9.3**.

9.3.4 No payment shall be made until the A/E has approved the Contractor's Schedule of Values.

9.4 Contractor Payment Request

9.4.1 The Contractor may submit a Contractor Payment Request for Work performed based upon the Schedule of Values to the A/E each month or upon another interval approved by the Contracting Authority. When the rate of Work and amount involved is sufficient that it is considered appropriate by the Contracting Authority, the Contractor may submit Contractor Payment Requests twice a month.

9.4.1.1 The Contractor shall support each Contractor Payment Request with documentation substantiating the Contractor's right to payment. The Contractor shall supply additional documentation as the A/E may request in connection with each payment to the Contractor.

9.4.1.2 The Contracting Authority may require proof of the renewal of required insurance as a condition precedent to payment.

9.4.1.3 The Contractor shall attach certified payroll reports for the relevant period to one copy of each Contractor Payment Request, see **Document 00 73 43 - Prevailing Wage Requirements**.

9.4.1.4 The Contractor may list on the Contractor Payment Request any Change Orders approved and performed prior to submission of the Contractor Payment Request.

9.4.1.5 The Contractor shall submit its Contractor Payment Request using the Contractor Payment Request form or forms current at the time of each application and as provided by the Contracting Authority in the manner prescribed by the Contracting Authority.

9.4.1.6 The Contractor shall submit one draft copy of its Contractor Payment Request ("Pencil Copy") to the A/E not less than one week prior to submitting multiple copies of its Contractor Payment Request. The A/E shall review the Pencil Copy and provide comments to the Contractor within three days after receiving it. The Contractor shall incorporate the A/E's comments into its Contractor Payment Request prior to submitting multiple copies for payment.

9.4.1.7 The Contractor shall clearly indicate on the Contractor Payment Request, the amount(s) requested for each EDGE-certified Business used in the performance of the Contract. The amount(s) shall indicate labor and materials, as appropriate.

9.4.1.8 The Contractor shall submit an electronic copy of the Contractor Payment Request to the A/E with its paper copies of the Contractor Payment Request for collection and reporting of information used for contract compliance evaluation and statistical purposes. The Contractor may issue the copy in any electronic media acceptable to the Contracting Authority.

9.4.2 Payments for Unit Price Work shall be made to the Contractor only for the authorized actual quantities of Work performed or materials furnished in accordance with the Contract Documents.

9.4.3 Subject to **Section 9.8**, the Owner shall pay an approved Contractor Payment Request within 30 days after the date the A/E recommends acceptance of the Contractor Payment Request.

9.4.4 Notwithstanding any other provision of the Contract Documents, partial payments made pursuant to this **Section 9.4** constitutes neither acceptance of any Defective Work, nor a waiver of any rights set forth in the Contract Documents or otherwise provided by Applicable Law.

9.4.5 The Contracting Authority and Owner may audit Contractor Payment Requests as described under **Section 7.9**.

9.5 Labor Payments

9.5.1 Partial payments to the Contractor for labor shall be made at the rate of 92 percent of the amount invoiced through the Contractor Payment Request that shows the Work is 50 percent complete.

9.5.2 After the Work is 50 percent complete, as evidenced by payments of at least 50 percent of the Contract Sum including approved Change Orders to date, no additional funds shall be retained from payments for labor.

9.5.3 If the Project involves more than one Phase as explicitly identified in the Agreement, this **Section 9.5** will apply on a per-Phase basis.

9.6 Material Payments

9.6.1 The Owner shall pay the Contractor at the rate of 100 percent of the scheduled value for materials incorporated into the Project.

9.6.2 The Owner shall pay the Contractor at the rate of 92 percent of the invoice cost, not to exceed the scheduled value in a Unit Price or lump sum Contract, for materials delivered to the Site, or other off-site storage location approved by the A/E, provided the Contractor provides the following information with the Contractor Payment Request:

9.6.2.1 a list of the fabricated materials consigned to the Project, giving the place of storage, together with copies of invoices verifying quantity and cost, written evidence of insurance covering the off-site stored materials; and

9.6.2.2 a certification of materials stored off-site, prepared by the Contractor and signed by the A/E to evidence that the materials are in conformity with the Specifications and have been tagged with the Project name and number for delivery to the Project. The Contractor shall directly reimburse the A/E for all costs incurred to visit a storage site, other than the areas adjacent to the Project.

9.6.2.3 The Owner shall pay the balance of the scheduled value when the materials are incorporated into and become a part of the Project.

9.6.3 When payment is allowed for materials delivered to the Site or other approved off-site storage location but not yet incorporated into the Project, the materials are the property of the Owner.

9.6.3.1 The Owner may, at its sole discretion, retain any material not ultimately incorporated into the Project or return it to the Contractor for credit of an amount proportionate to the value of the extra materials.

9.7 Retainage

9.7.1 If the total Contract Sum is \$15,000 or more, when the Contract is 50 percent complete, all funds retained for faithful performance of the Work, in accordance with **Section 9.5.1**, shall be deposited in an escrow account with a bank in the state in accordance with the terms and conditions provided in an escrow agreement executed by the Contractor, Contracting Authority, and applicable bank.

9.7.2 When the Contractor has achieved Substantial Completion of all Work, and there is no other reason to retain funds; upon request of the Contractor, the funds retained in connection with that Work shall be released from escrow and paid to the Contractor, withholding only that amount necessary to assure faithful completion in the sole discretion of the Contracting Authority, including but not limited to compliance with **Section 6.25.2**.

9.7.3 Upon consent by the Contractor's Surety, the Contracting Authority may reduce the amount of funds retained for the faithful performance of Work by 50 percent of the amount of funds required to be retained, provided the Contractor's Surety remains responsible for all damages that may be caused due to default by the Contractor, including, but not limited to, the following:

9.7.3.1 completion of the Work;

9.7.3.2 all interference, disruption, hindrance, and delay claims;

9.7.3.3 all Liquidated Damages; and

9.7.3.4 all additional expenses incurred by the State.

9.7.4 If the Project involves more than one Phase as explicitly identified in the Agreement, this **Section 9.7** will apply on a per-Phase basis.

9.8 Payments Withheld

9.8.1 The A/E may recommend to the Contracting Authority that payments be withheld from, or Liquidated Damages be assessed against, a Contractor Payment Request.

9.8.2 The Contracting Authority may decline to approve any Contractor Payment Request or part thereof, or nullify any previous Contractor Payment Request, in whole or in part, to the extent necessary in the Contracting Authority's sole opinion to protect the Owner from loss because of:

9.8.2.1 Defective Work not remedied;

9.8.2.2 damage caused by the Contractor;

9.8.2.3 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

9.8.2.4 reasonable evidence that the Work will not be completed within the Contract Times, and that the unpaid balance would not be adequate to cover damages under the Contract Documents for the anticipated delay;

9.8.2.5 failure to comply with Applicable Law including, but not limited to, the requirements of ORC Chapter 4115;

9.8.2.6 failure to timely submit EDGE Participation Reports in accordance with **Section 1.8.2**;

9.8.2.7 failure to timely identify the Contractor's proposed Subcontractors in accordance with **Section 4.1.1**;

- 9.8.2.8 failure to timely fulfill the Contractor's obligations related to the Construction Progress Schedule;
- 9.8.2.9 failure to carry out the Work in accordance with the Contract Documents; or
- 9.8.2.10 that which is permitted under other provisions of the Contract Documents.

9.8.3 If the Contractor remedies the basis for withholding payment under **Section 9.8.2** to the Contracting Authority's satisfaction, the Owner shall pay the amounts withheld.

9.9 Final Contractor Payment Request

9.9.1 The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and to final payment, shall complete all requirements of the Contract Documents.

9.9.1.1 The Contractor and each of its Subcontractors, regardless of tier, shall execute a Payment Release Affidavit to certify that the Contractor and each of its Subcontractors, regardless of tier, have complied with all requirements of ORC Chapter 4115, and to certify that all of its Subcontractors have been paid in full for all Work performed or materials furnished for the Project.

9.9.2 The Owner shall pay the final Contractor Payment Request within 30 days after the date the A/E recommends acceptance of the final Contractor Payment Request.

9.9.3 Acceptance of final payment by the Contractor or a Subcontractor constitutes the payee's waiver of all claims against the State except those previously made in writing under **Article 8** and identified by that payee as unsettled at the time of the final Contractor Payment Request.

ARTICLE 10 - BONDS, INSURANCE, AND INDEMNIFICATION

10.1 Payment and Performance Bonds

10.1.1 Before signing the Agreement, the Contractor shall provide the Bond required under Applicable Law and below:

10.1.1.1 If the Contractor provided **Document 00 43 13 - Bid Security Form** as its Bid Guaranty, then that form shall be the Bond.

10.1.1.2 If the Contractor provided another form of Bid Guaranty, then **Document 00 61 13 - Performance and Payment Bond Form** shall be the Bond.

10.1.1.3 Each Surety under the Bond shall be licensed to do business in Ohio and satisfactory to the Contracting Authority.

10.1.1.4 If there is more than one Surety under the Bond, each of them shall be jointly and severally liable as surety under the Bond.

10.1.1.5 Unless the Contracting Authority and the Owner are the same entity, the Bond shall name as co-obligees **(1)** the State by and through the Contracting Authority and **(2)** the Owner.

- .1 If any document is used to name the required co-obligees of the Bond (e.g., a form commonly known as a "dual obligee rider"), that document will not alter the terms of the Contract in any way or the terms of the Bond in any way beyond merely naming the co-obligees notwithstanding any term of that document to the contrary.
- .2 The Surety will not be obligated to more than the Penal Sum of any Bond solely on account of the existence of more than one obligee under that Bond.

10.1.1.6 The penal sum of the Bond, when initially submitted, shall be equal to one-hundred percent of the Contract Sum.

10.1.2 The Contractor shall submit with the executed Bond **(1)** a certified copy of the authority to act (power of attorney) of the agent signing the Bond on behalf of the Surety and **(2)** a current and signed Certificate of Compliance under ORC Section 9.311 issued by the Ohio Department of Insurance showing the Surety is licensed to do business in Ohio.

10.1.3 If the Contract Sum increases at any time such that it exceeds the penal sum of the Bond, the Contractor shall cause the penal sum of the Bond to be increased such that the penal sum equals one-hundred percent of the increased Contract Sum.

10.1.4 Any time the Contractor increases the penal sum of the Bond under **Section 10.1.3**, the Contractor shall deliver to the Contracting Authority an Acknowledgment of Surety from the affected Surety or Sureties to evidence the Surety's or Sureties' receipt of notice of the increased penal sum.

10.1.4.1 The Contracting Authority's receipt of the required Acknowledgement(s) of Surety is a condition precedent to the Owner's obligation to pay the Contractor for any portion of the Work associated with the increase of the penal sum.

10.1.4.2 The Contractor's failure to submit a required Acknowledgment of Surety or a Surety's failure or refusal to provide an Acknowledgment of Surety will not relieve the Surety of its obligation for the increased penal sum.

10.1.4.3 If any Surety fails or refuses to provide a required Acknowledgment of Surety, the Contracting Authority may require the Contractor to deliver to the Contracting Authority a new Bond showing the increased penal sum and written consent of the affected Surety or Sureties confirming the increased penal sum. In that event, the Contracting Authority's receipt of replacement Bonds will be a condition precedent to the Owner's obligation to pay the Contractor for any portion of the Work associated with the increase of the penal sum.

10.1.4.4 Each Acknowledgment of Surety shall be **(1)** on a form provided by the Contracting Authority and **(2)** subject to the acceptance of the Contracting Authority.

10.1.5 If at any time prior to final payment, any surety providing a Bond for the Project **(1)** is adjudged bankrupt or has made a general assignment for the benefit of its creditors; **(2)** has liquidated all assets or has made a general assignment for the benefit of its creditors; **(3)** is placed in receivership; **(4)** otherwise petitions a state or federal court for protection from its creditors; or **(5)** allows its license to do business in Ohio to lapse or to be revoked, then the Contractor shall, within 21 days after any such action listed above, provide the Contracting Authority with a new Bond in the form and amount described in this **Section 10.1**. The Contracting Authority's receipt of a replacement Bond is a condition precedent to the Owner's obligation to pay the Contractor.

10.1.6 If notice of any change affecting the Contract is required by any Surety or by the provision of any Bond, the Contractor shall provide that notice.

10.2 Contractor's General Insurance Requirements

10.2.1 Throughout the performance of the Work or longer as may be described below, the Contractor shall obtain, pay for, and keep in force, the minimum insurance coverage described in this **Article 10**.

10.2.1.1 Each requirement of this **Article 10** applies to Subcontractors just as it applies to the Contractor.

10.2.1.2 If a Subcontractor's usual insurance coverage does not meet the minimum coverage requirements, before entering into an agreement with that Subcontractor, the Contractor shall submit to the Contracting Authority **(1)** a certificate of insurance evidencing the insurance the Subcontractor will carry without additional compensation and **(2)** if the Contracting Authority requests, a written proposal from the Subcontractor to provide coverage that meets the minimum coverage requirements. The Contracting Authority will decide whether to accept the non-conforming insurance coverage or the proposal to provide conforming coverage.

.1 Notwithstanding any other provision of the Contract to the contrary, the Contractor will not be entitled to any increase of the Contract Sum, Contract Times, or both on account of the Contracting Authority's refusal to accept a Subcontractor's nonconforming insurance coverage.

10.2.1.3 On a case-by-case basis, the Contracting Authority and Contractor may agree to adjust the below requirements for any particular Subcontractor.

10.2.2 Before starting the Work on the Site, upon renewal of any policy, and upon a change of any insurance carrier, the Contractor shall deliver to the Contracting Authority certificates evidencing that the required insurance is in force.

10.2.2.1 Certificates of insurance for other than government-controlled workers' compensation insurance shall identify **(1)** all below-required additional insureds and **(2)** the Project name.

10.2.3 With the exception of government-controlled workers' compensation coverage:

10.2.3.1 the Contractor shall place the insurance with companies that **(1)** are satisfactory to the Contracting Authority, **(2)** hold an A.M. Best Rating of A-, X, or higher, and **(3)** are authorized to conduct business in Ohio;

10.2.3.2 the policies shall be endorsed to require the Contractor's insurance carrier to **(1)** provide 30-days' written notice to the Contracting Authority (as certificate holder) of the cancellation or non-renewal of the insurance and **(2)** provide at least ten-days' written notice to the Contracting Authority (as certificate holder) of the cancellation of the insurance for non-payment of premium; and

10.2.3.3 within 30 days after the Contracting Authority's request, the Contractor shall submit insurance-company certified copies of the policies, the policy endorsements, loss-run reports, or all three.

10.2.4 The Contractor shall pay all deductibles, or self-insured retentions, or both contained in the Contractor's policies of insurance required or provided in connection with the Project. The Contracting Authority reserves the right to approve

or reject all levels of self-insured retention, captive insurance programs, or other alternative risk financing the Contractor may use to comply with any insurance requirement.

10.2.5 The Contractor shall pay a proportionate share of the deductibles, or self-insured retentions, or both contained in any insurance policy the Contracting Authority purchases for the Project. The Contractor's proportionate share will derive from the percentage of the associated claim or loss attributable to the alleged or actual negligence of the Contractor or a Subcontractor.

10.2.6 The Contracting Authority and Owner do not represent that required coverage or limits are adequate to protect the Contractor.

10.2.7 Failure of the Contracting Authority to demand a certificate or other evidence of full compliance with the insurance requirements or failure of the Contracting Authority to identify a deficiency from evidence that is provided shall not be construed as a waiver of the Contractor's obligation to maintain the required insurance.

10.2.8 The Contracting Authority may terminate the Contract for cause on account of the Contractor's failure to maintain required insurance.

10.3 Contractor's Minimum Coverage Requirements

10.3.1 Workers Compensation. The Contractor shall maintain workers' compensation coverage meeting the requirements of Applicable Law including, without limitation, the Jones Act and the Longshore & Harbor Workers Compensation Act if Work involves hazards arising from work on or near navigable waterways, including vessels and docks.

10.3.2 Employers' Liability Coverage. The Contractor shall maintain employers' liability coverage with **(1)** an each-accident limit of not less than \$1,000,000, **(2)** a disease each-employee limit of not less than \$1,000,000, and **(3)** a disease policy limit of not less than \$1,000,000.

10.3.3 Commercial General Liability. The Contractor shall maintain commercial general liability ("CGL") coverage that provides **(1)** an each-occurrence limit of not less than \$1,000,000, **(2)** a general-aggregate limit of not less than \$2,000,000, and **(3)** a products and completed-operations aggregate limit of not less than \$2,000,000.

10.3.3.1 The CGL insurance shall be written on ISO occurrence form CG 00 01 04 13 or a substitute form, providing at least equivalent coverage for liability arising from premises, operations, independent contractors, products/completed-operations, personal and advertising injury, and liability assumed under an insured contract.

10.3.3.2 The Contractor shall include the State, Contracting Authority, Owner, and A/E as additional insureds under the CGL policy using ISO endorsement CG 20 10 07 04 and ISO endorsement CG 20 37 07 04 or a substitute form(s) providing equivalent coverage.

10.3.3.3 The CGL policy shall be endorsed using ISO endorsement CG 25 03 or a substitute form providing equivalent coverage to provide that the general aggregate limit applies separately to each of the insured's projects.

10.3.3.4 The CGL policy shall not exclude coverage for property damage to the Work arising out of the products/completed-operations hazard where a Subcontractor performed the damaged Work or the Work out of which the damage arises.

10.3.3.5 The CGL insurance shall not exclude coverage for property damage to electronic data.

10.3.3.6 The CGL insurance shall apply as primary and non-contributory insurance with respect to any other insurance or self-insurance programs that cover the additional insured(s).

10.3.3.7 The CGL policy shall not exclude coverage to the additional insured(s) for bodily injury or property damage arising out of the products/completed-operations hazard.

10.3.3.8 The Contractor shall maintain the CGL insurance in effect for no less than five years after the earlier of termination of the Contract or Substantial Completion of all Work.

10.3.4 Business Automobile Liability. The Contractor shall maintain business automobile ("BA") coverage written on ISO form CA 00 01 04 13 or a substitute form, providing at least equivalent coverage with a limit of not less than \$1,000,000 each accident.

10.3.4.1 The coverage shall extend to any auto (owned, not owned, leased, rented, hired, or borrowed).

10.3.4.2 The Contractor shall include the State, Contracting Authority, Owner, and A/E as additional insureds under the BA policy.

10.3.4.3 The BA policy shall include an MCS-90 endorsement if transporting hazardous wastes/materials.

10.3.5 Umbrella/Excess Liability. The Contractor may employ an umbrella/excess liability policy to achieve the above-required minimum coverage.

10.3.5.1 The Contractor shall maintain umbrella/excess liability coverage with a limit of not less than \$2,000,000 (in addition to the above-required limits) if the Work (or the Work to be performed by the Subcontractor) includes any of the following:

- .1 brick/block masonry;
- .2 exterior caulking/sealant;
- .3 cast-in-place or precast concrete;
- .4 curtain wall;
- .5 dampproofing/waterproofing;
- .6 electrical;
- .7 elevator;
- .8 exterior glass and/or glazing;
- .9 exterior marble, granite, and/or other stonework;
- .10 miscellaneous metals;
- .11 plaster/stucco;
- .12 plumbing;
- .13 HVAC;
- .14 roofing and/or sheet metal;
- .15 scaffolding;
- .16 spray-on fireproofing;
- .17 sprinkler and/or fire protection; or
- .18 structural steel and/or metal deck.

10.3.5.2 The Contractor shall maintain umbrella/excess liability coverage with a limit of not less than \$5,000,000 (in addition to the above-required limits) if the Work (or the Work to be performed by the Subcontractor) includes any of the following:

- .1 caissons and/or piles;
- .2 demolition;
- .3 excavation and/or utility work;
- .4 sheeting, shoring, and/or underpinning;
- .5 window washing equipment; or
- .6 wrecking.

10.3.6 Contractor's Pollution Liability. If the Work includes environmentally sensitive, hazardous types of activities (such as demolition, exterior insulation finish systems, Asbestos abatement, storage-tank removal, or similar activities), or involves Hazardous Materials, the Contractor shall maintain a contractor's pollution liability ("CPL") policy with **(1)** a per-claim limit of not less than \$1,000,000 and **(2)** an annual-aggregate limit of not less than \$1,000,000, covering the acts, errors and/or omissions of the Contractor for damages (including from mold) sustained by the Owner by reason of the Contractor's performance of the Work.

10.3.6.1 The CPL policy shall have an effective date, which is on or before the date that the Contractor first started to perform any Project-related services.

10.3.6.2 Upon submission of the associated certificate of insurance and at each policy renewal, the Contractor shall advise the Contracting Authority in writing of any actual or alleged claims that may erode the CPL policy's limits.

10.3.6.3 The Contractor shall maintain the CPL insurance in effect for no less than five years after the earlier of termination of the Contract or Substantial Completion of all Work.

10.3.7 Professional Liability—Contractor. The Contractor shall maintain contractor’s professional liability (“PL”) insurance (including without limitation for sprinkler and/or fire protection and other design-build work included in the Work, and services related to coordination and scheduling of construction activities, and means and methods) without design-build exclusions with limits not less than as identified in the following table:

Contract Sum	Each Claim	Annual Aggregate
Up to \$50,000,000	\$1,000,000	\$2,000,000
More than \$50,000,000	\$2,000,000	\$4,000,000

10.3.7.1 The PL policy shall have an effective date on or before the date that the Contractor first started to provide any Project-related services.

10.3.7.2 Upon submission of the associated certificate of insurance and at each policy renewal, the Contractor shall advise the Contracting Authority in writing of any actual or alleged claims that may erode the PL policy’s limits.

10.3.7.3 The Contractor shall maintain the PL insurance in effect for no less than five years after the earlier of termination of the Contract or Substantial Completion of all Work.

10.3.7.4 If the Contractor is authorized under Applicable Law to directly provide professional design services, the Contractor may satisfy the requirements of this **Section 10.3.7** by providing a professional liability insurance policy.

10.3.7.5 If the Contractor is a joint venture:

- .1 the Contractor may meet the requirements of this **Section 10.3.7** by providing a PL policy under which each joint venturer is the insured; or
- .2 each joint venturer shall individually meet the requirements of this **Section 10.3.7** by providing a PL policy **(1)** under which the individual joint venturer is the insured and **(2)** that covers that joint venturer’s interests in the joint venture by endorsement or otherwise. The certificate of insurance shall reflect that the PL policy covers the joint venturer’s interest in the joint venture.

Example: Assume that the Contractor **(1)** is the “XY joint venture” of company “X” and company “Y”; and **(2)** is required under **Section 10.3.7** to maintain PL insurance limits of \$1M/\$2M. In order to comply with **Section 10.3.7.5.2**, “X” must maintain PL insurance limits of \$1M/\$2M and “Y” must maintain PL insurance limits of \$1M/\$2M.

10.3.7.6 If the Contractor is a limited-liability company, which members consist of two or more separate firms:

- .1 the Contractor may meet the requirements of this **Section 10.3.7** by providing a PL policy under which the limited-liability company is the insured; or
- .2 each member of the limited-liability company shall individually meet the requirements of this **Section 10.3.7** by providing a PL policy **(1)** under which the individual member is the insured and **(2)** that covers that member’s interests in the limited-liability company by endorsement or otherwise. The certificate of insurance shall reflect that the PL policy covers the member’s interest in the limited-liability company.

Example: Assume that the Contractor **(1)** is the “XY limited-liability company,” the members of which are “X” and “Y”; and **(2)** is required under **Section 10.3.7** to maintain PL insurance limits of \$1M/\$2M. In order to comply with **Section 10.3.7.6.2**, “X” must maintain PL insurance limits of \$1M/\$2M and “Y” must maintain PL insurance limits of \$1M/\$2M.

10.3.8 Professional Liability—Subcontractors. If the Work to be performed by a Subcontractor includes any professional design services (including without limitation sprinkler and/or fire protection and other design-build work) the Subcontractor shall maintain contractor’s PL insurance without design-build exclusions with limits not less than as identified in the following table:

Subcontract Sum	Each Claim	Annual Aggregate
Up to \$50,000,000	\$1,000,000	\$2,000,000
More than \$50,000,000	\$2,000,000	\$4,000,000

10.3.8.1 The PL policy shall have an effective date on or before the date that the Subcontractor first started to provide any Project-related services.

10.3.8.2 Upon submission of the associated certificate of insurance and at each policy renewal, the Contractor shall advise the Contracting Authority in writing of any actual or alleged claims that may erode the Subcontractor’s PL policy’s limits.

10.3.8.3 The Subcontractor shall maintain the PL insurance in effect for no less than five years after the earlier of termination of the Contract or Substantial Completion of all Work.

10.3.8.4 If the Subcontractor is authorized under Applicable Law to directly provide professional design services, the Subcontractor may satisfy the requirements of this **Section 10.3.7.5** by providing a professional liability insurance policy.

10.3.9 Aviation Liability. If the Contractor or a Subcontractor uses manned or unmanned aircraft, including helicopters, in performance of the Work, the Contractor shall maintain aircraft or aviation liability coverage in an amount of no less than \$10,000,000. The Contracting Authority and Owner will not be liable for any damage to any aircraft owned, leased, rented, or borrowed by the Contractor or a Subcontractor.

10.3.10 Watercraft Liability. If the Contractor or a Subcontractor uses watercraft in performance of the Work, the Contractor shall maintain watercraft liability coverage including protection and indemnity insurance in an amount of no less than \$5,000,000. The Contracting Authority and Owner will not be liable for any damage to any watercraft owned, leased, rented, or borrowed by the Contractor or Subcontractor.

10.3.11 Equipment Coverage. The Contracting Authority and Owner will not insure or be liable for damage to any Contractor or Subcontractor owned, leased, rented, or borrowed tools, equipment, or vehicles. The Contractor and Subcontractors are solely responsible for maintaining all insurance necessary to cover their tools, equipment, and vehicles.

10.3.12 Ocean Marine Insurance. If the shipment of equipment or materials for the Work will not be covered by the builder's risk insurance described under **Section 10.4**, the Contractor shall maintain ocean marine insurance to the Site including cost, insurance, and freight with limits of not less than an amount equal to the full replacement cost of equipment/materials shipped to final destination point. The insurance shall include the following minimum requirements:

- 10.3.12.1** all-risk basis including war risk and all forms of terrorism;
- 10.3.12.2** coverage for general average and salvage charges;
- 10.3.12.3** "on deck" coverage;
- 10.3.12.4** warehouse-to-warehouse coverage;
- 10.3.12.5** coverage to include losses from strikes, riots, and civil commotions ("SR&CC coverage");
- 10.3.12.6** coverage to include losses from free of capture and seizure warranty ("FC&S Warranty coverage");
- 10.3.12.7** "Inchmaree" clause;
- 10.3.12.8** sue and labor;
- 10.3.12.9** "both-to-blame" coverage;
- 10.3.12.10** free of particular average;
- 10.3.12.11** inland coverage including on-land shipment, port storage, and barge transit upon inland waterways; and
- 10.3.12.12** damage by saltwater and rainwater perils and cargo sweat.

10.3.13 Additional Property Insurance. For any demolition, blasting, excavating, tunneling, shoring, or similar operations, the Contractor shall provide and maintain Property Damage Liability insurance with a limit of liability equal to the limit as specified in the applicable sections of **Article 10**.

10.4 Builder's Risk Insurance

10.4.1 The Contractor shall maintain a builder's risk insurance policy written on a special causes of loss form and an open-perils basis providing coverage for direct physical loss of or damage to covered property arising from insured perils that shall not exclude: theft; fire; vandalism; malicious mischief; earthquake; earth movement; tornado; lightning; explosion; breakage of glass; flood; windstorm; collapse; water damage; hot and cold testing; debris removal and/or demolition occasioned by enforcement of Applicable Law; sudden and accidental equipment breakdown; and resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials.

10.4.1.1 The policy shall cover the Project in the course of construction including false-work, temporary buildings and structures, and materials used in the construction process, stored on or off-site, or while in transit.

10.4.1.2 The coverage shall be written on a replacement-cost basis in an amount equal to not less than the initial Contract Sum, plus the value of: **(1)** all subsequent GMP Amendments and Modifications; **(2)** materials supplied and installed by others; and **(3)** any furnishings, fixtures, materials, or equipment located at the Site. All sub-limits of coverage are subject to the prior written approval of the Contracting Authority and Owner.

10.4.1.3 The policy shall not include any deductible of more than \$25,000 per occurrence. Any deductible over that amount is subject to the prior written approval of the Contracting Authority and Owner.

10.4.1.4 The named insureds under the policy shall include the State, Contracting Authority, Owner, Contractor, Subcontractors at all tiers, and Separate Contractors.

10.4.1.5 Coverage shall include the reasonable extra costs of acceleration and expediting temporary and permanent repairs to, or permanent replacement of, damaged property. Those covered costs shall include overtime wages and the extra cost of “express” or other means for rapidly transporting materials and supplies necessary to the repair or replacement.

10.4.1.6 Coverage shall include a “soft cost endorsement” including, but not limited to, the reasonable extra costs of the A/E and reasonable Contractor extension or acceleration costs.

10.4.1.7 Coverage shall waive all rights between the Owner, Contracting Authority, Contractor, and Subcontractors at any tier, for damages caused by fire or any other perils to the extent of actual recovery of any insurance proceeds under the policy.

10.4.1.8 Coverage shall include provisions for mechanical or electrical breakdown, or boiler system testing if a boiler system is part of the Work.

10.4.1.9 Coverage shall include temporary structures and scaffolding, along with collapse coverage.

10.4.1.10 Coverage shall be primary to all other applicable insurance.

10.4.1.11 The policy shall specifically permit and allow for Partial Occupancy as defined under the Contract Documents and for partial occupancy or a similar term as used under the policy.

10.4.1.12 The Contractor shall maintain the policy in effect until Substantial Completion of all Work. The Contractor shall provide written notice to the Contracting Authority no less than 30 days before the expiration or termination of the policy.

10.4.1.13 The Contractor’s tools and equipment shall not be covered under the builder’s risk policy. It is the Contractor’s sole responsibility to maintain such coverage, the cost of which shall be included in its Overhead (a component of Contractor’s Fee) and not included as a separate item in the Contractor’s Schedule of Values.

10.4.2 If the Contractor is involved solely in the installation of material and equipment and not in new building construction, the Contractor shall purchase and maintain a builder’s risk, builder’s risk-renovations, or installation floater insurance policy. The policy shall comply with the provisions of **Section 10.4.1**.

10.4.3 No less than ten days before the Contractor starts to perform any Work on the Site, the Contractor shall provide to the Contracting Authority an insurance-company certified copy of the complete insurance policy required under **Section 10.4.1** or **10.4.2** as applicable. The Contracting Authority’s receipt of that copy of the policy is a condition precedent to the Contractor’s entitlement to payment of any portion of the Contract Sum.

10.5 Waivers of Subrogation

10.5.1 To the fullest extent permitted by Applicable Law, the Contractor waives all rights against the Owner, Contracting Authority, and their agents and employees for damages to the extent covered by any insurance, except rights to the proceeds of that insurance. All policies shall accomplish the waiver of subrogation by endorsement or otherwise.

10.5.2 The Owner, Contracting Authority, and Contractor waive all rights against each other for damages caused by fire or other perils to the extent of actual recovery of any insurance proceeds under any property insurance, inland marine insurance, or builder’s risk insurance applicable to the Work.

10.6 Indemnification for Injury or Damage

10.6.1 To the fullest extent permitted by Applicable Law, the Contractor shall indemnify, defend, and hold harmless the Indemnified Parties from and against all claims, costs, damages, losses, fines, penalties, and expenses (including but not limited to all fees and charges of attorneys and other professionals, and all court, arbitration, or other dispute-resolution costs) arising out of or in connection with the Project, provided that any such claim, cost, damage, loss, fine, penalty, or expense is attributable to:

10.6.1.1 bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property but only to the extent caused by the negligent acts, errors, or omissions of the Contractor or a person or entity for whom the Contractor may be liable;

10.6.1.2 infringement of patent rights or copyrights by the Contractor or a person or entity for whom the Contractor may be liable; or

10.6.1.3 a violation of Applicable Law but only to the extent attributable to the Contractor or a person or entity for whom the Contractor may be liable.

10.6.2 The Contractor's indemnification obligation under **Section 10.6** exists regardless of whether or not and the extent to which the claim, damage, loss, fine, penalty, or expense is caused in part by a party indemnified under **Section 10.6**. But nothing in **Section 10.6** obligates the Contractor to indemnify any individual or entity from and against the consequences of that individual or entity's own negligence.

10.6.3 The Contractor's obligations under **Section 10.6** shall not extend to the liability of the A/E, A/E's consultants, agents, representatives, or employees for negligent preparation or approval of Drawings, Specifications, Change Orders, opinions, and any other responsibility of the A/E, except to the extent covered by the Contractor's insurance.

10.6.4 In claims against an Indemnified Party by any direct or indirect employee (or the survivor or personal representative of that employee) of the Contractor or a person or entity for whom the Contractor may be liable, the indemnification obligation under **Section 10.6** will not be limited by a limitation on the amount or type of damages, compensation, or benefits payable under workers' compensation acts, disability benefit acts, or other employee benefit acts.

10.6.5 The Contractor's indemnification obligation under **Section 10.6** will not be limited by any insurance policy provided or required in connection with the Project.

10.6.6 The Contractor's obligations under **Section 10.6** shall not negate, abridge, or reduce other rights or obligations of indemnity, which would otherwise exist as to an Indemnified Party.

10.6.7 The Contractor's indemnification obligation under **Section 10.6** will survive termination of the Contract and Contract Completion.

10.6.8 The Contracting Authority may deduct from the Contract Sum the claims, damages, losses, fines, penalties, and expenses for which the Contractor is liable under **Section 10.6**. If those claims, damages, losses, fines, penalties, and expenses exceed the unpaid balance of the Contract Sum, the Contractor shall immediately pay the difference to the Owner.

ARTICLE 11 - SUSPENSION AND TERMINATION

11.1 Suspension of the Work

11.1.1 The Contracting Authority, without cause and without prejudice to any other right or remedy it may have, may order the Contractor in writing to suspend, delay, or interrupt performance of the Work in whole or in part for such period as the Contracting Authority may determine.

11.1.1.1 If the Contracting Authority suspends the Work under this **Section 11.1.1** and the Contractor complies with **Article 8**, the Contract Sum and Contract Times shall be adjusted for increases in the cost and time caused by the suspension, delay, or interruption. The adjustment of the Contract Sum, however, shall not include profit (a component of Contractor's Fee).

11.1.1.2 Notwithstanding the foregoing, no adjustment shall be made to the Contract Sum or Contract Times to the extent that:

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

11.1.1.3 If the Contracting Authority suspends the Work under this **Section 11.1.1** and the Contractor submits a proper Contractor Payment Request, subject to all other provisions of the Contract Documents, the Contractor shall be entitled to payment of compensation due under the Contract Documents for Work performed before the suspension based upon the Schedule of Values.

11.1.2 The Contracting Authority, without prejudice to any other right or remedy it may have, may order the Contractor in writing to suspend, delay, or interrupt the performance of the Work in whole or in part for such period as the Contracting Authority may determine for any of the following reasons: **(1)** Defective Work; **(2)** the Contractor is causing undue risk of damage to any part of the Project or adjacent area; **(3)** the Contractor fails to furnish or perform the Work in such a way that the complete Work will conform to the requirements of the Contract Documents; or **(4)** any other cause the Contracting Authority reasonably believes justifies suspension.

11.1.2.1 The Contracting Authority's exercise of its right to suspend the Work under this **Section 11.1.2** shall not entitle the Contractor to any adjustment of the Contract Sum, Contract Times, or both.

11.1.2.2 If the Contracting Authority is adjudged to have improperly or unjustifiably suspended the Work under this **Section 11.1.2**, the suspension shall be deemed to have been a suspension under **Section 11.1.1**.

11.1.3 Upon receipt of notice of suspension under this **Section 11.1**, the Contractor shall cease Work on the suspended activities and take all necessary or appropriate steps to limit disbursements and minimize respective costs. The Contractor shall furnish a report to the Contracting Authority, within five days after receiving the notice of suspension, describing the status of the Work, including, but not limited to, results accomplished, resulting conclusions, and other information as the Contracting Authority may require.

11.1.4 The Contracting Authority's right to stop the Work shall not give rise to any duty to exercise the right for the benefit of the Contractor or any other party, and the Contracting Authority's exercise or failure to exercise the right shall not prejudice any of the Contracting Authority's other rights.

11.2 Termination for Convenience

11.2.1 The Contracting Authority may at any time terminate the Contract in whole or in part for the Owner's convenience and without cause, upon ten days' written notice to the Contractor.

11.2.2 Upon receipt of the notice of termination for convenience, the Contractor shall immediately proceed with performance of the following duties in accordance with instructions from the Contracting Authority:

11.2.2.1 cease operation as specified in the notice;

11.2.2.2 place no further orders and enter into no further subcontracts for materials, labor, services, or facilities, except as necessary to complete continued portions of the Project;

11.2.2.3 terminate all subcontracts and orders to the extent they relate to the Work terminated;

11.2.2.4 proceed with Work not terminated; and

11.2.2.5 take actions that may be necessary, or that the Contracting Authority may direct, for the protection and preservation of the terminated Work.

11.2.3 Upon termination, the Contracting Authority shall pay the Contractor in accordance with the Schedule of Values for Work completed, including any retained funds, and the value of materials ordered and delivered, less any salvage credit the Contractor may receive for them.

11.2.3.1 All materials, equipment, facilities, and supplies at the Site or stored off-site, for which the Contractor has received payment, shall become the property of the Owner.

11.2.3.2 The Contractor is entitled to a fair and reasonable profit for Work performed and reasonable expenses directly attributable to termination of the Contract. In no event shall the Contractor be entitled to **(1)** Contractor's Fee on Work not performed or **(2)** compensation in excess of the total Contract Sum.

11.2.4 If the Contracting Authority terminates the Work under this **Section 11.2**, the termination shall not affect the rights or remedies of the State against the Contractor then existing or which may thereafter accrue.

11.2.5 Notwithstanding **Section 11.2.3**, if the Contracting Authority terminates the Work under this **Section 11.2**, but there exists an event of the Contractor's default, the Contractor shall be entitled to receive only such amounts as it would be entitled to receive following the occurrence of an event of default as provided in **Section 11.3**.

11.3 Termination for Cause

11.3.1 The Contracting Authority may terminate the Contract in whole or in part if the Contractor commits a material breach of the Contract including but not limited to:

11.3.1.1 failure to prosecute the Work with the necessary force or in a timely manner;

11.3.1.2 refusal to remedy Defective Work;

11.3.1.3 failure to supply enough properly skilled workers or proper materials;

11.3.1.4 failure to properly make payment to Subcontractors or Consultants;

11.3.1.5 performance of any services outside of the United States;

11.3.1.6 permitting its Subcontractors or Consultants to perform any services outside of the United States; or

11.3.1.7 disregarding laws, ordinances, or rules, regulations, or orders of a public authority with jurisdiction over the Project.

11.3.2 If the Contracting Authority intends to exercise its termination rights under this **Section 11.3**, the Contracting Authority shall issue not less than five days' written notice to the Contractor and the Contractor's Surety in accordance with ORC Section 153.17 ("Five-Day Notice").

11.3.2.1 Notwithstanding any provision of the Contract to the contrary **(1)** the issuance of a 72-Hour Notice under **Section 6.23.1** is not a condition precedent to the Contracting Authority's exercise of its rights under **Section 11.3** and **(2)** the Contracting Authority's decision to not issue a 72-Hour Notice under **Section 6.23.1** will not prejudice the Contracting Authority's rights under **Section 11.3**.

11.3.3 If the Contractor fails to satisfy the requirements set forth in the Five-Day Notice within 15 days after receipt of the Five-Day Notice, the Contracting Authority may declare the Contractor in default, terminate the Contract, and employ upon the Work the additional force or supply materials or either as appropriate, and remove Defective Work.

11.3.4 If the Contract is terminated, the Contractor's Surety may perform the Contract. If the Contractor's Surety does not commence performance of the Contract within ten days after the date of Contract termination, the Contracting Authority may complete the Work by any means the Contracting Authority determines appropriate. The Contracting Authority may take possession of and use all materials, facilities, and equipment at the Site or stored off-site, for which the State has paid.

11.3.5 If the Contract is terminated, the Contractor shall not be entitled to further payment. If the unpaid balance of the Contract Sum exceeds the costs of finishing the Work, including without limitation the fees and charges of engineers, architects, attorneys, and other professionals and court costs, and other damages incurred by the Owner and not expressly waived, the Contractor or Surety shall immediately pay the amount of the insufficiency to the Owner. This obligation for payment shall survive termination of the Contract.

11.3.6 If the Contractor's Surety performs the Work, the provisions of the Contract Documents govern the Surety's performance, with the Surety in place of the Contractor in all provisions including, but not limited to, provisions for payment for the Work, and provisions of the right of the Contracting Authority to complete the Work.

11.3.7 If the Contracting Authority terminates the Contract under this **Section 11.3**, the termination shall not affect any rights or remedies of the State against the Contractor then existing or which may thereafter accrue. The Contracting Authority's retention or payment of funds due the Contractor shall not release the Contractor or the Contractor's Surety from liability for performance of the Work in accordance with the requirements of the Contract Documents.

11.3.8 If the Contracting Authority is adjudged to have improperly or unjustifiably terminated the Contract under this **Section 11.3**, the termination will be deemed to have been a termination under **Section 11.2**.

11.4 Contractor Insolvency

11.4.1 The Contracting Authority may immediately terminate the Contract for cause if:

11.4.1.1 the Contractor commences a voluntary case under Title 11 of the United States Code or the corresponding provisions of any successor laws; or

11.4.1.2 any legal entity commences an involuntary case against the Contractor under Title 11 of the United States Code or the corresponding provisions of any successor laws and **(1)** the case is not dismissed within 60 days after its commencement; or **(2)** the court before which the case is pending issues an order for relief or similar order approving the case; or

11.4.1.3 a court of competent jurisdiction appoints, or the Contractor makes an assignment of all or substantially all of its assets to, a receiver, trustee, liquidator, or other similar custodian for the Contractor or all or substantially all of the Contractor's assets; or

11.4.1.4 any attachment, execution, or other judicial seizure is levied against all or substantially all of the Contractor's assets; or

11.4.1.5 the Contractor takes any action toward the dissolution or winding up of its business; or

11.4.1.6 the Contractor fails generally to pay its debts as they become due (unless those debts are subject to a good-faith dispute as to liability or amount) or it acknowledges in writing that it is unable to do so.

11.4.2 If the Contractor files a voluntary petition in bankruptcy or has an involuntary petition in bankruptcy filed against it, the Contractor, the Contractor as the debtor-in-possession, or the trustee of the Contractor's bankruptcy estate shall file a motion to assume or reject the Contract under Bankruptcy Code §365, 11 U.S.C. §365, within 20 days after the filing of the voluntary petition or involuntary petition and shall diligently prosecute that motion to conclusion so as to obtain an order granting or denying that motion within 45 days after the filing of the voluntary or involuntary petition.

11.4.3 If the Contracting Authority intends to exercise its termination rights under this **Section 11.4**, the Contracting Authority shall notify the Contractor in writing of the Contracting Authority's termination of the Contract and the cause(s) for that termination.

11.4.4 The Contractor agrees to the granting of relief from the automatic stay of the Bankruptcy Code, 11 U.S.C. §362(a), to permit the Contracting Authority to terminate the Contract for cause in such instance and issue and serve all notices necessary to terminate the Contract or arising out of the termination of the Contract and to take any and all other action necessary to terminate the Contract.

ARTICLE 12 - GENERAL PROVISIONS

12.1 Contractor's Documents and Contract Documents

12.1.1 Ownership.

12.1.1.1 The Owner alone owns the Contractor's Documents and the Contract Documents and every right, title, and interest therein.

- .1** The Contractor must execute and deliver and cause its employees and agents and all Subcontractors and Consultants to execute and deliver, to the Owner any transfers, assignments, documents, or other instruments (if any) necessary to vest in the Owner complete right, title, interest in and ownership of the Contractor's Documents and the Contract Documents.

12.1.1.2 The Contractor may retain copies, including reproducible copies, of the Contractor's Documents and the Contract Documents for information, reference, and performance of the Work.

12.1.1.3 The submission or distribution of the Contractor's Documents or the Contract Documents to meet official regulatory requirements or for similar purposes in connection with the Project is not a waiver of the Owner's reserved rights in the Contractor's Documents and the Contract Documents. Any unauthorized use of the Contractor's Documents or the Contract Documents shall be at the sole risk of the entity making the unauthorized use.

12.1.1.4 The Contractor shall provide Electronic Files (in native format) to Separate Consultants and Separate Contractors for their use in connection with the Project. The Contractor shall provide the Electronic Files **(1)** at no additional cost to the Separate Consultants, Separate Contractors, and Owner and **(2)** without requiring the Separate Consultants, Separate Contractors, or Owner to agree to any terms or conditions concerning the provision, receipt, or use of the Electronic Files that differ in any material respect from the Contract.

12.1.2 Intent.

12.1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor.

12.1.2.2 The Contract Documents are complementary, and what is required by one is binding as if required by all.

12.1.2.3 The Contractor shall provide all labor and materials necessary for the entire completion of the Work described in the Contract Documents and reasonably inferable to produce the intended results.

12.1.2.4 The Drawings govern dimensions, details, and locations of the Work. The Specifications govern quality of materials and workmanship.

12.1.2.5 The organization of the Specifications in divisions, sections, and articles, and the arrangement of Drawings shall not restrict the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

12.1.2.6 In the event of inconsistency or conflict within the Contract Documents, the Contractor shall provide the better quality or greater quantity of Work, and comply with the stricter requirement.

12.1.2.7 Unless otherwise defined in the Contract Documents, words that have well-known technical or construction industry meanings are used in accordance with those recognized meanings.

12.1.2.8 The Sections of Division 01 - "General Requirements" govern the performance of the Work of all Sections of the Specifications.

12.1.3 Use of Electronic Files.

12.1.3.1 The Owner, Contracting Authority, A/E, and Contractor reasonably expect that they will provide Electronic Files to each other to facilitate the design and construction of the Project consistent with current practices and customs in the construction industry.

12.1.3.2 The Owner, Contracting Authority, A/E, and Contractor acknowledge that the use of Electronic Files involves risks not generally associated with the use of paper documents. Those risks include, for example and

without limitation, alteration (inadvertent or intentional) and deterioration, both of which may not be readily apparent through casual observation.

12.1.3.3 The Owner, Contracting Authority, A/E, and Contractor do not warrant to each other that any Electronic File they provide **(1)** was not altered through transmission; **(2)** is compatible with the recipient's computer system or software; **(3)** will not be altered through degradation of the recipient's storage media; or **(4)** is suitable for conversion/translation to and subsequent use in a system or format other than the Electronic File's original system or format.

12.1.3.4 Before relying on any Electronic File it receives, the recipient is responsible for verifying that the Electronic File was not altered through transmission, degradation of the recipient's own storage media, or other causes.

12.1.3.5 If the recipient of an Electronic File converts/translates the Electronic File from its original system or format to an alternate system or format, the recipient assumes the risk that the conversion/translation created errors in the converted/translated file.

12.1.3.6 The Owner, Contracting Authority, A/E, and Contractor shall each maintain and operate its own computer systems and storage media in a commercially reasonable way and take reasonable steps to prevent errors in and deterioration of the Electronic Files it creates, provides, and receives.

12.1.3.7 In the event of a discrepancy between information contained in a paper version of a document and the Electronic File of that document, the paper version will govern.

12.1.3.8 This **Section 12.1.3** does not relieve the Contractor of its responsibility for the preparation, completeness, or accuracy of the Contractor's Documents.

12.2 Public Relations

12.2.1 Publicity prior to completion of the Project. Prior to completion of the Project, public relations or publicity about the Project shall be solely within the control, and with the consent of, the Owner.

12.2.2 Publicity after completion of the Project. After completion of the Project, the Contractor may exercise reasonable public relations and marketing efforts related to the Project, provided the Contractor properly identifies the Owner and Contracting Authority, and their participation in the Project.

12.2.3 Professional Photography. If the Contractor commissions photography of the completed Project, the Contractor shall include in its photography agreements a release for unrestricted and unlimited use of photographs by the Owner and Contracting Authority, and shall provide the Owner and Contracting Authority with a reasonable quantity of photographs for use in the Owner's and the Contracting Authority's marketing and awareness activities, including, but not limited to, profiles of the Project on their respective websites.

12.2.4 Craft Awards and Other Recognition. If the Contractor submits the Project for craft awards or other similar venues for recognition of the Project, the Contractor shall properly identify the Owner and Contracting Authority, and their participation in the Project. In addition, if the Project receives any craft award or other recognition, the Contractor shall provide duplicate copies of the award plaque or other memento of the award to the Owner and Contracting Authority.

12.3 Application and Governing Law

12.3.1 The Contract and the rights of the parties thereunder shall be governed by the laws of the state of Ohio and only Ohio courts shall have jurisdiction over any action or proceeding concerning the Contract and/or performance thereunder. The Contractor irrevocably consents to such jurisdiction.

12.3.2 The parties to the Contract shall comply with Applicable Law.

12.3.3 Other rights and responsibilities of the Contractor, A/E, Contracting Authority, and Owner are set forth throughout the Contract Documents and included under different titles, articles, and paragraphs for convenience.

12.4 Conditions of the Contract

12.4.1 These General Conditions govern, take precedence over, and shall not be superseded or amended by Drawings and Specifications, unless so provided in Supplementary Conditions prepared by the Contracting Authority and approved by the Ohio Facilities Construction Commission.

12.5 Notice of Commencement.

12.5.1 The Contracting Authority shall prepare a Notice of Commencement and make it available as required under ORC Section 1311.252.

12.5.2 Upon request, the Contracting Authority or the Contractor shall furnish the Notice of Commencement to Subcontractors or any other member of the public.

12.6 Written Notice

12.6.1 Notice under the Contract Documents shall be validly given if:

12.6.1.1 delivered personally to a member of the organization for whom the notice is intended;

12.6.1.2 delivered by trackable delivery service, or sent by registered or certified mail, to the last known business address of the organization; or

12.6.1.3 sent by facsimile, email, or web-based project management software, provided the original, signed document is delivered within three business days after the date of the electronic transmission.

12.6.2 When the Owner, Contracting Authority, A/E, or Contractor gives notice to one of the other three, it shall also simultaneously send a copy of that notice to the others.

12.6.3 A copy of all notices, certificates, requests, or other communications to the Contracting Authority shall be sent to the Project Manager.

12.6.4 In the event of an emergency involving the Project, including, but not limited to, a fatality, serious injury, fire, collapse, flood, utility, or power loss to occupied facilities, explosion, or environmental damage, the Contractor shall immediately notify the A/E, Contracting Authority, and Owner by the most expedient means available.

12.6.5 The Contracting Authority, Owner, A/E, or Contractor may, by written notice given hereunder, designate addresses, telephone numbers, email addresses, or facsimile numbers to which notices, certificates, requests, or communications shall be sent.

12.7 Taxes

12.7.1 Only those materials that ultimately become a part of the completed structure or improvement that constitutes the Project shall be exempt from state sales tax and state use tax.

12.7.2 The purchase, lease, or rental of material, equipment, parts, or expendable items as concrete form lumber, tools, oils, greases, and fuels, which are used in connection with the Work, are subject to the application of state sales tax and state use tax.

12.8 Computing Time

12.8.1 When the Contract Documents refer to a period of time by a number of days, the period shall be computed to exclude the first and include the last day of the period. If the last day of the period falls on a Saturday, Sunday, or a legal holiday, that day shall be omitted from the computation and the period shall end on the next succeeding day that is not a Saturday, Sunday, or legal holiday.

12.8.2 Except as excluded under **Section 12.8.1**, the Contract Times and all other periods referred to in the Contract Documents includes Saturdays, Sundays, and all days defined as legal holidays by **Section 12.8.4**.

12.8.3 The standard workdays for State projects are Monday through Friday, excluding legal holidays.

12.8.4 Legal holidays are as follows:

12.8.4.1 New Year's Day – First Day in January;

12.8.4.2 Martin Luther King Jr. Day – Third Monday in January;

12.8.4.3 Washington-Lincoln (President's) Day – Third Monday in February;

12.8.4.4 Memorial Day – Last Monday in May;

12.8.4.5 Juneteenth Day – Nineteenth Day of June;

12.8.4.6 Independence Day – Fourth day of July;

12.8.4.7 Labor Day – First Monday in September;

12.8.4.8 Columbus Day – Second Monday in October;

12.8.4.9 Veterans' Day – Eleventh Day of November;

12.8.4.10 Thanksgiving Day – Fourth Thursday of November; and

12.8.4.11 Christmas Day – Twenty-fifth day of December.

12.8.5 If a legal holiday falls on a Saturday, it is observed on the preceding Friday. If a legal holiday falls on a Sunday, it is observed on the following Monday.

12.9 Time of the Essence

12.9.1 Time limits stated in the Contract Documents are of the essence of the Contract and all obligations under the Contract. By signing the Agreement, the Contractor acknowledges that the Contract Times are reasonable, taking into consideration the usual weather and other conditions prevailing in the locality of the Project. By signing the Construction Schedule, the Contractor acknowledges that the specified Milestone dates are reasonable, taking into consideration the usual weather and other conditions prevailing in the locality of the Project.

12.9.1.1 The Notice to Proceed establishes the date for commencement of the Work.

12.9.1.2 The Contractor acknowledges that the Owner has entered into, or may enter into, agreements for use of all or part of the premises where the Work is to be completed based upon the Contractor achieving Contract Completion within the associated Contract Time.

12.9.1.3 The Contractor shall perform the Work in a reasonable, efficient, and economical sequence, and in the order and time as provided in the Construction Progress Schedule.

12.9.1.4 The Contractor acknowledges that it may be subject to interference, disruption, hindrance, or delay in the progress of the Work from any cause.

12.10 Successors and Assigns

12.10.1 The Contracting Authority and Contractor each bind themselves, their successors, assigns, and legal representatives, to the other party to this Contract and to the successors, assigns, and legal representatives of the other party with respect to all terms of this Contract.

12.10.2 The Contracting Authority and Contractor each acknowledge that the Owner is an intended third-party beneficiary of this Contract.

12.10.3 The Contractor shall not assign or transfer any right, title, or interest in this Contract without the Contracting Authority's prior written consent.

12.11 Extent of Contract

12.11.1 Entire Contract. Contract Documents represent the entire and integrated agreement between the Contracting Authority and Contractor and supersede all prior negotiations, representations, or agreements, either written or oral.

12.11.2 Multiple Counterparts. This Contract may be executed in any number of counterparts, each of which shall be regarded as an original and all of which shall constitute but one and the same instrument.

12.11.3 Captions. The captions and headings in this Contract are for convenience only and in no way define, limit, or describe the scope or intent of any provisions or sections hereof.

12.11.4 Precedence. If there are any inconsistencies between the provisions of the Contract Documents and the provisions of the Contract, the provisions of this Contract shall prevail.

12.12 Severability

12.12.1 If any term or provision of this Contract or the application thereof to any Person or circumstance, is finally determined to be invalid or unenforceable by a court of competent jurisdiction, the remainder of this Contract or the application of such term or provision to other Persons or circumstances, shall not be affected thereby, and each term and provision of this Contract shall be valid and enforced to the fullest extent permitted by Applicable Law.

12.13 Electronic and Facsimile Signatures

12.13.1 Any party hereto may deliver a copy of its counterpart signature page to this Contract via electronic signature software, fax, e-mail, or web-based project management software. Each party hereto shall be entitled to rely upon an electronic, scanned, or facsimile signature of any other party delivered in such a manner as if such signature were an original.

12.14 No Third-Party Interest

12.14.1 Except as expressly provided under **Sections 6.2.3** through **6.2.6** and **Section 12.10.2, (1)** no person or entity, other than the Contracting Authority, Owner, and Contractor, will have any right or interest under the Contract, and **(2)** the Contract does not create a contractual relationship of any kind between any people or entities other than the Contracting Authority, Owner, and Contractor.

12.15 Ohio Retirement System

12.15.1 All individuals employed by the Contractor that provide personal services to the Contracting Authority or Owner are not public employees for the purposes of ORC Chapter 145, as amended.

12.15.2 If the Contractor is a PERS retirant, as defined by ORC Section 145.38, the Contractor shall notify the Contracting Authority of such status in writing prior to commencement of Work. The Contracting Authority, Owner, or State is not responsible for changes to the Contractor's retirement benefits resulting from entering into this Contract.

12.16 No Waiver

12.16.1 The failure of the Contracting Authority or Contractor to insist in any one or more instances upon the strict performance of any one or more of the provisions of the Contract or to exercise any rights under the Contract or provided by law will not be construed as a waiver or relinquishment of that provision or right or of the right to subsequently demand strict performance or exercise the right and the rights will continue unchanged and remain in full force and effect.

12.17 Rights and Remedies

12.17.1 The duties, obligations, rights, and remedies under the Contract are in addition to and not a limitation of the duties, obligations, rights, and remedies otherwise imposed by or available under Applicable Law.

12.18 Survival of Obligations

12.18.1 All representations, indemnity obligations, warranties, guarantees, and necessarily continuing obligations under the Contract, will survive final payment, completion and acceptance of the Work, and termination or completion of the Contract.

KEYWORD INDEX**A**

acceleration, 34, 35, 37, 51
 Acceptable Components, 16
 Affirmative Action, 2
 Agreement, 2, 45, 58
 Allowance, 41, 42
 Alternative Dispute Resolution ("ADR"), 9, 40
 antitrust claims, 2
 Applicable Law, 1, 2, 4, 7, 8, 15, 16, 17, 20, 21, 24, 33,
 37, 41, 43, 44, 47, 51, 56, 59
 approval, 3, 5, 7, 8, 11, 12, 13, 14, 20, 21, 22, 23, 25, 27,
 29, 32, 52
 Architect/Engineer Agreement, 6
 As-Built Documents, 25, 26
 audit, 32, 35, 40

B

Basis of Design Component, 16
 Bond, 28, 33, 45, 46
 builder's risk, 33, 50, 51
 Building Information Modeling ("BIM"), 14

C

capacity charges, 9
 Certificate of Contract Completion, 25, 27, 28, 45
 certificate of occupancy, 25, 27
 Certificate of Substantial Completion, 24, 26
 Change Directive, 28, 29, 30, 31, 32, 35
 change in the Work, 5, 28, 29, 30, 31, 32, 33, 34, 42
 Change Order, 13, 15, 21, 23, 24, 28, 29, 30, 31, 32, 34,
 35, 39, 40, 42, 43, 52
 Change Order Log, 29
 Claim, 31, 32, 35, 36, 37, 39, 40, 41
 cleaning, 19, 26
 Commissioning, 20
 Commissioning Agent ("CxA"), 9, 20
 Computer-Aided Design ("CAD"), 14
 construction procedures, 11
 Construction Progress Schedule, 10, 11, 12, 13, 14, 23,
 31, 35, 36, 37, 45, 58
 Construction Specifications Institute ("CSI"), 42
 Construction Stage, 10
 construction supervision, 12

Contract, 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 15, 22, 23, 24, 28, 29, 30, 31, 32, 35, 36, 37, 38, 41, 42, 43, 44, 46, 47, 48, 49, 52, 53, 54, 56, 58, 59
 Contract Completion, 10, 11, 12, 24, 25, 27, 28, 37, 52, 58
 Contract Documents, 5, 6, 7, 8, 10, 11, 12, 14, 15, 16, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 37, 38, 39, 41, 43, 44, 45, 52, 54, 55, 56, 57, 58
 Contract Sum, 2, 3, 4, 6, 8, 15, 23, 24, 28, 29, 30, 31, 32, 33, 35, 36, 37, 38, 39, 41, 42, 43, 44, 45, 49, 52, 53, 54
 Contract Times, 4, 6, 15, 22, 23, 28, 29, 30, 31, 34, 35, 37, 38, 39, 44, 52, 57, 58
 Contractor Payment Request, 3, 4, 25, 35, 43, 44, 45, 52
 Contractor Personnel Costs, 32
 Contractor's Fee, 34, 41, 42
 Coordination Areas, 14
 Coordination Drawings, 14, 42
 coordination meetings, 14
 Coordination Participant, 14
 correction of the Work, 23
 Correction Period, 7, 24
 critical path, 12, 13, 35, 37, 38

D

daily log, 11, 36
 default, 44, 53, 54
 Defective Work, 7, 16, 22, 23, 24, 25, 26, 43, 44, 52, 53, 54
 demonstration and training, 27
 Differing Site Conditions, 31, 32, 36
 dispute review board, 40
 Domestic Steel, 2, 22
 drainage, 18
 Drawings, 25, 52, 55, 56
 Drug Free Safety Program ("DFSP"), 2, 3

E

electric service, 18, 19
 electronic signature, 58
 emergency, 4, 57
 Encouraging Diversity, Growth and Equity ("EDGE"), 3, 4, 42, 43, 44
 environmental controls, 17
 Equal Employment Opportunity, 2
 Equal Opportunity Coordinator ("EOC"), 1, 2, 3, 4
 equipment, 10, 11, 14, 16, 17, 19, 20, 22, 33, 39, 41, 42, 48, 50, 51, 53, 54, 57
 Estimated Construction Cost, 12
 explosives, 20

F

facilities, 17
 Field Conditions, 15
 Final Inspection, 27
 Fire Marshal, 9, 25

G

General Conditions, 56
 General Conditions Costs, 33, 42
 Green Building Certification Institute, 5

H

Hazardous Materials, 17, 48
 hoisting facilities, 19

I

indemnification, 51, 52
 Institution of Higher Education, 40
 Institutional Designee, 40
 insurance, 20, 27, 33, 40, 41, 43, 46, 47, 48, 49, 50, 51, 52
 interruption of existing services, 20

J

joint venture, 49

L

labor, 2, 3, 16, 32, 33, 34, 37, 38, 39, 41, 42, 43, 50, 53, 55
 Leadership in Energy and Environmental Design ("LEED") Rating System, 5
 legal holiday, 57, 58
 licenses, 9
 limited-liability company, 49
 Liquidated Damages, 35, 38, 44

M

MasterFormat, 42
 material, 10, 11, 15, 16, 17, 19, 20, 21, 22, 25, 26, 27, 29, 30, 32, 33, 35, 39, 41, 42, 43, 44, 45, 50, 51, 53, 54, 55, 57
 mediation, 40
 Milestone, 12, 13, 35, 38, 58
 minor change in the Work, 6, 28, 29, 31
 Modification, 4, 28, 30, 35

N

National Pollutant Discharge Elimination System ("NPDES"), 10, 11
 negotiation, 40
 Neutral Facilitator, 5, 6, 9
 no damage for delay, 37, 38
 Nondiscrimination, 1
 Notice of Commencement, 57
 Notice to Proceed, 5, 7, 10, 13, 42, 58
 Notice, 72-Hour, 23, 54
 Notice, Five-Day, 53, 54

O

Occupational Safety and Health Administration (“OSHA”), 16, 17
 Ohio Building Code, 7
 Ohio Bureau of Workers’ Compensation (“OBWC”), 2, 3
 Ohio Construction Contract Information Report, 2
 Ohio Department of Commerce, 2, 33
 Ohio Environmental Protection Agency, 10
 Ohio Facilities Construction Commission, 5, 32, 40, 42, 56
 Operation and Maintenance Manuals, 20, 25

P

Partial Occupancy, 24, 27, 51
 partnering, 9
 Pencil Copy, 43
 performance evaluation, 6
 permits, 9
 Plan Approval, 9
 Prevailing Wage Requirements, 43
 Pricing Criteria, 32, 34
 Product Data, 20, 21, 25
 progress meetings, 6, 13, 14, 17
 Project Manager, 5, 9, 15, 17, 19, 39, 40, 57
 Project Schedule, 42
 Proposal, 30, 31, 32, 35, 37
 Proposal Request, 28, 29, 30
 Protection of the Project, 15
 Punch List, 12, 26, 27, 28, 42

R

Record Documents, 26, 42
 Request for Change Order, 30
 Request for Information (“RFI”), 15, 25, 36
 Retainage, 44
 royalties and patents, 2

S

Safety Data Sheet (“SDS”), 17
 Samples, 20, 21, 25
 schedule of submittals, 10
 Schedule of Values, 33, 42, 43, 51, 52, 53
 Separate Consultant, 10, 38

Separate Contractor, 10, 21, 38
 Shop Drawings, 12, 13, 20, 21, 22, 25
 snow and ice, 11
 special inspection, 7, 22, 23
 Specifications, 25, 44, 52, 55, 56
 State, 2, 3, 5, 6, 7, 8, 19, 24, 25, 37, 41, 44, 45, 51, 53, 54, 57
 storm water, 10
 structural testing, 7
 Subcontract, 4, 8, 12, 41, 42, 49
 Subcontractor, 2, 3, 6, 7, 8, 9, 12, 14, 16, 19, 22, 25, 32, 33, 34, 35, 36, 40, 41, 44, 45, 47, 49, 50, 53, 55, 57
 Substantial Completion, 11, 12, 13, 15, 18, 20, 22, 23, 24, 26, 27, 33, 35, 44, 47, 48, 49, 51
 Substitutions, 16
 Supplementary Conditions, 56
 Surety, 11, 23, 24, 26, 28, 44, 45, 53, 54
 Suspension of the Work, 52
 sustainability, 4, 5

T

tap fees, 9
 taxes, 34, 57
 Termination for Cause, 53
 Termination for Convenience, 53
 testing, 7, 22, 23, 50, 51
 tests and inspections, 22
 third-party beneficiary, 10, 58, 59

U

U.S. Green Building Council, 5
 uncovering the Work, 23
UniFormat, 42
 Unit Price, 29, 32, 33, 42, 43, 44
 utilities, 17

W

Waivers of Subrogation, 51
 warranty, 22
 waste materials and rubbish, 19
 water, 18
 weather delay, 37
 written notice, 4, 11, 15, 17, 21, 23, 27, 30, 31, 32, 35, 36, 40, 46, 53, 57

END OF DOCUMENT

Document 00 73 00 - Supplementary Conditions (GC)

State of Ohio Standard Requirements for Public Facility Construction

Certifications

These Supplementary Conditions amend and supplement the General Conditions and other provisions of the Contract Documents as indicated below. All provisions not amended remain in full force and effect. The terms in these Supplementary Conditions defined in the Contracting Definitions or the General Conditions shall have the meanings assigned to them in those documents.

These Supplementary Conditions are authorized, by the Ohio Facilities Construction Commission, for use on projects constructed by the Ohio Facilities Construction Commission for the Edison State Community College.

Contracting Authority

Ohio Facilities Construction Commission
30 W. Spring Street
Columbus, Ohio 43215
(614) 466-6290
www.ofcc.ohio.gov

MODIFICATIONS TO GENERAL CONDITIONS

Insert Section 7.10 and subordinate Sections as follows:

7.10 Weather Delays

7.10.1 The parties expect adverse weather to delay the Work to some extent and have included in the Contract Times a certain number of Work Days lost on account of adverse weather as follows:

Month	Expected Number of Work Days Lost Due to Weather
January	8
February	8
March	7
April	6
May	5
June	5
July	4
August	4
September	5
October	6
November	6
December	6

7.10.2 The contractor will not be entitled to an extension of the Contract Time on account of adverse weather unless the actual number of Work Days lost due to adverse weather in a particular calendar month exceed the expected number of Work Days lost in that calendar month due to adverse weather. The Contractor must reconcile lost Work Days with the A/E on a weekly basis.

7.10.3 A Work Day will be “lost” if adverse weather reduces the Contractor’s efficiency on the Work on the critical path that Work Day to less than 50%. The Contractor shall substantiate its claim that its efficiency on the Work on the critical path that Work Day was less than 50%.

7.10.4 If the Contractor reasonably believes that it is entitled to an extension of the Contract Times on account of Work Days lost due to adverse weather in a particular month. The Contractor may request a Change Order by giving written notice under Section 7.3.2 within ten days after the last calendar day of that month.

Delete Section 8.4.2 in its entirety.

END OF DOCUMENT

Document 00 73 43 - Wage Rate Requirements

State of Ohio Standard Requirements for Public Facility Construction

PREVAILING WAGE RATES

1.1 Payment of Prevailing Wage Rates

1.1.1 The Contractor shall pay the prevailing wage rates of the Project locality, as issued by the Ohio Department of Commerce, Wage and Hour Bureau to laborers and mechanics performing Work on the Project.

1.1.2 The Contractor shall comply with the provisions, duties, obligations, and is subject to the remedies and penalties of ORC Chapter 4115.

1.1.3 If the Contractor or its Subcontractors fail to comply with ORC Chapter 4115, the Contracting Authority may withhold payment pursuant to **Section 9.8.2.5** of the **General Conditions**. The Contractor is liable for violations committed by the Contractor or its Subcontractors to the extent provided in ORC Chapter 4115.

1.1.4 The Contractor shall submit all payroll reports in compliance with the requirements of **Section 1.2** for all employees of the Contractor and of the Contractor's Subcontractors.

1.1.5 By executing a Contract, the Contractor certifies that it based its Bid upon the prevailing rates of wages as ascertained by the Ohio Department of Commerce, Wage and Hour Bureau for the Project as provided in ORC Sections 4115.03 through 4115.14, which are inserted at the end of this Document.

1.2 Prevailing Wage Rate Revisions

1.2.1 The Contracting Authority shall, within 7 business days after receipt of a notice of a change in the prevailing wage rates, notify the Contractor of the change. The prevailing wage rates are available at the Ohio Department of Commerce's web site: <http://com.state.oh.us/>.

1.2.2 The Contractor shall pay any revised wage rates issued during the term of the Contract.

1.3 Payroll Schedule

1.3.1 Within 10 days of the date of the Notice to Proceed, the Contractor shall provide the Contracting Authority's Prevailing Wage Coordinator a schedule of dates during the term of the Contract on which wages shall be paid to employees for the Project.

1.4 Payroll Reports

1.4.1 The Contractor shall submit payroll reports with each Contractor Payment Request, which reports shall be certified by the Contractor that the payroll is correct and complete, and that the wage rates shown are not less than those required by the Contract. The Contractor is responsible for submitting all payroll reports of its Subcontractors.

1.4.1.1 Each payroll report shall indicate the period covered and include a list containing the name, address, and last four digits of the social security number of each employee of the Contractor and its Subcontractors paid for the Work.


1.4.1.2 Each payroll report shall list the number of hours each employee worked each day on the Project during the reporting period, the total hours each week on the Project, the employee's hourly rate of pay, job classification, hourly rate of fringe benefits, and all deductions from wages and net pay.

1.4.1.3 Each payroll report shall list each fringe benefit and state if it is paid as cash to the employee or to a named plan.

1.4.1.4 The Contractor and its Subcontractors shall submit apprenticeship agreements for all apprentices utilized on the Project with the first payroll report from the Contractor or its Subcontractor that includes apprentices.

END OF DOCUMENT

Prevailing Wage Determination Cover Letter

County: 
Determination Date: 04/03/2024
Expiration Date: 07/03/2024

THE FOLLOWING PAGES ARE PREVAILING RATES OF WAGES ON PUBLIC IMPROVEMENTS FAIRLY ESTIMATED TO BE MORE THAN THE AMOUNT IN O.R.C. SEC. 4115.03 (b) (1) or (2), AS APPLICABLE.

Section 4115.05 provides, in part: "Where contracts are not awarded or construction undertaken within ninety days from the date of the establishment of the prevailing wages, there shall be a redetermination of the prevailing rate of wages before the contract is awarded." The expiration date of this wage schedule is listed above for your convenience only. This wage determination is not intended as a blanket determination to be used for all projects during this period without prior approval of this Department.

Section 4115.04, Ohio Revised Code provides, in part: "Such schedule of wages shall be attached to and made a part of the specifications for the work, and shall be printed on the bidding blanks where the work is done by contract..."

The contract between the letting authority and the successful bidder shall contain a statement requiring that mechanics and laborers be paid a prevailing rate of wage as required in Section 4115.06, Ohio Revised Code.

The contractor or subcontractor is required to file with the contracting public authority upon completion of the project and prior to final payment therefore an affidavit stating that he has fully complied with Chapter 4115 of the Ohio Revised Code.

The wage rates contained in this schedule are the "Prevailing Wages" as defined by Section 4115.03, Ohio Revised Code (the basic hourly rates plus certain fringe benefits). These rates and fringes shall be a minimum to be paid under a contract regulated by Chapter 4115 of the Ohio Revised Code by contractors and subcontractors. The prevailing wage rates contained in this schedule include the effective dates and wage rates currently on file. In cases where future effective dates are not included in this schedule, modifications to the wage schedule will be furnished to the Prevailing Wage Coordinator appointed by the public authority as soon as prevailing wage rates increases are received by this office.

"There shall be posted in a prominent and accessible place on the site of work a legible statement of the Schedule of Wage Rates specified in the contract to the various classifications of laborers, workmen, and mechanics employed, said statement to remain posted during the life of such contract." Section 4115.07, Ohio Revised Code.

Apprentices will be permitted to work only under a bona fide apprenticeship program if such program exists and if such program is registered with the Ohio Apprenticeship Council.

Section 4115.071 provides that no later than ten days before the first payment of wages is due to any employee of any contractor or subcontractor working on a contract regulated by Chapter 4115, Ohio Revised Code, the contracting public authority shall appoint one of his own employees to act as the prevailing wage coordinator for said contract. The duties of the prevailing wage coordinator are outlined in Section 4115.071 of the Ohio Revised Code.

Section 4115.05 provides for an escalator in the prevailing wage rate. Each time a new rate is established, that rate is required to be paid on all ongoing public improvement projects.

A further requirement of Section 4115.05 of the Ohio Revised Code is: "On the occasion of the first pay date under a contract, the contractor shall furnish each employee not covered by a collective bargaining agreement or understanding between employers and bona fide organizations of Labor with individual written notification of the job classification to which the employee is assigned, the prevailing wage determined to be applicable to that classification, separated into the hourly rate of pay and the fringe payments, and the identity of the prevailing wage Coordinator appointed by the public authority. The contractor or subcontractor shall furnish the same notification to each affected employee every time the job classification of the employee is changed."

Work performed in connection with the installation of modular furniture may be subject to prevailing wage.

THIS PACKET IS NOT TO BE SEPARATED BUT IS TO REMAIN COMPLETE AS IT IS SUBMITTED TO YOU. (Reference guidelines and forms are included in this packet to be helpful in the compliance of the Prevailing Wage law.)
wh1500



- ▶ forms
- ▶ contacts
- ▶ about LAWS
- ▶ search

Ohio Department of Commerce

Bureau of Wage & Hour Administration

[Consumers](#)
 [Business](#)
 [License/Permit Holders & Applicants](#)
 [Other Government Agencies](#)

[Back to wage rate search](#) [Back to Home](#)

Classification = All, County = MIAMI, Union = All

County	Classification	Effective	Posted	Union
MIAMI	Asbestos Worker	8/23/2018	8/23/2018	Asbestos Local 207 OH
MIAMI	Asbestos Worker	3/6/2024	3/6/2024	Asbestos Local 50 Zone 2
MIAMI	Boilermaker	10/1/2013	9/25/2013	Boilermaker Local 105
MIAMI	Bricklayer	6/7/2023	6/7/2023	Bricklayer Local 23 Heavy Hwy (A)
MIAMI	Bricklayer	6/7/2023	6/7/2023	Bricklayer Local 23 Heavy Hwy (B)
MIAMI	Bricklayer	7/5/2023	7/5/2023	Bricklayer Local 23 (Dayton Tile Finisher)
MIAMI	Bricklayer	7/5/2023	7/5/2023	Bricklayer Local 23 (Dayton Tile Mechanic)
MIAMI	Bricklayer	6/7/2023	6/7/2023	Bricklayer Local 23 (Dayton)
MIAMI	Carpenter	9/20/2023	9/20/2023	Carpenter Floorlayer SW District G
MIAMI	Carpenter	9/20/2023	9/20/2023	Carpenter Millwright Local 1090 SW Zone II
MIAMI	Carpenter	3/5/2014	3/5/2014	Carpenter NE District Industrial Dock & Door
MIAMI	Carpenter	6/7/2023	6/7/2023	Carpenter & Pile Driver SW Zone 1
MIAMI	Carpenter	5/3/2023	5/3/2023	Carpenter & Pile Driver SW District HevHwy
MIAMI	Cement	6/1/2023	5/31/2023	Cement Mason Local 132 (Dayton)
MIAMI	Cement Mason	5/1/2023	4/26/2023	Cement Mason Statewide HevHwy
MIAMI	Lineman	2/7/2024	2/7/2024	Electrical Local 71 DOT Traffic Signal Highway Lighting American Line Builders
MIAMI	Lineman	2/7/2024	2/7/2024	Electrical Local 71 High Tension Pipe Type Cable
MIAMI	Lineman	2/7/2024	2/7/2024	Electrical Local 71 Outside Utility Power
MIAMI	Lineman	2/7/2024	2/7/2024	Electrical Local 71 Underground Residential Distribution
MIAMI	Voice Data Video	3/6/2024	3/6/2024	Electrical Local 71 Voice Data Video Outside
MIAMI	Electrical	12/27/2023	12/27/2023	Electrical Local 82 Inside
MIAMI	Electrical	3/30/2022	3/30/2022	Electrical Local 82 Inside Lt Commercial South West
MIAMI	Electrical	12/5/2022	11/23/2022	Electrical Local 82 Lightning Rod
MIAMI	Voice Data Video	11/27/2023	11/22/2023	Electrical Local 82 Voice Data Video
MIAMI	Elevator	1/5/2021	1/5/2021	Elevator Local 11
MIAMI	Glazier	11/22/2023	11/22/2023	Glazier Local 387
MIAMI	Ironworker	11/17/2023	11/17/2023	Ironworker Local 290
MIAMI	Laborer Group 1	5/1/2023	4/26/2023	Labor HevHwy 3
MIAMI	Laborer	4/5/2023	4/5/2023	Labor Local 1410 Building
MIAMI	Operating Engineer	5/1/2023	4/26/2023	Operating Engineers - Building Local 18 - Zone III
MIAMI	Operating Engineer	5/1/2023	4/26/2023	Operating Engineers - HevHwy Zone II
MIAMI	Drywall Finisher	11/22/2023	11/22/2023	Painter Local 249
MIAMI	Painter	11/22/2023	11/22/2023	Painter Local 249
MIAMI	Painter	11/22/2023	11/22/2023	Painter Local 249 HevHwy
MIAMI	Painter	6/10/2015	6/10/2015	Painter Local 639
MIAMI	Painter	3/22/2023	3/22/2023	Painter Local 639 Zone 2 Sign
MIAMI	Plaster	5/3/2023	5/3/2023	Plasterer Local 132 (Dayton)
MIAMI	Plumber/Pipefitter	8/30/2023	8/30/2023	Plumber Pipefitter Local 162
MIAMI	Roofer	8/26/2022	8/26/2022	Roofer Local 75
MIAMI	Sheet Metal Worker	6/7/2023	6/7/2023	Sheet Metal Local 24 (Dayton)
MIAMI	Sprinkler Fitter	4/6/2022	4/6/2022	Sprinkler Fitter Local 669
MIAMI	Truck Driver	5/1/2023	4/26/2023	Truck Driver Bldg & HevHwy Class 1 Locals 20,40,92,92b,100,175,284,438,377,637,908,957
MIAMI	Truck Driver	5/1/2023	4/26/2023	Truck Driver Bldg & HevHwy Class 2 Locals 20,40,92,92b,100,175,284,438,377,637,908,957
MIAMI	Truck Driver	5/1/2023	4/26/2023	Truck Driver Bldg & HevHwy Class 3 Locals 20,40,92,92b,100,175,284,438,377,637,908,957

[Back to home](#)

Prevailing Wage Rate Skilled Crafts

Name of Union: Asbestos Local 207 OH

Change # : LCN01-2018fbLoc207OH

Craft : Asbestos Worker Effective Date : 08/23/2018 Last Posted : 08/23/2018

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Asbestos Abatement	\$25.50	\$7.25	\$6.45	\$0.65	\$0.00	\$0.00	\$0.07	\$0.00	\$0.00	\$39.92	\$52.67
Trainee	\$16.50	\$7.25	\$1.50	\$0.65	\$0.00	\$0.00	\$0.07	\$0.00	\$0.00	\$25.97	\$34.22

Special Calculation Note :

Ratio :

3 Journeymen to 1 Trainee

Jurisdiction (* denotes special jurisdictional note):

ADAMS, ASHLAND, ASHTABULA*, ATHENS, AUGLAIZE, BROWN, BUTLER*, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GEAUGA, GREENE, GUERNSEY, HAMILTON, HARDIN, HARRISON, HIGHLAND, HOCKING, HOLMES, HURON, KNOX, LAKE, LICKING, LOGAN, LORAIN, MADISON, MAHONING, MARION, MEDINA, MIAMI, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PORTAGE, PREBLE, RICHLAND, ROSS, SHELBY, STARK, SUMMIT, TRUMBULL, TUSCARAWAS, UNION, VINTON, WARREN*, WAYNE

Special Jurisdictional Note : Butler County:(townships of Fairfield,Hanover,Liberty,Milford,Morgan,Oxford,Ripley,Ross,StClair,Union & Wayne.) (Lemon & Madison) Warren County: (townships of: Deerfield, Hamilton, Harlan, Salem, Union & Washington). (Clear Creek, Franklin, Mossie, Turtle Creek & Wayney). Ashtabula County: (post offices & townships of Ashtabula, Austinburg, Geneva, Harperfield, Jefferson, Plymouth & Saybrook) (townships of Andover, Cherry Valley, Colbrook, Canneaut, Denmark, Dorset, East Orwell, Hartsgrove, Kingville, Lenox, Monroe,Morgan,New Lyme,North Kingsville, Orwell, Pierpoint, Richmond Rock Creek, Rome, Sheffield, Trumbull, Wayne, Williamsfield & Windsor) Erie County:(post offices & townships of Berlin, Berlin Heights,Birmingham,Florence ,Huron, Milan, Shinrock & Vermilion)

Details :

Asbestos & lead paint abatement including, but not limited to the removal or encapsulation of asbestos & lead paint, all

work in conjunction with the preparation of the removal of same & all work in conjunction with the clean up after said removal. The removal of all insulation materials, whether they contain asbestos or not, from mechanical systems (pipes, boilers, ducts, flues, breaching, etc.) is recognized as being the exclusive work of the Asbestos Abatement Workers.

On all mechanical systems (pipes, boilers, ducts, flues, breaching, etc.) that are going to be demolished, the removal of all insulating materials whether they contain asbestos or not shall be the exclusive work of the Laborers. An Abatement Journeyman is anyone who has more than 300 hours in the Asbestos Abatement field.

Prevailing Wage Rate Skilled Crafts

Name of Union: Asbestos Local 50 Zone 2

Change # : LCN01-2024ibAsbLoc50Zone2

Craft : Asbestos Worker Effective Date : 03/06/2024 Last Posted : 03/06/2024

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Asbestos Insulation Mechanic	\$33.75		\$9.20	\$8.35	\$0.50	\$0.00	\$3.75	\$0.10	\$0.00	\$0.00	\$55.65	\$72.52
Firestop Technician	\$33.75		\$9.20	\$8.35	\$0.50	\$0.00	\$3.75	\$0.10	\$0.00	\$0.00	\$55.65	\$72.52
Apprentice	Percent											
1st year	57.12	\$19.28	\$8.96	\$0.00	\$0.44	\$0.00	\$0.50	\$0.10	\$0.00	\$0.00	\$29.28	\$38.92
2nd year	69.48	\$23.45	\$9.20	\$0.95	\$0.44	\$0.00	\$0.85	\$0.10	\$0.00	\$0.00	\$34.99	\$46.71
3rd year	80.94	\$27.32	\$9.20	\$2.38	\$0.44	\$0.00	\$1.25	\$0.10	\$0.00	\$0.00	\$40.69	\$54.35
4th year	88.68	\$29.93	\$9.20	\$2.38	\$0.44	\$0.00	\$1.50	\$0.10	\$0.00	\$0.00	\$43.55	\$58.51

Special Calculation Note : *other is labor mgt training fund

Ratio :

1 Journeyman to 1 Apprentice
4 Journeymen to 1 Apprentice thereafter

Jurisdiction (* denotes special jurisdictional note) :

CHAMPAIGN, CLARK, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE

Special Jurisdictional Note : In Butler County the following townships are included: (Lemon Twp, Madison Twp) In Warren County the following townships are included: (Clear Creek Twp, Franklin Twp, Massie Twp, Turtle Creek Twp, Wayne Twp)

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: **Boilermaker Local 105**

Change # : LCN02-2013fbLoc 105

Craft : Boilermaker Effective Date : 10/01/2013 Last Posted : 09/25/2013

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Boilermaker	\$35.26		\$7.07	\$13.28	\$0.89	\$0.00	\$3.00	\$0.55	\$0.00	\$0.00	\$60.05	\$77.68
Apprentice	Percent											
1st 6 months	70.03	\$24.69	\$7.07	\$11.30	\$0.89	\$0.00	\$2.10	\$0.55	\$0.00	\$0.00	\$46.60	\$58.95
2nd 6 months	75.02	\$26.45	\$7.07	\$11.30	\$0.89	\$0.00	\$2.25	\$0.55	\$0.00	\$0.00	\$48.51	\$61.74
3rd 6 months	80.00	\$28.21	\$7.07	\$11.30	\$0.89	\$0.00	\$2.40	\$0.55	\$0.00	\$0.00	\$50.42	\$64.52
4th 6 months	85.02	\$29.98	\$7.07	\$11.30	\$0.89	\$0.00	\$2.55	\$0.55	\$0.00	\$0.00	\$52.34	\$67.33
5th 6 months	87.52	\$30.86	\$7.07	\$13.28	\$0.89	\$0.00	\$2.63	\$0.55	\$0.00	\$0.00	\$55.28	\$70.71
6th 6 months	90.03	\$31.74	\$7.07	\$13.28	\$0.89	\$0.00	\$2.70	\$0.55	\$0.00	\$0.00	\$56.23	\$72.11
7th 6 months	92.50	\$32.62	\$7.07	\$13.28	\$0.89	\$0.00	\$2.78	\$0.55	\$0.00	\$0.00	\$57.19	\$73.49
8th 6 months	95.00	\$33.50	\$7.07	\$13.28	\$0.89	\$0.00	\$2.85	\$0.55	\$0.00	\$0.00	\$58.14	\$74.89

Special Calculation Note : Other is Supplemental Health and Welfare

Ratio :

5 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note):

ADAMS, ATHENS, BROWN, BUTLER, CHAMPAIGN, CLARK, CLERMONT, CLINTON, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GREENE, GUERNSEY, HAMILTON, HIGHLAND, HOCKING, JACKSON, LAWRENCE, LICKING, MADISON, MEIGS, MIAMI, MONTGOMERY, MORGAN, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE, PREBLE, ROSS, SCIOTO, VINTON, WARREN

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Bricklayer Local 23 Heavy Hwy (A)

Change # : LCN01-2023ibLoc23HevHwyA

Craft : Bricklayer Effective Date : 06/07/2023 Last Posted : 06/07/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Cement Mason Bricklayer Sewer Water Works A	\$32.40		\$9.75	\$9.03	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$51.70	\$67.90
Apprentice	Percent											
1st year	70.00	\$22.68	\$9.75	\$9.03	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$41.98	\$53.32
2nd year	80.00	\$25.92	\$9.75	\$9.03	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.22	\$58.18
3rd year	90.00	\$29.16	\$9.75	\$9.03	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$48.46	\$63.04

Special Calculation Note : NOT FOR BUILDING CONSTRUCTION.

Ratio :

- 3 Journeymen to 1 Apprentice
- 6 Journeymen to 2 Apprentice
- 9 Journeymen to 3 Apprentice
- 12 Journeymen to 4 Apprentice
- 15 Journeymen to 5 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

- ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DEFIANCE, DELAWARE, ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GEAUGA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE, LICKING, LOGAN, LORAIN, LUCAS, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, SUMMIT, TRUMBULL, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE

Special Jurisdictional Note :

Details :

(A) Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site Heavy Construction, Airport Construction Or Railroad Construction Work.

(B) Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work ,Pollution Control,Sewer Plant, Waste Plant, & Water Treatment Facilities, Construction.

Prevailing Wage Rate Skilled Crafts

Name of Union: **Bricklayer Local 23 Heavy Hwy (B)**

Change # : LCN01-2023ibLoc23HevHwyB

Craft : Bricklayer Effective Date : 06/07/2023 Last Posted : 06/07/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Cement Mason Bricklayer Power Plants Tunnels Amusement Parks B	\$33.39		\$9.75	\$9.03	\$0.53	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$52.70	\$69.39
Apprentice	Percent											
1st year	70.00	\$23.37	\$9.75	\$9.03	\$0.53	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$42.68	\$54.37
2nd year	80.00	\$26.71	\$9.75	\$9.03	\$0.53	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$46.02	\$59.38
3rd year	90.00	\$30.05	\$9.75	\$9.03	\$0.53	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$49.36	\$64.39

Special Calculation Note : NOT FOR BUILDING CONSTRUCTION.

Ratio :

- 3 Journeymen to 1 Apprentice
- 6 Journeymen to 2 Apprentice
- 9 Journeymen to 2 Apprentice
- 12 Journeymen to 4 Apprentice
- 15 Journeymen to 5 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

- ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DEFIANCE, DELAWARE, ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GEauga, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE, LICKING, LOGAN, LORAIN, LUCAS, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, SUMMIT, TRUMBULL, TUSCARAWAS, UNION, VAN WERT, VINTON,

WARREN, WASHINGTON, WAYNE

Special Jurisdictional Note :

Details :

(A) Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site Heavy Construction, Airport Construction Or Railroad Construction Work.

(B) Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work ,Pollution Control,Sewer Plant, Waste Plant, & Water Treatment Facilities, Construction.

Prevailing Wage Rate Skilled Crafts

Name of Union: Bricklayer Local 23 (Dayton Tile Finisher)

Change # : LCN01-2023ibLoc23DaytonTF

Craft : Bricklayer Effective Date : 07/05/2023 Last Posted : 07/05/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Bricklayer Tile Marble Terrazzo Finisher	\$26.80		\$3.50	\$6.56	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$37.33	\$50.73
Base Machine	\$27.30		\$3.50	\$6.56	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$37.83	\$51.48
Apprentice	Percent											
1st 6 months 0- 600 hrs	60.00	\$16.08	\$3.50	\$0.00	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$20.05	\$28.09
2nd 6 months 601-1200 hrs	65.00	\$17.42	\$3.50	\$0.00	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$21.39	\$30.10
3rd 6 months 1201-1800 hrs	70.00	\$18.76	\$3.50	\$6.56	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.29	\$38.67
4th 6 months 1801-2400	75.00	\$20.10	\$3.50	\$6.56	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$30.63	\$40.68
5th 6 months 2401-3000 hrs	80.00	\$21.44	\$3.50	\$6.56	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$31.97	\$42.69
6th 6 months 3001-3600 hrs	90.00	\$24.12	\$3.50	\$6.56	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$34.65	\$46.71
TMT Helper - May enter Apprentice Program after 90 day completionr												
First 90	45.00	\$12.06	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$12.06	\$18.09

Prevailing Wage Rate Skilled Crafts

Name of Union: Bricklayer Local 23 (Dayton Tile Mechanic)

Change # : LCN01-2023ibLoc23DaytonTM

Craft : Bricklayer Effective Date : 07/05/2023 Last Posted : 07/05/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Bricklayer Tile Marble Terrazzo Mechanics	\$30.00		\$8.31	\$6.44	\$0.55	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.30	\$60.30
Terrazzo Worker	\$30.00		\$8.31	\$6.44	\$0.55	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.30	\$60.30
Apprentice	Percent											
1st 6 Months	60.00	\$18.00	\$8.31	\$0.00	\$0.55	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$26.86	\$35.86
2nd 6 Months	65.00	\$19.50	\$8.31	\$0.00	\$0.55	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$28.36	\$38.11
3rd 6 Months	70.00	\$21.00	\$8.31	\$6.44	\$0.55	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$36.30	\$46.80
4th 6 Months	75.00	\$22.50	\$8.31	\$6.44	\$0.55	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$37.80	\$49.05
5th 6 months	80.00	\$24.00	\$8.31	\$6.44	\$0.55	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.30	\$51.30
6th 6 months	85.00	\$25.50	\$8.31	\$6.44	\$0.55	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.80	\$53.55
7th 6 months	90.00	\$27.00	\$8.31	\$6.44	\$0.55	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$42.30	\$55.80
8th 6 months	95.00	\$28.50	\$8.31	\$6.44	\$0.55	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.80	\$58.05

Special Calculation Note : Classification title contains "Bricklayer" because contract originates within the Bricklayer Local.

Note that the classification description is clarified after the local union number at the top of the page.

Ratio :

- 5 Journeymen to 1 Apprentice
- 10 Journeymen to 2 Apprentice
- 15 Journeymen to 3 Apprentice
- 20 Journeymen to 4 Apprentice
- 25 Journeymen to 5 Apprentice

Jurisdiction (* denotes special jurisdictional note):

CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, HIGHLAND, LOGAN, MIAMI, MONTGOMERY, PREBLE*, SHELBY

Special Jurisdictional Note : In Preble County the following townships are included: (Jackson, Jefferson, Monroe, Harrison, Twin and Washington)

Details :

** (Tile layers work) the laying, cutting or setting of all tile where used for floors, walls, ceilings, walks, promenade roofs, stair treads, stair risers, facings, hearths, fireplaces & decorative inserts together with any marble plinths, thresholds or window stools used in connection with any tile work. the building, shaping forming construction or repairing of all fireplace work, whether in connection with a mantel hearth facing or not, & the setting & preparing of all material such as cement, plaster, mortar, brickwork, iron work or other materials necessary for the proper, safe construction & completion of such work: except that a mantel made exclusively of brick, marble or stone shall be conceded to be bricklayers, marble setters or stonemasons' work respectively.

** Marble, mosaic, venetian enamel & terrazzo. Cutting and assembling of mosaics. all rolling of terrazzo work.

** Caulking of all expansion, perimeter & angle joints shall be the exclusive work of the tile mechanic.

** Marble masons shall consist of carving, cutting & setting of all marble, slate (including blackboards) stone, alberene, carrara, sanionyx, vitrolite & similar opaque glass, scagliola, what ever thickness or dimension.

Prevailing Wage Rate Skilled Crafts

Name of Union: **Bricklayer Local 23 (Dayton)**

Change # : LCN01-2023ibLoc23Dayton

Craft : Bricklayer Effective Date : 06/07/2023 Last Posted : 06/07/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Bricklayer Stone Mason Refractory	\$31.78		\$9.25	\$7.19	\$0.59	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$48.81	\$64.70
Pointer/Caulker/Cleaner	\$31.78		\$9.25	\$7.19	\$0.59	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$48.81	\$64.70
Improver Apprentices 25 day probationary period then												
1st 6 months	\$20.66		\$9.25	\$0.00	\$0.49	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$30.40	\$40.73
2nd 6 months	\$23.84		\$9.25	\$0.00	\$0.49	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$33.58	\$45.50
3rd 6 months	\$27.01		\$9.25	\$5.89	\$0.49	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$42.64	\$56.15
4th 6 months	\$30.19		\$9.25	\$5.89	\$0.49	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.82	\$60.92
Bricklayer Stone Mason Refractory and PCC Apprentice	Percent											
1st 6 months	60.00	\$19.07	\$9.25	\$0.00	\$0.49	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$28.81	\$38.34
2nd 6 months	65.00	\$20.66	\$9.25	\$0.00	\$0.49	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$30.40	\$40.73
3rd 6 months	70.02	\$22.25	\$9.25	\$5.89	\$0.49	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$37.88	\$49.01
4th 6 months	75.00	\$23.83	\$9.25	\$5.89	\$0.49	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.47	\$51.38
5th 6 months	80.00	\$25.42	\$9.25	\$5.89	\$0.49	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$41.05	\$53.77
6th 6 months	85.00	\$27.01	\$9.25	\$5.89	\$0.49	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$42.64	\$56.15
7th 6 months	90.00	\$28.60	\$9.25	\$5.89	\$0.49	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$44.23	\$58.53
8th 6 months	95.00	\$30.19	\$9.25	\$5.89	\$0.49	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.82	\$60.92
Mason Trainee-1-90 Days	45.00	\$14.30	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$14.30	\$21.45
91-365 Days	45.00	\$14.30	\$9.25	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$23.55	\$30.70
2nd Year	50.00	\$15.89	\$9.25	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$25.14	\$33.09

Special Calculation Note : Classification title contains "Bricklayer" because contract originates within the Bricklayer Local.

Note that the classification description is clarified after the local union number at the top of the page. Apprentice and Apprentice Improver, Health and Welfare after 30 days. Mason Trainees Health and Welfare

after 90 days.

Ratio :

Bricklayer Stone Mason Refractory Worker:

1-2 Journeymen to 1 Apprentice

3-4 Journeymen to 2 Apprentice

5-6 Journeymen to 2 Apprentice

7-10 Journeymen to 3 Apprentice

Mason Trainee Ratio:

1 Apprentice permits 1 Mason Trainee

2 Apprentice permits 1 Mason Trainee

3 Apprentice permits 2 Mason Trainee

4 Apprentice permits 2 Mason Trainee

In order to utilize a Pre-Apprentice, you must have 1 registered apprentice in your employ.

Ratio of Improver Apprentices to Journeymen in no case shall their be no more than 1 Improver Apprentice to 6 Journeymen

Special Jurisdictional Note : In Preble County the following townships are included: Jackson, Monroe, Harrison, Twin, Jefferson and Washington

Details :

Apprentice Ratio's covers: Bricklayer, Stone Mason, Refractory worker and Pointer, Cleaner, Caulker.

Jurisdiction (* denotes special jurisdictional note):

CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, HIGHLAND, LOGAN, MIAMI, MONTGOMERY, PREBLE*, SHELBY

Prevailing Wage Rate Skilled Crafts

Name of Union: **Carpenter Floorlayer SW District G**

Change # : LCN01-2023ibLocSWG

Craft : Carpenter Effective Date : 09/20/2023 Last Posted : 09/20/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Carpenter Floorlayer	\$29.02		\$8.31	\$6.95	\$0.60	\$0.00	\$2.28	\$0.15	\$0.00	\$0.00	\$47.31	\$61.82
Apprentice	Percent											
1st 3 months	65.00	\$18.86	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$18.86	\$28.29
2nd 3 months	65.00	\$18.86	\$8.31	\$0.00	\$0.60	\$0.00	\$2.28	\$0.15	\$0.00	\$0.00	\$30.20	\$39.63
2nd 6 months	65.00	\$18.86	\$8.31	\$0.00	\$0.60	\$0.00	\$2.28	\$0.15	\$0.00	\$0.00	\$30.20	\$39.63
3rd 6 months	70.00	\$20.31	\$8.31	\$0.00	\$0.60	\$0.00	\$2.28	\$0.15	\$0.00	\$0.00	\$31.65	\$41.81
4th 6 months	75.00	\$21.76	\$8.31	\$0.00	\$0.60	\$0.00	\$2.28	\$0.15	\$0.00	\$0.00	\$33.11	\$43.99
5th 6 months	80.00	\$23.22	\$8.31	\$6.95	\$0.60	\$0.00	\$2.28	\$0.15	\$0.00	\$0.00	\$41.51	\$53.11
6th 6 months	85.00	\$24.67	\$8.31	\$6.95	\$0.60	\$0.00	\$2.28	\$0.15	\$0.00	\$0.00	\$42.96	\$55.29
7th 6 months	90.00	\$26.12	\$8.31	\$6.95	\$0.60	\$0.00	\$2.28	\$0.15	\$0.00	\$0.00	\$44.41	\$57.47
8th 6 months	95.00	\$27.57	\$8.31	\$6.95	\$0.60	\$0.00	\$2.28	\$0.15	\$0.00	\$0.00	\$45.86	\$59.64

Special Calculation Note : Other fs for UBC National Fund and Install

Ratio :
1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note):
BROWN, BUTLER, CHAMPAIGN, CLARK, CLERMONT, CLINTON, DARKE, GREENE, HAMILTON, LOGAN, MIAMI, MONTGOMERY, PREBLE, SHELBY, WARREN

Special Jurisdictional Note :

Details :
Scope of work shall include, but not be limited to: receiving,unloading,handling,distribution and installation of all

carpeting materials, carpet padding or matting materials and all resilient materials whether for use on walls, floors, counter, sink, table and all preparation work necessary in connection therewith, including sanding work. the installation of nonstructural under-layment and the work of removing, cleaning waxing of any of the above. Carpeting shall include any floor covering composed of either natural or synthetic fibers that are made in breadths to be sewed, fastened or directly glued to floors or over cushioning sound-proofing materials. Resilient Floors shall consist of and include the laying of all special designs of wood, wood block, wood composition, cork, linoleum, asphalt, mastic, plastic, rubber tile, whether nailed or glued.

Prevailing Wage Rate Skilled Crafts

Name of Union: Carpenter Millwright Local 1090 SW Zone II

Change # : LCN01-2023ibLoc1090SW2

Craft : Carpenter Effective Date : 09/20/2023 Last Posted : 09/20/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Carpenter Millwright	\$33.50		\$8.13	\$6.95	\$0.62	\$0.00	\$7.47	\$0.18	\$0.00	\$0.00	\$56.85	\$73.60
Apprentice	Percent											
1st 6 months	60.00	\$20.10	\$8.13	\$4.27	\$0.62	\$0.00	\$4.48	\$0.18	\$0.00	\$0.00	\$37.78	\$47.83
2nd 6 months	65.00	\$21.78	\$8.13	\$4.61	\$0.62	\$0.00	\$4.86	\$0.18	\$0.00	\$0.00	\$40.17	\$51.06
3rd 6 months	70.00	\$23.45	\$8.13	\$4.94	\$0.62	\$0.00	\$5.23	\$0.18	\$0.00	\$0.00	\$42.55	\$54.28
4th 6 months	75.00	\$25.12	\$8.13	\$5.28	\$0.62	\$0.00	\$5.60	\$0.18	\$0.00	\$0.00	\$44.94	\$57.50
5th 6 months	80.00	\$26.80	\$8.13	\$5.61	\$0.62	\$0.00	\$5.98	\$0.18	\$0.00	\$0.00	\$47.32	\$60.72
6th 6 months	85.00	\$28.47	\$8.13	\$5.95	\$0.62	\$0.00	\$6.35	\$0.18	\$0.00	\$0.00	\$49.71	\$63.94
7th 6 months	90.00	\$30.15	\$8.13	\$6.28	\$0.62	\$0.00	\$6.72	\$0.18	\$0.00	\$0.00	\$52.08	\$67.16
8th 6 months	95.00	\$31.82	\$8.13	\$6.62	\$0.62	\$0.00	\$7.10	\$0.18	\$0.00	\$0.00	\$54.47	\$70.39

Special Calculation Note : Other (\$0.18) \$0.13 National Fund and \$0.05 for National Millwright Fund.

Ratio :
3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note):
CHAMPAIGN, CLARK, DARKE, GREENE, LOGAN, MIAMI, MONTGOMERY, PREBLE, SHELBY

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Carpenter NE District Industrial Dock & Door

Change # : LCN01-2014fbCarpNEStatewide

Craft : Carpenter Effective Date : 03/05/2014 Last Posted : 03/05/2014

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Carpenter	\$19.70		\$5.05	\$1.00	\$0.15	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$25.90	\$35.75
Trainee												
	Percent											
1st Year	60.00	\$11.82	\$5.05	\$1.00	\$0.15	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$18.02	\$23.93
2nd Year	80.20	\$15.80	\$5.05	\$1.00	\$0.15	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$22.00	\$29.90

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

1 Journeymen to 1 Trainee

Jurisdiction (* denotes special jurisdictional note):

ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DEFIANCE, DELAWARE, ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GEauga, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE, LICKING, LOGAN, LORAIN, LUCAS, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, SUMMIT, TRUMBULL, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WOOD, WYANDOT

Special Jurisdictional Note : Industrial Dock and Door is the installation of overhead doors, roll up doors and dock leveling equipment

Details :

10/27/10 New Contract jc

Prevailing Wage Rate Skilled Crafts

**Name of Union: Carpenter & Pile Driver
SW Zone 1**

Change # : LCN01-2023ibLoc136SWZone1

Craft : Carpenter Effective Date : 06/07/2023 Last Posted : 06/07/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Carpenter	\$30.22		\$8.00	\$6.95	\$0.60	\$0.00	\$2.60	\$0.15	\$0.00	\$0.00	\$48.52	\$63.63
Pile Driver	\$30.22		\$8.00	\$6.95	\$0.60	\$0.00	\$2.60	\$0.15	\$0.00	\$0.00	\$48.52	\$63.63
Apprentice	Percent											
1st 3 Months	60.00	\$18.13	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$18.13	\$27.20
2nd 3 Months	60.00	\$18.13	\$8.00	\$0.00	\$0.60	\$0.00	\$2.60	\$0.15	\$0.00	\$0.00	\$29.48	\$38.55
2rd 6 Months	60.00	\$18.13	\$8.00	\$0.00	\$0.60	\$0.00	\$2.60	\$0.15	\$0.00	\$0.00	\$29.48	\$38.55
3th 6 Months	65.00	\$19.64	\$8.00	\$0.00	\$0.60	\$0.00	\$2.60	\$0.15	\$0.00	\$0.00	\$30.99	\$40.81
4th 6 Months	65.00	\$19.64	\$8.00	\$0.00	\$0.60	\$0.00	\$2.60	\$0.15	\$0.00	\$0.00	\$30.99	\$40.81
5th 6 Months	70.00	\$21.15	\$8.00	\$6.95	\$0.60	\$0.00	\$2.60	\$0.15	\$0.00	\$0.00	\$39.45	\$50.03
6th 6 Months	75.00	\$22.66	\$8.00	\$6.95	\$0.60	\$0.00	\$2.60	\$0.15	\$0.00	\$0.00	\$40.97	\$52.30
7th 6 Months	80.00	\$24.18	\$8.00	\$6.95	\$0.60	\$0.00	\$2.60	\$0.15	\$0.00	\$0.00	\$42.48	\$54.56
8th 6 Months	85.02	\$25.69	\$8.00	\$6.95	\$0.60	\$0.00	\$2.60	\$0.15	\$0.00	\$0.00	\$43.99	\$56.84

Special Calculation Note : Other is for UBC National Fund

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note):

CHAMPAIGN, CLARK, DARKE, GREENE, LOGAN, MIAMI, MONTGOMERY, PREBLE, SHELBY

Special Jurisdictional Note :

Details :

Carpenter duties shall include but not limited to: Pile driving, milling, fashioning, joining, assembling, erecting, fastening, or dismantling of all material of wood, plastic, metal, fiber, cork, and composition, and all other substitute materials: pile

driving, cutting, fitting, and placing of lagging, and the handling, cleaning, erecting, installing, and dismantling of machinery, equipment, and erecting pre-engineered metal buildings.

Pile Drivers work but not limited to: unloading, assembling, erection, repairs, operation, signaling, dismantling, and reloading all equipment that is used for pile driving including pile butts. pile butts is defined as sheeting or scrap piling. Underwater work that may be required in connection with the installation of piling. The diver and his tender work as a team and shall arrive at their own financial arrangements with the contractor. Any configuration of wood, steel, concrete, or composite that is jetted, driven, or vibrated onto the ground by conventional pile driving equipment for the purpose of supporting a future load that may be permanent or temporary.

Driving bracing, plumbing, cutting off and capping of all piling whether wood, metal, pipe piling or composite. loading, unloading, erecting, framing, dismantling, moving, and handling of pile driving equipment. piling used in the construction and repair of all wharves, docks, piers, trestles, caissons, cofferdams, and the erection of all sea walls and breakwaters. All underwater and marine work on bulkheads, wharves, docks, shipyards, caissons, piers, bridges, pipeline work, viaducts, marine cable and trestles, as well as salvage and reclamation work where divers are employed.

Rate shall include carpenters, acoustic, and ceiling installers, drywall installers, pile drivers, and floorlayers.

Prevailing Wage Rate Skilled Crafts

Name of Union: Carpenter & Pile Driver SW District HevHwy

Change # : LCN01-2023ibCarpSWHevHwy

Craft : Carpenter Effective Date : 05/03/2023 Last Posted : 05/03/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Journeyman	\$33.28		\$8.44	\$6.95	\$0.60	\$0.00	\$4.57	\$0.15	\$0.00	\$0.00	\$53.99	\$70.63
Apprentice	Percent											
1st 6 Months	60.00	\$19.97	\$8.44	\$6.95	\$0.60	\$0.00	\$4.57	\$0.15	\$0.00	\$0.00	\$40.68	\$50.66
2nd 6 Months	65.00	\$21.63	\$8.44	\$6.95	\$0.60	\$0.00	\$4.57	\$0.15	\$0.00	\$0.00	\$42.34	\$53.16
3rd 6 Months	70.00	\$23.30	\$8.44	\$6.95	\$0.60	\$0.00	\$4.57	\$0.15	\$0.00	\$0.00	\$44.01	\$55.65
4th 6 Months	75.00	\$24.96	\$8.44	\$6.95	\$0.60	\$0.00	\$4.57	\$0.15	\$0.00	\$0.00	\$45.67	\$58.15
5th 6 Months	80.00	\$26.62	\$8.44	\$6.95	\$0.60	\$0.00	\$4.57	\$0.15	\$0.00	\$0.00	\$47.33	\$60.65
6th 6 Months	85.00	\$28.29	\$8.44	\$6.95	\$0.60	\$0.00	\$4.57	\$0.15	\$0.00	\$0.00	\$49.00	\$63.14
7th 6 Months	90.00	\$29.95	\$8.44	\$6.95	\$0.60	\$0.00	\$4.57	\$0.15	\$0.00	\$0.00	\$50.66	\$65.64
8th 6 Months	95.00	\$31.62	\$8.44	\$6.95	\$0.60	\$0.00	\$4.57	\$0.15	\$0.00	\$0.00	\$52.33	\$68.13

Special Calculation Note : Other is UBC National Fund.

Ratio :

1 Journeymen to 1 Apprentice

An employer shall have the right to employ one (1) Apprentice for one (1) Journeyman Carpenter in its employment for the first Apprentice employed, and 1 (1) Apprentice for two (2) Journeyman Carpenter for additional Apprentices employed.

Thereafter, every third additional carpenter hired shall be an apprentice, if available, and if practical for the type of work being performed.

Jurisdiction (* denotes special jurisdictional note):

BROWN, BUTLER, CHAMPAIGN, CLARK, CLERMONT, CLINTON, DARKE, GREENE, HAMILTON, LOGAN, MIAMI, MONTGOMERY, PREBLE, SHELBY, WARREN

Special Jurisdictional Note :

Details :

Highway Construction, Airport Construction, Heavy Construction but not limited to:(tunnels,subways,drainage projects,flood control,reservoirs). Railroad Construction,Sewer Waterworks & Utility Construction but not limited to: (storm sewers, waterlines, gaslines). Industrial & Building Site, Power Plant, Amusement Park, Athletic Stadium Site, Sewer and Water Plants.

When the Contractor furnishes the necessary underwater gear for the Diver, the Diver shall be paid one and one half (1&1/2) times the journeyman rate for the time spent in the water.

Prevailing Wage Rate Skilled Crafts

Name of Union: Cement Mason Local 132 (Dayton)

Change # : LCN01-2023ibLoc132

Craft : Cement Effective Date : 06/01/2023 Last Posted : 05/31/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Cement Mason	\$28.32		\$8.05	\$7.35	\$0.85	\$0.00	\$2.35	\$0.06	\$0.00	\$0.00	\$46.98	\$61.14
Apprentice												
	Percent											
1st Six Months	70.00	\$19.82	\$8.05	\$7.35	\$0.85	\$0.00	\$2.35	\$0.06	\$0.00	\$0.00	\$38.48	\$48.40
2nd Six Months	80.00	\$22.66	\$8.05	\$7.35	\$0.85	\$0.00	\$2.35	\$0.06	\$0.00	\$0.00	\$41.32	\$52.64
3rd Six Months	90.00	\$25.49	\$8.05	\$7.35	\$0.85	\$0.00	\$2.35	\$0.06	\$0.00	\$0.00	\$44.15	\$56.89

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

*Other is International Training

Ratio :

2 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE, SHELBY

Special Jurisdictional Note :

Details :

Other: Is Industry Promotion: Cement Masons on outrigger, swing, scaffolds, manlifts -\$.75 per hour above scale up to (25) feet and \$.75 per hour for each additional (25) feet or part of same. A Cement Mason operating a grinder- \$.30 per hour above the journeyman scale.

Prevailing Wage Rate Skilled Crafts

Name of Union: Cement Mason Statewide HevHwy

Change # : LCN01-2023ibCementHevHwy

Craft : Cement Mason Effective Date : 05/01/2023 Last Posted : 04/26/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Cement Mason	\$33.74		\$8.50	\$7.55	\$0.65	\$0.00	\$2.25	\$0.07	\$0.00	\$0.00	\$52.76	\$69.63
Apprentice												
	Percent											
1st Year	70.00	\$23.62	\$8.50	\$7.55	\$0.65	\$0.00	\$2.25	\$0.07	\$0.00	\$0.00	\$42.64	\$54.45
2nd Year	80.00	\$26.99	\$8.50	\$7.55	\$0.65	\$0.00	\$2.25	\$0.07	\$0.00	\$0.00	\$46.01	\$59.51
3rd Year	90.00	\$30.37	\$8.50	\$7.55	\$0.65	\$0.00	\$2.25	\$0.07	\$0.00	\$0.00	\$49.39	\$64.57

Special Calculation Note : Other \$0.07 is for International Training Fund

Ratio :

1 Journeymen to 1 Apprentice
2 to 1 thereafter

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ALLEN, ASHLAND, ASHTABULA*,
ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER,
CARROLL, CHAMPAIGN, CLARK, CLERMONT,
CLINTON, COLUMBIANA, COSHOCTON,
CRAWFORD, CUYAHOGA*, DARKE, DEFIANCE,
DELAWARE, ERIE, FAIRFIELD, FAYETTE,
FRANKLIN, FULTON*, GALLIA, GEAUGA*,
GREENE, GUERNSEY, HAMILTON, HANCOCK*,
HARDIN, HARRISON, HENRY*, HIGHLAND,
HOCKING, HOLMES, HURON, JACKSON,
JEFFERSON, KNOX, LAKE*, LAWRENCE, LICKING,
LOGAN, LORAIN, LUCAS*, MADISON, MAHONING,
MARION, MEDINA, MEIGS, MERCER, MIAMI,
MONROE, MONTGOMERY, MORGAN, MORROW,
MUSKINGUM, NOBLE, OTTAWA, PAULDING,
PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE,
PUTNAM*, RICHLAND, ROSS, SANDUSKY, SCIOTO,
SENECA, SHELBY, STARK, SUMMIT, TRUMBULL,
TUSCARAWAS, UNION, VAN WERT, VINTON,
WARREN, WASHINGTON, WAYNE, WILLIAMS,
WOOD*, WYANDOT

Special Jurisdictional Note : (A) Highway Construction, Sewer, Waterworks And Utility Construction, Industrial & Building Site, Heavy

Construction, Airport Construction Or Railroad Construction Work, Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work, Pollution Control, Sewer Plant, Waste & Water Plant, Water Treatment Facilities Construction.

*For Power Plant, Tunnels, Amusement Park, Athletic Stadium Site Work, Pollution Control, Sewer Plant, Waste & Water Plant, Water Treatment Facility Construction work in the following Counties: Ashtabula, Cuyahoga, Fulton, Geauga, Hancock, Henry, Lake, Lucas, Putnam and Wood Counties, those counties will use the Cement Mason Statewide Heavy Highway Exhibit B District 1 Wage Rate.

Details :

This rate replaces the previous Cement Mason Heavy Highway Statewide Rates (Exhibit A and Exhibit B rates), except for Cement Mason Statewide Heavy Highway Exhibit B Dist 1. sks

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 71 DOT Traffic Signal Highway Lighting American Line Builders

Change # : LCN01-2024ibLoc71DOTClev

Craft : Lineman Effective Date : 02/07/2024 Last Posted : 02/07/2024

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Electrical Lineman	\$44.52	\$7.25	\$1.34	\$0.45	\$0.00	\$8.90	\$0.50	\$0.00	\$0.00	\$62.96	\$85.22
Traffic Signal & Lighting Journeyman	\$42.93	\$7.25	\$1.29	\$0.42	\$0.00	\$8.59	\$0.50	\$0.00	\$0.00	\$60.98	\$82.45
Equipment Operator	\$39.11	\$7.25	\$1.17	\$0.39	\$0.00	\$7.82	\$0.50	\$0.00	\$0.00	\$56.24	\$75.79
Groundman 0 to 12 months (W/O CDL)	\$23.71	\$7.25	\$0.71	\$0.24	\$0.00	\$4.74	\$0.50	\$0.00	\$0.00	\$37.15	\$49.01
Groundman 0 to 12 Months (W CDL)	\$25.90	\$7.25	\$0.77	\$0.26	\$0.00	\$5.18	\$0.50	\$0.00	\$0.00	\$39.86	\$52.81
Groundman greater than 1 year (W CDL)	\$28.11	\$7.25	\$0.84	\$0.28	\$0.00	\$5.62	\$0.50	\$0.00	\$0.00	\$42.60	\$56.66
Traffic Apprentice											
1st 1000 hrs	\$25.76	\$7.25	\$0.77	\$0.26	\$0.00	\$5.15	\$0.50	\$0.00	\$0.00	\$39.69	\$52.57
2nd 1000 hrs	\$27.90	\$7.25	\$0.84	\$0.28	\$0.00	\$5.58	\$0.50	\$0.00	\$0.00	\$42.35	\$56.30
3rd 1000 hrs	\$30.05	\$7.25	\$0.90	\$0.30	\$0.00	\$6.01	\$0.50	\$0.00	\$0.00	\$45.01	\$60.03
4th 1000 hrs	\$32.20	\$7.25	\$0.97	\$0.32	\$0.00	\$6.44	\$0.50	\$0.00	\$0.00	\$47.68	\$63.78
5th 1000 hrs	\$34.34	\$7.25	\$1.03	\$0.34	\$0.00	\$6.87	\$0.50	\$0.00	\$0.00	\$50.33	\$67.50
6th 1000 hrs	\$38.64	\$7.25	\$1.16	\$0.39	\$0.00	\$7.73	\$0.50	\$0.00	\$0.00	\$55.67	\$74.99
Lineman Apprentice	Percent										

1st 1,000 Hours	60.00	\$26.71	\$7.25	\$0.80	\$0.27	\$0.00	\$5.34	\$0.50	\$0.00	\$0.00	\$40.87	\$54.23
2nd 1,000 Hours	65.00	\$28.94	\$7.25	\$0.87	\$0.29	\$0.00	\$5.79	\$0.50	\$0.00	\$0.00	\$43.64	\$58.11
3rd 1,000 Hours	70.00	\$31.16	\$7.25	\$0.93	\$0.31	\$0.00	\$6.23	\$0.50	\$0.00	\$0.00	\$46.38	\$61.97
4th 1,000 Hours	75.00	\$33.39	\$7.25	\$1.00	\$0.33	\$0.00	\$6.68	\$0.50	\$0.00	\$0.00	\$49.15	\$65.84
5th 1,000 Hours	80.00	\$35.62	\$7.25	\$1.07	\$0.36	\$0.00	\$7.12	\$0.50	\$0.00	\$0.00	\$51.92	\$69.72
6th 1,000 Hours	85.00	\$37.84	\$7.25	\$1.14	\$0.38	\$0.00	\$7.57	\$0.50	\$0.00	\$0.00	\$54.68	\$73.60
7th 1,000 Hours	90.00	\$40.07	\$7.25	\$1.20	\$0.40	\$0.00	\$8.01	\$0.50	\$0.00	\$0.00	\$57.43	\$77.46

Special Calculation Note : Other is Health Reimbursement Account

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

AUGLAIZE, CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, LOGAN, MERCER, MIAMI, MONTGOMERY, PREBLE, SHELBY

Special Jurisdictional Note :

Details :

A groundman when directed shall assist a Journeymen in the performance of his/her work on the ground, including the use of hand tools. Under no circumstances shall this classification climb poles, towers, ladders, or work from an elevated platform or bucket truck. This classification shall not perform work normally assigned to an apprentice lineman. No more than three (3) Groundmen shall work alone. Jobs with more that three Groundmen shall be supervised by a Groundcrew Foreman, Journeyman Lineman, Journeyman Traffic Signal Technician or an Equipment Operator.

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 71 High Tension Pipe Type Cable

Change # : LCN01-2024ibLoc71HighTension

Craft : Lineman Effective Date : 02/07/2024 Last Posted : 02/07/2024

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Electrical Lineman	\$50.66	\$7.25	\$1.52	\$0.51	\$0.00	\$12.16	\$0.75	\$0.00	\$0.00	\$72.85	\$98.18
Certified Lineman Welder	\$50.66	\$7.25	\$1.52	\$0.51	\$0.00	\$12.16	\$0.75	\$0.00	\$0.00	\$72.85	\$98.18
Certified Cable Splicer	\$50.66	\$7.25	\$1.52	\$0.51	\$0.00	\$12.16	\$0.75	\$0.00	\$0.00	\$72.85	\$98.18
Operator A	\$45.39	\$7.25	\$1.36	\$0.45	\$0.00	\$10.89	\$0.75	\$0.00	\$0.00	\$66.09	\$88.79
Operator B	\$40.18	\$7.25	\$1.21	\$0.40	\$0.00	\$9.64	\$0.75	\$0.00	\$0.00	\$59.43	\$79.52
Operator C	\$32.29	\$7.25	\$0.97	\$0.32	\$0.00	\$7.75	\$0.75	\$0.00	\$0.00	\$49.33	\$65.47
Groundman 0-12 months Exp	\$25.33	\$7.25	\$0.76	\$0.25	\$0.00	\$6.08	\$0.75	\$0.00	\$0.00	\$40.42	\$53.08
Groundman 0-12 months Exp w/CDL	\$27.86	\$7.25	\$0.84	\$0.28	\$0.00	\$6.69	\$0.75	\$0.00	\$0.00	\$43.67	\$57.60
Groundman 1 yr or more	\$27.86	\$7.25	\$0.84	\$0.28	\$0.00	\$6.69	\$0.75	\$0.00	\$0.00	\$43.67	\$57.60
Groundman 1 yr or more w/CDL	\$32.92	\$7.25	\$0.99	\$0.33	\$0.00	\$7.90	\$0.75	\$0.00	\$0.00	\$50.14	\$66.60
Equipment Mechanic A	\$40.18	\$7.25	\$1.21	\$0.40	\$0.00	\$9.64	\$0.75	\$0.00	\$0.00	\$59.43	\$79.52
Equipment Mechanic B	\$36.23	\$7.25	\$1.09	\$0.36	\$0.00	\$8.70	\$0.75	\$0.00	\$0.00	\$54.38	\$72.50
Equipment Mechanic C	\$32.29	\$7.25	\$0.97	\$0.32	\$0.00	\$7.75	\$0.75	\$0.00	\$0.00	\$49.33	\$65.47
X-Ray Technician	\$50.66	\$7.25	\$1.52	\$0.51	\$0.00	\$12.16	\$0.75	\$0.00	\$0.00	\$72.85	\$98.18

Apprentice	Percent											
1st 1000 hrs	60.00	\$30.40	\$7.25	\$0.91	\$0.30	\$0.00	\$7.30	\$0.75	\$0.00	\$0.00	\$46.91	\$62.10
2nd 1000 hrs	65.00	\$32.93	\$7.25	\$0.99	\$0.33	\$0.00	\$7.90	\$0.75	\$0.00	\$0.00	\$50.15	\$66.61
3rd 1000 hrs	70.00	\$35.46	\$7.25	\$1.06	\$0.35	\$0.00	\$8.51	\$0.75	\$0.00	\$0.00	\$53.38	\$71.11
4th 1000 hrs	75.00	\$38.00	\$7.25	\$1.14	\$0.38	\$0.00	\$9.12	\$0.75	\$0.00	\$0.00	\$56.64	\$75.63
5th 1000 hrs	80.00	\$40.53	\$7.25	\$1.22	\$0.41	\$0.00	\$9.73	\$0.75	\$0.00	\$0.00	\$59.89	\$80.15
6th 1000 hrs	85.00	\$43.06	\$7.25	\$1.29	\$0.43	\$0.00	\$10.33	\$0.75	\$0.00	\$0.00	\$63.11	\$84.64
7th 1000 hrs	90.00	\$45.59	\$7.25	\$1.37	\$0.46	\$0.00	\$10.94	\$0.75	\$0.00	\$0.00	\$66.36	\$89.16

Special Calculation Note : Other is Health Reimbursement Account

Operator "A"

John Henry Rock Drill, D-6 (or equivalent) and above, Trackhoe Digger, (320 Track excavator), Cranes (greater than 25 tons and less than 45 tons).

Operator "B"

Cranes (greater than 6 tons and up to 25 tons), Backhoes, Road Tractor, Dozer up to D-5, Pressure Digger-wheeled or tracked, all Tension wire Stringing equipment.

Operator "C"

Trench, Backhoe, Riding type vibratory Compactor, Ground Rod Driver, Boom Truck (6 ton & below), Skid Steer Loaders, Material Handler.

*All Operators of cranes 45 ton or larger shall be paid the journeyman rate of pay.

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GEauga, GREENE, GUERNSEY, HAMILTON, HARRISON, HIGHLAND, HOCKING, HOLMES, JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE, LICKING, LOGAN, LORAIN, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE, RICHLAND, ROSS, SCIOTO, SHELBY, STARK, SUMMIT, TRUMBULL, TUSCARAWAS, UNION, VINTON, WARREN, WASHINGTON, WAYNE

Special Jurisdictional Note :

Details :

Heli - Arc Welding will be paid \$.30 above Journeyman rate. Additional compensation of 10% over the Journeyman Lineman and Journeyman Technician for performing work on structures outside of buildings such as water towers, smoke stacks, radio and television towers, more than 75' above the ground.

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 71 Outside Utility Power

Change # : LCN01-2024ibLoc7OutsideUtility

Craft : Lineman Effective Date : 02/07/2024 Last Posted : 02/07/2024

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Electrical Lineman	\$47.99	\$7.25	\$1.44	\$0.48	\$0.00	\$11.52	\$0.75	\$0.00	\$0.00	\$69.43	\$93.42
Substation Technician	\$47.99	\$7.25	\$1.44	\$0.48	\$0.00	\$11.52	\$0.75	\$0.00	\$0.00	\$69.43	\$93.42
Cable Splicer	\$50.26	\$7.25	\$1.51	\$0.50	\$0.00	\$12.06	\$0.75	\$0.00	\$0.00	\$72.33	\$97.46
Operator A	\$43.01	\$7.25	\$1.29	\$0.43	\$0.00	\$10.32	\$0.75	\$0.00	\$0.00	\$63.05	\$84.56
Operator B	\$38.02	\$7.25	\$1.14	\$0.38	\$0.00	\$9.12	\$0.75	\$0.00	\$0.00	\$56.66	\$75.67
Operator C	\$30.52	\$7.25	\$0.92	\$0.31	\$0.00	\$7.32	\$0.75	\$0.00	\$0.00	\$47.07	\$62.33
Groundman 0-12 months Exp	\$24.00	\$7.25	\$0.72	\$0.24	\$0.00	\$5.76	\$0.75	\$0.00	\$0.00	\$38.72	\$50.72
Groundman 0-12 months Exp w/CDL	\$26.40	\$7.25	\$0.79	\$0.26	\$0.00	\$6.33	\$0.75	\$0.00	\$0.00	\$41.78	\$54.98
Groundman 1 yr or more	\$26.40	\$7.25	\$0.79	\$0.26	\$0.00	\$6.33	\$0.75	\$0.00	\$0.00	\$41.78	\$54.98
Groundman 1 yr or more w/CDL	\$31.19	\$7.25	\$0.94	\$0.31	\$0.00	\$7.49	\$0.75	\$0.00	\$0.00	\$47.93	\$63.53
Equipment Mechanic A	\$38.02	\$7.25	\$1.14	\$0.38	\$0.00	\$9.12	\$0.75	\$0.00	\$0.00	\$56.66	\$75.67
Equipment Mechanic B	\$34.28	\$7.25	\$1.03	\$0.34	\$0.00	\$8.23	\$0.75	\$0.00	\$0.00	\$51.88	\$69.02
Equipment Mechanic C	\$30.52	\$7.25	\$0.92	\$0.31	\$0.00	\$7.32	\$0.75	\$0.00	\$0.00	\$47.07	\$62.33
Line Truck w/uuger	\$33.65	\$7.25	\$1.01	\$0.34	\$0.00	\$8.08	\$0.75	\$0.00	\$0.00	\$51.08	\$67.90
Apprentice	Percent										

1st 1000 hrs	60.00	\$28.79	\$7.25	\$0.86	\$0.29	\$0.00	\$6.91	\$0.75	\$0.00	\$0.00	\$44.85	\$59.25
2nd 1000 hrs	65.00	\$31.19	\$7.25	\$0.94	\$0.31	\$0.00	\$7.49	\$0.75	\$0.00	\$0.00	\$47.93	\$63.53
3rd 1000 hrs	70.00	\$33.59	\$7.25	\$1.01	\$0.34	\$0.00	\$8.06	\$0.75	\$0.00	\$0.00	\$51.00	\$67.80
4th 1000 hrs	75.00	\$35.99	\$7.25	\$1.08	\$0.36	\$0.00	\$8.64	\$0.75	\$0.00	\$0.00	\$54.07	\$72.07
5th 1000 hrs	80.00	\$38.39	\$7.25	\$1.15	\$0.38	\$0.00	\$9.21	\$0.75	\$0.00	\$0.00	\$57.13	\$76.33
6th 1000 hrs	85.00	\$40.79	\$7.25	\$1.22	\$0.41	\$0.00	\$9.79	\$0.75	\$0.00	\$0.00	\$60.21	\$80.61
7th 1000 hrs	90.00	\$43.19	\$7.25	\$1.30	\$0.43	\$0.00	\$10.37	\$0.75	\$0.00	\$0.00	\$63.29	\$84.89

Special Calculation Note : Other is Health Reimbursement Account

Operator "A"

John Henry Rock Drill, D-6 (or equivalent) and above, Trackhoe Digger, (320 Track excavator), Cranes (greater than 25 tons and less than 45 tons).

Operator "B"

Cranes (greater than 6 tons and up to 25 tons), Backhoes, Road Tractor, Dozer up to D-5, Pressure Digger-wheeled or tracked, all Tension wire Stringing equipment.

Operator "C"

Trench, Backhoe, Riding type vibratory Compactor, Ground Rod Driver, Boom Truck (6 ton & below), Skid Steer Loaders, Material Handler.

Ratio :

(1) Journeyman Lineman to (1) Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GEAUGA, GREENE, GUERNSEY, HAMILTON, HARRISON, HIGHLAND, HOCKING, HOLMES, JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE, LICKING, LOGAN, LORAIN, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE, RICHLAND, ROSS, SCIOTO, SHELBY, STARK, SUMMIT, TRUMBULL, TUSCARAWAS, UNION, VINTON, WARREN, WASHINGTON, WAYNE

Special Jurisdictional Note :

Details :

Heli - Arc Welding will be paid \$.30 above Journeyman rate. Additional compensation of 10% over the Journeyman Lineman and Journeyman Technician for performing work on structures outside of buildings such as water towers,

smoke stacks, radio and television towers, more than 75' above the ground.

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 71 Underground Residential Distribution

Change # : LCN01-2024ibLoc7URD

Craft : Lineman Effective Date : 02/07/2024 Last Posted : 02/07/2024

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
URD Electrician	\$36.41		\$7.25	\$1.09	\$0.36	\$0.00	\$8.74	\$0.75	\$0.00	\$0.00	\$54.60	\$72.80
Equipment Operator A	\$32.57		\$7.25	\$0.98	\$0.33	\$0.00	\$7.82	\$0.75	\$0.00	\$0.00	\$49.70	\$65.98
Equipment Operator B	\$29.91		\$7.25	\$0.90	\$0.30	\$0.00	\$7.18	\$0.75	\$0.00	\$0.00	\$46.29	\$61.25
Directional Drill Locator	\$32.57		\$7.25	\$0.98	\$0.33	\$0.00	\$7.82	\$0.75	\$0.00	\$0.00	\$49.70	\$65.98
Directional Drill Operator	\$29.91		\$7.25	\$0.90	\$0.30	\$0.00	\$7.18	\$0.75	\$0.00	\$0.00	\$46.29	\$61.25
Groundman 0-12 months Exp	\$23.64		\$7.25	\$0.71	\$0.24	\$0.00	\$5.76	\$0.75	\$0.00	\$0.00	\$38.35	\$50.17
Groundman 0-12 months Exp w/CDL	\$26.07		\$7.25	\$0.78	\$0.26	\$0.00	\$6.26	\$0.75	\$0.00	\$0.00	\$41.37	\$54.41
Groundman 1 yr or more	\$26.07		\$7.25	\$0.78	\$0.26	\$0.00	\$6.26	\$0.75	\$0.00	\$0.00	\$41.37	\$54.41
Groundman 1 yr or more w/CDL	\$30.96		\$7.25	\$0.93	\$0.31	\$0.00	\$7.43	\$0.75	\$0.00	\$0.00	\$47.63	\$63.11
Apprentice	Percent											
1st 1000 hrs	80.00	\$29.13	\$7.25	\$0.87	\$0.29	\$0.00	\$6.99	\$0.75	\$0.00	\$0.00	\$45.28	\$59.84
2nd 1000 hrs	85.00	\$30.95	\$7.25	\$0.93	\$0.31	\$0.00	\$7.43	\$0.75	\$0.00	\$0.00	\$47.62	\$63.09
3rd 1000 hrs	90.00	\$32.77	\$7.25	\$0.98	\$0.33	\$0.00	\$7.86	\$0.75	\$0.00	\$0.00	\$49.94	\$66.32
4th 1000 hrs	95.00	\$34.59	\$7.25	\$1.04	\$0.35	\$0.00	\$8.28	\$0.75	\$0.00	\$0.00	\$52.26	\$69.55

Special Calculation Note : Other: Health Reimbursement Account

Ratio :

(1) Journeyman Lineman to (1) Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GEAUGA, GREENE, GUERNSEY, HAMILTON, HARRISON, HIGHLAND, HOCKING, HOLMES, JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE, LICKING, LOGAN, LORAIN, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE, RICHLAND, ROSS, SCIOTO, SHELBY, STARK, SUMMIT, TRUMBULL, TUSCARAWAS, UNION, VINTON, WARREN, WASHINGTON, WAYNE

Special Jurisdictional Note :

Details :

This work applies to projects designated for any outside Underground Residential Distribution construction work for electrical utilities, municipalities and rural electrification projects.

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 71 Voice Data Video Outside

Change # : LCN02-2024ibLoc71VDV

Craft : Voice Data Video Effective Date : 03/06/2024 Last Posted : 03/06/2024

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Electrical Installer Technician I	\$35.39		\$7.25	\$1.06	\$0.00	\$0.00	\$1.77	\$0.00	\$0.00	\$0.00	\$45.47	\$63.17
Installer Technician II	\$33.37		\$7.25	\$1.00	\$0.00	\$0.00	\$1.67	\$0.00	\$0.00	\$0.00	\$43.29	\$59.97
Installer Repairman	\$33.37		\$7.25	\$1.00	\$0.00	\$0.00	\$1.67	\$0.00	\$0.00	\$0.00	\$43.29	\$59.97
Equipment Operator II	\$24.98		\$7.25	\$0.75	\$0.00	\$0.00	\$1.25	\$0.00	\$0.00	\$0.00	\$34.23	\$46.72
Cable Splicer	\$35.39		\$7.25	\$1.06	\$0.00	\$0.00	\$1.77	\$0.00	\$0.00	\$0.00	\$45.47	\$63.17
Ground Driver W/CDL	\$16.69		\$7.25	\$0.50	\$0.00	\$0.00	\$0.83	\$0.00	\$0.00	\$0.00	\$25.27	\$33.62
Groundman	\$14.57		\$7.25	\$0.44	\$0.00	\$0.00	\$0.73	\$0.00	\$0.00	\$0.00	\$22.99	\$30.28
Trainees	Percent											
Trainee F	50.02	\$17.70	\$7.25	\$0.53	\$0.00	\$0.89	\$0.00	\$0.00	\$0.00	\$0.00	\$26.37	\$35.22
Trainee E	58.00	\$20.53	\$7.25	\$0.62	\$0.00	\$1.03	\$0.00	\$0.00	\$0.00	\$0.00	\$29.43	\$39.69
Trainee D	66.00	\$23.36	\$7.25	\$0.70	\$0.00	\$1.17	\$0.00	\$0.00	\$0.00	\$0.00	\$32.48	\$44.16
Trainee C	74.00	\$26.19	\$7.25	\$0.79	\$0.00	\$1.31	\$0.00	\$0.00	\$0.00	\$0.00	\$35.54	\$48.63
Trainee B	82.00	\$29.02	\$7.25	\$0.87	\$0.00	\$1.45	\$0.00	\$0.00	\$0.00	\$0.00	\$38.59	\$53.10
Trainee A	90.00	\$31.85	\$7.25	\$0.96	\$0.00	\$1.59	\$0.00	\$0.00	\$0.00	\$0.00	\$41.65	\$57.58

Special Calculation Note :

Ratio :

1Trainee to 1 Journeyman

Jurisdiction (* denotes special jurisdictional note):

ADAMS, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA,

GEAUGA, GREENE, GUERNSEY, HAMILTON,
HARRISON, HIGHLAND, HOCKING, HOLMES,
JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE,
LICKING, LOGAN, LORAIN, MADISON, MAHONING,
MARION, MEDINA, MEIGS, MERCER, MIAMI,
MONROE, MONTGOMERY, MORGAN, MORROW,
MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE,
PORTAGE, PREBLE, RICHLAND, ROSS, SCIOTO,
SHELBY, STARK, SUMMIT, TRUMBULL,
TUSCARAWAS, UNION, VINTON, WARREN,
WASHINGTON, WAYNE

Special Jurisdictional Note :

Details :

Cable Splicer: Inspect and test lines or cables, analyze results, and evaluate transmission characteristics. Cover conductors with insulation or seal splices with moisture-proof covering. Install, splice, test, and repair cables using tools or mechanical equipment. This will include the splicing of fiber.

Installer Technician I: Must know all aspects of telephone and cable work. This is to include aerial, underground, and manhole work. Must know how to climb and run bucket. Must have all the tools required to perform these tasks. Must be able to be responsible for the safety of the crew at all times. Must also have CDL license and have at least 5 years experience.

Installer Repairman: Perform tasks of repairing, installing, and testing phone and CATV services.

Installer Technician II: Have at least three years of telephone and CATV experience. Must have the knowledge of underground, aerial, and manhole work. Must be able to climb and operate bucket. Must have CDL. Must have all tools needed to perform these tasks.

Equipment Operator II: Able to operate a digger derrick or bucket truck. Have at least 3 years of experience and must have a valid CDL license.

Groundman W/CDL: Must have a valid CDL license and be able to perform tasks such as: climbing poles, pulling down guys, making up material, and getting appropriate tools for the job. Must have at least 5 year's experience.

Groundman: Perform tasks such as: climbing poles, pulling down guys, making up material, and getting appropriate tools for the job. Experience 0-5 years.

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 82 Inside

Change # : LCR01-2023ibLoc82in

Craft : Electrical Effective Date : 12/27/2023 Last Posted : 12/27/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Electrician	\$36.00		\$7.55	\$9.83	\$0.61	\$0.00	\$4.00	\$0.00	\$0.00	\$0.00	\$57.99	\$75.99
Apprentice	Percent											
1st period 0 - 1000 hrs	42.00	\$15.12	\$4.14	\$0.65	\$0.26	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$20.17	\$27.73
2nd period 1001-2000 hrs	42.00	\$15.12	\$4.14	\$0.65	\$0.26	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$20.17	\$27.73
3rd period 2001-3500 hrs	47.00	\$16.92	\$7.02	\$4.62	\$0.29	\$0.00	\$1.88	\$0.00	\$0.00	\$0.00	\$30.73	\$39.19
4th period 3501-5000 hrs	52.00	\$18.72	\$7.07	\$5.11	\$0.32	\$0.00	\$2.08	\$0.00	\$0.00	\$0.00	\$33.30	\$42.66
5th period 5001-6500 hrs	62.00	\$22.32	\$7.17	\$6.10	\$0.38	\$0.00	\$2.48	\$0.00	\$0.00	\$0.00	\$38.45	\$49.61
6th period 6501-8000 hrs	77.00	\$27.72	\$7.32	\$7.57	\$0.47	\$0.00	\$3.08	\$0.00	\$0.00	\$0.00	\$46.16	\$60.02

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

1 to 3 Journeymen to 4 Apprentices
4 to 6 Journeymen to 8 Apprentices
per job site

Jurisdiction (* denotes special jurisdictional note):

CLINTON, DARKE, GREENE, MIAMI,
MONTGOMERY, PREBLE, WARREN*

Special Jurisdictional Note : The following townships in Warren County are included: Clearcreek, Franklin and Wayne.

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 82 Inside Lt Commercial South West

Change # : LCNO1-2021sksLoc82in

Craft : Electrical Effective Date : 03/30/2022 Last Posted : 03/30/2022

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Electrician	\$33.25		\$6.47	\$9.35	\$0.72	\$0.00	\$3.50	\$0.00	\$0.00	\$0.00	\$53.29	\$69.91
CE-3 12,001-14,000	\$24.66		\$6.47	\$0.74	\$0.72	\$0.00	\$0.74	\$0.00	\$0.00	\$0.10	\$33.43	\$45.76
CE-2 10,001-12,000 Hrs	\$19.56		\$6.47	\$0.59	\$0.72	\$0.00	\$0.59	\$0.00	\$0.00	\$0.10	\$28.03	\$37.81
CE-1 8,001-10,000 Hrs	\$17.86		\$6.47	\$0.54	\$0.72	\$0.00	\$0.54	\$0.00	\$0.00	\$0.10	\$26.23	\$35.16
CW-4 6,001-8,000 Hrs	\$16.16		\$6.47	\$0.48	\$0.72	\$0.00	\$0.48	\$0.00	\$0.00	\$0.10	\$24.41	\$32.49
CW-3 4,001-6,000 Hrs	\$14.46		\$6.47	\$0.43	\$0.72	\$0.00	\$0.43	\$0.00	\$0.00	\$0.10	\$22.61	\$29.84
CW-2 2,001-4,000 Hrs	\$13.61		\$6.47	\$0.41	\$0.72	\$0.00	\$0.41	\$0.00	\$0.00	\$0.10	\$21.72	\$28.52
CW-1 0-2,000 Hrs	\$12.76		\$6.47	\$0.38	\$0.72	\$0.00	\$0.38	\$0.00	\$0.00	\$0.10	\$20.81	\$27.19
Apprentice	Percent											
1st period 0 - 1000 hrs	42.00	\$13.97	\$4.07	\$0.62	\$0.24	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$18.89	\$25.88
2nd period 1001-2000 hrs	42.00	\$13.97	\$4.07	\$0.62	\$0.24	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$18.89	\$25.88
3rd period 2001-3500 hrs	47.00	\$15.63	\$6.92	\$4.39	\$0.27	\$0.00	\$1.65	\$0.00	\$0.00	\$0.00	\$28.86	\$36.67
4th period 3501-5000 hrs	52.00	\$17.29	\$6.97	\$4.86	\$0.29	\$0.00	\$1.82	\$0.00	\$0.00	\$0.00	\$31.23	\$39.88
5th period 5001-6500	62.00	\$20.61	\$7.07	\$5.80	\$0.35	\$0.00	\$2.17	\$0.00	\$0.00	\$0.00	\$36.01	\$46.31

hrs												
6th period 6501-8000 hrs	77.00	\$25.60	\$7.22	\$7.20	\$0.44	\$0.00	\$2.70	\$0.00	\$0.00	\$0.00	\$43.16	\$55.96

Special Calculation Note : *Misc amount is Administrative Fees

Ratio :
 1 to 3 Journeymen to 3 Apprentices
 4 to 6 Journeymen to 6 Apprentices
 per job site

Jurisdiction (* denotes special jurisdictional note) :
 CLINTON, DARKE, GREENE, MIAMI,
 MONTGOMERY, PREBLE, WARREN*

Construction Electrician and Construction Wireman Ratio
 There shall be a minimum ratio of one inside Journeyman to every (4) employees of different classification per jobsite. An inside Journeyman Wireman is required on the project as the fifth (5th) worker or when apprentices are used.

Special Jurisdictional Note : The following townships in Warren County are included: Clearcreek, Franklin and Wayne.

The scope of work for the light commercial agreement shall apply to the following facilities not to exceed 200,000 square feet; office buildings, shopping centers, auto sales agencies and garages, churches, funeral homes, nursing homes, hotels, retail and wholesale facilities, small stand-alone manufacturing facilities when free standing and not part of a larger facility (not to exceed 50,000 square fee), solar projects (500 panels or less) unless otherwise covered under the agreement, lighting retrofits (when not associated with remodels involving branch re-circuiting) lighting retrofits shall be defined as the changing of lamps and ballasts in existing light fixtures and shall also include the one for one replacement of existing fixtures, warehouses, gas stations, food service centers, restaurants, entertainment facilities, hospitals, clinics, motels, residential buildings.

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 82 Lightning Rod

Change # : LCN02-2022ibLoc82

Craft : Electrical Effective Date : 12/05/2022 Last Posted : 11/23/2022

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Electrical Lightning Rod Technican	\$32.79	\$7.45	\$9.58	\$0.00	\$0.00	\$3.50	\$0.00	\$0.00	\$0.00	\$53.32	\$69.71

Special Calculation Note : No Apprentice approved by OSAC.

Ratio : **Jurisdiction (* denotes special jurisdictional note) :**
CLINTON, DARKE, GREENE, MIAMI,
MONTGOMERY, PREBLE, WARREN*

Special Jurisdictional Note : The following townships in Warren County are included: (Clearcreek, Franklin and Wayne)

Details :

.

Prevailing Wage Rate Skilled Crafts

Name of Union: Electrical Local 82 Voice Data Video

Change # : LCN01-2023ibLoc82VDV

Craft : Voice Data Video Effective Date : 11/27/2023 Last Posted : 11/22/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Electrical Installer Technician A	\$27.70		\$6.70	\$6.83	\$0.53	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$41.76	\$55.61
Electrical Installer Technician B	\$26.32		\$6.70	\$6.79	\$0.50	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.31	\$53.47
JW Installer Technician	\$24.93		\$6.70	\$6.75	\$0.47	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$38.85	\$51.32
NON BICSI Installer	\$18.01		\$3.94	\$0.54	\$0.34	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$22.83	\$31.83
Apprentice	Percent											
1st 0-1000 hours	55.00	\$15.24	\$3.94	\$3.76	\$0.29	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$23.23	\$30.84
2nd 1001-2000 hours	55.00	\$15.24	\$3.94	\$3.76	\$0.29	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$23.23	\$30.84
3rd 2001-3000 hours	65.00	\$18.00	\$6.65	\$4.44	\$0.34	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.44	\$38.44
4th 3001-4000 hours	65.00	\$18.00	\$6.65	\$4.44	\$0.34	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.44	\$38.44
5th 4001-5000 hours	75.00	\$20.77	\$6.66	\$6.62	\$0.39	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$34.45	\$44.83
6th 5001-6000 hours	75.00	\$20.77	\$6.66	\$6.62	\$0.39	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$34.45	\$44.83
7th 6001-7000 hours	80.00	\$22.16	\$6.67	\$6.66	\$0.42	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$35.91	\$46.99
8th 7001 hours	80.00	\$22.16	\$6.67	\$6.66	\$0.42	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$35.91	\$46.99
Cable Puller	50.00	\$13.85	\$3.94	\$0.42	\$0.26	\$0.00	\$0.25	\$0.00	\$0.00	\$0.00	\$18.72	\$25.65

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

1 Journeymen to 2 Apprentice

Jurisdiction (* denotes special jurisdictional note):

CLINTON, DARKE, GREENE, MIAMI,
MONTGOMERY, PREBLE, WARREN*

Special Jurisdictional Note : The following townships in Warren County are included: (Clearcreek, Franklin and Wayne)

Details :

Work covered but not limited to: installation which utilize transmission and/or transference of voice, sound, vision or digital for commercial, education, security and entertainment purposes for the following:

TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multimedia, multiplex, nurse call system, radio page, school intercom, sound and low voltage master clock systems.

Fire Alarm work is excluded on all new construction sites or wherever the fire alarm system is installed in conduit.

All HVAC control work is not covered by this wage rate but by the Inside Electrical wage rate.

Prevailing Wage Rate Skilled Crafts

Name of Union: Elevator Local 11

Change # : LCN01-2020fbLoc11

Craft : Elevator Effective Date : 01/05/2021 Last Posted : 01/05/2021

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Elevator Mechanic	\$48.82		\$15.88	\$10.46	\$0.64	\$3.91	\$8.85	\$1.56	\$0.00	\$0.00	\$90.12	\$114.53
Probationary Apprentice	50.00	\$24.41	\$0.00	\$0.00	\$0.00	\$1.46	\$0.00	\$0.78	\$0.00	\$0.00	\$26.65	\$38.86
1st year	55.00	\$26.85	\$15.88	\$10.46	\$0.64	\$1.61	\$8.85	\$0.86	\$0.00	\$0.00	\$65.15	\$78.58
2nd year	65.00	\$31.73	\$15.88	\$10.46	\$0.64	\$1.90	\$8.85	\$1.02	\$0.00	\$0.00	\$70.48	\$86.35
3rd year	70.00	\$34.17	\$15.88	\$10.46	\$0.64	\$2.05	\$8.85	\$1.09	\$0.00	\$0.00	\$73.14	\$90.23
4th year	80.00	\$39.06	\$15.88	\$10.46	\$0.64	\$2.34	\$8.85	\$1.25	\$0.00	\$0.00	\$78.48	\$98.00
Helper	70.00	\$34.17	\$15.88	\$10.46	\$0.64	\$2.05	\$8.85	\$1.09	\$0.00	\$0.00	\$73.14	\$90.23
Assistant Mechanic	80.00	\$39.06	\$15.88	\$10.46	\$0.64	\$2.34	\$8.85	\$1.25	\$0.00	\$0.00	\$78.48	\$98.00

Special Calculation Note : Other is Holiday Pay. Vacation calculated at 6%.

Ratio : **Jurisdiction (* denotes special jurisdictional note) :**

The total number of Helpers & Apprentices employed shall not exceed the number of Mechanics on any one job, except on jobs where (2) teams or more are working, (1) extra Helper or Apprentice may be employed for the first (2) teams and an extra Helper or Apprentice for each additional (3) teams.

ADAMS, BROWN, BUTLER, CLERMONT, CLINTON, DARKE, GREENE, HAMILTON, HIGHLAND, MIAMI, MONTGOMERY, PREBLE, SCIOTO, SHELBY, WARREN

- 1 Journeymen to 1 Apprentice
- 2 Journeymen to 5 Apprentice
- 3 Journeymen to 6 Apprentice

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Glazier Local 387

Change # : LCN01-2023ibLoc387

Craft : Glazier Effective Date : 11/22/2023 Last Posted : 11/22/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Glazier	\$31.95		\$6.50	\$11.25	\$0.45	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$50.15	\$66.12
Apprentice	Percent											
1st Year	65.00	\$20.77	\$6.50	\$7.86	\$0.45	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$35.58	\$45.96
2nd Year	75.00	\$23.96	\$6.50	\$8.83	\$0.45	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.74	\$51.72
3rd Year	85.00	\$27.16	\$6.50	\$9.80	\$0.45	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.91	\$57.49
4th Year	95.00	\$30.35	\$6.50	\$10.77	\$0.45	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$48.07	\$63.25

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

Each employer may employ and train Apprentices in the following ratio to journeymen workers employed.
1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note):

ADAMS, BROWN, BUTLER, CHAMPAIGN, CLARK, CLERMONT, CLINTON, DARKE, FAYETTE*, GREENE, HAMILTON, HIGHLAND, MIAMI, MONTGOMERY, PREBLE, WARREN

Special Jurisdictional Note : Fayette County: Eastern portion of route #41 being the dividing line between locals 372 and 387. Local 387 has jurisdiction of projects built on property which borders route #41 East.

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Ironworker Local 290

Change # : LCN01-2023ibLoc290

Craft : Ironworker Effective Date : 11/17/2023 Last Posted : 11/17/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Ironworker Structural	\$32.69		\$8.90	\$9.50	\$0.65	\$0.00	\$5.00	\$0.01	\$0.00	\$0.00	\$56.75	\$73.10
Welder	\$32.69		\$8.90	\$9.50	\$0.65	\$0.00	\$5.00	\$0.01	\$0.00	\$0.00	\$56.75	\$73.10
Fence Erector	\$32.69		\$8.90	\$9.50	\$0.65	\$0.00	\$5.00	\$0.01	\$0.00	\$0.00	\$56.75	\$73.10
Reinforcing Rods	\$32.69		\$8.90	\$9.50	\$0.65	\$0.00	\$5.00	\$0.01	\$0.00	\$0.00	\$56.75	\$73.10
Machinery Mover	\$32.69		\$8.90	\$9.50	\$0.65	\$0.00	\$5.00	\$0.01	\$0.00	\$0.00	\$56.75	\$73.10
Sheeter	\$32.69		\$8.90	\$9.50	\$0.65	\$0.00	\$5.00	\$0.01	\$0.00	\$0.00	\$56.75	\$73.10
Metal Building Erector	\$32.69		\$8.90	\$9.50	\$0.65	\$0.00	\$5.00	\$0.01	\$0.00	\$0.00	\$56.75	\$73.10
Rigger & Erector	\$32.69		\$8.90	\$9.50	\$0.65	\$0.00	\$5.00	\$0.01	\$0.00	\$0.00	\$56.75	\$73.10
Apprentice	Percent											
1st year	64.60	\$21.12	\$8.90	\$9.50	\$0.65	\$0.00	\$3.50	\$0.01	\$0.00	\$0.00	\$43.68	\$54.24
2nd year	74.60	\$24.39	\$8.90	\$9.50	\$0.65	\$0.00	\$3.50	\$0.01	\$0.00	\$0.00	\$46.95	\$59.14
3rd year	84.60	\$27.66	\$8.90	\$9.50	\$0.65	\$0.00	\$3.50	\$0.01	\$0.00	\$0.00	\$50.22	\$64.04
4th year	94.62	\$30.93	\$8.90	\$9.50	\$0.65	\$0.00	\$3.50	\$0.01	\$0.00	\$0.00	\$53.49	\$68.96

Special Calculation Note : Other is for Industry Fund.

Ratio :

ON STRUCTURAL WORK: 1 Apprentice to 3 Journeymen

ON ROD WORK: 1 Apprentice to 3 Journeymen

ON ALL FINISHING, STEEL SASH, STAIRWAY AND ORNAMENTAL WORK: 1 Apprentice to 1 Journeyman

ON ALL INDUSTRIAL MAINTENANCE PROJECTS NOT COVERED BY OTHER SPECIALTY

Jurisdiction (* denotes special jurisdictional note):

ALLEN*, AUGLAIZE, BUTLER*, CHAMPAIGN*, CLARK, CLINTON, DARKE, FAYETTE*, GREENE, HARDIN*, HIGHLAND*, LOGAN*, MADISON*, MERCER*, MIAMI, MONTGOMERY, PREBLE, SHELBY, VAN WERT*, WARREN*

AGREEMENTS: 2 Apprentices to 2 Journeymen

Special Jurisdictional Note : Allen County Twps included are: Auglaize, Perry, Shawnee, Amanda, Spencer, Marion, Sugar Creek, American, Bath, Jackson. Butler County Twps included are: Milford, Wayne, Madison, Lemon. Champaign Cnty Twps included are: Union, Urbana, Jackson, Concord, Salem, Mad River, Johnson, Harrison, Adams. Fayette County Twps included are: Green, Jasper, Concord, Jefferson. Hardin County Twps included are: Round Head, Marion, Liberty. Highland County Twps included are: Fairfield, Penn, Union, Marshall, Liberty, Paint, Brush Creek. Logan County Twps included are: Richland, Stokes, Bloomfield, Washington, Harrison, McArthur, Lake, Liberty, Pleasant, Miami. Madison County Twps included are: Stokes. Mercer County Twps included are: Dublin, Washington, Jefferson, Recovery, Gibson, Union, Liberty, Butler, Granville, Center, Hopewell, Franklin, Marion. VanWert County Twps included are: Jennings. Warren County Twps included are: Franklin, Clear Creek, Turtle Creek, Wayne, Massie, Washington, Salem, Union.

Details :

Structural Iron Work but not limited to:field fabrication, all loading to and including the erecting,rigging,assembly,dismantling, placing, temporary and permanent securing by any means of all structural iron,steel,ornamental lead,bronze,brass,copper,aluminum,glass all ferrous and non ferrous metal and composite material, precast prestressed and post-stressed concrete structures. Bridges and bridge rails,bridge viaducts,bucks bulkheads,bumper and bumper post,canopies and unistrut canopies,corrugated ferrous and non ferrous sheets when attached to steel frames,columns,beams,bar-joists,trusses,grinders,roof decking,electrical supports,elevator cars,elevator fronts and enclosures,erection of steel towers,flag poles, gymnasium equipment,stadium and arena seating,jail cell work,jail cell beds,benches,bunks,chairs,tables,mirrors,jail cell access doors,rigging and installation of machinery and equipment(erection,aligning,anchoring and dismantling, erection and dismantling of tower cranes,derrick monorail systems, Chicago booms,overhead cranes,gantries,material and personnel hoists,tanks,hoppers and conveyors. All pre-engineered metal buildings and their entirety including siding,roofing, gutters, downspouts and erection of all.

Ornamental Iron Work but not limited to:all work in connection with field fabrication,handling including loading/off loading,sorting,cutting,fastening,anchoring,bending,hoisting,placing,burning,welding,and tying,dismantling of all materials used in miscellaneous iron or steel, for stairs,hand railings,rolling doors, rolling gates,rolling shutters,fence,windows,curtain wall,erection and welding of all metal, sash,architectural and ornamental treatments, but not necessarily limited to all sizes and types of ornamental,steel iron,lead,bronze,brass,copper,aluminum,all ferrous and non ferrous metals and composite materials

Fence Erector Iron Worker but not limited to: All work in connection with the field fabrication and erection of chain link fence,which includes but not limited to the loading and of the fence fabric and posts also the installation of the above.

Prevailing Wage Rate Skilled Crafts

Name of Union: Labor HevHwy 3

Change # : LCN01-2023ibLocalHevHwy3

Craft : Laborer Group 1 Effective Date : 05/01/2023 Last Posted : 04/26/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Laborer Group 1	\$34.62		\$8.20	\$4.05	\$0.45	\$0.00	\$1.00	\$0.00	\$0.10	\$0.00	\$48.42	\$65.73
Group 2	\$34.79		\$8.20	\$4.05	\$0.45	\$0.00	\$1.00	\$0.00	\$0.10	\$0.00	\$48.59	\$65.98
Group 3	\$35.12		\$8.20	\$4.05	\$0.45	\$0.00	\$1.00	\$0.00	\$0.10	\$0.00	\$48.92	\$66.48
Group 4	\$35.57		\$8.20	\$4.05	\$0.45	\$0.00	\$1.00	\$0.00	\$0.10	\$0.00	\$49.37	\$67.15
Watch Person	\$27.35		\$8.20	\$4.05	\$0.45	\$0.00	\$1.00	\$0.00	\$0.10	\$0.00	\$41.15	\$54.83
Apprentice	Percent											
0-1000 hrs	60.00	\$20.77	\$8.20	\$4.05	\$0.45	\$0.00	\$1.00	\$0.00	\$0.10	\$0.00	\$34.57	\$44.96
1001-2000 hrs	70.00	\$24.23	\$8.20	\$4.05	\$0.45	\$0.00	\$1.00	\$0.00	\$0.10	\$0.00	\$38.03	\$50.15
2001-3000 hrs	80.00	\$27.70	\$8.20	\$4.05	\$0.45	\$0.00	\$1.00	\$0.00	\$0.10	\$0.00	\$41.50	\$55.34
3001-4000 hrs	90.00	\$31.16	\$8.20	\$4.05	\$0.45	\$0.00	\$1.00	\$0.00	\$0.10	\$0.00	\$44.96	\$60.54
More than 4000 hrs	100.00	\$34.62	\$8.20	\$4.05	\$0.45	\$0.00	\$1.00	\$0.00	\$0.10	\$0.00	\$48.42	\$65.73

Special Calculation Note : Watchmen have no Apprentices. Tunnel Laborer rate with air-pressurized add \$1.00 to the above wage rate.

Ratio :

1 Journeymen to 1 Apprentice
3 Journeymen to 1 Apprentice thereafter

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW,

MUSKINGUM, NOBLE, PAULDING, PERRY,
PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND,
ROSS, SCIOTO, SENECA, SHELBY, TUSCARAWAS,
UNION, VAN WERT, VINTON, WARREN,
WASHINGTON, WAYNE, WILLIAMS, WYANDOT

Special Jurisdictional Note : Hod Carriers and Common Laborers - Heavy, Highway, Sewer, Waterworks, Utility, Airport, Railroad, Industrial and Building Site, Sewer Plant, Waste Water Treatment Facilities Construction

Details :

Group 1

Laborer (Construction); Plant Laborer or Yardman, Right-of-way Laborer, Landscape Laborer, Highway Lighting Worker, Signalization Worker, (Swimming) Pool Construction Laborer, Utility Man, *Bridge Man, Handyman, Joint Setter, Flagperson, Carpenter Helper, Waterproofing Laborer, Slurry Seal, Seal Coating, Surface Treatment or Road Mix Laborer, Riprap Laborer & Grouter, Asphalt Laborer, Dump Man (batch trucks), Guardrail & Fence Installer, Mesh Handler & Placer, Concrete Curing Applicator, Scaffold Erector, Sign Installer, Hazardous Waste (level D), Diver Helper, Zone Person and Traffic Control.

*Bridge Man will perform work as per the October 31, 1949, memorandum on concrete forms, by and between the United Brotherhood of Carpenters and Joiners of America and the Laborers' International Union of North America, which states in; "the moving, cleaning, oiling and carrying to the next point of erection, and the stripping of forms which are not to be re-used, and forms on all flat arch work shall be done by members of the Laborers' International Union of North America."

Group 2

Asphalt Raker, Screwman or Paver, Concrete Puddler, Kettle Man (pipeline), All Machine-Driven Tools (Gas, Electric, Air), Mason Tender, Brick Paver, Mortar Mixer, Skid Steer, Sheeting & Shoring Person, Surface Grinder Person, Screedperson, Water Blast, Hand Held Wand, Power Buggy or Power Wheelbarrow, Paint Striper, Plastic fusing Machine Operator, Rodding Machine Operator, Pug Mill Operator, Operator of All Vacuum Devices Wet or Dry, Handling of all Pumps 4 inches and under (gas, air or electric), Diver, Form Setter, Bottom Person, Welder Helper (pipeline), Concrete Saw Person, Cutting with Burning Torch, Pipe Layer, Hand Spiker (railroad), Underground Person (working in sewer and waterline, cleaning, repairing and reconditioning). Tunnel Laborer (without air), Caisson, Cofferdam (below 25 feet deep), Air Track and Wagon Drill, Sandblaster Nozzle Person, Hazardous Waste (level B), ***Lead Abatement, Hazardous Waste (level C)

***Includes the erecting of structures for the removal, including the encapsulation and containment of Lead abatement process.

Group 3

Blast and Powder Person, Muckers will be defined as shovel men working directly with the miners, Wrencher (mechanical joints & utility pipeline), Yarnier, Top Lander, Hazardous Waste (level A), Concrete Specialist, Curb Setter and Cutter, Grade Checker, Concrete Crew in Tunnels. Utility pipeline Tappers, Waterline, Caulker, Signal Person will receive the rate equal to the rate paid the Laborer classification for which the Laborer is signaling.

Group 4

Miner, Welder, Guniting Nozzle Person

A.) The Watchperson shall be responsible to patrol and maintain a safe traffic zone including but not limited to barrels, cones, signs, arrow boards, message boards etc.

The responsibility of a watchperson is to see that the equipment, job and office trailer etc. are secure.

Prevailing Wage Rate Skilled Crafts

Name of Union: Labor Local 1410 Building

Change # : LCN01-2023ibLoc1410

Craft : Laborer Effective Date : 04/05/2023 Last Posted : 04/05/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Laborer Group 1	\$30.35		\$8.20	\$4.05	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$43.10	\$58.28
Group 2	\$30.95		\$8.20	\$4.05	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$43.70	\$59.17
Group 3	\$31.45		\$8.20	\$4.05	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$44.20	\$59.92
Apprentice	Percent											
Building Laborer 1-1000 hrs	60.00	\$18.21	\$8.20	\$4.05	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$30.96	\$40.07
1001-2000	70.02	\$21.25	\$8.20	\$4.05	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$34.00	\$44.63
2001-3000	80.00	\$24.28	\$8.20	\$4.05	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$37.03	\$49.17
3001-4000	89.99	\$27.31	\$8.20	\$4.05	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$40.06	\$53.72
More than 4000 hrs	100.00	\$30.35	\$8.20	\$4.05	\$0.40	\$0.00	\$0.00	\$0.00	\$0.10	\$0.00	\$43.10	\$58.28

Special Calculation Note : \$0.10 LECET is for Labor Management.

Ratio :

1 Journeymen to 1 Apprentice
4 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note):

CHAMPAIGN, CLARK, DARKE, GREENE, LOGAN, MIAMI, MONTGOMERY, PREBLE

Special Jurisdictional Note :

Details :

Group 1
Building & Construction Laborer, Railroad Laborer, Asbestos & Hazardous Waste (Levels A,B,C, & D), Concrete Crew, Form Setter, Pipelayer, Bottom Man, Burner (Cutting Torch), Welder Helper, All Machine & Power Driven Tools, Sandblaster
Yardman-Landscaping, Sewer Jet, Waterperson, Tool Cage Laborer, Unloading Furniture & Fixtures, Final Clean-Up
Watchman, Residential Construction, Signal Men

Group 2
Mason Tender For Bricklayers, Flexcore, Firebrick Tender (Blast Furnaces, Soaking Pits, Stoves & Stacks), Plasterer
Tenders & Lathers

Group 3 Tender Operator

Asbestos, Lead and Hazardous Material:

The removal, abatement or encapsulation of asbestos, lead and/or toxic and hazardous waste or materials is defined as all work included in the erection, moving servicing and dismantling of all enclosures, scaffolding, barricades, etc. and the operation of all tools and equipment (including generators, compressors and vacuums) normally used in the removal or abatement or asbestos, lead and toxic and hazardous waste or materials; the labeling, bagging, cartoning, crating or otherwise packaging of materials for disposal; as well as the clean-up of the work site and all other work incidental to the removal, abatement or encapsulation of asbestos, lead or toxic and hazardous waste materials.

Level A

Protective equipment is required when the area has been determined to contain extremely toxic contaminants or contaminants unknown but may be expected to be extremely toxic and/or immediately dangerous to life and health. This ensemble includes a fully encapsulated chemical suit, self contained breathing apparatus (SCBA) or airline fed respirator, and various types and numbers of boots and gloves.

Level B

Protective equipment includes a chemically resistant splash suit and a SCBA or airline respirator. This ensemble is required when the situation is very hazardous, such as oxygen deficient atmospheres, IDLH atmospheres, or confined space entries.

Level C

Protective equipment includes a protective suit and an air purifying respirator (APR) with the appropriate filter canisters.

Level D

To be worn only in established "safe zones" may consist of, from normal work clothes to normal skin protection such as gloves, face shields goggles, coveralls and occasionally respiratory protection.

Prevailing Wage Rate Skilled Crafts

Name of Union: Operating Engineers - Building Local 18 - Zone III

Change # : LCN01-2023ibLoc18zone3

Craft : Operating Engineer Effective Date : 05/01/2023 Last Posted : 04/26/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Operator Group A	\$41.49		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$57.74	\$78.48
Operator Group B	\$41.37		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$57.62	\$78.30
Operator Group C	\$40.33		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$56.58	\$76.74
Operator Group D	\$39.15		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$55.40	\$74.97
Operator Group E	\$33.69		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$49.94	\$66.78
Master Mechanic	\$41.74		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$57.99	\$78.86
Cranes & Mobile Concrete Pumps 150'-180'	\$41.99		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$58.24	\$79.23
Cranes & Mobile Concrete Pumps 180'-249'	\$42.49		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$58.74	\$79.98
Cranes & Mobile Concrete Pumps 249' and over	\$42.74		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$58.99	\$80.36
Apprentice	Percent											
1st Year	50.00	\$20.75	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$37.00	\$47.37
2nd Year	60.00	\$24.89	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$41.14	\$53.59
3rd Year	70.00	\$29.04	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$45.29	\$59.81
4th Year	80.00	\$33.19	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$49.44	\$66.04
Field Mechanic Trainee												

1st Year	50.00	\$20.75	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$37.00	\$47.37
2nd Year	60.00	\$24.89	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$41.14	\$53.59
3rd Year	70.00	\$29.04	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$45.29	\$59.81
4th Year	80.00	\$33.19	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$49.44	\$66.04

Special Calculation Note : Other: Education & Safety \$0.09; *Misc is National Training

Ratio :

For every (3) Operating Engineer Journeymen employed by the company there may be employed (1) Registered Apprentice or trainee Engineer through the referral when they are available. An apprenice, while employed as part of a crew per Article VIII, paragraph 78, will not be subject to the apprenticeship ratios in this collective bargaining agreement

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WYANDOT

Special Jurisdictional Note :

Details :

Note: There will be a 10% increase for the apprentices on top of the percentages listed above provided they are operating mobile equipment. Mechanic Trainees will receive 10% increase if required to have CDL

Group A- Barrier Moving Machines; Boiler Operators or Compressor Operators, when compressor or boiler is mounted on crane (Piggyback Operation); Boom Trucks (all types); Cableways Cherry Pickers; Combination - Concrete Mixers & Towers; All Concrete Pumps with Booms; Cranes (all types); Compact Cranes, track or rubber over 4,000 pounds capacity; Cranes self-erecting, stationary, track or truck (all configurations); Derricks (all types); Draglines; Dredges (dipper, clam or suction) 3-man crew; Elevating Graders or Euclid Loaders; Floating Equipment; Forklift (rough terrain with winch/hoist); Gradalls; Helicopter Operators, hoisting building materials; Helicopter Winch Operators, Hoisting building materials; Hoes (All types); Hoists (with two or more drums in use); Horizontal Directional Drill; Hydraulic Gantry (lift system); Laser Finishing Machines; Laser Screed and like equipment; Lift Slab or Panel Jack Operators; Locomotives (all types); Maintenance Operator/Technician(Mechanic Operator/Technician and/or Welder); Mixers, paving (multiple drum); Mobile Concrete Pumps, with booms; Panelboards, (all types on site); Pile Drivers; Power Shovels; Prentice Loader; Rail Tamper (with automatic lifting and aligning device); Rotary Drills (all), used on caissons for foundations and sub-structure; Side Booms; Slip Form Pavers; Straddle Carriers (Building Construction on site); Trench Machines (over 24” wide); Tug Boats.

Group B - Articulating/end dumps (minus \$4.00/hour from Group B rate); Asphalt Pavers; Bobcat-type and/or skid steer loader with hoe attachment greater than 7000 lbs.; Bulldozers; CMI type Equipment; Concrete Saw, Vermeer-type; Endloaders; Hydro Milling Machine; Kolman-type Loaders (Dirt Loading); Lead Greasemen; Mucking Machines; Pettibone-Rail Equipment; Power Graders; Power Scoops; Power Scrapers; Push Cats;, Rotomills (all), grinders and planers of all types.

Group C - A-Frames; Air Compressors, Pressurizing Shafts or Tunnels; All Asphalt Rollers; Bobcat-type and/or Skid

Steer Loader with or without attachments; Boilers (15 lbs. pressure and over); All Concrete Pumps (without booms with 5 inch system); Fork Lifts (except masonry); Highway Drills - all types (with integral power); Hoists (with one drum); House Elevators (except those automatic call button controlled), Buck Hoists, Transport Platforms, Construction Elevators; Hydro Vac/Excavator (when a second person is needed, the rate of pay will be "Class E"); Man Lifts; Material hoist/elevators; Mud Jacks; Pressure Grouting; Pump Operators (installing or operating Well Points or other types of Dewatering Systems); Pumps (4 inches and over discharge); Railroad Tie (Inserter/Remover); Rotovator (Lime-Soil Stabilizer); Submersible Pumps (4" and over discharge); Switch & Tie Tampers (without lifting and aligning device); Trench Machines (24" and under); Utility Operators.

Group D - Backfillers and Tampers; Ballast Re-locator; Batch Plant Operators; Bar and Joint Installing Machines; Bull Floats; Burlap and Curing Machines; Clefplanes; Compressors, on building construction; Concrete Mixers, more than one bag capacity; Concrete Mixers, one bag capacity (side loaders); All Concrete Pumps (without boom with 4" or smaller system); Concrete Spreader; Conveyors, used for handling building materials; Crushers; Deckhands; Drum Fireman (in asphalt plants); Farm type tractors pulling attachments; Finishing Machines; Form Trenchers; Generators; Gunite Machines; Hydro-seeders; Pavement Breakers (hydraulic or cable); Post Drivers; Post Hole Diggers; Pressure Pumps (over 1/2") discharge); Road Widening Trenchers; Rollers (except asphalt); Self-propelled sub-graders; Shotcrete Machines; Tire Repairmen; Tractors, pulling sheepsfoot post roller or grader; VAC/ALLS; Vibratory Compactors, with integral power; Welders.

Group E – Allen Screed Paver (concrete); Boilers (less than 15 lbs. pressure); Cranes-Compact, track or rubber (under 4,000 pounds capacity); Directional Drill "Locator"; Fueling and greasing +\$3.00; Inboard/outboard Motor Boat Launches; Light Plant Operators; Masonry Fork Lifts; Oilers/Helpers; Power Driven Heaters (oil fired); Power Scrubbers; Power Sweepers; Pumps (under 4 inch discharge); Signalperson, Submersible Pumps (under 4" discharge).

Master Mechanics - Master Mechanic

Cranes 150' – 180' - Boom & Jib 150 - 180 feet

Cranes 180' – 249' - Boom & Jib 180 - 249 feet

Cranes 250' and over - Boom & Jib 250-feet or over

Prevailing Wage Rate Skilled Crafts

Name of Union: Operating Engineers - HevHwy Zone II

Change # : LCN01-2023ibLoc18hevhwyl

Craft : Operating Engineer Effective Date : 05/01/2023 Last Posted : 04/26/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Operator Class A	\$41.49		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$57.74	\$78.48
Operator Class B	\$41.37		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$57.62	\$78.30
Operator Class C	\$40.33		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$56.58	\$76.74
Operator Class D	\$39.15		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$55.40	\$74.97
Operator Class E	\$33.69		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$49.94	\$66.78
Master Mechanic	\$41.74		\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$57.99	\$78.86
Apprentice	Percent											
1st Year	50.00	\$20.75	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$37.00	\$47.37
2nd Year	60.00	\$24.89	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$41.14	\$53.59
3rd Year	70.00	\$29.04	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$45.29	\$59.81
4th Year	80.00	\$33.19	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$49.44	\$66.04
Field Mech Trainee Class 2												
1st year	50.00	\$20.75	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$37.00	\$47.37
2nd year	60.00	\$24.89	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$41.14	\$53.59
3rd year	70.00	\$29.04	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$45.29	\$59.81
4th year	80.00	\$33.19	\$9.01	\$6.25	\$0.85	\$0.00	\$0.00	\$0.09	\$0.00	\$0.05	\$49.44	\$66.04

Special Calculation Note : Other: Education & Safety Fund is \$0.09 per hour. *Misc is National Training

Ratio : **Jurisdiction (* denotes special jurisdictional note):**

For every (3) Operating Engineer Journeymen employed by the company, there may be employed (1) Registered Apprentice or Trainee Engineer through the referral when they are available. An Apprentice, while employed as part of a crew per Article VIII, paragraph 65 will not be subject

ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN,

to the apprenticeship ratios in this collective bargaining agreement

FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LUCAS, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WOOD, WYANDOT

Special Jurisdictional Note :

Details :

**Apprentices will receive a 10% increase on top of the percentages listed above provided they are operating mobile equipment. Mechanic Trainees will receive 10% increase if they are required to have CDL.

Class A - Air Compressors on Steel Erection; Asphalt Plant Engineers (Cleveland District Only); Barrier Moving Machine; Boiler Operators, Compressor Operators, or Generators, when mounted on a rig; Boom Trucks (all types); Cableways; Cherry Pickers; Combination- Concrete Mixers & Towers; Concrete Plants (over 4 yd capacity); Concrete Pumps; Cranes (all types); Compact Cranes track or rubber over 4,000 pounds capacity; Cranes self-erecting stationary, track or truck; Derricks (all types); Draglines; Dredges dipper, clam or suction; Elevating Graders or Euclid Loaders; Floating Equipment (all types); Gradalls; Helicopter Crew (Operator- hoist or winch); Hoes (all types); Hoisting Engines; Hoisting Engines, on shaft or tunnel work; Hydraulic Gantry (lifting system); Industrial-type Tractors; Jet Engine Dryer (D8 or D9) diesel Tractors; Locomotives (standard gauge); Maintenance Operators/Technicians (class A); Mixers, paving (single or double drum); Mucking Machines; Multiple Scrapers; Piledriving Machines (all types); Power Shovels, Prentice Loader; Quad 9 (double pusher); Rail Tamper (with automatic lifting and aligning device); Refrigerating Machines (freezer operation); Rotary Drills, on caisson work; Rough Terrain Fork Lift with winch/hoist; Side Booms; Slip Form Pavers; Survey Crew Party Chiefs; Tower Derricks; Tree Shredders; Trench Machines (over 24" wide); Truck Mounted Concrete Pumps; Tug Boats; Tunnel Machines and /or Mining Machines; Wheel Excavators.

Class B - Asphalt Pavers; Automatic Subgrade Machines, self-propelled (CMI-type); Bobcat-type and /or Skid Steer Loader with hoe attachment greater than 7000 lbs.; Boring Machine Operators (more than 48 inches); Bulldozers; Concrete Saws, Vermeer type; Endloaders; Horizontal Directional Drill (50,000 ft. lbs. thrust and over); Hydro Milling Machine; Kolman-type Loaders (production type-dirt); Lead Greasemen; Lighting and Traffic Signal Installation Equipment includes all groups or classifications; Maintenance Operators/Technicians, Class B; Material Transfer Equipment (shuttle buggy) Asphalt; Pettibone-Rail Equipment; Power Graders; Power Scrapers; Push Cats; Rotomills (all), Grinders and Planners of all types, Groovers (excluding walk-behinds); Trench Machines (24 inch wide and under).

Class C - A-Frames; Air Compressors, on tunnel work (low Pressure); Articulating/straight bed end dumps if assigned (minus \$4.00 per hour); Asphalt Plant Engineers (Portage and Summit Counties only); Bobcat-type and/or skid steer loader with or without attachments; Drones; Highway Drills (all types); HydroVac/Excavator (when a second person is needed, the rate of pay will be "Class E"); Locomotives (narrow gauge); Material Hoist/Elevators; Mixers, concrete (more than one bag capacity); Mixers, one bag capacity (side loader); Power Boilers (over 15 lbs. pressure); Pump Operators (installing or operating well Points); Pumps (4 inch and over discharge); Railroad Tie Inserter/Remover; Rollers, Asphalt; Rotovator (lime-soil Stabilizer); Switch & Tie Tampers (without lifting and aligning device); Utilities Operators, (small equipment); Welding Machines and Generators.

Class D – Backfillers and Tampers; Ballast Re-locator; Bar and Joint Installing Machines; Batch Plant Operators; Boring Machine Operators (48 inch or less); Bull Floats; Burlap and Curing Machines; Concrete Plants (capacity 4 yds.

and under); Concrete Saws (multiple); Conveyors (highway); Crushers; Deckhands; Farm type tractors, with attachments (highway); Finishing Machines; Firemen, Floating Equipment (all types); Fork Lifts (highway), except masonry; Form Trenchers; Hydro Hammers; Hydro Seeders; Pavement Breakers (hydraulic or cable); Plant Mixers; Post Drivers; Post Hole Diggers; Power Brush Burners; Power Form Handling Equipment; Road Widening Trenchers; Rollers (brick, grade, macadam); Self-Propelled Power Spreaders; Self-Propelled Sub-Graders; Steam Firemen; Survey Instrument men; Tractors, pulling sheepsfoot rollers or graders; Vibratory Compactors, with integral power.

Class E - Compressors (portable, Sewer, Heavy and Highway); Cranes-Compact, track or rubber under 4,000 pound capacity; Drum Firemen (asphalt plant); Fueling and greasing (Primary Operator with Specialized CDL Endorsement Add \$3.00/hr); Generators; Inboard-Outboard Motor Boat Launches; Masonry Fork Lifts; Oil Heaters (asphalt plant); Oilers/Helpers; Power Driven Heaters (oil fired); Power Scrubbers; Power Sweepers; Pumps (under 4 inch discharge); Signalperson; Survey Rodmen or Chairmen; Tire Repairmen; VAC/ALLS.
Master Mechanic - Master Mechanic

Prevailing Wage Rate Skilled Crafts

Name of Union: Painter Local 249

Change # : LCN03-2023ibLoc249

Craft : Drywall Finisher Effective Date : 11/22/2023 Last Posted : 11/22/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Painter Drywall Finisher	\$25.60		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.12	\$51.92
Apprentice Percent												
30 Day Probationary	50.00	\$12.80	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$20.08	\$26.48
1st Year	65.00	\$16.64	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$23.92	\$32.24
2nd Year	65.00	\$16.64	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$23.92	\$32.24
3rd Year	75.00	\$19.20	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$26.48	\$36.08
4th Year	85.00	\$21.76	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.04	\$39.92

Special Calculation Note :

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

CLARK, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE

Special Jurisdictional Note :

Details :

Industrial work but not limited to:work done on industrial plants, repair garages, processing plants,storage tanks, warehouses, skeleton structures,bridges,whether new or old construction, office buildings in industrial sites and interior of shopping malls.

Prevailing Wage Rate Skilled Crafts

Name of Union: Painter Local 249

Change # : LCN03-2023ibLoc249

Craft : Painter Effective Date : 11/22/2023 Last Posted : 11/22/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Painter Brush Roll	\$25.60		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.12	\$51.92
Paper Hanger	\$25.60		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.12	\$51.92
Spray Commercial	\$25.60		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.12	\$51.92
Spray Industrial	\$25.60		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.12	\$51.92
Sandblasting, Steam Cleaning-Lead Abatment	\$26.35		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.87	\$53.05
Special Coating (Coal Tar) Spray Applied	\$27.10		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.62	\$54.17
Steeplejack Work	\$26.55		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.07	\$53.35
Elevated Tanks	\$29.54		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.06	\$57.83
Water Blasting	\$26.35		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.87	\$53.05
Apprentice	Percent											
30 Day Probationary	50.00	\$12.80	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$20.08	\$26.48
1st Year	65.00	\$16.64	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$23.92	\$32.24
2nd Year	65.00	\$16.64	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$23.92	\$32.24
3rd Year	75.00	\$19.20	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$26.48	\$36.08
4th Year	85.00	\$21.76	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.04	\$39.92

Special Calculation Note :

Ratio :

Jurisdiction (* denotes special jurisdictional note

1 Journeymen to 1 Apprentice

):
CLARK, DARKE, GREENE, MIAMI, MONTGOMERY,
PREBLE

Special Jurisdictional Note :

Details :

Industrial work but not limited to:work done on industrial plants, repair garages, processing plants,storage tanks, warehouses, skeleton structures,bridges,whether new or old construction, office buildings in industrial sites and interior of shopping malls.

Prevailing Wage Rate Skilled Crafts

Name of Union: Painter Local 249 HevHwy

Change # : LCN03-2023ibLoc249

Craft : Painter Effective Date : 11/22/2023 Last Posted : 11/22/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Painter Bridge Blaster Class 1	\$37.31		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$50.83	\$69.48
Bridge Painter, Rigger, Containment Builder, Spot Blaster Class 2	\$34.31		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$47.83	\$64.98
Equipment Operator/Field Mechanic, Grit Reclamation, Paint Mixer, Traffic Control, Boat Person, Driver Class 3	\$32.31		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.83	\$61.99
Concrete Sealing, Concrete Blasting/Power Washing/Etc. Class 4	\$30.31		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.83	\$58.98
Quality Control/Quality Assurance, Traffic safety, Competent Person Class 5	\$30.31		\$6.50	\$6.69	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.83	\$58.98
Apprentice	Percent											
30 day Probationary	50.00	\$18.66	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$25.93	\$35.26
1st Year	65.00	\$24.25	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$31.53	\$43.66
2nd Year	65.00	\$24.25	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$31.53	\$43.66
3rd Year	75.00	\$27.98	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$35.26	\$49.25
4th Year	85.00	\$31.71	\$6.50	\$0.45	\$0.33	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$38.99	\$54.85

Special Calculation Note :

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note):

CLARK, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Painter Local 639

Change # : LCNO1-2015fbLoc639

Craft : Painter Effective Date : 06/10/2015 Last Posted : 06/10/2015

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Painter Metal Finisher/Helpers											
Top Helper Class A	\$19.09	\$3.65	\$0.00	\$0.00	\$0.66	\$0.00	\$0.00	\$0.00	\$0.00	\$23.40	\$32.94
Top Helper Class B	\$19.09	\$3.65	\$0.65	\$0.00	\$1.03	\$0.00	\$0.37	\$0.00	\$0.00	\$24.79	\$34.33
Top Helper Class C	\$19.09	\$3.65	\$1.00	\$0.00	\$1.76	\$0.00	\$0.37	\$0.00	\$0.00	\$25.87	\$35.41
Helper Class A	\$14.69	\$3.65	\$0.00	\$0.00	\$0.51	\$0.00	\$0.00	\$0.00	\$0.00	\$18.85	\$26.19
Helper Class B	\$14.69	\$3.65	\$0.65	\$0.00	\$0.79	\$0.00	\$0.28	\$0.00	\$0.00	\$20.06	\$27.40
Helper Class C	\$14.69	\$3.65	\$1.00	\$0.00	\$1.64	\$0.00	\$0.28	\$0.00	\$0.00	\$21.26	\$28.60
New Hire 90 Days	\$11.00	\$3.65	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$14.65	\$20.15

Special Calculation Note : Other is Sick and Personal Time

Ratio :

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, CUYAHOGA, DARKE, DEFIANCE, DELAWARE, ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GEAUGA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAKE, LAWRENCE, LICKING, LOGAN, LORAIN, LUCAS, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, SUMMIT, TRUMBULL,

TUSCARAWAS, UNION, VAN WERT, VINTON,
WARREN, WASHINGTON, WAYNE, WILLIAMS,
WOOD, WYANDOT

Special Jurisdictional Note :

Details :

Top Helper: Shall perform the responsibilities of a Helper and be responsible for the setup, break down, safety and quality of the company's product.

Helper : Shall be responsible for performing tasks in refinishing, compliance with safety procedures, setting up and breaking down job sites, scaffolding and swing stages and preparing surfaces for refinishing including but not limited to, masking and stripping and cleaning, oxidizing, polishing and scratch removal on various surfaces

Class A Workers: Less than 1 Year of Service.

Class B Workers: More than 1 and less than 8 Years of Service.

Class C Workers: More than 8 Years of Service.

Metal Polisher Scope of Work: Polishing, buffing, stripping, coloring, lacquering, spraying, cleaning and maintenance of ornamental and architectural metals, iron, bronze, nickel, aluminum and stainless steel and in mental specialty work, various stone finishes, stone specialty work and any other work pertaining to the finishing of metal, stones, woods, and any window washing/cleaning done in conjunction with this work, using chemicals, solvents, coatings and hand applied lacquer thinner, removing scratches from mirror finished metals, burnishing of bronze, statuary finishes on exterior and interior surfaces and the use of all tools required to perform such work, including but not limited to polishes, spray equipment and scaffolding.

Swing State Rate: All work on scaffold 4 sections or higher, including any boom lifts and swing stage scaffolds including the rigging and derigging of hanging/suspended swing stage systems and rappelling/bolson chair work, ADD \$1.50 per hour.

Prevailing Wage Rate Skilled Crafts

Name of Union: Painter Local 639 Zone 2 Sign

Change # : LCN01-2023ibLoc639

Craft : Painter Effective Date : 03/22/2023 Last Posted : 03/22/2023

	BHR	Fringe Benefit Payments						Irrevocable Fund		Total PWR	Overtime Rate
		H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)	MISC (*)		
Classification											
Painter Sign Journeyman Tech/Team Leader Class A	\$25.28	\$1.70	\$0.21	\$0.00	\$0.00	\$0.00	\$0.68	\$0.00	\$0.00	\$27.87	\$40.51
Painter Sign Journeyman Tech/Team Leader Class B	\$25.28	\$1.70	\$0.21	\$0.00	\$0.49	\$0.00	\$0.68	\$0.00	\$0.00	\$28.36	\$41.00
Painter Sign Journeyman Tech/Team Leader Class C	\$25.28	\$1.70	\$0.21	\$0.00	\$0.97	\$0.00	\$0.68	\$0.00	\$0.00	\$28.84	\$41.48
Painter Sign Journeyman Tech/Team Leader Class D	\$25.28	\$1.70	\$0.21	\$0.00	\$1.46	\$0.00	\$0.68	\$0.00	\$0.00	\$29.33	\$41.97
Sign Journeyman Class A	\$25.00	\$1.70	\$0.21	\$0.00	\$0.00	\$0.00	\$0.67	\$0.00	\$0.00	\$27.58	\$40.08
Sign Journeyman Class B	\$25.00	\$1.70	\$0.21	\$0.00	\$0.48	\$0.00	\$0.67	\$0.00	\$0.00	\$28.06	\$40.56
Sign Journeyman Class C	\$25.00	\$1.70	\$0.21	\$0.00	\$0.96	\$0.00	\$0.67	\$0.00	\$0.00	\$28.54	\$41.04
Sign Journeyman Class D	\$25.00	\$1.70	\$0.21	\$0.00	\$1.44	\$0.00	\$0.67	\$0.00	\$0.00	\$29.02	\$41.52
Tech Sign Fabrication/ Erector Class A	\$19.67	\$1.70	\$0.21	\$0.00	\$0.00	\$0.00	\$0.53	\$0.00	\$0.00	\$22.11	\$31.95
Tech Sign	\$19.67	\$1.70	\$0.21	\$0.00	\$0.38	\$0.00	\$0.53	\$0.00	\$0.00	\$22.49	\$32.33

Fabrication/ Erector Class B											
Tech Sign Fabrication/ Erector Class C	\$19.67	\$1.70	\$0.21	\$0.00	\$0.76	\$0.00	\$0.53	\$0.00	\$0.00	\$22.87	\$32.71
Tech Sign Fabrication/ Erector Class D	\$19.67	\$1.70	\$0.21	\$0.00	\$1.13	\$0.00	\$0.53	\$0.00	\$0.00	\$23.24	\$33.08

Special Calculation Note : Other is for paid holidays.

Ratio :

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ALLEN, AUGLAIZE, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GREENE, HAMILTON, HANCOCK, HARDIN, HENRY, HIGHLAND, HOLMES, HURON, JACKSON, KNOX, LICKING, LOGAN, LORAIN, LUCAS, MADISON, MAHONING, MARION, MERCER, MIAMI, MONTGOMERY, MORROW, MUSKINGUM, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TRUMBULL, TUSCARAWAS, UNION, VAN WERT, WARREN, WAYNE, WILLIAMS, WOOD, WYANDOT

Special Jurisdictional Note :

Details :

- Class A: less that 1 year.
- Class B: 1-3 years.
- Class C; 3-10 years.
- Class D: More than 10 years.

Prevailing Wage Rate Skilled Crafts

Name of Union: Plasterer Local 132 (Dayton)

Change # : LCN01-2023ibLoc132

Craft : Plaster Effective Date : 05/03/2023 Last Posted : 05/03/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Plasterer	\$27.39		\$7.80	\$7.35	\$0.70	\$0.00	\$3.45	\$0.06	\$0.00	\$0.00	\$46.75	\$60.45
Apprentice	Percent											
1st 6 months	70.00	\$19.17	\$7.80	\$0.00	\$0.70	\$0.00	\$3.45	\$0.06	\$0.00	\$0.00	\$31.18	\$40.77
2nd 6 months	74.00	\$20.27	\$7.80	\$0.00	\$0.70	\$0.00	\$3.45	\$0.06	\$0.00	\$0.00	\$32.28	\$42.41
3rd 6 months	78.00	\$21.36	\$7.80	\$7.35	\$0.70	\$0.00	\$3.45	\$0.00	\$0.00	\$0.00	\$40.66	\$51.35
4th 6 months	82.00	\$22.46	\$7.80	\$7.35	\$0.70	\$0.00	\$3.45	\$0.00	\$0.00	\$0.00	\$41.76	\$52.99
5th 6 months	86.00	\$23.56	\$7.80	\$7.35	\$0.70	\$0.00	\$3.45	\$0.00	\$0.00	\$0.00	\$42.86	\$54.63
6th 6 months	90.00	\$24.65	\$7.80	\$7.35	\$0.70	\$0.00	\$3.45	\$0.00	\$0.00	\$0.00	\$43.95	\$56.28
7th 6 months	94.00	\$25.75	\$7.80	\$7.35	\$0.70	\$0.00	\$3.45	\$0.00	\$0.00	\$0.00	\$45.05	\$57.92
8th 6 months	98.00	\$26.84	\$7.80	\$7.35	\$0.70	\$0.00	\$3.45	\$0.00	\$0.00	\$0.00	\$46.14	\$59.56

Special Calculation Note : *Other is International Training.

Ratio :

1 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note):

CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE, SHELBY

Special Jurisdictional Note :

Details :

OTHER IS:Industry Fund

Prevailing Wage Rate Skilled Crafts

Name of Union: Plumber Pipefitter Local 162

Change # : LCN01-2023ibLoc162

Craft : Plumber/Pipefitter Effective Date : 08/30/2023 Last Posted : 08/30/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Plumber Pipefitter	\$40.00		\$11.75	\$10.87	\$0.90	\$0.00	\$3.35	\$0.00	\$0.00	\$0.00	\$66.87	\$86.87
Apprentice Indentured AFTER 6/1/2002												
Percent												
1st Year	51.00	\$20.40	\$11.75	\$3.26	\$0.50	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$35.91	\$46.11
2nd Year	55.90	\$22.36	\$11.75	\$5.69	\$0.54	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$40.34	\$51.52
3rd Year	60.80	\$24.32	\$11.75	\$8.53	\$0.58	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.18	\$57.34
4th Year	72.45	\$28.98	\$11.75	\$10.63	\$0.66	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$52.02	\$66.51
5th Year	80.40	\$32.16	\$11.75	\$10.87	\$0.74	\$0.00	\$3.35	\$0.00	\$0.00	\$0.00	\$58.87	\$74.95

Special Calculation Note :

Ratio :

- 1 Journeyman to 1 Apprentice
- 2 - 4 Journeymen to 2 Apprentices
- 5 - 7 Journeymen to 3 Apprentices
- 8 - 10 Journeymen to 4 Apprentices

Jurisdiction (* denotes special jurisdictional note):

CHAMPAIGN, CLARK, CLINTON, DARKE, FAYETTE, GREENE, MIAMI, MONTGOMERY, PREBLE

Special Jurisdictional Note :

Details :

Wage rate covers: all plumbing, pipefitting, heating, refrigeration and air conditioning work.

Prevailing Wage Rate Skilled Crafts

Name of Union: Roofer Local 75

Change # : LCN01-2022sksLoc75

Craft : Roofer Effective Date : 08/26/2022 Last Posted : 08/26/2022

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Roofer	\$25.63		\$8.73	\$8.78	\$0.76	\$0.00	\$0.00	\$1.80	\$0.00	\$0.00	\$45.70	\$58.51
Slate and Tile	\$25.85		\$8.73	\$8.78	\$0.76	\$0.00	\$0.00	\$1.80	\$0.00	\$0.00	\$45.92	\$58.85
Apprentice												
	Percent											
1st term 1000 hrs	66.32	\$17.00	\$2.50	\$0.50	\$0.76	\$0.00	\$0.00	\$1.80	\$0.00	\$0.00	\$22.56	\$31.06
2nd term 1000 hrs	70.22	\$18.00	\$8.58	\$1.32	\$0.76	\$0.00	\$0.00	\$1.80	\$0.00	\$0.00	\$30.46	\$39.46
3rd term 1000 hrs	74.12	\$19.00	\$8.58	\$2.20	\$0.76	\$0.00	\$0.00	\$1.80	\$0.00	\$0.00	\$32.34	\$41.84
4th term 1000 hrs	78.02	\$20.00	\$8.58	\$3.07	\$0.76	\$0.00	\$0.00	\$1.80	\$0.00	\$0.00	\$34.21	\$44.20
5th term 1000 hrs	81.95	\$21.00	\$8.58	\$3.95	\$0.76	\$0.00	\$0.00	\$1.80	\$0.00	\$0.00	\$36.09	\$46.60
Tradesman	79.00	\$20.25	\$5.00	\$1.58	\$0.76	\$0.00	\$0.00	\$1.80	\$0.00	\$0.00	\$29.39	\$39.51

Special Calculation Note : Other is for National Roofing Industry Pension Plan.

Ratio :

3 Journeymen to 2 Apprentices

Jurisdiction (* denotes special jurisdictional note):

ALLEN, AUGLAIZE, CLARK, CLINTON, DARKE, GREENE, MERCER, MIAMI, MONTGOMERY, PREBLE, SHELBY, VAN WERT

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Sheet Metal Local 24 (Dayton)

Change # : LCN01-2023ibLoc24(Day)

Craft : Sheet Metal Worker Effective Date : 06/07/2023 Last Posted : 06/07/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Sheet Metal Worker	\$31.23		\$9.64	\$15.10	\$1.05	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$57.02	\$72.63
Apprentice	Percent											
Apprentice												
5th Year B	85.00	\$26.55	\$9.40	\$11.47	\$1.05	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$48.47	\$61.74
5th Year A	80.00	\$24.98	\$9.31	\$10.28	\$1.05	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.62	\$58.12
4th Year B	75.00	\$23.42	\$9.23	\$9.07	\$1.05	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$42.77	\$54.48
4th Year A	70.00	\$21.86	\$9.15	\$7.85	\$1.05	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$39.91	\$50.84
3rd year B	65.00	\$20.30	\$9.06	\$6.65	\$1.05	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$37.06	\$47.21
3rd Year A	60.00	\$18.74	\$8.98	\$5.44	\$1.05	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$34.21	\$43.58
2 Year B	57.52	\$17.96	\$8.94	\$4.84	\$1.05	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$32.79	\$41.78
2 Year A	55.00	\$17.18	\$8.90	\$4.23	\$1.05	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$31.36	\$39.94
Probationary 1 Year	52.50	\$16.40	\$8.86	\$3.63	\$1.05	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$29.94	\$38.13

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

1 Journeyman to 1 Apprentice then,
1 Apprentice for every 2 Journeymen thereafter

Jurisdiction (* denotes special jurisdictional note):

ALLEN, AUGLAIZE, BUTLER, CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, HARDIN, LOGAN, MERCER, MIAMI, MONTGOMERY, PREBLE, SHELBY, VAN WERT, WARREN, WYANDOT

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Sprinkler Fitter Local 669

Change # : LCN01-2022sksLoc669

Craft : Sprinkler Fitter Effective Date : 04/06/2022 Last Posted : 04/06/2022

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Sprinkler Fitter	\$43.75		\$10.99	\$7.10	\$0.52	\$0.00	\$5.12	\$0.00	\$0.00	\$0.00	\$67.48	\$89.35
Apprentice Indentured after April 1, 2013	Percent											
CILASS 1	45.00	\$19.69	\$7.85	\$0.00	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$28.06	\$37.90
CLASS 2	50.02	\$21.88	\$7.85	\$0.00	\$0.52	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$30.25	\$41.20
CLASS 3	54.43	\$23.81	\$10.99	\$7.10	\$0.52	\$0.00	\$1.15	\$0.00	\$0.00	\$0.00	\$43.57	\$55.48
CLASS 4	59.43	\$26.00	\$10.99	\$7.10	\$0.52	\$0.00	\$1.15	\$0.00	\$0.00	\$0.00	\$45.76	\$58.76
CLASS 5	64.43	\$28.19	\$10.99	\$7.10	\$0.52	\$0.00	\$1.40	\$0.00	\$0.00	\$0.00	\$48.20	\$62.29
CLASS 6	69.43	\$30.38	\$10.99	\$7.10	\$0.52	\$0.00	\$1.40	\$0.00	\$0.00	\$0.00	\$50.39	\$65.57
CLASS 7	74.43	\$32.56	\$10.99	\$7.10	\$0.52	\$0.00	\$1.40	\$0.00	\$0.00	\$0.00	\$52.57	\$68.85
CLASS 8	79.42	\$34.75	\$10.99	\$7.10	\$0.52	\$0.00	\$1.40	\$0.00	\$0.00	\$0.00	\$54.76	\$72.13
CLASS 9	84.43	\$36.94	\$10.99	\$7.10	\$0.52	\$0.00	\$1.40	\$0.00	\$0.00	\$0.00	\$56.95	\$75.42
CLASS 10	89.44	\$39.13	\$10.99	\$7.10	\$0.52	\$0.00	\$1.40	\$0.00	\$0.00	\$0.00	\$59.14	\$78.70

Special Calculation Note :

Ratio :

1 Journeyman to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note):

ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LUCAS, MADISON, MAHONING, MARION, MEDINA, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW,

MUSKINGUM, NOBLE, OTTAWA, PAULDING,
PERRY, PICKAWAY, PIKE, PORTAGE, PREBLE,
PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO,
SENECA, SHELBY, STARK, SUMMIT, TRUMBULL,
TUSCARAWAS, UNION, VAN WERT, VINTON,
WARREN, WASHINGTON, WAYNE, WILLIAMS,
WOOD, WYANDOT

Special Jurisdictional Note :

Details :

Sprinkler Fitter work shall consist of the installation,dismantling,maintenance,repairs,adjustments,and corrections of all fire protection and fire control systems including the unloading,handling by hand,power equipment and installation of all piping or tubing,appurtenances and equipment pertaining thereto,including both overhead and underground water mains,fire hydrants and hydrant mains,standpipes and hose connections to sprinkler systems used in connection with sprinkler and alarm systems. Also all tanks and pumps connected thereto,also included shall be CO-2 and Cardox Systems, Dry Chemical Systems,Foam Systems and all other fire protection systems.

Prevailing Wage Rate Skilled Crafts

Name of Union: Truck Driver Bldg & HevHwy Class 1
Locals 20,40,92,92b,100,175,284,438,377,637,908,957

Change # : LCN01-2023ibBldgHevHwy

Craft : Truck Driver Effective Date : 05/01/2023 Last Posted : 04/26/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Truck Driver CLASS 1 4 wheel service, dump, and batch trucks; drivers on tandems; truck sweepers (not to include power sweepers & scrubbers)	\$31.24		\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$48.39	\$64.01
Apprentice	Percent											
First 6 months	80.00	\$24.99	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$42.14	\$54.64
7-12 months	85.00	\$26.55	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.70	\$56.98
13-18 months	90.00	\$28.12	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.27	\$59.32
19-24 months	95.00	\$29.68	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$46.83	\$61.67
25-30 months	100.00	\$31.24	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$48.39	\$64.01

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :
3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :
 ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT,

CLINTON, COLUMBIANA, COSHOCTON,
CRAWFORD, DARKE, DEFIANCE, DELAWARE,
ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON,
GALLIA, GREENE, GUERNSEY, HAMILTON,
HANCOCK, HARDIN, HARRISON, HENRY,
HIGHLAND, HOCKING, HOLMES, HURON,
JACKSON, JEFFERSON, KNOX, LAWRENCE,
LICKING, LOGAN, LORAIN, LUCAS, MADISON,
MAHONING, MARION, MEDINA, MEIGS, MERCER,
MIAMI, MONROE, MONTGOMERY, MORGAN,
MORROW, MUSKINGUM, NOBLE, OTTAWA,
PAULDING, PERRY, PICKAWAY, PIKE, PORTAGE,
PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY,
SCIOTO, SENECA, SHELBY, STARK, SUMMIT,
TRUMBULL, TUSCARAWAS, UNION, VAN WERT,
VINTON, WARREN, WASHINGTON, WAYNE,
WILLIAMS, WOOD, WYANDOT

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

Name of Union: Truck Driver Bldg & HevHwy Class 2
Locals 20,40,92,92b,100,175,284,438,377,637,908,957

Change # : LCN01-2023ibBldgHevHwy

Craft : Truck Driver Effective Date : 05/01/2023 Last Posted : 04/26/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Truck Driver CLASS 2 Tractor Trailer-Semi Tractor Trucks; Pole Trailers; Ready Mix Trucks; Fuel Trucks; 5 Axle & Over; Belly Dumps; Low boys - Heavy duty Equipment(irrespective of load carried) when used exclusively for transportation; Truck Mechanics (when needed)	\$31.66		\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$48.81	\$64.64
Apprentice	Percent											
First 6 months	80.00	\$25.33	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$42.48	\$55.14
7-12 months	85.00	\$26.91	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$44.06	\$57.52
13-18 months	90.00	\$28.49	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45.64	\$59.89
19-24 months	95.00	\$30.08	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$47.23	\$62.27
25-30 months	100.00	\$31.66	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$48.81	\$64.64

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note):

ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE,

LICKING, LOGAN, LORAIN, LUCAS, MADISON,
MAHONING, MARION, MEDINA, MEIGS, MERCER,
MIAMI, MONROE, MONTGOMERY, MORGAN,
MORROW, MUSKINGUM, NOBLE, OTTAWA,
PAULDING, PERRY, PICKAWAY, PIKE, PORTAGE,
PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY,
SCIOTO, SENECA, SHELBY, STARK, SUMMIT,
TRUMBULL, TUSCARAWAS, UNION, VAN WERT,
VINTON, WARREN, WASHINGTON, WAYNE,
WILLIAMS, WOOD, WYANDOT

Special Jurisdictional Note :

Details :

Prevailing Wage Rate Skilled Crafts

**Name of Union: Truck Driver Bldg & HevHwy Class 3
Locals 20,40,92,92b,100,175,284,438,377,637,908,957**

Change # : LCN01-2023ibBldgHevHwy3

Craft : Truck Driver Effective Date : 05/01/2023 Last Posted : 04/26/2023

	BHR		Fringe Benefit Payments					Irrevocable Fund		Total PWR	Overtime Rate	
			H&W	Pension	App Tr.	Vac.	Annuity	Other	LECET (*)			MISC (*)
Classification												
Truck Driver CLASS 3 Articulated Dump Trucks; Ridge-Frame Rock Trucks; Distributor Trucks)	\$32.66		\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$49.81	\$66.14
Apprentice	Percent											
First 6 months	80.00	\$26.13	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$43.28	\$56.34
7-12 months	85.00	\$27.76	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$44.91	\$58.79
13-18 months	90.00	\$29.39	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$46.54	\$61.24
19-24 months	95.00	\$31.03	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$48.18	\$63.69
25-30 months	100.00	\$32.66	\$7.75	\$9.20	\$0.20	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$49.81	\$66.14

Special Calculation Note : No special calculations for this skilled craft wage rate are required at this time.

Ratio :

3 Journeymen to 1 Apprentice

Jurisdiction (* denotes special jurisdictional note) :

ADAMS, ALLEN, ASHLAND, ASHTABULA, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COLUMBIANA, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, ERIE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY,

HIGHLAND, HOCKING, HOLMES, HURON,
JACKSON, JEFFERSON, KNOX, LAWRENCE,
LICKING, LOGAN, LORAIN, LUCAS, MADISON,
MAHONING, MARION, MEDINA, MEIGS, MERCER,
MIAMI, MONROE, MONTGOMERY, MORGAN,
MORROW, MUSKINGUM, NOBLE, OTTAWA,
PAULDING, PERRY, PICKAWAY, PIKE, PORTAGE,
PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY,
SCIOTO, SENECA, SHELBY, STARK, SUMMIT,
TRUMBULL, TUSCARAWAS, UNION, VAN WERT,
VINTON, WARREN, WASHINGTON, WAYNE,
WILLIAMS, WOOD, WYANDOT

Special Jurisdictional Note :

Details :

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes following:
1. Work covered by Contract Documents
 2. Type of Contract
 3. Permits, fees, and notices
 4. Owner-furnished products
 5. Use of premises
 6. Owner's right to maintain school operations
 7. Owner's occupancy requirements
 8. Work restrictions
 9. Specification formats and conventions
 10. Miscellaneous provisions
 11. Use of domestic steel
 12. Smoking policy
 13. Contractors construction sequence.
- B. Related Sections include following:
1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Edison State Community College, Convocation Center Expansion, Project No. 223193.00
1. Project Location: 1973 Edison Drive, Piqua, Ohio 45653
- B. Owner: Edison State Community College, 1973 Edison Drive, Piqua, Ohio 45653
1. Owner's Representative: Harold Hitchcock, 1973 Edison Drive, Piqua, Ohio 45653.
- C. Contracting Authority: Ohio Facilities Construction Commission (OFCC)
1. OFCC Representative: Heather Brink, Project Manager, 614-551-3024, Heather.Brink@ofcc.ohio.gov.
 2. OFCC Coordinator: Amber Cantrell, Project Coordinator, 614-809-8985, Amber.Cantrell@ofcc.ohio.gov.
- D. A/E: Fanning/Howey Associates, Inc., 128 West Market Street, Celina, Ohio 45822
- E. Other Owner Consultants: The Owner has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. Access Engineering Solutions, LLC, 1200 Irmischer Boulevard, Suite B, Celina, Ohio 45822
 2. CTL Engineering, Inc., 102 Commerce Drive, Wapakoneta, Ohio 45895
 3. Jezerinac Geers & Associates, Inc., 5640 Frantz Road, Dublin, Ohio 43017
 4. Prater Engineering Associates, Inc., 6130 Wilcox Road, Dublin, Ohio 43016
- F. Project Web Site: A Project Web Site administered by OFCC will be used for the purposes of managing communication and documents during the construction stage.
1. See Division 01 Section "Project Management and Coordination" for CM's requirements for administering and utilizing the Project Web Site.

- G. Work consists of following:
 - 1. The work includes construction of an addition on the east side of the existing Convocation Center located in the North Hall area of the campus. This area will be used for two locker rooms, two coaches' offices, and a storage room with washer/dryer hookups. A new set of egress exit doors at the northwest corner of the gym are to be included. The existing opening will become the entrance to the locker rooms. A new entrance to the existing exercise room from new locker rooms is to be installed.

1.3 TYPE OF CONTRACT

- A. Project will be constructed under a single prime contract.

1.4 PERMITS, FEES, AND NOTICES

- A. Contractor shall secure and pay for permits, inspections, governmental fees, tap-in fees, and licenses necessary for proper execution and completion of Work, which are applicable at time bids are received, unless otherwise noted.
 - 1. A/E shall assist Owner in applying for "Certificate of Plan Approval" (General Building Permit) typically required by law for projects similar to one for which A/E's services are engaged.
 - 2. General Trades Contractor shall complete Notice of Termination (NOT) Form for Ohio EPA General Permits (EPA Form 4493). See Division 00 Document "Ohio EPA "Notice for Termination (NOT) of Coverage Under Ohio Environmental Protection Agency General NPDES Permit". Notify Owner that request for NOT has been applied for.
- B. Utility Tie-Ins: Shall be arranged with local utility company and other involved parties for minimum interruption of service.
- C. Inspections of installed work shall be performed by governing authority as arranged for by Contractor. Work shall not be covered until approved.
- D. Contractor shall give notices and comply with laws, ordinances, rules, regulations, and orders of public authorities bearing on performance of his Work. If a Contractor observes that Contract Documents are at variances therewith, he shall promptly notify A/E in writing, and necessary changes shall be adjusted by appropriate notification. If a Contractor performs Work knowing it to be contrary to such laws, ordinances, rules, and regulations, and without such notice to A/E, he shall assume full responsibility therefore and shall bear costs attributable thereto.

1.5 WORK UNDER OTHER CONTRACTS

- A. Owner intends to complete following items of Work outside provisions of these Contract Documents. Contractor shall not restrict or interfere with Owner's right to Project to accomplish this Work.
 - 1. Existing school maintenance work.
 - 2. Loose equipment and furniture except as scheduled and specified under Divisions 11 and 12 and shown on Drawings.
 - 3. Purchase and supplying of certain materials as noted in Project Manual.

1.6 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.
- B. Owner-Furnished Products:
 - 1. Division 10 Section "Toilet, Bath, and Laundry Accessories".

1.7 USE OF PREMISES

- A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which Work is indicated.
 - 1. Owner Occupancy: Allow for Owner occupancy of Project site and use by public.
 - 2. Driveways and Entrances: Keep undesignated driveways parking area, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use undesignated areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 OWNER'S RIGHT TO MAINTAIN SCHOOL OPERATIONS

- A. During course of this Project, normal and customary school functions and operations must be maintained. Contract Documents are intended to define a strict separation between school activities of students and staff from activities of construction project.
- B. A/E and Owner will not tolerate any visible or audible actions initiated or responded to by any employees of Contractors on this Project toward any students, teachers, or staff members at school system. Violators shall be promptly removed from site.
- C. Owner intends to instruct students, teachers, and staff to refrain from communications with Contractor's personnel working on this Project. All communication with Owner and staff shall be through A/E.
- D. Contractors shall expend their best effort toward protection of health, safety, and welfare of occupants on Owner's property during course of Work on this Project.
- E. Contractors and subcontractors shall be subject to such rules and regulations for conduct of Work as Owner may establish. Employees shall be properly and completely clothed while working. Bare torsos, legs, and feet will not be allowed. Possession or consumption of alcoholic beverages or drugs, tobacco, or other noxious behavior on Project site is strictly prohibited. Violators shall be promptly removed from Project site. Smoking is not permitted on school property or within school buildings.

1.9 OWNER'S OCCUPANCY REQUIREMENTS

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

- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of Work. Such placement of equipment and partial occupancy shall not constitute acceptance of total Work.
 - 1. A/E will prepare a Certificate of Substantial Completion for each specific portion of Work to be occupied before Owner occupancy.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
 - 3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.10 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Work shall be generally performed inside existing building during normal business working hours of 7:00 a.m. to 4:00 p.m., Monday through Friday, except otherwise indicated.
 - 1. Work outside normal business hours must be approved by A/E and Owner at least 24 hours in advance.
 - a. No work including work outside normal business hours may be performed without Contractor's Foreman/Superintendent present.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify A/E and Owner not less than two days in advance of proposed disruptive operations.
 - 2. Obtain A/E's and Owner's written permission before proceeding with disruptive operations.
- E. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
- F. The implementation and adherence of the COVID-19 safety protocols are the responsibility of the companies, as are all other aspects of worker safety. These safety protocols may be updated time to time, and in accordance with other guidelines and orders.
 - 1. For more information and resources about COVID-19, visit coronavirus.ohio.gov and call 1-833-4-ASK-ODH with your questions. You may also contact your local health department.
 - 2. Please direct questions regarding OFCC-specific guidelines and protocols to Coronavirus@ofcc.ohio.gov.

1.11 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
 2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by CM. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by CM or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.12 SMOKING POLICY

- A. Smoking Ban:
1. Smoking is prohibited in any "public place" or "place of employment" as of December 7, 2006. For definitions of a "public place" and "place of employment," refer to ORC 3794.01 Definitions.
 2. All "public places" and "places of employment" must, by December 7, 2006, post conspicuous signs at each entrance. The signs shall be clearly legible and shall contain a toll-free number for reporting violations. Refer to ORC 3794.06 (A) Posting of Signs.

1.13 CONTRACTOR'S CONSTRUCTION SEQUENCE

- A. Sequence of construction is based upon receiving bids May 1, 2024; beginning Work May 7, 2024; and Substantial Completion by January 7, 2025.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

NO SMOKING



To report violations call
866-559-OHIO (6446)
in accordance with Chapter 3794
of the Ohio Revised Code.

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
- C. Related Sections include the following:
 - 1. Division 00 Document – General Conditions (Paragraphs 4.2 and 4.3).
 - 2. Divisions 02 through 49 Sections for items of Work covered by allowances.

1.2 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise A/E of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At A/E's request, obtain and submit not less than three (3) proposals for the work of each allowance for use in making final selections. Include recommendations that are relevant to proper performance of the Work.
- C. Purchase products and systems selected (in writing) by A/E from the designated supplier.
- D. Submit proposals and recommendations, for purchase of products or systems of allowances, in form specified for Change Orders.

1.3 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.4 COORDINATION

- A. Coordinate allowance items with other portions of the Work to ensure that each selection is completely integrated and interfaced with related work. Furnish templates as required to coordinate installation.

1.5 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.

- B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by A/E under allowance shall be included as part of the Contract Sum and not part of the allowance.
 - 1. The Contract includes the following paragraph:
 - a. "The CM's cost for handling, labor, installation, overhead, profit, and other expense contemplated for the original allowance must be included in the Contract Sum and not in the allowance".

1.6 CHANGE ORDER DATA

- A. Where applicable, include in each change order proposal both the quantities of products being purchased and unit costs, along with total amount of purchases to be made. Indicate, delivery charges, and amount of applicable trade discounts.

1.7 CHANGE ORDER MARK-UP

- A. Except as otherwise indicated, comply with provisions of General Conditions. For each allowance, CM's claims for increased costs (for either purchase order amount of CM's handling, labor, installation, overhead and profit), because of a change in scope or nature of the allowance work as described in contract documents, must be submitted within 60 days of initial change order authorizing work to proceed on that allowance; otherwise, such claims will be rejected.

1.8 UNUSED MATERIALS

- A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by A/E, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by A/E, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

1.9 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 - 3. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Lump Sum Allowances: Include the following lump sum allowance amounts in Base Bid for inclusion in the Contract Sum:
1. Allowance No. 1: Include the sum of \$10,000 in Base Bid, as specified in Division 11 Section "Commercial Laundry Equipment".

END OF SECTION 01 21 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. 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.
 - 2. Alternates described in this Section are part of the Work only if enumerated in the Contract.

1.3 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: Training Room
 - 1. Base Bid: Provide for future training room expansion as indicated.
 - 2. Alternate: Provide training room addition as indicated.
- B. Alternate No. 2: Built-In Casework
 - 1. Base Bid: Provide only built-in casework as indicated in Laundry Room.
 - 2. Alternate: Provide built-in casework as indicated in office(s).
- C. Alternate No. 3: Loose Furnishings
 - 1. Base Bid: No work.
 - 2. Alternate: Provide loose furnishings in lieu of built-in casework as indicated.

- D. Alternate No. 4: Plastic Toilet Compartments
 - 1. Base Bid: Provide metal toilet compartments as indicated.
 - 2. Alternate: Provide solid-plastic toilet compartments in lieu of metal toilet compartments as indicated.

- E. Alternate No. 5: Moisture Vapor Emission Control
 - 1. Base Bid: No additional moisture vapor emission control at resinous flooring beyond prime.
 - 2. Alternate: Provide moisture vapor emission control under decorative resinous flooring as indicated and specified in Division 09 Section "Moisture Vapor Emission Control".

- F. Alternate No. 6: Parking Lot Cameras
 - 1. Base Bid: Existing wall mounted cameras remain.
 - 2. Alternate: Provide two 360-degree pole mounted parking lot cameras to be installed as indicated in lieu of wall mounted cameras.

END OF SECTION 01 23 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Construction Progress Schedule.
 - a. Article 6.5 "Construction Progress Schedule of the General Conditions".
 - 2. Daily construction reports.
 - 3. Material location reports.
 - 4. Field condition reports.
 - 5. Use of site plan.
 - 6. Special reports.
- B. Related Sections include the following:
 - 1. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
 - 2. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.2 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in electronic format:
- B. Construction Progress Schedule: Submit copies of initial schedule, large enough to show entire schedule for entire construction period.
- C. Daily Construction Reports: Submit at weekly intervals.
- D. Material Location Reports: Submit at monthly intervals.
- E. Field Condition Reports: Submit at time of discovery of differing conditions.
- F. Special Reports: Submit at time of unusual event.

PART 2 - PRODUCTS

2.1 CONSTRUCTION PROGRESS SCHEDULE, GENERAL

- A. Refer to "Construction Progress Schedule" in Article 6.5 "Construction Progress Schedule of the General Conditions" of the General Conditions.

2.2 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. Approximate count of personnel at Project site.
 - 3. Equipment at Project site.
 - 4. Material deliveries.
 - 5. High and low temperatures and general weather conditions.
 - 6. Accidents.
 - 7. Meetings and significant decisions.
 - 8. Unusual events (refer to special reports).
 - 9. Stoppages, delays, shortages, and losses.
 - 10. Meter readings and similar recordings.
 - 11. Emergency procedures.

12. Orders and requests of authorities having jurisdiction.
13. Work/Change Orders received and implemented.
14. Services connected and disconnected.
15. Equipment or system tests and startups.
16. Partial Completions and occupancies.
17. Contract Completions authorized.

- B. Material Location Reports: 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 of 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.

2.3 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within 3 days 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, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

2.4 PROJECT USE OF SITE PLAN

- A. The Contractor will prepare a proposed Project Use of Site Plan.
- B. Confine operations at the Project site to areas within the areas indicated and as approved on the Use of Site Plan, and as permitted by law, ordinances, and permits. Site shall not be unreasonably encumbered with materials, products, or construction equipment.
- C. Proposed Use of Site Plan shall include access to proposed building for construction purposes, storage of materials and products, parking, where possible, for employees, temporary facilities including offices, storage, and workshop sheds or portable trailers, and unloading space.
 1. Indicate staff and student access routes; zoning of building areas; temporary exists to eliminate dead-end corridors during construction.
 - a. Indicate how mechanical systems air handling units are zoned and ductwork routed, so construction can be isolated without affecting air distribution in occupied areas.
 - b. Indicate routing of existing electrical feeders and switchgear to ensure occupied spaces have continuous power sourcing.
 - c. Indicate where temporary partitions will be used to protect students.
 - d. Designate staging areas protected from students and public.
- D. The Owner will indicate which portions of the existing parking lot and nonpaved areas can be used for construction activities. Damage to existing parking lot or unpaved areas shall be paid for by the Contractor.
- E. Construction fencing to separate areas from students, staff and visitors.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 00

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes Preliminary Construction Schedule, Baseline Schedule, Monthly Progress Schedules, and Recovery Schedules.
 - 1. For clarity, this Section uses the term Schedule Manager for activities performed by the Contractor (General Contracting).
 - 2. In its Base Bid, the Contractor shall include providing scheduling services to meet these requirements.
- B. Accepted Schedules will be used to plan organize, and execute the work, to measure the progress of the work, to coordinate and complete remaining work, to aid in evaluating time extensions, and to provide the basis for all progress payments.
- C. Failure to maintain Schedules in a contract compliant status may result in the Contracting Authority withholding payment until the schedule is accepted in accordance with Section 9.8 of the General Conditions.
- D. Related Sections:
 - 1. 01 11 00 – Summary of Work
 - 2. 01 30 00 – Administrative Requirements
 - 3. 01 70 00 – Execution and Closeout Requirements

1.02 DEFINITIONS

- A. Construction Type 1 - Earth Moving: Construction activities include but not limited to excavation, grading, trenching, backfilling, landscaping.
- B. Construction Type 2 - Structures and Surfacing: Construction activities include but not limited to civil structures, engineered structures, architectural assemblies, pavements.

1.03 SUBMITTALS

- A. 90-Day Preliminary Schedule with Narrative Report: Defines the Contractor's planned operations for the first 90 calendar days and shall be submitted for acceptance within 30 calendar days after the Notice to Proceed is issued.
- B. Baseline Schedule with Narrative Report: Defines the Contractor's planned operations for the duration of the contract to completion, issuance of the Certificate of Substantial Completion and shall be submitted for acceptance within 90 calendar days after the Notice to Proceed is issued.
- C. Monthly Progress Schedules with Narrative Report: Indicates deviations from the Baseline Schedule and the preceding Monthly Progress Schedule and/or Recovery Schedule as applicable with Narrative Report. The narrative report should include, but not limited to, logic changes, added/deleted activities and justification for changes made. Monthly Progress Schedules with Narrative Report shall be submitted at the last Progress Meeting of the month.

- D. Recovery Schedules with Narrative Report: Indicates revisions to a Monthly Progress Schedule to regain contract compliance with Milestone dates, date of Substantial Completion, date of Contract Completion, and deviations from the Baseline Schedule. Recovery Schedules with Narrative Report shall be submitted before the first Progress Meeting of the month. Recovery Schedule with Narrative Report is required if the preceding Monthly Progress Schedule with recorded adverse weather exceeds the Baseline Schedule's Milestone dates, date of Substantial Completion, and/or date of Contract Completion by calendar days greater than the recorded adverse weather days.
- E. Two-Week Look-Ahead Report: Reports the activities of the previous 7 calendar days, approximate percentage of total activity completed to date, and manpower loading-by-trade; activities anticipated in the succeeding 7 calendar days; and activities in the succeeding 7 calendar days thereafter. The Two-Week Look-Ahead Report shall be submitted at each Progress Meeting. Two-Week Look-Ahead Report activities are to correlate to activities within the construction schedule, including additional detail as necessary.
- F. Schedule Manager Resume: Submitted by email for acceptance no later than 7 calendar days after the Notice to Proceed.
- G. Schedule submittals are to be submitted as a live file in .XML format as well as a PDF for reference.
- H. Submittal Procedure for Schedules: Submitted through the Schedule Approvals business process in the State's web-based project management system, OAKS Capital Improvements (OCI).

1.04 QUALIFICATIONS

- A. Schedule Manager: Minimum 5 years' experience in critical path method scheduling using Oracle's Primavera P6 software.

1.05 SCHEDULE KICK-OFF MEETING

- A. The purpose of the Schedule Kick-Off Meeting is to review the contract requirements for construction scheduling including, but not limited to:
 - 1. Applicable delivery method template
 - 2. Project calendars
 - 3. Project Level Activity Codes
 - 4. Minimum WBS breakdown
 - 5. Anticipated project work sequence
 - 6. Submission methodologies

PART 2 PRODUCTS

2.01 SCHEDULE SOFTWARE

- A. The computer software utilized by the Schedule Manager to produce the project schedules will be Oracle's Primavera P6 software, version 6 or later.

PART 3 EXECUTION

3.01 CRITICAL PATH METHOD

- A. The Critical Path Method (CPM) of network calculations will be used to generate the schedule. The Schedule Manager shall provide project schedules (Preliminary, Baseline, Progress Updates, Recovery, etc.) in .XML formatting as well as a .PDF for reference. Note: The required formatting may be waived by the Project Manager if the Contractor's proposed alternate formatting is supported by exceptional circumstances, i.e., short contract duration (less than six months) with a single trade.

3.02 SCHEDULE STRUCTURE

- A. With the exception of the Preliminary Schedule submission, the Construction Schedule shall include an appropriate level of detail. Failure of the Schedule Manager to develop or update the schedule or provide resource information will result in the schedule not being accepted.
 - 1. Provide a standard project calendar working day schedule that shows the various activities of work in sufficient detail to demonstrate a reasonable and workable plan to complete the work per the contract. Show the order and interdependence of activities and the sequence for accomplishing the work. Describe all activities in sufficient detail so that the Contracting Authority can readily identify the work and measure the progress of each activity. The Baseline Schedule must reflect the scope of work, required phasing, Owner requirements, Owner activities as predecessors to Contractor activities, interim Milestone completion dates (as needed), Substantial Completion Finish on or Before Milestone, the Contract Completion Finish on or Before Milestone, and other project milestones established in the Contract Documents. Include activities for critical project submittals, working drawings, shop drawing preparation, review and approval time for submittals and shop drawings, material procurement and fabrication, and the delivery of materials, plant, and equipment, and other similar activities.
 - 2. The Contractor shall be responsible for assuring all work, including all subcontractor work, is included in the Baseline Schedule. The Contractor shall be responsible for assuring that all work sequences are logical and that the schedule indicates a coordinated plan.
 - 3. Failure by the Contractor to include any element of work required for performance of the Contract shall not excuse the Contractor from completing all work within the required time. The Contracting Authority's review of the baseline schedule will be for compliance with the specifications and contract requirements. Acceptance by the Contracting Authority will not relieve the Contractor of any of their responsibilities for the accuracy or feasibility of the schedule. Omissions and errors will be corrected as described in paragraph 3.02.F. Project Level Activity Codes or paragraph 3.02.K. Milestones and will not affect the Contract Times.
- B. Activity Durations:
 - 1. Submit the following data to support the standard project calendar as it relates to durations. Failure of the Schedule Manager to include this data will delay the review of the submittal until the Contracting Authority receives the missing data.
 - a. The proposed number of working days per week
 - b. The holidays to be observed during the life of the contract (by day, month, and year)
 - c. Exception dates set aside by the Owner as non-working days
 - d. The planned number of shifts per day
 - e. Break up the work into activities of a duration no longer than 20 workdays each, except as to non-construction activities (e.g., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities for which the contracting Authority may approve a longer duration.

- f. Activity durations will be in whole days, do not include decimals in the duration. Do not represent the Owner requirements, erosion control, and other similar items as single activities extending to the Substantial Completion date. Break these Contract Items into component activities.
- C. Activity Logic:
1. All activities, except the first activity, shall have a predecessor(s). All activities, except the final activity, shall have a successor(s).
 2. Use only finish to start relationships with no leads or lags to link activities or using start to start relationships with lags no greater than the predecessor duration to link activities.
 3. Use of finish-to-finish relationships is permitted when both activities are already lined with a start to start relationship.
- D. Procurement Activities:
1. Prepare the schedule in chronological order of critical submittals. Show specification section of the submittal, name of Contractor and generic description of work covered. Include activities to cover the complete procurement process to include submittal, review, approval, resubmittal, re-review, procurement, fabrication, delivery, permits, and similar pre-construction work.
- E. Project Level Resources:
1. Activities shall include a primary resource of estimated budgeted units indicating man hours associated with each activity.
 2. Identification of manpower, material, or equipment restrictions, as well as any activity requiring unusual shift work, such as two shifts per day, six-day work week, specified overtime, or work at times other than regular days or hours shall clearly be identified in the Project Schedule as needed.
 3. Critical or near Critical Paths resulting from the use of manpower or equipment restraints shall be kept to a minimum. Near Critical Paths are defined as paths having 10 workdays or less of total float.
- F. Project Level Activity Codes:
1. All activities shall be assigned, at a minimum, the following Project Level Activity Codes.
 - a. Responsibility indicating the party responsible to perform the work. Responsibility includes, but is not limited to, the contracting firm, the subcontracting firm, Contractor workforce or Agency performing a given task. Activities shall not belong to more than one responsible party.
 - b. Weather Dependent (Type 1, Type 2, or None)
 - c. Off hour work or unique shifting requirements
- G. Project Level Calendars:
1. Only project level calendars are to be utilized. All project level calendars are to be set with the detailed work hours/day calculating from 8 am-5 pm, with the noon hour break for lunch and shall inherit no exceptions or holidays from global calendars. The project level calendar names shall be utilized to identify specific planned work hours on site (4'10s, 5D, 6D, etc.) The contracting authority monitors progress on 1-day duration basis, it is the responsibility of the Contractor to execute the hours/resources needed to accomplish an activity in a given 1-day duration. No global data of any kind (codes, calendars, etc.) is to be used.

H. Activity Default Settings:

1. An activity should have the below default activity settings. Any variances must be approved by the Contracting Authority.
 - a. Activity Type: Task Dependent
 - b. Duration Type: Fixed Duration & Units
 - c. % Complete Type: Duration

I. Schedule Group and Sort Organization:

1. Arrange the schedule to show each major area of construction for each major category or unit of work by Work Breakdown Structure (WBS) or Project Level Activity Codes. The schedule organization should have a minimum of three levels.
2. All activity names shall include a reference to the group and sort associated which is agreed upon during the schedule kick off meeting. Activities shall not be allowed to cover more than one work area.

J. Change Order or Claim Number:

1. Any scope revision which modifies the critical path, or impacts an interim date, or Substantial Completion date must be represented in the schedule as a fragnet. A fragnet is defined as a sequence of new activities, to include the associated change identifier (PCO, CO, RFI, etc.), that are proposed to be added to the existing schedule. The fragnet shall identify the predecessors to the new activities and demonstrate the impacts to succeeding activities. The fragnet is to be added to the schedule at the progress update just prior to the known impact.

K. Milestones:

1. Milestone dates are defined in calendar days following the date set forth in the Notice to Proceed and are required to be met by the Contractor. Time is of the essence for the completion of Milestones, Substantial Completion date, and for the Contract Completion date.
2. The following Milestone dates are defined in calendar days from the Notice to Proceed, with the exception of Substantial Completion and Contract Completion, and shall be adhered to by the Contractor:
 - a. Milestone M1 – «insert milestone description»
 - b. Milestone M2 – «insert milestone description»
 - c. Milestone M3 – «insert milestone description»
 - d. Milestone M4 – «insert milestone description»

L. Adverse Weather:

1. Definitions
 - a. Adverse Weather Day: A day when the magnitude of a weather parameter (precipitation or temperature) is such that it creates conditions that inhibits the ability of the Contractor to work productively on critical construction activities.
 - b. Expected Adverse Weather Days: The number of adverse weather days expected to occur on a monthly basis and defined for two different construction types (Type 1: Earth Moving and Type 2: Structures and Surfacing).

- c. Unexpected Adverse Weather Days: The number of adverse days that exceed the expected number of adverse weather days determined on a monthly basis. Also include number of days with lightning and/or high winds that inhibit the ability of the Contractor to work productively on critical construction activities as corroborated by the Contracting Authority. The Contractor is to notify the contracting authority within one month of a weather event.
 - d. Actual Adverse Weather Days: The actual number of adverse weather days that occur during a single month.
 - e. Precipitation: Rain, snow, or hail where 1” of rain equals 12” of snow.
 - f. Calendar Day is based on all available days including weekends and holidays.
 - g. Working Day is based on a five-day work week and excludes weekends and legal holidays.
2. Methodology
- a. Adverse Weather Days Criteria
 - 1) A single precipitation threshold of greater than 7.62 mm (0.30 in) determines an adverse weather day for Type 1 and Type 2 construction.
 - 2) A single precipitation threshold of greater than 19.05 mm (0.75 in) the previous day determines an adverse weather day/additional consecutive non-working day for Type 1 construction only.
 - 3) A single precipitation threshold of greater than 7.62 mm (0.30 inch) reached before shut-down determines an adverse weather day for Type 1 and Type 2 construction.
 - 4) A single daily maximum temperature threshold of less than 0 degrees C (32 degrees F) determines an adverse weather day for Type 1 & Type 2 construction.
 - 5) A combination of daily maximum temperature less than 0 degrees C (32 degrees F) and precipitation greater than 7.62 mm (0.30 inch) determines a single adverse weather day.
 - b. Expected Adverse Weather Days
 - 1) Calculate the average number of expected adverse weather calendar days per month based on 5 years of data from the nearest National Oceanic and Atmospheric Administration (NOAA) Land-Based Station for each construction type. Data can be found at the NOAA associated National Centers for Environmental Information (NCEI) web site at <https://www.ncei.noaa.gov/>.
 - 2) Calculate the average number of expected adverse workdays per month by multiplying the average number of expected adverse weather calendar days per month by 5/7 and randomly, non-consecutive when possible, distribute the weather days throughout the project level weather calendars.

M. Scheduled Project Completion:

- 1. Project Start Date: The Construction Schedule may start no earlier than the date that the Notice to Proceed (NTP) was issued. The Schedule Manager shall include as the first activity in the Construction Schedule a Start Milestone called “Notice to Proceed.” The “Notice to Proceed” activity shall have: a start constraint equal to the date that the NTP was issued.
- 2. Constraint of Last Activity: Completion of the last Finish Milestone in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the Critical Path. The Schedule Manager shall include as the last activity in the Project Schedule an activity called “Contract Complete”. The completion milestones activity shall have a: Finish on or Before constraint, a constraint date equal to the Contract Completion milestone identified herein.
- 3. Project Details Must Finish By Date: The Schedule Manager shall set the “project details must finish by schedule date” to be equal to the “Contract Complete” date.

N. Interim Completion Dates (Milestones):

1. Contractually specified interim completion dates (Milestone dates) shall also be constrained to show negative float if early finish date of the last activity in that phase falls after the interim completion date.

O. Default Progress Data Disallowed:

1. Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in the CPM Scheduling Software. Actual Start and Finish dates and Remaining Durations on the CPM Schedule shall match those dates provided from Contractor Daily Reports for every in progress or completed activity and insure that the data contained on the Daily Reports is the sole basis for schedule updating. Failure to comply may result in the disapproval of schedule.

P. Out of Sequence Progress:

1. Activities that have posted progress without predecessors being completed (Out of Sequence Progress) shall be retained in the schedule only by the case by case concurrence of the Contracting Authority. The Contracting Authority may direct that changes in schedule logic be made to correct any or all Out of Sequence Work. Schedule must be calculated with the retained logic setting.

Q. Negative Lag(s):

1. Lag durations contained in the schedule shall not have a negative value unless approved by the Contracting Authority.

R. Definition of, and Conditions Relating to Float:

1. Float is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any activity in the schedule. Total float is defined as the amount of time any given activity or path of activities may be delayed before it will affect the project completion time.
2. Float is not time for the exclusive use or benefit of the Contractor and shall be used in the best interest of completing the project on time.
3. Extensions of the Contract Times required under the General Conditions pertaining to equitable time adjustment will be granted only to the extent that the equitable time adjustment exceeds total float in the activity or path of activities affected at the time approval was issued for the change.
4. Use of float suppression techniques such as preferential sequences, special lead/lag logic restraints, extended activity times, or imposed dates, other than as required by the Contract, shall be cause for rejection of the Construction Schedule and any revisions or updates.

3.03 LAYOUTS / VIEWS

A. Each submitted schedule shall utilize the below layouts/views as stipulated by the Contracting Authority:

1. Preliminary Schedule Review
2. Baseline Schedule Review
3. Progress Review
4. Progress vs. Baseline Comparison

5. Progress vs. Previous Progress Comparison
6. Progress vs. Previous Progress vs. Baseline Comparison
7. Recovery Schedule vs. Previous Progress Comparison
8. Baseline Finish Date
9. Total Float
10. Actual Start and Actual Finish dates shall be printed for those activities in progress or completed

- B. Activity ID Report: A list of all activities sorted according to Activity ID number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.
- C. Logic Report: A list of preceding and succeeding activities for every activity in ascending order by activity number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.
- D. Total Float Report: A list of all activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates.

3.04 90-DAY PRELIMINARY CONSTRUCTION SCHEDULE

- A. The accepted Preliminary Construction Schedule shall be used for payment purposes and the basis for measuring Contractor progress not to exceed 90 days after Notice to Proceed is issued.
- B. Schedule Review and Comments:
 1. Comments made by the Contracting Authority on the Preliminary Construction Schedule during review shall not relieve the Contractor from compliance with the requirements of the Contract Documents.
 2. Following the Contractor's receipt of the Contracting Authority's review comments, the Contractor shall correct the schedule to identify missing activities and relationships relevant to the Scope of Work. No time extensions will be granted to complete activities not initially included in the Contractor's Preliminary Construction Schedule.
 3. To the extent that there are any conflicts between the accepted Preliminary Construction Schedule and the requirements of the Contract Documents, the Contract Documents shall govern.
- C. Resubmittal of Preliminary Construction Schedule:
 1. Should the Contracting Authority reject the Preliminary Construction Schedule, the Schedule Manager shall comply with the Contracting Authority's direction and resubmit the Preliminary Construction Schedule and all associated submittals within seven calendar days.

3.05 BASELINE CONSTRUCTION SCHEDULE

- A. The Contracting Authority shall accept or reject, in writing, the Baseline Construction Schedule and the associated submittals. If the Baseline Construction Schedule is rejected, the Contracting Authority shall provide comments in writing to the Schedule Manager stating the reasons why the submission was not accepted.

- B. Acceptance of the baseline schedule does not revise the Contract Documents. The baseline schedule must be “accepted” or “accepted as noted” by the Contracting Authority prior to the Contracting Authority evaluating any Contractor claims associated with time impacts.

3.06 MONTHLY PROGRESS SCHEDULES

- A. Construction Contract Adjustment for Unexpected Adverse Weather:
 1. Contract adjustment is justified when the number of actual adverse weather workdays exceeds the expected number of adverse weather workdays over the life of the project.
 2. The number of actual adverse weather workdays as reported at the nearest NOAA Land-Based Station and related construction task(s) are to be reported on a monthly basis at the last Progress Meeting of the month as a condition of Payment Application approval.
 3. The Contracting Authority is to verify with documentation the actual adverse weather workdays reported by the Contractor.
 4. Execution: At the first Progress Meeting of each month the total number of actual adverse weather days is compared to the expected number of adverse weather days and reported by the Contracting Authority. If the number of actual adverse weather days exceeds the expected amount, then the difference is the potential days for extensions of the Contract Times due to weather. A running total will be kept for every month of the entire project. Once the project Substantial Completion date is reached, or the number of working days is completed, the Contactor may request that any net positive adverse weather days for the running total be awarded as a time extension.

3.07 DATA SUBMISSION

- A. The preliminary, baseline, progress, and recovery Construction Schedules shall be provided in the form of a .XML file prepared in Oracle’s Primavera P6 software.

Table 1 – Schedule Filename Convention			
Schedule	1st Submission	2nd Submission	3rd Submission
Preliminary Schedule	YY.MM.DD_PPP-000000_01PS	YY.MM.DD_PPP-000000_02PS	YY.MM.DD_PPP-000000_03PS
Baseline Schedule	YY.MM.DD_PPP-000000_01B	YY.MM.DD_PPP-000000_02B	YY.MM.DD_PPP-000000_03B
Progress Schedule #1	YY.MM.DD_PPP-000000_01SU01	YY.MM.DD_PPP-000000_02SU01	YY.MM.DD_PPP-000000_03SU01
Progress Schedule #2	YY.MM.DD_PPP-000000_01SU02	YY.MM.DD_PPP-000000_02SU02	YY.MM.DD_PPP-000000_03SU02
Delay Analysis	YY.MM.DD_PPP-000000_01TIA01	YY.MM.DD_PPP-000000_02TIA01	YY.MM.DD_PPP-000000_03TIA01
Weather Delay Analysis	YY.MM.DD_PPP-000000_01WD01	YY.MM.DD_PPP-000000_02WD01	YY.MM.DD_PPP-000000_03WD01
Recovery Schedule	YY.MM.DD_PPP-000000_01RS01	YY.MM.DD_PPP-000000_02RS01	YY.MM.DD_PPP-000000_P03RS01
YY – Project Year MM – Month DD – Day PPP-000000 – Project Number			

3.08 APPROVED CHANGES VERIFICATION

- A. Only Construction Schedule changes that have been previously accepted by the Contracting Authority shall be included in the schedule submission. The narrative report shall specifically reference, on an activity-by-activity basis, all changes made since the previous period and relate each change to documented, accepted schedule changes.
- B. The Contractor shall prosecute the work in accordance with the accepted Construction Schedule. Out of sequence construction, defined as a change from the Construction Schedule in the Contractor's actual operation requires prior concurrence from the Contracting Authority.
- C. Upon the approval of a Change Order or the issuance of a Change Directive by the Contracting Authority, the agreed upon change order activities, activity durations, logic and impacts shall be reflected in the next schedule submittal by the Schedule Manager.
- D. No change to the accepted activities, original activity durations, logic, interdependencies, milestones, planned sequence of operations, or resource loading of the Construction Schedule shall be made without prior approval from the Contracting Authority. If the Contractor desires to make a change to the accepted Construction Schedule, the Contractor shall outline the revisions made within the updated narrative, stating the reasons for the change as well as the specifics, such as the proposed changes in activities, original activity durations, logic, interdependencies, milestones, planned sequence of operations, or resource loading of the baseline Construction Schedule. The Contracting Authority shall respond within three calendar days after the receipt of the Contractor's request.
- E. If the Contracting Authority considers the Construction Schedule change requested by the Contractor to be a major change, it may require the Contractor to revise and submit for acceptance, without additional cost to the Owner, all of the affected portions of the network diagrams, and any schedule reports, or construction equipment reports deemed necessary to show the probable effect on the entire project. The proposed network revision and required reports shall be submitted to the Contracting Authority within seven calendar days after the Contracting Authority notifies the Contractor that the requested revision is a major change. Only upon the approval of the requested change by the Contracting Authority may it be reflected in the next Construction Schedule update submitted by the Contractor.
- F. A change will be considered of a major nature if the time estimated for an activity or sequence of activities is varied from the original plan to the degree that there is reasonable doubt that the Substantial Completion date, Contract Completion date, or milestones will be met, or if the change impacts the work of Separate Contractors at the job site. Changes to activities having adequate float may be considered as minor changes, except that an accumulation of minor changes may be considered a major change when such changes affect the Substantial Completion date, Contract Completion date, or milestones.

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Progress Schedule and the Submittals Schedule.
 - 2. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
 - 3. Division 01 Section "Closeout Procedures" for submitting warranties.
 - 4. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 5. Division 01 Section "Project Record Documents" for submitting Record Drawings.
 - 6. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
 - 7. Divisions 02 through 33 Sections for specific requirements for submittals in those Sections.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires A/E's responsive action. Action submittals are submittals indicated in individual specification sections as "Action Submittals".
- B. Informational / Quality Assurance/Control Submittals: Written information that does not require A/E's approval. Submittals may be rejected for not complying with requirements.
- C. Closeout Submittals: Written and graphic information and physical extra stock items required at or near completion of a project. Requirements for these submittals are included in the General Conditions of the contract and Division 01 Section "Closeout Procedures".
- D. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- E. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 SUBMITTAL SCHEDULE

- A. General: Refer to General Conditions Article 6.5 "Construction Progress Schedule".
- B. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by A/E and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
3. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for A/E's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.4 SUBMITTAL PROCEDURE

- A. General: Refer to General Conditions Article 6.20 Action Submittals.
- B. A/E's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings shall be provided by A/E for use in preparing submittals.
- C. Where submission of samples, shop drawings, or other items is required from suppliers or subcontractors, it shall be the responsibility of the Contractor for whom the subcontractor is executing the Work to see that the submittal items required are complete and properly submitted, and corrected and resubmitted at the time and in the order required so as not to delay the progress of the Work. Submittals shall be made through the Contractor. Submittals shall include sufficient detail to determine that the Contractor clearly understands the requirements of the Contract Documents.
 1. Submittal Schedule: Comply with requirements of Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
 2. Incomplete Submittals: By sending incomplete submittals, the Contractor risks delaying completion of submittal review by submitting information that the A/E is likely to reject.
- D. The Contractor shall check shop drawings, samples, and other submittals and submit them to the A/E with a letter of transmittal giving his approval, comments, and suggestions.
 1. Each transmittal shall include the following information:
 - a. Date submitted.
 - b. Project title and number.
 - c. Subcontractor's name and address, if applicable.
 - d. Identification by Specification Section, drawing number and detail references, as appropriate, and quantity submitted for each submittal.
 - e. Name and address of subcontractor, manufacturer, and supplier.
 - f. Notification of deviations from the Contract Documents for each submittal.
- E. The Contractor shall prepare, review, and stamp with his approval and submit, with reasonable promptness or within the specified time periods and in orderly sequence so as to cause no delay in the Work, submittals required by these Contract Documents or subsequently required by modifications.

- F. The A/E shall review and take action on submittals with reasonable promptness, so as to cause no delay in the progress. Incomplete submittals may be returned without review with a request to resubmit when complete. Similarly, submittals containing non-specified items may be rejected. A reasonable period of time in accordance with approved project schedule for review of and action taken on submittals shall be as specified herein, but in no case shall it be less than 14 calendar days from the time it is received by the A/E until the time the submittal is marked and forwarded or returned. Contractor shall allow enough time for submittal review, including time for resubmittals, as follows:
1. Initial Review: Allow 14 calendar days for initial review of each submittal, unless otherwise noted. Allow additional time if processing must be delayed to permit coordination with subsequent submittals or where concurrent review is required. A/E will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Concurrent Review: Where concurrent review of submittals by A/E's team, consultants, Owner, and other parties is required, allow 21 calendar days for initial review of each submittal. Sections to be scheduled for concurrent review include the following:
 - a. Division 05 Section "Structural Steel Framing"
 - b. Division 05 Section "Steel Joist Framing"
 - c. Division 05 Section "Steel Decking"
 - d. Division 05 Section "Cold-Formed Metal Framing"
 - e. Division 05 Section "Metal Fabrications"
 - f. Division 08 Section "Door Hardware"
 - g. Division 10 Section "Interior Panel Signage"
 - h. Division 33 Section "Utilities Services"
 3. Expedited Submittals: Long lead items need to take priority because a delay in their review may have undesirable consequences. Some submittals must be submitted before permits can be obtained. Both long lead items and items necessary for permits are to be issued within 60 days of the Notice to Proceed, unless otherwise approved by A/E in writing. These items include, but are not limited to the following:
 - a. Division 05 Section "Structural Steel Framing".
 - b. Division 05 Section "Steel Joist Framing"
 - c. Division 05 Section "Steel Decking"
 - d. Division 05 Section "Cold-Formed Metal Framing"
 - e. Division 07 Section "Penetration Firestopping".
 - f. Division 07 Section "Joint Firestopping".
 - g. Division 10 Section "Interior Panel Signage".
 - h. Division 21 – All fire suppression sections.
 - i. Division 28 – All fire alarm and detection sections.
 4. Allow 14 calendar days for processing each resubmittal.
 5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- G. Submittals Not Required: A/E will send a transmittal indicating submittals were "not required for review". All copies of the submittals may be disposed of by the A/E.
- H. Submit electronic files of submittals to the A/E, and CxA, if applicable, for review, using the "Submittals" business process.
- I. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single bookmarked file with links enabling navigation to each item.
 2. Each submittal shall be transmitted separately and shall cover only one specification section.
 3. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (for example, LNHS-061000.01). Re-submittals shall include an alphabetic suffix after another decimal point (for example, LNHS-061000.01.A).

4. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by A/E.
5. Transmittal Form for Electronic Submittals: Use electronic form acceptable to A/E containing the following information.
 - a. Project name.
 - b. Date.
 - c. Name and address of A/E.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Name of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section, number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal
 - o. Transmittal number, numbered consecutively.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Remarks.
6. Include the following information as keywords in the electronic file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES, GENERAL

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 1. Post electronic submittals as PDF electronic files directly to Contracting Authorities web site specifically established for Project.
 - a. A/E will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 2. Submit electronic submittals via email as PDF electronic files.
 - a. A/E will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
- B. Electronic submittals will only be accepted in an unchangeable electronic format such as pdf. File formats such as MS Word (.doc or .docx), MS Excel (.xls or .xlsx), AutoDesk, AutoCAD (.dwg or .dxf), are considered unacceptable as the original file submitted could be accidentally altered from the originators intended document. These file types will be rejected by A/E.

2.2 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual specification sections.
- B. Product Data: Collect information into a single submittal for each element of construction or system. Product data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Contractor must annotate information. Highlighting proposed or striking out item not to be used is acceptable. Product data unmarked by Contractor may be returned unreviewed by A/E. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts
 - b. Manufacturer's product specifications
 - c. Standard color charts
 - d. Statement of compliance with specified referenced standards
 - e. Testing by recognized testing agency
 - f. Application of testing agency labels and seals
 - g. Notation of coordination requirements
 - h. Availability and delivery time information
 2. For equipment, include the following in addition to the above, as applicable.
 - a. Wiring diagrams showing factory installed wiring
 - b. Printed performance curves
 - c. Operational range diagrams
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 3. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed. Submit before or concurrent with Samples and Shop Drawings.
 - a. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
 4. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.
 5. In compliance with the OSHA Hazard Communication Standard (1910.1200, 08-24-1987) Contractors shall post at the site MSDS (Material Safety Data Sheets) for ALL products classified as hazardous that their firm has knowledge that they will be furnishing, using, or storing on the jobsite during the duration of this Project in accordance with OSHA standards. At the completion of the project, the Contractor shall turn their "MSDS" information directly over to the Owner with a receipt for the Owner to sign. A copy of the signed receipt only shall be submitted to the A/E.
 - a. Material Safety Data Sheets (MSDS) shall not be submitted to the A/E for review. Material Safety Data Sheets submitted to A/E will be returned with no action taken.
- 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. The Contractor shall perform no portion of the Work requiring submittal and review of shop drawings, product data, samples or similar submittals until the A/E has approved the respective submittal. Such Work shall be in accordance with approved submittals.
 2. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the bases of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
 - a. AutoCAD Drawings: Electronic production drawing files may be available from the A/E.
 - b. Refer to "Informational Submittals" for coordination drawing procedures.
 3. Shop drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data that are prepared by the Contractor or subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work. Do not base shop drawings on reproduction of the Contract Documents.
 - a. Advertising brochures will not be accepted as shop drawings.

- b. Erection and setting drawings as referred to in these Specifications will be considered as shop drawings and shall be submitted along with detailed shop drawings.
 - c. Where schedules are required to indicate locations, they shall be submitted as part of the shop drawings package for that item.
 - d. Shop drawings and schedules shall repeat the identification shown on the Contract Drawings.
 - e. The Contractor shall check all shop drawings, samples and other submittals and submit them to the A/E utilizing a Transmittal Form, giving his approval and/or comments and suggestions. Failure to use a Transmittal Form will result in submittals being returned "without action".
 - f. Preparation:
 - 1) Identification of products and materials included by sheet and detail number.
 - 2) Compliance with specified standards
 - 3) Notation of coordination requirements
 - 4) Notation of dimensions established by field measurements.
 - 5) Fabrication and installation drawings
 - 6) Roughing-in and setting diagrams
 - 7) Wiring diagrams showing field installed wiring, including power, signal, and control wiring
 - 8) Shop work manufacturing instructions
 - 9) Templates and patterns
 - 10) Schedules
 - 11) Design calculations
 - 12) Relationship and attachment to adjoining construction clearly indicated.
4. Preparation of Submittals: Provide permanent marking on each submittal to identify project, date, Contractor, Subcontractor, submittal name, and similar information to distinguish it from other submittals. Show Contractor's executed review and approval marking and provide space for A/E's "action" marking. Package each submittal appropriately for transmittal and handling.
 5. By approving and submitting shop drawings, the Contractor thereby represents that they have determined and verified field measurements, field construction criteria, materials, catalog numbers, and similar data, and that they have checked and coordinated each shop drawing with the requirements of the Work and of the Contract Documents prior to submitting to the A/E.
 6. The Contractor shall make corrections required by the A/E and shall resubmit the required number of corrected copies of shop drawings until appropriately marked. The Contractor shall direct specific attention in writing or on resubmitted shop drawings to revisions other than the corrections requested by the A/E on previous submissions.
 7. The A/E will review shop drawings only for conformance with the design concept of the Project and with the information given in the Contract Documents. The A/E's review of a separate item shall not indicate review of an assembly in which the item functions.
 - a. Only shop drawings, product data, and samples marked "No Exceptions Taken" or "Note Markings" shall be considered "final" and used in conjunction with the work of this Project.
 8. The A/E's review of shop drawings shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents unless the Contractor has informed the A/E in writing of such deviation at the time of submission and the A/E has given written approval to the specific deviation, nor shall the A/E's action relieve the Contractor from responsibility for errors or omissions in the shop drawings.
 - a. The A/E's review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and qualities, or for substantiating instructions or performance of equipment or systems, all of which remain the responsibility of the CM as required by the Contract Documents. The A/E's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the A/E, of any construction means, methods, techniques, sequences, or procedures. The A/E's approval of a specific item shall not indicate approval of an assembly of which it is a component.

9. Notations and remarks added to shop drawings by the A/E are to ensure compliance to Drawings and Specifications and do not imply a requested or approved change to contract cost.
 10. Should deviations, discrepancies, or conflicts between shop and contract drawings and Specifications be discovered, either prior to or after review, Contract Documents shall control and be followed.
 11. Submit shop drawings in the following format (preferred):
 - a. PDF electronic file (preferred).
 12. Shop drawings not requested by the A/E shall be returned without action.
 13. Shop drawings will be marked as follows: Contractor shall take the following action for each respective marking:
 - a. "NO EXCEPTIONS TAKEN" – Distribute copies to subcontractors and related trades.
 - b. "NOTE MARKINGS" – Final Release; Contractor may proceed with fabrication, taking into account the necessary corrections on submittal and with Contract Documents.
 - c. "NOTE MARKINGS/RESUBMIT" - Contractor may proceed with fabrication, taking into account the necessary corrections. Corrected shop drawings shall be resubmitted before fabrication of this work is complete to obtain a different action marking. Do not allow drawings marked "Resubmit" to be used in connection with installation of the Work.
 - d. "REJECTED" - Contractor will be required to resubmit shop drawings in their entirety. No fabrication or installation shall be started until shop drawings so marked have been completely revised, resubmitted, and marked by A/E according to preceding Paragraphs a. or b.
 14. Where resubmittal is required, distribution shall be the same as the Initial Submittal.
- D. Samples for Initial Selection: Prepare physical units of materials or products, including the following:
1. The Contractor shall submit to the A/E samples to illustrate materials or workmanship, colors, and textures, and establish standards by which the Work will be judged.
 2. Provide corresponding electronic submittal of sample transmittal, digital image file illustrating sample characteristics, and identification information for record.
 3. 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 for Initial Selection: Submit two full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. A/E will return one submittal with options selected.
- E. Samples for Verification: Submit full size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
1. Number of Samples for Verification: Submit 3 sets of samples. A/E will retain sample sets, unless otherwise noted.
 - a. Contractor shall receive written notification.
 2. Provide corresponding electronic submittal of sample transmittal, digital image file illustrating sample characteristics, and identification information for record.
 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. Identification: Permanently attach label on unexposed side of Samples that includes the following:

- a. Project name and submittal number
 - b. Generic description of Sample
 - c. Product name and name of manufacturer
 - d. Sample source
 - e. Number and title of applicable Specification Section
 - f. Specification paragraph number and generic name of each item
5. Submit samples for review of size, kind, color, pattern, and texture. Submit samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture, and other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 6. By approving and submitting samples, the Contractor thereby represents that he has determined and verified materials, catalog numbers, and similar data, and that he has checked and coordinated each sample with the requirements of the Work and of the Contract Documents prior to submitting to the A/E.
 7. The Contractor shall resubmit the required number of correct or new samples until approved. The Contractor shall direct specific attention in writing or on resubmitted samples to revisions other than the changes requested by the A/E on previous submissions.
 8. The A/E will review samples but only for conformance with the design concept of the Project and with the information given in the Contract Documents. The A/E's review of a separate item shall not indicate approval of an assembly in which the item functions.
 9. The A/E's action shall not relieve the Contractor of responsibility for deviations from the requirements of the Contract Documents unless the Contractor has informed the A/E in writing of the deviation at the time of submission and the A/E has given written approval to the specific deviation, nor shall the A/E's action relieve the Contractor from responsibility for errors or omissions in the samples.
 10. Unless otherwise specified, samples shall be in triplicate and of adequate size to show function, equality, type, color, range, finish, and texture of material. When requested full technical information and certified test data shall be supplied.
 - a. Each sample shall be labeled, bearing material name and quality, the Contractor's name, date, project name, and other pertinent data.
 - b. Transportation charges to and from the A/E's office must be prepaid on samples forwarded. The A/E shall retain samples until the Work for which they were submitted has been accepted.
 11. Materials shall not be ordered until final review is received in writing from the A/E. Materials shall be furnished, equal in every respect to reviewed samples. Where color or shade cannot be guaranteed, the manufacturer shall indicate the maximum deviation. Work shall be in accordance with the final reviewed samples.

2.3 INFORMATIONAL / QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. General: Prepare and submit informational submittals required by other Specification Sections.
 1. Submit Informational / Quality Assurance/Control Submittals in the following format (preferred):
 - a. PDF electronic file.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. An officer shall sign certificates and certifications or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
 3. Test and Inspection Reports: Comply with requirements in Division 01 Section "Quality Requirements".

- B. 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 A/E's and Owners, and other information specified.
- C. 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 assumption 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.
- D. Certificates:
1. Certificates and Certification Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 2. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
 3. Use of Domestic Steel Certifications: Where indicated technical specification sections shall require the "Steel Fabricator Certification" and "Contractor Certification" at the end of Section be placed on the front cover of, or on the initial sheet of each steel fabrication shop drawing. Certification shall be signed and dated by an official authorized by the company prior to beginning of fabrication.
 4. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
 5. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized for this specific project.
 6. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
 7. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
- E. Test and Research Reports
1. 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.
 2. 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.
 3. 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.
 4. 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.
 5. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. 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.
 - a. Test reports shall be no older than 15 months, unless otherwise noted or approved by A/E.

- F. **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

- G. **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.

- H. **Material Safety Data Sheets (MSDSs) or Safety Data Sheets (SDS):** Submit information directly to Owner; do not submit to A/E.
 1. A/E will not review submittals that include MSDSs and will return the entire submittal for resubmittal.
 2. MSDS relate directly to construction safety, which is the sole responsibility of the Contractor.
 3. MSDS or SDS shall not be submitted to the A/E for review.
 4. MSDS or SDS submitted to A/E will be either removed or crossed out of submittal with no action taken.

- I. **Coordination Drawings:** Comply with requirements specified General Conditions.

2.4 CLOSEOUT SUBMITTALS

- A. **General:** Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 1. **Maintenance Data:** Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 01 Section "Closeout Procedures".
 - a. Refer to General Condition's paragraph 6.19.4.

2.5 DELEGATED-DESIGN SERVICES

- A. **Performance and Design Criteria:** Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to A/E.

- B. **Delegated-Design Services Certification:** In addition to Shop Drawings, Product Data, and other required submittals, submit digitally-signed PDF electronic file signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting.
- B. Contractor's Approval: Indicate Contractor's approval for each Submittal with a uniform, approval stamp or indication in Web-Based Project Management software. 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 A/E'S ACTION

- A. General: A/E will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: A/E will review each submittal, make marks to indicate corrections or modifications required, and return it.
- C. Informational/Quality Assurance/Control Submittals: A/E will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. A/E will forward each submittal to appropriate party.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION 01 33 00

SECTION 01 33 13.01 – STEEL FABRICATOR CERTIFICATION

Steel Fabricator Certification

The steel fabricator identified below certifies that for this project all load-bearing structural steel (as defined by the State of Ohio Department of Administrative Services, Directive Number _____, dated _____, has been fabricated or produced, to the best of its knowledge, only from steel made in the United States in accordance with Sections 153.011 and 153.99, of the Ohio Revised Code (ORC). Further, the steel fabricator hereby certifies that it has read and understands that a monetary penalty for violations may be imposed under the authority of the referenced sections of the ORC.

[Printed or Typed Name of Fabrication Company]

by

[Printed or Typed Name of Company Official]

Signature of Company Official

Date

SECTION 01 33 13.02 – CONTRACTOR CERTIFICATION

Contractor Certification

The Contractor identified below certifies that it has required as a condition of purchase, that for this project all load-bearing structural steel (as defined by the State of Ohio Department of Administrative Services, Directive Number _____, dated _____), shall be fabricated and produced using, to the best of its knowledge, only steel made in the United States in accordance with Sections 153.011 and 153.99 of the Ohio Revised Code (ORC). Further, the Contractor certifies that it has read and understands that a monetary penalty for violations may be imposed under the authority of the referenced sections of the ORC.

[Printed or Typed Contractor Company Name]

By

[Printed or Typed Name and Title of Contractor Company Official]

Signature of Company Official

Date

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 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 Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in 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 Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by A/E, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections include following:
 - 1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
 - 2. Division 01 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
 - 3. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of 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 Work to evaluate that actual products incorporated into Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by A/E.
- 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. Approved mockups establish standard by which Work will be judged.
 - 1. Integrated Exterior Mockups: Mockups of exterior envelope erected separately from building but on project site, consisting of multiple products, assemblies and subassemblies.
- D. Preconstruction Testing: Tests and inspections that are performed specifically for Project before products and materials are incorporated into Work to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an accredited, independent 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 source, i.e., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean 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 trades people of corresponding generic name.
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of three previous project similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and standards establish different or conflicting requirements for minimum quantities or quality levels, comply with most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to A/E for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: Quantity or quality level shown or specified shall be minimum provided or performed. Actual installation may comply exactly with minimum quantity or quality specified, or it may exceed minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for context of requirements. Refer uncertainties to A/E for a decision before proceeding.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Testing Agencies Qualification: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in form of a recent report on inspection of testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include 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 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 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 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 Work.
- E. Contractor's Quality Control Plan: For quality-assurance and quality-control activities and responsibilities.

1.5 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Construction Progress Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including following:
1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 2. Special inspections required by authorities having jurisdiction and indicated on "Statement of Special Inspections."
 3. Owner-performed tests and inspections indicated in Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.
- G. Coordination: Coordinate activities included in various sections to assure efficient and orderly installation of each component. Coordinate operations included under different Sections that are dependent on each other for proper installation and operation.
1. Interior Finishes: Schedule construction operations with consideration for indoor air quality.

1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include 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 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 Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include following:
1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include following:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

1.7 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish 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 kind indicated. Engineering services are defined as those performed for installations of system, assembly, or product that is similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of 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 activities indicated.
1. Requirement for specialists shall not supersede building codes and regulations governing Work.
- G. Testing Agency Qualifications: An accredited, independent agency with 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. Meet requirements of ASTM E329, current edition "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as used in Construction."
 - a. Term "agency" as used in Section 4 of ASTM E329 shall mean local or closest office of said agency.
 2. Laboratory qualifications for inspection, sampling and testing of soils and aggregates shall be comparable to requirements of ASTM E329.
 3. Testing Equipment: Calibrated at maximum 12-month intervals by devices of accuracy acceptable to A/E.
 4. Submit documentation of specified requirements.
 5. All testing and inspection performed by testing laboratory shall be under direct supervision of a professional engineer licensed in state where Project is located. This professional engineer shall submit a letter certifying that all testing services are in conformance with standards and specifications as specified in these Contract Documents. Letter shall also certify that all tested and inspected items and procedures conform to Contract Documents, except where specifically noted on inspection reports.
 6. All inspectors shall have at least one year of experience performing type of inspections to be performed on this Project. Qualifications and experience of proposed inspectors shall be submitted to A/E for approval prior to beginning of testing.
- 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 following:
1. Contractor responsibilities include 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 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 laboratory mockups at testing facility using personnel, products, and methods of construction indicated for completed Work.
 - e. 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 A/E, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from Contract Documents.
- J. Mockups: Before installing portions of Work requiring mockups, build mockups for each form of construction and finish required to comply with following requirements, using materials indicated for completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by A/E.
 2. Notify A/E 7 days in advance of dates and times when mockups will be constructed.
 3. Demonstrate proposed range of aesthetic effects and workmanship.
 4. Obtain A/E's approval of mockups before starting work, fabrication, or construction.
 - a. Allow 7 days for initial review and each re-review of each mockup.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging completed Work.
 6. Demolish and remove mockups when directed, unless otherwise indicated.
- K. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual specification sections, along with supporting materials.

1.8 QUALITY CONTROL

- A. Owner/A/E Responsibilities: Where quality-control services are indicated as Owner's/A/E's responsibility, Owner will engage a qualified testing agency to perform these services.
1. A/E/Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with Contract Documents will be charged to Contractor, and Contract Sum will be adjusted by Change Order.
- B. Tests and inspections not explicitly assigned to Owner/A/E 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/A/E, 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 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 Contract Documents.

- E. Testing Agency Responsibilities: Cooperate with A/E and subcontractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify A/E promptly of irregularities or deficiencies observed in Work during performance of its services.
 2. Determine 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 triplicate, of each test, inspection, and similar quality-control service, including following information, as applicable.
 - a. Date issued.
 - b. Project title and number.
 - c. Testing laboratory name and address.
 - d. Name and signature of field inspector.
 - e. Date of inspection or sampling.
 - f. Record of temperature and weather.
 - g. Name and signature of laboratory inspector.
 - h. Identification of product and specification section.
 - i. Location in Project.
 - j. Designation of work and test method.
 - k. Observations regarding compliance with Contract Documents.
 - l. Complete inspection or test data.
 - m. Test results and an interpretation of test results.
 - n. Recommendations on retesting.
 5. Does not release, revoke, alter, or increase Contract Document requirements or approve or accept any portion of Work.
 6. Do not perform any duties of CM.
- 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 following:
1. Access to 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. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 5. 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 Contract Documents. Submit schedule within 30 days of date established for Notice to Proceed.
1. Distribution: Distribute schedule to Owner, A/E, testing agencies, and each party involved in performance of portions of Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner/A/E will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as responsibility of Owner/A/E, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing completeness and adequacy of those procedures to perform Work.

2. Notifying A/E, Contractor, and subcontractor promptly of irregularities and deficiencies observed in Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to A/E and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Contract Completion, this 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 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 following:
 1. Date test or inspection was conducted.
 2. Description of Work tested or inspected.
 3. Date test or inspection results were transmitted to A/E.
 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 A/E'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 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 assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - 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 Division 00 Section "Contracting Definitions".
- 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. "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 the 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
 - 1. Refer to Article 6 of the General Conditions.
- B. Related Sections include the following:
 - 1. Division 01 Section "Summary" for limitations on utility interruptions and other work restrictions.
 - 2. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
 - 3. Division 01 Section "Progress Cleaning" for progress cleaning requirements.
 - 4. Divisions 02 through 33 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.
 - 5. Division 06 Section "Miscellaneous Rough Carpentry" for lumber and plywood requirements.
 - 6. Division 09 Sections "Exterior Painting" and "Interior Painting" for painting requirements.
 - 7. Division 31 Section "Site Clearing" for temporary tree and plant protection.
 - 8. Division 31 Section "Earth Moving" for disposal of ground water at Project site.

1.2 USE CHARGES

- A. Refer to Article 6 of the General Conditions.

1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Use-of-Site Plan: Show temporary facilities, utility lines and connections, staging areas, parking areas, and vehicle circulation for construction personnel and construction site entrances.
- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate CM personnel responsible for management of fire-prevention program.
 - 1. Fire-Protection Plan: Prepare a written plan for preventing fires during Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, and mold. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.
 - 1. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- D. Dust-Control and HVAC-Control Plan: Submit combined coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of the work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air filtration system discharge.

4. Other dust-control measures.
 5. Waste management plan.
- E. Noise and Vibration Control Plan: Identify construction activities that might impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by Owner. Include the following:
1. Methods used to meet the goals and requirements of Owner.
 2. Concrete cutting methods to be used.
 3. Location of construction devices on the site.
 4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
 5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with Owner.

1.4 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
1. Building code requirements
 2. Health and safety regulations
 3. Utility company regulations
 4. Police, fire department, and rescue squad rules
 5. Environmental protection regulations
- B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations", ANSI A10 Series Standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities".
1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code".
- C. Design Standards: Requirements for temporary facilities are minimum standards. Provide additional facilities as required for proper execution of Work and to meet responsibilities for protection of persons and property.
1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
 2. Desiccant Wheels: Bacteriostatic and non-toxic, glass fibers which form support matrix shall be made from uniform continuous strands larger than 5 microns in diameter that are nonrespirable and are not considered a possible health risk by International Agency for Research on Cancer (IARC). Wheels shall be tested according to ASTM E84-90 ("Standard Test Method for Surface Burning Characteristics of Building Materials") and shall achieve a flame spread index of 0 and a smoke developed index of 10.
 3. Once building is enclosed and finishes are beginning to be applied, take and record the following measurements:
 - a. Contractor shall install temperature and relative humidity gauges for each unit of the facility or as deemed acceptable by the A/E.
 - b. Contractor shall record daily readings in their log.
- D. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.
- E. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural and Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

- A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.
- B. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
 - 1. 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.
- C. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
 - 1. Keep temporary services and facilities clean and neat.
 - 2. Relocate temporary services and facilities as required by progress of the work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials suitable for use intended.
 - 1. Undamaged, previously used materials in serviceable condition may be used.
- B. Lumber and Plywood: Comply with requirements in Division 06 Section "Miscellaneous Rough Carpentry".
- C. Paint: Comply with requirements of Division 09 Sections "Exterior Painting" and "Interior Painting".
- D. Tarpaulins: Provide waterproof, fire resistant, UL labeled tarpaulins with flame spread rating of 15 or less. For temporary enclosures, provide translucent, nylon reinforced, laminated polyethylene or polyvinyl chloride, fire retardant tarpaulins.
 - 1. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mil, minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- E. Water: Provide potable water approved by local health authorities.
- F. Chain-Link Fencing: Minimum 2 inch, 0.148 inch thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8 inch O.D. line posts and 2-7/8 inch O.D. corner and pull posts, with 1-5/8 inch O.D. top rails.
 - 1. Plastic construction may be used, where indicated or approved by A/E.
- G. Portable Chain-Link Fencing: Minimum 2 inch, 0.148 inch thick, galvanized, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8 inch O.D. line posts and 2-7/8 inch O.D. corner and pull posts, with 1-5/8 inch O.D. top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.
- H. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain link fence, sized to height of fence, in color selected by A/E from manufacturer's standard colors.
- I. Gypsum Board: Minimum 5/8 inch thick Type "X" panels with tapered edges.

- J. 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.
- K. Dust Control Walk-Off Mats: Provide mats minimum 36 by 60 inches.

2.2 EQUIPMENT

- A. General: Provide equipment suitable for use intended.
 - 1. Undamaged, previously used equipment in serviceable condition may be used.
- B. Water Hoses: Provide 3/4 inch, heavy duty, abrasion resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured, NEMA polarized outlets to prevent insertion of 110 to 120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords. Use hard service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length voltage ratio.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures where exposed to breakage. Provide exterior rated fixtures where exposed to moisture.
- F. Heating Equipment: Provide vented, self-contained, liquid propane, natural gas or fuel oil heaters with individual space thermostatic control.
 - 1. The burners may be fueled with natural gas, liquid propane, or fuel oil, and they should enable the contractor to practically maintain a safe and healthy working environment, with acceptable levels of carbon monoxide. Use of gasoline burning space heaters, open flame heaters, or salamander type heating units is strictly 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 location and application.
- G. Fire Extinguishers: Provide hand carried, portable, UL rated; Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand carried, portable, UL rated, Class ABC, dry chemical extinguishers or a combination of extinguishers of NFPA recommended classes for the exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- H. Self Contained Toilet Units: Single occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a high-density polyethylene (HDPE) shell or similar nonabsorbent material.
- I. Air Filtration Units: HEPA primary and secondary filter equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

2.3 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 Owners, A/E, and construction personnel office activities and to accommodate Project meets specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-Vac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4 foot square tack and markerboards.
 - 3. Drinking water and private toilet.
 - 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg. F.
 - 5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. 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.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections of disposition of salvaged materials that are designated as Owner's property.
- B. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the work.
- C. Provide each facility ready for use where needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- D. Isolation of Work Areas in Occupied Facilities: prevent dust, fumes, and odors from entering occupied areas.

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 a time when service can be interrupted if necessary, to make connections for temporary services.
 - a. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked in services.
 - 3. Obtain easements to bring temporary utilities to the Project site where the Owner's easements cannot be used for that purpose.
- B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent offsite in a lawful manner.

1. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
2. Connect temporary sewers to the municipal system, where applicable, as directed by sewer department officials.
3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
4. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

C. Water Service and Distribution

1. The Owner will make provisions for the use of existing water facilities at the Project site and shall designate the location where the service will be provided. Contractor shall provide means of conveying water from the designated location, as approved by the Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
 - a. Sterilization: Sterilize temporary water piping prior to use.
2. Install water services and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
 - a. Provide a minimum of 2 hose bibbs with vacuum breakers at each temporary tap. Distribution piping shall be sized to provide sufficient pressure at outlet of 100-foot hose attached to hose bibb. Maintain and service temporary water supply. This shall include, but not be limited to, replacement and repair of damaged pipe and equipment due to freezing or other causes.
 - b. Contractor shall provide own means of conveying water from temporary water taps to work.
 - c. Sterilization: Sterilize temporary water piping prior to use and conduct water testing to demonstrate effectiveness.
3. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to eliminate water damage. Drain accumulated water promptly from pans.

D. Temporary Electric Power and Light

1. The Owner will make provisions for the use of existing service at the Project site and shall designate the location where the service will be provided. Contractor shall provide own means of extending the electrical service from the designated location, as approved by the Owner, as long as equipment is maintained in a condition acceptable to Owner and does not interfere with Owner's use of the existing building.
 - a. Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period.
 - b. Should the demolition of any facilities require that power to facilities which are to remain, be interrupted for any duration of time exceeding one hour, provide proper and adequate temporary electrical service to the facilities remaining until such time as permanent service to the remaining facilities can be restored.
 - c. Connect temporary service to Owner's existing power source, as directed by Owner.
2. The Contractor shall provide temporary light and power.
 - a. Refer to General Conditions Article 6.
3. Lamps for temporary lighting shall be provided and maintained. Every temporary lamp outlet must be properly lamped throughout the construction; dark or burned-out lamps shall be immediately replaced.
 - a. Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - b. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
4. Wiring of offices, trailers, storage facilities, and equipment used during construction, shall be the responsibility of the Contractor or subcontractors requiring it.

5. Where the use of energy at places other than those herein specified or of an amount greater than would be available from the specified temporary service, the Contractor shall make independent arrangements.
 6. When permanent facilities are approved by the A/E as ready for operation, they may be used for temporary light and power. The Contractor shall arrange with the utility for removal of the temporary metering and shall bear the cost involved in the changeover.
 7. If the permanent electrical system is used during construction, the Contractor shall furnish an extended warranty and services contract in effect until the expiration of the Correction Period.
 8. Should the demolition of existing facilities require that power to facilities which are to remain be interrupted for a duration of time exceeding one hour, the Contractor for this shall provide proper and adequate temporary electrical service to facilities remaining until such time as permanent service to the remaining facilities can be restored.
- E. Heating and Cooling, General: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Provide heating for materials to protect material against injury by frost or freezing and to permit construction to continue in accordance with the approved construction schedule. Select equipment from that specified that would not have a harmful effect on completed installations or elements being installed.
1. Maintain temperature between 50 degrees F and 80 degrees F in permanently enclosed portions of building for normal construction activities, and a minimum of 65 degrees F for finishing activities and areas where finished work has been installed, unless otherwise required by requirements in technical sections.
 2. Contractor to maintain relative humidity levels to meet product manufacturer's requirements in accordance with project schedule.
 - a. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
 3. Maintain a healthy working environment with carbon monoxide levels within OSHA guidelines.
 4. Provide temporary heating or cooling until the A/E confirms that permanent systems of the building are operational unless the Owner and A/E provide an exception.
- F. Heating/Cooling System - Existing Building
1. The existing building heating system shall remain "in-service" throughout construction of the new work.
 2. In the event the existing building heating system is specified to be modified, added to, or replaced in part or total, then the Contractor shall comply with the requirements hereinafter.
 3. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - a. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved combined coordination drawing and narrative.
 - 1) Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - 2) Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 - b. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
 - c. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

G. Temporary Heating - Prior to Temporary Enclosure

1. Until addition is temporarily enclosed, Contractor shall provide temporary heating as required to maintain adequate environmental conditions to facilitate the progress of their particular work activity, to meet specified minimum conditions for the installation and proper curing and/or drying of their materials, and to protect materials and finishes from damage due to temperature (for example, to afford protection of water-bearing material against injury by frost or freezing). Maintain such temporary heating until danger of frost or freezing has past.
 - a. Use of gasoline burning space heaters, open flame heaters, or salamanders and electric heaters will not be permitted; however, portable direct -fired heaters, indirect-fired or hydronic fired with LP gas, natural gas, kerosene, #1, or #2 fuel oil will be allowed in accordance only with the "Moisture-Protection Plan" and "Dust-Control and HVAC-Control Plan". When such heaters are employed, the Contractor shall observe safety precautions necessary; and in no case shall LP gas fired heaters be used in low places of construction, such as pits, tunnels, etc., which can collect heavier than air gas or fumes. Portable heaters must be UL approved.
 - b. Equipment producing carbon monoxide shall not be used where fumes will contact freshly placed concrete or mortar or create an unhealthy working environment.
 - c. If direct-fired type heating units are being used, provide temporary dehumidification systems to reduce ambient and moisture levels to avoid potential condensation and to allow installation or application of finishes and there proper curing or drying.

H. Temporary Heating/Cooling - After Temporary or Permanent Enclosure

1. Temporary heating facilities shall have adequate capacity based upon the following:
 - a. When incorporating special materials into the construction, maintain space temperatures in strict accordance with the manufacturer's instructions.
 - b. Maintain in heated area not less than 50 degrees F. space temperature.
 - c. Maintain constantly in heated areas when the space temperature is once raised above 65 degrees F. to prevent thermal shock to the structure.
 - d. Preheat materials in accordance with manufacturer's instructions and accepted trade practice.
2. After the facility or designated portions thereof have been at a minimum temporarily enclosed and temporary heat is required, the Contractor shall provide temporary heat using one of the 1 following methods:
 - a. Method 1 - The Use of a Permanent Heating System
 - 1) The permanent heating system may be used for temporary heating where available and if approved by the A/E as ready for operation. If the permanent system is used, the Contractor shall have installed in their permanent location such fan systems, heating coils, convectors, etc., as approved by the A/E. Provide such controls as are necessary to maintain the temperatures required.
 - 2) Temporary filters shall be used in the permanent system. Provide filter with MERV of 8 at each return air grille in system and remove at end of construction. Provide bases, shields, etc., around heating elements where required to prevent too rapid drying of adjacent concrete, masonry, or plaster. Some of the permanent heating system equipment may require relocation by the Contractor as required during construction, to prevent interference with continuing construction, where authorized by the A/E. Equipment so used shall be cleaned and restored to new conditions except for ordinary wear, prior to final acceptance, and its use shall in no way negate the Owner's one year warranty specified to commence on the date of Contract Completion.

- 3) If the permanent system is not fully operable or does not have sufficient controls to maintain the necessary heat in light of existing conditions, the Contractor shall furnish, install, and maintain temporary units connected to the permanent system. Each unit shall be installed complete with safety controls, venting, power, and fuel connections, room thermostat and necessary ductwork, and piping approved by the A/E. The Contractor shall remove portions of temporary heating system after they are no longer necessary. The Contractor shall relocate the temporary heating equipment as required during construction to prevent interference with continuing construction. The Contractor shall correlate this Work with the other trades involved.
 - 4) In the event of failure to portion of the permanent heating system being used for temporary heat, the CM shall immediately provide other means of temporary heat and shall notify the A/E of the failure. The CM shall immediately make necessary repairs as required to the satisfaction of the A/E.
 - 5) If Method 1 is selected by the CM and approved by the A/E, the start of the warranty on the permanent heating equipment and system(s) will not start until Contract Completion or Final Warranty is issued for complete Work, which means the CM must include costs required for an extended warranty given the above use conditions.
- b. Method 2 - The Use of Individual Portable Units
- 1) If the permanent system is not fully operable or does not have sufficient controls to maintain the necessary heat in light of existing conditions, the Contractor shall provide, maintain, and supervise the operation of A/E approved direct fired make-up air units, or similar equipment. No electric heat permitted. Utilize natural gas fired units when natural gas is available. Units shall be properly vented, piped, and wired and shall be provided with thermostat for temperature control and with required safety controls.
- c. Method 3 – Hydronic Heating System
- 1) If permanent system is not operable and the building is enclosed and heating is required, the contractor may furnish and install a temporary low pressure hydronic heating system. The temporary heating system shall consist of an atmospherically vented hydronic heat module utilizing non-hazardous propylene glycol and low pressure fluid flow, placed outside of the structure. The system shall be UL and CSA certified for a heating appliance. System will also provide for individual thermostatically controlled fluid fan coil units for placement inside the structure. Fan coil units shall be UL and CSA certified. Fan coils should have the ability to filter incoming structural air by utilizing MERV 8 replaceable air filters. Fan coils should also be duct able with lay flat ducting on the heat output side.
 - 2) Furthermore, if necessary, specific explosion proof fan coils UL and CSA certified Class 1 Division 1 Groups C and D, Class II, Division 1 Groups F and G should be utilized if vapors, gases or duct are present inside the structure. Said fan coils will utilize a fluid control valve for temperature control. Also, fan coil will be installed by a journeyman electrician for said hazardous location regulations.
 - 3) The temporary hydronic heating system will also provide safe, clean and dry heat with zero combustion by-products being introduced into the structure. Hydronic heat systems will provide low humidity and drying capabilities for the structure during the construction process. Hydronic heating system shall provide consistent temperature throughout the entire structure. Data monitoring systems may be utilized to confirm indoor environment requirements for temperature and humidity.
 - 4) Manufacturer/Product: Quest Climate Control CHH 980 and CHH 300 Hydronic Heating Systems and/or equal may be utilized for temporary construction heating projects.

3. Temporary Cooling: Contractor shall supply temporary cooling equipment to maintain temperatures below 80 degrees F.
 - a. Contractor may utilize the permanent heating/cooling system for temporary cooling when approved by A/E as ready for operation. Otherwise Contractor shall provide independent temporary cooling and dehumidification equipment.
 - 1) Reheat coils can be utilized to lower relative humidity in air stream.
 - b. Independent cooling and dehumidification equipment may be necessary even if permanent system is used if permanent system is not capable of maintaining temperature and humidity required in technical sections.
 - 1) Permanent system has been design for school operational use and not for temporary construction (drying) purposes.
 4. Provide electrical wiring required for temporary heating from temporary electrical service.
- I. Ventilation and Humidity Control - After Building Enclosure
1. Provide for ventilation and humidity control of the enclosed space for construction personnel in accordance with applicable laws. Provide ventilation, air conditioning, and humidity control of the enclosed space as required to facilitate drying of plaster, poured decks and floors, or other materials requiring ventilation in accordance with manufacturer's directions and as required to attain proper moisture levels within building including materials, surfaces and ambient air for installation and application of interior materials and equipment. Provide temporary ventilation and humidity control to protect 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.
 2. If the permanent ventilation and air conditioning system is approved by A/E for use, the Contractor shall assume full responsibility for maintenance of the permanent equipment and shall keep the system clean, furnish and change filters as needed, and turn the complete new heating-ventilation system over to the Owner in a clean condition when the project is completed. Permanent equipment shall not be used for temporary ventilation unless maintained and operated as follows:
 - a. Return air ducts shall not be used.
 - b. Supply air to each unit shall be filtered.
 - c. Filters shall be constantly checked and changed when necessary.
 - d. Operation of permanent equipment for ventilation shall not negate the Owner's warranty period specified to commence on the date of Contract Completion.
 3. Use dehumidification equipment to control environment in space 24 hours a day while joint compounds, paints, flooring, and fireproofing are being installed and until materials in space reach moisture levels as recommended by manufacturers.
 - a. Desiccant dehumidifiers shall be of solid desiccant design having a single rotary desiccant wheel capable of fully automatic continuous operation.
 - b. Do not re-circulate air through dehumidification equipment unless positive pressure is maintained.
- J. Electronic Communication Service: The Contractor will provide temporary electronic communication service, including electronic mail, in common use facilities. Provide secure Wi-Fi wireless connection to internet with provisions for access by A/E and Owner.
1. Provide a T-1 line, cable or DSL in primary field office.
 - a. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 1.0 Mbps upload and 15 Mbps download speeds.
 2. Printer: "All-in-one" unit equipped with printer server, combining color printing, photo copying, scanning, and faxing, or separate units for each of these three functions.
- K. Sanitary Facilities: The Contractor will provide, at the beginning of Work, and shall maintain temporary toilets, wash facilities, and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the project's needs.

1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit type privies will not be permitted.
 - a. Provide separate facilities for male and female personnel.
3. Drinking Water Facilities: Provide one of the following:
 - a. Drinking water fountains including paper cup supply.
 - b. Containerized, tap dispenser, bottled water drinking water units, including paper supply.
 - 1) Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 degrees F.

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 of building lines. Comply with NFPA 241.
 2. Maintain support facilities until Contract Completion or as directed by the A/E.
- B. Field Offices and Storage Sheds
 1. Mobile offices or storage facilities may also be supplied by subcontractors for their use under the same conditions, if approved by the Owner and A/E. Remove from and clean premises when directed by Owner and A/E.
 - a. Temporary utilities, electrical service, and telephone service shall be provided by Contractor and subcontractor for their respective construction trailers, offices, work areas, etc., and shall be located in accordance with approved "Use of Site Plan."
 - b. As required by the Contractor due to construction requirements, moving and relocating of trailers and offices will be the responsibility of the subcontractor involved, including costs associated therewith.
 2. Final location of temporary offices shall be as established by "Use of Site Plan," approved by the A/E prior to start of construction.
 - a. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
 3. Contractor shall provide storage sheds as required for own use, if approved on "Use of Site Plan". Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere onsite.
 - a. Store combustible materials apart from building.
 4. No signs will be allowed to be erected on the Project site or on the building unless approved by the Owner and A/E.
- C. Temporary Roads and Paving
 1. Existing drives and parking areas as indicated on the Drawings and as directed by the Owner and A/E, shall be used as access drives, staging, and parking areas for construction.
 - a. Party shall be held responsible for damage to existing surfaces resulting from operations relative to Work being performed under this Contract; and shall repair damaged areas to their original condition, as approved by the A/E, at no additional cost to the Owner.
 - b. If there is any right-of-way as identified on Drawings that the Owner is legally responsible to construct and/or maintain, cooperate fully in the construction and/or maintenance of such right of way and avoid interference in use of such right-of-way by others.
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 1. Protect existing site improvements to remain including curbs, pavement, and utilities.

2. Maintain access for fire fighting equipment and access to fire hydrants.
- E. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulation.
- G. Temporary Project Identification Signs
 1. Project Identification: Prepare project identification and other signs of size indicated. Do not permit installation of unauthorized signs.
 - a. The Contractor shall provide a painted project identification sign, professionally lettered and maintained, giving name of Project, the names and address of the Owner, and A/E and the Contractor. Sign shall be 96 inches by 96 inches with text on both sides.
 - 1) Face: 3/4-inch thick plywood, exterior type with smooth faces for paint finishes.
 - 2) Posts and Frame: Preservative treated structural lumber with smooth faces for paint finish.
 - 3) Finish: Wood primer and enamel finish coat of paint as approved.
 - b. The location of the project identification sign shall be as instructed by the A/E or as shown on the Drawings. The size and design shall be in accordance with the A/E's instructions.
 - 1) Refer to sign sample following this Section.
 - 2) Install signs where indicated to inform the public and persons seeking entrance to the Project.
 - c. Project sign shall be removed when instructed by the A/E or prior to completion and final acceptance, unless instructed by the A/E to be left on the site longer, in which case the Owner will remove it.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to the Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touch up signs, so they are legible at all times.
- H. Openings for Electrical, Mechanical, and Other Trades
 1. Temporary openings not called for on the Drawings, which may be required for the purpose of bringing equipment into the buildings or for placing same, shall be performed as approved by the Contractor. Perform the Work of providing and maintaining such openings and of restoring the structure.
- 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.

3.4 SECURITY AND PROTECTION FACILITIES

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and an adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access properly for that purpose.
- B. Temporary Enclosures

1. 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.
 - a. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 - 1) Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
 - b. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
 - 1) Where temporary wood or plywood enclosure exceeds 100 square feet in area, use UL labeled, fire retardant treated material for framing and main sheathing.

- C. Temporary Egress: Maintain temporary egress and exist ways for protection of life and property as required by authorities having jurisdiction.

- D. Site Enclosure Fencing: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site.
 1. The Construction Manager will install construction fencing in accordance with the "Use of Site Plan" and around temporary structures, storage areas, roadways, and other hazards as required for safety and security.
 - a. Chain Link Fencing: Unless otherwise noted, provide chain link fencing.
 - b. The Contractor shall remove fencing if necessary due to construction progress when directed by the A/E.

- E. Temporary First Aid Facilities: Applicable provisions of federal, state, county, and municipal regulations for construction safety in the State in which the Project is located shall govern these Construction Documents and the Construction hereby contemplated.

- F. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 - a. Minimum provisions, unless otherwise required by law(s), shall be 10# capacity ABC type fire extinguishers, plainly marked and easily accessible, in each area where work is in progress.
 - b. Provide wood standards for fire extinguishers and emergency alarm stations. The 2 by 3 foot plywood panel shall be painted green. The base shall be painted red.
 2. Store combustible materials in containers in fire safe locations.
 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 - a. Use of open flames is prohibited.
 4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 5. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other sections.
 6. Develop and supervise an overall fire-prevention and protection program for personnel at Project site. Provide temporary emergency systems, warning systems, and fire alarm systems in accordance with OSHA standards. Contractor to provide alarm stations consisting of an area plan showing alarm station locations, escape routes to nearby exits, and a distinctive alarm capable of being heard above ambient noise levels. Remove temporary systems after permanent systems are operational.

7. Provide temporary stand pipes 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.
8. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
9. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are preformed close to sprinklers, shield them temporarily with guards.
 - a. Remove temporary guards at end of work shifts, whenever operations are paused, and when nearby work is complete.

G. Environmental Protection

1. In order to prevent and to provide for abatement and control of environmental pollution arising from the construction activities in the performance of this Contract, comply with applicable federal, state, county, and municipal laws, and regulations concerning environmental pollution control and abatement as well as the specific requirements stated elsewhere in the Contract Documents.
2. Items having apparent historical or archaeological interest that are discovered in the course of construction activities shall be carefully preserved. Leave the archaeological find undisturbed and shall immediately report the find to the A/E so that the proper authorities may be notified.
3. Do not pollute water resources with fuels, oils, bitumen, calcium chloride, acids or harmful materials. Investigate and comply with applicable federal, state, county, and municipal laws concerning pollution of rivers and streams. Work under this Contract shall be performed in such a manner that objectionable conditions will not be created in water resources through or adjacent to the Project areas.
 - a. Spillages: Throughout the duration of the Project, special measures shall be taken to prevent chemicals, fuels, oils, grease, bituminous materials, waste washings, herbicides and insecticides, and cement from entering water resources.
 - b. Disposal: If waste material is dumped in unauthorized areas, remove the material and restore the area to the condition of the adjacent undisturbed area. If necessary, contaminated ground shall be excavated, disposed of as directed by the A/E, and replaced with suitable fill material, compacted and finished with topsoil.
4. Minimize dispersed dust at required excavations, embankments, stockpiles, haul roads, permanent access roads, plant sites, waste areas, borrow areas, and other work areas on or off site to minimize dispersed dust.
5. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Division 31 Section "Site Clearing".
6. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
 - a. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree or plant protection zones.
 - b. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - c. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from the Project site during the course of the Project.
 - d. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

H. Security Enclosure and Lockup

1. Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

- a. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of materials to minimize the opportunity for theft and vandalism.
 - 2. Provide temporary doors and closures.
 - a. Provide hinged plywood or batten doors with locks to maintain temperatures necessary to perform the Work and provide temporary building security.
 - b. Permanent closures of openings may be installed, provided that these are protected and are left in perfect condition when building is completed. Where required, closures shall be of a material or type that will permit passage of air for ventilation to dry out building.
 - 3. Relocate as required by progress of construction, by storage or work requirements, and to accommodate legitimate requirements of Owner and other Contractors employed at the site, if applicable. Completely remove when construction needs can be met by use of permanent construction. Clean and repair damage caused by installation or by use.
- I. Existing Utility Protection
- 1. Existing utility lines and structures indicated or known, and utility lines constructed for this Project shall be protected from damage during construction operations.
 - 2. Locate and flag lines and structures before beginning excavation and other construction operations.
 - 3. When utility lines and structures that are to be removed or relocated are encountered within the area of operations, notify the A/E and affected utility in ample time for the necessary measures to be taken to prevent interruption of the services.
 - 4. Damage to existing utility lines or structures not indicated or known shall be reported immediately to the A/E and the affected utility.
- J. Storm Water Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of storm water from heavy rains.

3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
- 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed work, and replacing water-damaged work.
 - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 - 3. Indicate methods to be used to avoid trapping water in finished work.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
- 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
- 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.

4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use temporary cooling equipment; reheat coils and/or dehumidification to control humidity or permanent heating/cooling system when approved by A/E.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 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. Protect from damage caused by freezing temperatures and similar elements.
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.
 2. Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. 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 the property of Contractor.
 2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 01 Section "Closeout Procedures".

END OF SECTION 01 50 00

Owner Logo

OWNER NAME

Project Name

In partnership with:



**Facilities
Construction
Commission**

Architect:

Architect Logo

Contractor:

Contractor Logo

Contractor:

Contractor Logo

**Site Photo/Rendering
(6.52 in x 4.98 in)**

COMPLETION DATE (SEASON/YEAR)

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 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; and comparable products.
1. It is the intent of the Specifications and Drawings to accomplish a complete and first-rate installation executed by competent and experienced workmen.
 2. Equipment, specialties, and similar items shall be checked for compliance and approved prior to installation. Contractor is cautioned that work or equipment installed without approval is subject to condemnation, removal, and subsequent replacement with an approved item without extra remuneration.
- B. Related Sections include the following:
1. Division 01 Section "Allowances" for products selected under an allowance.
 2. Division 01 Section "Alternates" for products selected under an alternate.
 3. Division 01 Section "References" for applicable industry standards for products specified.
 4. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
 5. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 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 are equivalent to 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.
1. Substitutions after Bid Opening
 - a. The A/E should consider Requests for Substitutions after the bid opening only when the Contractor can conclusively demonstrate to the A/E the following conditions:
 - 1) The specified Basis-of-Design Components, Acceptable Components, or Substitutions approved prior to the bid opening, through no fault of the Contractor or Subcontractors and Material Suppliers, are not available; or
 - 2) The specified Basis-of-Design Components, Acceptable Components, or previously-approved Substitutions will not perform as designed or intended.

1.3 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.

1.4 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.
 - 1. Where Contractor has an option preference should be given to products with minimal packaging and easily recyclable packaging as defined in ASTM D5834.
 - 2. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.
- 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.
- D. Contractor shall be responsible for materials he orders for delivery to the jobsite. Responsibility includes, but is not limited to, receiving, unloading, storing, protecting, and setting in place; ready for final connections.
 - 1. The Owner will not be responsible for deliveries related to the construction or operation of the Contractor. The Owner cannot sign delivery forms for the Contractor.
- E. Contractor shall insure that products are delivered to the Project in accordance with the Construction Progress Schedule of the Project. In determining date of delivery, sufficient time shall be allowed for shop drawings and sample approvals, including the possibility of having to resubmit improperly prepared submittals or products other than those specified and the necessary fabrication or procurement time along with the delivery method and distance involved.

1.5 WARRANTIES

- A. Specific warranties or bonds called for in the Contract Documents, in addition to that falling under the general warranty as set forth in General Conditions, shall be furnished in accordance with the requirements of the Specifications.

1. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - a. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- B. Contractor shall and does hereby agree to warrant for a period of one year, or for longer periods, where so provided in the Specifications, as evidenced by the date of Contract Completion issued by the A/E, products installed under the Contract to be of good quality in every respect and to remain so for periods described herein.
- C. Should defects develop in the previously mentioned Work within the specified periods, due to faults in products or their workmanship, the Contractor hereby agrees to make repairs and do necessary Work to correct defective Work to the A/E's satisfaction, in accordance with the General and Supplementary Conditions. Such repairs and corrective Work, including costs of making good other Work damaged by or otherwise affected by making repairs or corrective Work, shall be done without cost to the Owner and at the entire cost and expense of the Contractor within 30 days after written notice to the Contractor by the Owner.
 1. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
 2. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- D. Nothing herein intends or implies that the warranty shall apply to Work that has been abused or neglected or improperly maintained by the Owner or his successor in interest.
- E. Where service on products is required under this Article, it shall be promptly provided when notified by the Owner and no additional charge shall be made, unless it can be established that the defect or malfunctioning was caused by abuse or accidental damage not to be expected under conditions of ordinary wear and tear.
- F. In the event movement in the adjoining structure or components causes malfunctioning, the party responsible for the original installation of the adjoining structure or components shall provide such repair, replacement, or correction necessary to provide for proper functioning to bring the equipment back into the same operating condition as approved at the completion of the building.
- G. The manufacturer and supplier expressly warrants that each item of equipment furnished by him and installed in this Project is suitable for the application shown and specified in the Contract Documents and includes features, accessories, and performing characteristics listed in the manufacturer's catalog in force on the date bids are requested for the Work. This warranty is intended as an assurance by the manufacturer that his equipment is not being misapplied and is fit and sufficient for the service intended. This warranty is in addition to and not in limitation of other warranties or remedies required by law or by the Contract Documents. It shall be the responsibility of the Contractor for the particular equipment to obtain this warranty in writing.
- H. In case the Contractor fails to do Work so ordered, the Owner may have Work done and charge the cost thereof against monies retained as provided for in the Agreement and, if said retained monies shall be insufficient to pay such cost or if no money is available, the Contractor and his Sureties shall agree to pay to the Owner the cost of such Work.

- I. 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.

- J. 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.

- K. 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," A/E will make selection.
 - 5. Where products are accompanied by the term "match sample," sample to be matched is A/E's.
 - 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 - 7. Provide environmentally preferable products to the greatest extent possible. Provide products and materials that have a lesser or reduced effect on the environment considering raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and/or disposal of the 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.
 - a. Restricted List: Where specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Substitutions for convenience will not be considered after award.
 - 4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.

- a. Restricted List: Where specifications include a list of names, provide a product by one of the manufacturers listed that complies with requirements. Substitutions for convenience will not be considered.
- 5. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches A/E's sample. A/E'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 for "Substitutions" in the General Conditions.
- 6. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, and 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, A/E 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, A/E will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 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. Starting and adjusting.
 - 5. Protection of installed construction.

- B. Related Sections include the following:
 - 1. Division 01 Section "Summary" for coordination of Owner-furnished products and limits on use of Project sites.
 - 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 "Progress Cleaning" for progress cleaning.
 - 5. 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.

1.2 PREINSTALLATION MEETINGS

- A. Layout Conference: Conduct conference at Project site.
 - 1. Prior to establishing layout of new perimeter and structural column grids, review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform A/E of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:
 - a. Contractor's personnel.
 - 2. Review meetings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
 - 3. Review requirements for including layouts on shop drawings and other submittals.
 - 4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Informational/Quality Assurance/Control Submittals:
 - 1. Qualification Data: For land surveyor or professional engineer.
 - 2. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.

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.

- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this project in material, design, and extent.

- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturers written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.

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.
- 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:
 - a. Verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water service piping.
 - b. Verify the location of underground electrical services, natural gas piping and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Examination and 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. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
- D. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.
 - a. Recommended corrections.
- E. 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 and A/E 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 Interpretation to A/E. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.
- E. Protect roof areas where construction traffic is anticipated.

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 A/E promptly.
 - 1. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.
 - 2. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.
- B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
 - 1. Establish a minimum of 2 permanent benchmarks and control points to set lines and levels and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project Site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify A/E when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and 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 A/E.

3.4 FIELD ENGINEERING

- A. 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 A/E. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to A/E before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of 2 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.
- C. 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.

3.5 INSTALLATION, GENERAL

- A. 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 occupied spaces and 90 inches in unoccupied spaces, unless indicated on drawings.
- 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 Contract 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 of type expected for Project.
- E. Sequence the work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at height directed by A/E.
 - 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.
 - 4. Electrical wiring and associated metallic conduit shall not be embedded within roof assemblies or placed directly below roof decks. Electrical wiring or metallic conduit located near roof assemblies shall be positioned and supported at least 10 inches away from the bottom side of the metal roof deck or other substrate to which a roof system has been or will be applied.
 - 5. Suspension wires, straps, chains, and metal framing such as those used to support the following shall not be attached to or through steel roof decks.
 - a. Bulkheads.
 - b. Suspended ceilings.
 - c. Fire-suppression systems.
 - d. Ductwork.
 - e. Lighting.
 - f. Similar items.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 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: Inspect field-assembled components and equipment installation. Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Contract Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.
- D. Protect 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.

1. Protect new roof areas where continued construction traffic is anticipated.
 - a. Loosely lay 1-inch minimum thick, molded expanded polystyrene (MEPS) insulation over the roofing membrane in areas indicated. Loosely lay 15/32-inch plywood or OSB panels over MEPS. Extend MEPS past edges of plywood or OSB panels a minimum of 1 inch.
 - 1) Protection sheet or mat: provide a sacrificial layer of matching membrane sheet extending minimum 6 inches beyond insulation in all directions or a woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.
 - b. Limit traffic and material storage to areas or roofing that have been protected.

3.8 CORRECTION OF WORK

- A. Repair or remove and replace damaged, defective, or nonconforming work. Restore damaged substrates and finishes.
 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Repair work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Divisions 02 through 33 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.

1.2 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.
- C. Cutting and patching performed during the manufacture of products or during the initial fabrication, erection, or installation processes is not considered to be "cutting and patching" under this definition. Drilling of holes to install fasteners and similar operations are also not considered to be "cutting and patching".

1.3 QUALITY ASSURANCE

- A. Structural Elements:
 - 1. When cutting and patching structural elements, notify A/E of locations and details of cutting and await directions from the A/E before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Obtain approval of the cutting and patching proposal before cutting and patching structural elements.
- 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.
- 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.
- 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 A/E's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.4 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. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- B. Temporary Support: Provide temporary support of Work to be cut.
- C. 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.
- D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."
- E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 CUTTING AND PATCHING

- 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.
 - 2. Do not use cutting torches.

3. No cutting that may impair the strength of the building or its components. No holes except for small screws or bolts may be drilled in the beams or other structural members for the purpose of supporting, routing, or attaching Work without obtaining prior approval from the A/E.
 - a. Provide temporary support of work to be cut.
 4. Refer to other Sections of these Specifications for specific cutting and patching requirements and limitations applicable to individual units of Work.
 5. Unless otherwise specified, requirements of this Section apply to Mechanical and Electrical Work.
 - a. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- 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. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
 4. Proceed with patching only after other nearby 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
 - 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.
 - a. Refer to Division 09 Section "Acoustical Panel Ceilings" for replacement of acoustical ceilings.
 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 01 73 29

SECTION 01 74 00 – PROGRESS CLEANING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes cleaning requirements during construction operations.
- B. Related Work
 - 1. Division 00 Document "General Conditions" (Article 6).
 - 2. Division 01 Section "Closeout Procedures" for requirements for final cleaning.

1.2 RUBBISH CONTAINMENT

- A. Refer to Division 01 Section "Temporary Facilities and Controls".
- B. Hazards Control
 - 1. Store volatile wastes in covered metal containers and remove from premises daily.
 - 2. Prevent accumulation of wastes that create hazardous conditions.
 - 3. Provide adequate ventilation during use of volatile or noxious substances.
- C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
 - 1. Do not burn or bury rubbish and waste materials on project site.
 - 2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 - 3. Do not dispose of wastes into streams or waterways.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use only cleaning materials recommended by manufacturer of surface to be cleaned.
 - 1. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finish surface.

PART 3 - EXECUTION

3.1 DAILY/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.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- 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.
- K. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted or finished surfaces.

3.2 ROUTINE CLEANING

- A. Employ experienced workers for cleaning.
- B. Remove dirt, mud, and other foreign materials from sight exposed interior and exterior surfaces.
- C. Weekly, or at more frequent intervals, if work activities justify same, perform the following cleaning. This includes all dirt, dust, and debris not identifiable as part of a Contract. Broom clean floor and paved surfaces; rake clean other surfaces of ground.
- D. Maintain cleaning throughout the duration of the Project.
- E. Should the Contractor fail in the performance of this Work, the Owner may perform such Work in accordance with the General Conditions.
- F. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.

END OF SECTION 01 74 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion Inspection.
 - 2. Final Contract Completion.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of work.
- B. Related Sections include the following:
 - 1. Division 01 Section "Progress Cleaning" for progress cleaning of Project site.
 - 2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 4. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
 - 5. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at final completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 PREREQUISITIES TO SUBSTANTIAL COMPLETION INSPECTION

- A. Preliminary Procedures: Before requesting inspection for determining date of complete the following.
 - 1. Final Cleaning: Refer to Division 00 Document "General Conditions" (Article 6.25).
 - 2. Contractor's Punch List: Refer to Division 00 Document "General Conditions" (Article 6.26).

1.6 PREREQUISITIES TO CONTRACT COMPLETION

- A. Request a final inspection by A/E when all "Punch List Items" have been completed. Final inspection shall occur within 30 days of issuance of Substantial Completion.
 - 1. Contractor shall indicate any items to be deferred in request.

- B. Reinspection: A/E will reinspect work and if items have been completed and record documents have been received, A/E will process a Certificate of Contract Completion.

1.7 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit on digital media acceptable to Owner and A/E.
- 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.
 - 1. Refer to Article 6 of the General Conditions.
- 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. 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.
 - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - g. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
 - h. Vacuum and mop concrete.

- i. 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.
 - j. Remove labels that are not permanent.
 - k. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - l. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - m. 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.
 - n. Clean strainers.
 - o. 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.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Contract Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.

- B. Related Requirements:
 - 1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Division 01 Section "Closeout Procedures" for administrative and procedural requirements, including warranties.
 - 3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
 - 4. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the work of those Sections.

1.2 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.

1.3 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals as indicated in individual specification sections and as reviewed and approved at the time of Section submittals.
 - 1. A/E will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit on digital media acceptable to A/E or by uploading to approved web-based project software site. Enable reviewer comments on draft submittals.

- C. Initial Manual Submittal: To facilitate the Closeout and Commissioning Process, the Contractor shall submit the scope of items to be submitted in the form of an expanded Table of Contents to A/E and CxA, for review. Submit at least 30 days before commencing demonstration and training begins.

- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. A/E will return copy with comments.
 - 1. Correct or revise each manual to comply with A/E's comments. Submit copies of each corrected manual within 15 days of receipt of A/E's comments and prior to commencing demonstration and training.

- E. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.
 - 1. 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.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 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.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
 - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 - 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents.
- B. Related Sections include the following:
 - 1. Division 01 Section "Closeout Procedures" for general closeout procedures.
 - 2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Divisions 02 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings (As-Built Drawings): Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up Record Prints to the A/E.

PART 2 - PRODUCTS

2.1 PROJECT RECORD DOCUMENTS

- A. Record Documents, General
 - 1. Maintain at the jobsite one copy of Drawings, Project Manual, addenda, final shop drawings, change orders, field orders, other contract modifications, and other documents in compliance with various Sections of the Project Manual.
- B. Record Drawings
 - 1. Maintain "As-Built Drawings" on separate xerographic prints set-aside especially for this purpose on the job. Drawings shall incorporate changes made in the Work of the respective trades during the construction period. Such changes shall be indicated at the time they occur.
 - a. Accurately record information in an understandable drawing technique.
 - b. Record data as soon as possible after obtaining it. Record and check markup prior to enclosing concealed installations.
 - 2. Each of these drawings shall be clearly marked "As-Built Drawings"; maintained in good condition; available for observation by A/E; and shall not be used for construction purposes. Mark these drawings to show the actual installation where the installation varies from the installation shown originally. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later. Items required to be marked include, but are not limited to, the following:
 - a. Dimensional changes to the Drawings.
 - b. Significant detail not shown in the original Contract Documents including Change Orders or Change Directives.
 - c. The location of underground utilities and appurtenances dimensionally referenced to permanent surface improvements.
 - d. The location of internal utilities and appurtenances concealed in building structures, referenced to visible and accessible features of the structures.
 - e. When elements are placed exactly as shown on Drawings, so indicate; otherwise show changed location.
 - f. Revisions to details shown on the Drawings.
 - g. Depths of foundations below the first floor.
 - h. Revisions to routing of piping and conduits.
 - i. Revisions to electrical circuiting.
 - j. Actual equipment locations.

- k. Duct size and routing.
- l. Details not on original Contract Drawings.
- 3. Keep project drawings current. Do not permanently conceal work until the required information has been recorded. Mark record prints of Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where shop drawings are marked, show cross-reference on Drawings location.
 - a. Mark record sets with red, or color that may be photo copied, erasable colored pencil. Use other colors (no blue) to distinguish between changes for different categories of the work at the same location.
 - b. Note Change Directives, alternate numbers, change order numbers, and similar identification.
- 4. Prior to request for certificate of Contract Completion, organize the "As-Built Drawings" into manageable sets, bind the sets with durable paper cover sheets, certify to the accuracy of the "As-Built Drawings" by signature thereon, and deliver the "As-Built Drawings" to the A/E.

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. 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 A/E's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Full cooperation during the Owner's audio- and video-recording of demonstration and training sessions.
- B. Related Sections:
 - 1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit 2 copies of outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

- A. At completion of training, submit one complete training manual for Owner's use.
- B. Pre-Produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Meeting: Conduct meeting at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.

4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 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. Do not submit instruction program until operation and maintenance data has been reviewed and approved by A/E.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if subcontractor 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

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between subcontractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish subcontractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through A/E, with at least fourteen days' advance notice.
- D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 AUDIO- AND VIDEO-RECORDING OF DEMONSTRATION AND TRAINING

- A. General: Owner may engage a photographer or sound technician to audio- or video-record demonstration and training sessions.
- B. Subcontractor and trainer shall cooperate fully with the Owner's efforts to audio- or video-record demonstration and training sessions.

END OF SECTION 01 79 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure to accommodate new work.
- B. Related Sections include the following:
 - 1. Division 01 Section "Summary" for use of premises and Owner-occupancy requirements.
 - 2. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
 - 3. Division 01 Section "Cutting and Patching" for cutting and patching procedures.
 - 4. Division 31 Section "Site Clearing" for removing above- and below-grade site improvements.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. When permitted by the A/E, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- F. Asbestos-Containing Materials (ACM): Materials containing greater than 1 percent asbestos; however since OSHA regulates the removal of materials containing less than or equal to 1 percent asbestos even those containing less than 1 percent can be considered ACM.

1.3 MATERIALS OWNERSHIP

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

1.4 COORDINATION

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

1.5 PREINSTALLATION MEETINGS

- A. Pre-demolition Meeting: Conduct meeting at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
4. Review areas where existing construction is to remain and require protection.
5. Review and finalize protection requirements.
6. Review procedures for noise control and dust control.
7. Review storage, protection, and accounting for items to be removed for salvage or reinstallation.

1.6 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

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

1.7 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing National Emission Standards for Hazardous Air Pollutants (NESHAP) and EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
1. Comply with requirements specified in Division 01 Section "Summary."
- B. Notify A/E of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify A/E and Owner. Owner will remove hazardous materials under a separate contract, unless otherwise noted.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 COORDINATION

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to A/E.
- D. Perform an engineering survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 PREPARATION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surface and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls".
- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location and reinstalled in their original locations after selective demolition operations are complete.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
 - 1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."
 - 2. Maintain fire-protection facilities in service during selective demolition operations.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches.
 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by A/E, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete adjacent to Construction Indicated to Remain: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- B. Explosives: Use of explosives or cutting torches is not permitted.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING/PATCHING

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

- B. Repair demolition performed in excess of that required. Return structures, substrates, and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.
 - 1. Refer to Division 01 Section "Cutting and Patching".

END OF SECTION 02 41 19

SECTION 03 06 30.01 - CONCRETE SCHEDULE

ITEM OR STRUCTURE	COMPRESSIVE STRENGTH AND OTHER REQUIREMENTS
Trench footings, footings, and interior foundation and retaining walls	3500 P.S.I. at 28 days Max W/C Ratio = 0.55 Slump Limit: Not less than one inch and not more than 3 inches.
Foundation and retaining walls exposed to exterior	4500 P.S.I. at 28 days Max W/C Ratio = 0.45 Use mid-range water reducer Slump Limit: Not less than one inch and not more than 3 inches. Air Content: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4 inch nominal maximum aggregate size.
Exposed interior floor slabs and carpeted floors, unless otherwise noted	4000 P.S.I. at 28 days Max W/C Ratio – 0.45 Use mid-range water reducer Slump Limit: 4 inches, plus or minus 1 inch, before adding water-reducing or plasticizing admixtures, with maximum slump less than 6 inches. Do not use high range water reducers. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
Interior floor slabs scheduled to receive thin-set flooring, resilient flooring and other flooring types, unless otherwise noted	4000 P.S.I. at 28 days Max W/C Ratio = 0.45 Use mid-range water reducer Slump Limit: 4 inches, plus or minus 1 inch, before adding water-reducing or plasticizing admixtures, with maximum slump less than 6 inches. Do not use high range water reducers. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent. Use mid-range water reducer
Exterior walks, stoops, steps, aprons, and curbs; exterior formed concrete exposed to view; exterior concrete not otherwise indicated	4500 P.S.I. at 28 days Max W/C Ratio = 0.45 Use mid-range water reducer Air Content: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4 inch nominal maximum aggregate size.
Flowable Fill – Type 1 Utility Trench Backfill	50-100 P.S.I. at 28 days Unconfined compression strength per ASTM D4832
Flowable Fill – Type 2 Under Foundations	100 P.S.I. at 28 days Unconfined compression strength per ASTM D4832
Lean concrete fill under footings and encasement of underground utilities or connections	1500 P.S.I. at 28 days Max W/C Ratio = 0.55 for non-air entrained mix

*Refer to Section 033000 – Cast-In-Place Concrete for percent of air entrainment required for concrete mix.

**Refer to Section 033000 – Cast-In-Place Concrete for definitions of finishes.

END OF SECTION 03 06 30.01

SECTION 03 06 30.03 - CONCRETE MIX DESIGN SUBMITTAL

CONCRETE MIX DESIGN SUBMITTAL FORM

Project: _____

City: _____

General Contractor: _____

Concrete Contractor: _____

Concrete Strength (Class): _____

Use (describe): _____

Design Mix Information

Please Check One

Based on Standard Deviation Analysis
Trial Mix Test Data

Design Characteristics:

Density		pcf
Strength		psi (28 day)
Air		% specified

*If trial mixes are used the Mix Design is proportioned to achieve $f'_{cr} = f'_c + 1200$ psi
(1400 psi for strength higher than 5000 psi at 28 days)*

<u>MATERIALS</u>	Type/ Source	Specific Gravity	Weight/lb.	Absolute Vol. cu. ft.
Cement				
Flyash				
Microsilica				
Coarse Aggregate				
Fine Aggregate				
Water				
Other				
TOTAL				27.0 cu. ft.

* **Water/Cement Ratio (lbs. water/lbs. cement) = _____%**

ADMIXTURES	Manufacturer	Dosage oz/cwt
Water Reducer		
Air Entraining Agent		
Mid Range Water Reducer		
Fibrous Reinforcement		
Other		

Slump before HRWR _____ inches

Slump after HRWR _____ inches

Standard Deviation Analysis (from experience records):

# of Test Cylinders Evaluated:	
Standard Deviation:	

$$f'_{cr} = f'_c + 1.34s \text{ or } f'_{cr} = f'_c + 2.33s - 500$$

(Refer to ACI 301 for increased deviation factor when less than 30 tests are available)

LABORATORY TEST DATA

Compressive Strength

Age (days)	Mix #1	Mix #2	Mix #3
7	psi	psi	psi
7	psi	psi	psi
28	psi	psi	psi
28	psi	psi	psi
28 average	psi	psi	psi

REQUIRED ATTACHMENTS:

Please Check

<i>Coarse Aggregate Gradation Report</i>	
<i>Fine Aggregate Gradation Report</i>	
<i>Concrete Compressive Strength Data or Trial Mixture Test Data</i>	
<i>Admixture Compatability certification letter</i>	
<i>Rapid Permeability that results per AASHTO T277</i>	

Submitted by:

Name: _____

Address: _____

Phone #: _____

Main Plant Location: _____

Miles from Project: _____

Secondary Plant Location: _____

Miles from Project: _____

Date: _____

END OF SECTION 03 06 30.03

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for following:
 - 1. Exterior Concrete
 - a. Stoops
 - 2. Interior Concrete
 - a. Slab-on-ground
 - b. Bases and curbs
 - c. Foundations, footings, pads, piers
 - 3. Provide other cast-in-place concrete and related work as indicated for complete and finished work, except concrete work specifically designated to be provided under Work of other Sections of these Specifications.
- B. Related Sections include following:
 - 1. Division 07 Section "Joint Sealants" for sealing joints and penetrations in slab-on-grade or slabs below grade.
 - 2. Division 09 Finish sections for coordination with substrate requirements of finish materials.
 - 3. Division 10 Section "Metal Lockers" for coordination with locker base.
 - 4. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.2 DEFINITIONS

- A. Cementitious Materials: Materials that have cementing value if used in concrete, including Portland cement alone or in combination with one or more of following: fly ash and slag cement (ground granulated blast-furnace slag), silica fume, and medtakaolin; subject to compliance with requirements.
- B. Mineral Fillers: Finely ground inert materials that are used to help the water to powder ratio and are used to supplement cementitious materials.
- C. Water-Cementitious Materials Ratio (w/cm): Ratio by weight of water to cementitious materials, excluding that absorbed by aggregate, stated as a decimal.
- D. Formwork: Total system of support of freshly placed concrete, including mold or sheathing that contacts concrete, as well as supporting members, hardware, and necessary bracing.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate with other trades to maintain protection of concrete surfaces scheduled remain exposed. Protect concrete surfaces from physical damage and staining that could result from subsequent construction operations and might compromise final concrete finish.
- B. Pre-installation Meeting: Conduct meeting(s) at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Note: In lieu of one pre-installation meeting as work progresses, additional pre-installation meetings might need to take place to facilitate installation sequences i.e., footing and foundations and slab-on-grade.
 - 1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including following:
 - a. Contractor's superintendent.
 - b. Independent testing agency for special inspection and testing and inspecting agency procedures for field quality control.

- c. Ready-mix concrete manufacturer.
- d. Concrete subcontractor, including finisher.
- 2. Review the following:
 - a. Construction joints, control joints, isolation joints, and joint-filler strips
 - b. Vapor-retarder installation
 - c. Anchor rod and anchorage devices installation tolerances
 - d. Concrete mixtures-specification and constructability requirements
 - e. Scheduling and details of placement
 - f. Contract information of responsible persons during placement
 - g. Placement procedures and rate of placement
 - h. Jobsite adjustments permitted and decision process
 - i. Cold and hot weather requirements
 - j. Concrete finishes and finishing
 - k. Curing procedures
 - l. Methods for achieving specified floor and slab flatness and levelness
 - m. Floor and slab flatness and levelness measurements
 - n. Concrete repair procedures
 - o. Concrete protection
 - p. Special inspection and testing and inspecting agency procedures for field quality control
 - q. Testing frequency, sampling location

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including the following, if used for concrete mixtures:
 - 1. Portland cement
 - 2. Fly ash
 - 3. Aggregates
 - 4. Each type of steel reinforcing
 - a. Bar supports
 - 5. Include installation instructions where applicable.
 - a. Vapor Barrier: Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
 - 6. Admixtures: Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature of time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
 - 7. Curing materials
 - 8. Joint fillers
 - 9. Repair materials
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. Prepare and submit design mixes for each type of concrete and flowable fill. Use an independent testing facility acceptable to A/E for testing compressive strength of proposed mix designs. Submit compression test results for each design mix used to document that proposed mixture will achieve the required average compressive strength and other specified requirement. Test report shall clearly indicate design mix for which it applies. Each design mix shall indicate types of structures in which it is to be used.
 - 1. Field test records for concrete strength test records must be from concrete supplied from the same production facilities proposed for work. Test data shall be from concrete mixtures containing similar materials proposed for work, including:
 - a. Minimum 28-day compressive strength
 - b. Maximum w/cm
 - c. Slump limit
 - d. Air content
 - e. Nominal maximum aggregate size

2. Strength test reports for establishing a standard deviation for each class of concrete or for documenting the required average strength for work shall not be greater than 24 months old and shall be collected over a period not less than 45 days.
 3. Indicate amounts of mixing water to be withheld for later addition at Project site.
 - a. Note: A workability retaining admixture may also be used.
 4. Sample design mix submittal form is enclosed.
- C. Construction Joint Layout: Indicate proposed construction joints required to construct structure.
1. Location of construction joints is subject to approval of A/E.
- D. Concrete Schedule: For each location of each class of concrete indicated in "Concrete Mixtures" article, include following:
1. Location within project.
 2. Formed surface finish designation. Final finish for floors.
 3. Curing process.
- 1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS
- A. Qualification Data: For installer and manufacturer.
1. Installer: Include copies of applicable ACI certificates or NRMCA Certification.
- B. Material Test Reports: For following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- C. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.
- D. Proposed curing schedule shall include method and duration.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician or equivalent.
1. When requested, the Installer shall furnish a Quality Control Plan.
- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities", certification or approval by a state or highway agency or equivalent. Criteria of equal certification shall be included in the submittal.
 2. Quality control personnel with responsibility for concrete mixtures certified as an NRMCA Concrete Technologist Level 2, or equivalent. Criteria of equivalent certification shall be included in the submittal.
 3. When requested, the manufacturer shall furnish a Quality Control Plan.
- C. Environmental Requirements: Manufacturer and Contractor shall conform to Federal, State, and Local V.O.C. (Volatile Organic Compound) Regulations in area where Project is located. Notify A/E in writing if variations to Specifications herein are required.
- D. Regulatory Requirements: Comply with requirements of latest edition or edition approved by authorities having jurisdiction.
1. ACI Publications: Comply with following unless modified by requirements in Contract Documents:
 - a. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 - b. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

- c. ACI 347 "Recommended Practice of Concrete Formwork."
 - d. ACI 318, "Building Code Requirements for Structural Concrete."
 - e. ACI PRC-211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete."
 - f. ACI PRC-212.3 "Report on Chemical Admixtures for Concrete."
 - g. ACI PRC-302.1 "Guide for Concrete Floor and Slab Construction."
 - h. ACI PRC-304 "Guide for Measuring, Mixing, Transporting, and Placing Concrete."
 - i. ACI SPEC-305.1 "Specification for Hot Weather Concreting."
 - j. ACI SPEC-306.1 "Standard Specification for Cold Weather Concreting."
 - k. ACI SPEC-308.1 "Specification for Curing Concrete."
 - l. ACI PRC-311.4 "Guide for Concrete Inspection."
- 2. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
 - 3. ASTM Intl.:
 - a. ASTM A 1064 "Standard Specification for "Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete."
 - b. ASTM C33 "Standard Specification Curing Concrete."
 - c. ASTM C94 "Standard Specification for Ready-Mix Concrete."
 - d. ASTM C138 "Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete."
 - e. ASTM C260 "Standard Specification for Air Entraining Admixtures for Concrete."
 - f. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
 - g. ASTM C309 "Standard Specification for Liquid Membrane – Forming Compounds for Curing Concrete."
 - h. ASTM C779 "Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces."
 - i. ASTM C1315 "Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete."
 - j. ASTM E1155 "Determining Floor Flatness and Levelness Using F-Number System."
 - k. ASTM F609 "Standard Test Method for Using a Horizontal Pull Slip Meter (HPS)."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Concrete: Comply with ASTM C94 and ACI SPEC-301.
 - 1. Delivery tickets to contain the following, in addition to the information required by C94:
 - a. Reading of revolution counter at first addition of water.
 - b. Type and brand of cement and supplementary cementitious materials.
 - c. Cementitious content.
 - d. Total water content by producer.
 - e. Maximum size of aggregate.
 - 2. ASTM C94 requires discharge within 1-1/2 hours or 300 revolutions; whichever comes first, after the introduction of water to cement and aggregates, or the introduction of cement to aggregates. A/E may require an earlier discharge during hot water, or when high-early strength cement is being used.
- B. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Store reinforcement to avoid contact with earth.
- C. Vapor Barrier:
 - 1. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
 - 2. Store materials in a clean, dry area in accordance with manufacturer's instructions.
 - 3. Protect materials during handling and application to prevent damage or contamination.

1.8 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI SPEC-301 and ACI SPEC-306.1.

- B. Hot-Weather Placement: Comply with ACI SPEC-301 and ACI SPEC-305.1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
 - 2. Products: Subject to compliance with requirements, provide one of products specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for A/E's approval must be accompanied by "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Obtain all concrete mixtures from same ready mixed concrete manufacturer for entire Project.
 - 1. All cement to be from same mill.

2.2 CONCRETE, GENERAL

- A. ACI Publications: Comply with following, unless modified by requirements in Contract Documents:
 - 1. ACI SPEC-301
 - 2. ACI SPEC-117

2.3 FORM-FACING MATERIALS

- A. Smooth-Formed Finished (Exposed) Concrete Form-Facing Material (As-Cast Surface): Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, fiberglass, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
 - 1. Products:
 - a. Greenstreak 622; Greenstreak
 - b. Vinylex CSN-3/4; Vinylex Corp.
 - c. CHM-75-75-110 Poly-Comp Plastic Chamfer; Sylvan Products
 - d. CS-750 Chamfer Former; BoMetals Inc.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

2.4 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed for bars No. 3 to 11, unless otherwise noted.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets. Note: Roll stock is not acceptable.

2.5 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. Over vapor barriers, use precast concrete chairs to prevent penetration of membrane.

2.6 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type of class or cementitious material of same brand from same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Material: Use cementitious materials, of same type, brand, and source, throughout Project. Supplement cement as necessary to meet project conditions.
 - 1. Coordinate with mix design for special finishes.
 - 2. Portland Cement: ASTM C 150, Type I or III, gray.
 - 3. Limit fly ash to Class F if concrete expansion from alkali silica are anticipated.
 - a. Fly Ash: ASTM C 618, Class C or F.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, uniformly graded not to exceed 1-1/2 inch nominal size per ACI 301. Provide aggregates from a single source to ensure uniformity in color, size, and shape with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials. Aggregates shall not be potentially reactive as defined in Appendix X1 of ASTM C33.
 - 1. Local aggregates not complying with ASTM C33, but which have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to A/E.
 - 2. Fine Aggregate: Clean, sharp, natural sand free from loam, clay lumps, or other deleterious substances.
 - 3. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
 - a. Crushed stone, processed from natural rock or stone.
 - b. Washed gravel, either natural or crushed. Use of pit or bank-run gravel is not permitted.
 - c. Maximum Aggregate Size: Not larger than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourths of minimum clear spacing between individual reinforcing bars or bundles of bars.
 - d. Exterior concrete shall have crushed limestone aggregate, complying with ASTM C33, Class 4S or better.

4. Alkali-Silica Reaction: Comply with one of following:
 - a. Expansion Result of Aggregate: 14-day expansion less than or equal to 0.10 percent when tested in accordance with ASTM C 1260, or not more than 0.04 percent at one-year when tested in accordance with ASTM C 1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C 1567. Do not use this option with fly ash with an alkali content greater than 4.0 percent. Submit supporting data for each aggregate showing expansion in excess of 0.10 percent when tested in accordance with ASTM C1260.
 - c. Alkali Content in Content in Concrete: Not more than 4 lb./cu.yd. for moderately reactive aggregate or 3 lb./cu.yd. for highly reactive aggregate, when tested in accordance with ASTM C 1293 and categorized in accordance with ASTM C 1778, based on alkali content being calculated in accordance with ACI SPEC-301. Calculate alkali content of concrete in accordance with ACI 301. Do not use this option with natural pozzolan or fly ash that has a calcium oxide content greater than 18 percent or an alkali content greater than 4.0 percent; or for an aggregate with expansion at one year greater than or equal to 0.24 percent when tested in accordance with ASTM C1293.
- D. Combined aggregate gradation for slabs and other designated concrete shall be 8%-18% for large, top size aggregates (1-1/2 inch) or 8%-22% for smaller, top size aggregates (1 inch or 3/4 inch) retained on each sieve size below top size and above No. 100.

E. Water: ASTM C1602.

2.7 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260 as indicated in Article "Concrete Mixtures for Building Elements".
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Admixtures containing intentionally-added chlorides shall conform to limit consistent with ACI 318 and ACI 301.
 1. Water-Reducing Admixture: ASTM C 494, Type A.
 2. Retarding Admixture: ASTM C 494, Type B or D.
 3. Accelerating Admixture: ASTM C 494, Type C or E.
 4. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 5. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
 6. High-Range, Water-Reducing Admixture: ASTM C 494, Type F or G.
 7. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 8. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
 9. Workability-Retaining Admixture: ASTM C494, Type S. Shall retain concrete workability without affecting time of setting or early-age strength development.
 10. ASR-Inhibiting Admixtures: ASTM C494, Type S. Shall contain a nominal lithium nitrate content of 30 percent.
 11. Other Specific Performance Admixtures: ASTM C494, Type S.
 12. Admixtures with no standard (ASTM or other) designation shall be used with the permission of the engineer of record when its use for specific properties is required and can be submitted with documentation that demonstrates appropriate testing.

2.8 VAPOR BARRIER AND ACCESSORIES

- A. Vapor Barrier:
 1. Plastic Vapor Barrier
 - a. Water Vapor Barrier: ASTM E-1745; meets or exceeds Class A.
 - b. Permeance Rating: ASTM E-96 or ASTM F 1249; 0.01 Perms or less.
 - c. Thickness of Barrier: ACI 302.2R-06; not less than 15 mils.

2. Products:
 - a. Stego Wrap (15 mil) Vapor Barrier; Stego Industries
 - b. VaporBlock 15/VaporBlock G; Raven Industries
 - c. Perminator (15 mil); W.R. Meadows
 - d. Viper Vaporcheck II (15 mil); Insulation Solutions Inc.
 - e. Barrier-Bac VB-35 16 mil); Interplast
 - f. Husky Yellow Guard (15 mil); Poly-America
 - g. Tex-Trude Xtreme Vapor Barrier (15 mil); Tex-Trude, LP

B. Vapor Barrier Accessories

1. Seam/Transition Tape: Tape with pressure sensitive adhesive or double-sided adhesive. Minimum width 4 inches.
2. Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instruction.

C. Drainage Fill (Coarse):

1. Narrowly graded mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448; ODOT Item No. 304, Aggregate Base; with 100 percent passing a 2-inch sieve and 90 to 33 percent passing a No. 30 sieve.

2.9 CURING MATERIALS

A. Evaporation Reducer: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products:
 - a. Spray-Film; ChemMasters.
 - b. AquaFilm; Dayton Superior Corporation.
 - c. Eucobar; Euclid Chemical Company (The).
 - d. Vapor Aid; Kaufman Products, Inc.
 - e. Lambco Skin; Lambert Corporation.
 - f. E-Con; Laticrete International, Inc.
 - g. MasterKure ER 50; Master Builders Solutions.
 - h. Evapre; Meadows, W. R., Inc.
 - i. Waterhold; Metalcrete Industries.
 - j. Monofilm; Nox-Crete Products Group, Kinsman Corporation.
 - k. SikaFilm; Sika Corporation, Inc.
 - l. Certi-Vex EnvioSet; Vexcon Chemicals, Inc.
 - m. TK-2120 TRI-FILM; TK Products, Division of Sierra Corp.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

1. Color:
 - a. Ambient Temperature below 50 deg. F.: Black.
 - b. Ambient Temperature between 50 deg F. and 85 deg F.: Any color or clear.
 - c. Ambient Temperature above 85 deg F.: White.

D. Curing Paper: Eight feet wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

E. Water: Potable or complying ASTM C1602 that does not cause staining of the surface.

F. Curing Compound: Do not use.

2.10 SEALERS

- A. Penetrating Anti-Spalling Sealer (Exterior stoops): Sealer shall be a siloxane-based compound or silane modified siloxane emulsion formulated to reduce chloride ion absorption/intrusion by 80 percent when tested in accordance with NCHRP #244, Test Method Series II or IV tests. In addition, sealer-treated concrete shall exhibit no scaling when exposed to 125 cycles of freezing and thawing when tested in accordance with ASTM C 672. Tests shall be by an independent testing laboratory.
1. Products:
 - a. Baracade WB 244; Euclid Chemical Co.
 - b. Saltguard WB; PROSOCO, Inc.
 - c. Aquapel Plus; L & M Construction Chemical Co.
 - d. SpallGuard WB-10; ChemMasters
 - e. Sikagard 701W; Sika Corporation
 - f. Weather Worker S-100 (J29); Dayton Superior Corporation
 - g. Intraguard/Pentreat 244-40; W.R. Meadows
 - h. V-Seal 102 Winter Guard; V-Seal Concrete Sealers and Concrete Coatings

2.11 ACCESSORIES

- A. Expansion and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, ASTM D 1752, cork or self-expanding cork, or ASTM 4819, Type II, or ASTM D 1622 closed-cell compressible foam, 1/4-inch maximum thickness.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.12 REPAIR MATERIALS

- A. Epoxy Crack Injection Adhesive (Repair): ASTM C881, Type I, Grade 1, solvent free.
1. Products:
 - a. Sikadur 35 Hi-Mod LV; Sika Corp.
 - b. Sure-Inject J56; Dayton Superior Corp.
 - c. EUCO #452 LV; Euclid Chemical Co.
 - d. MasterInject 1380; Master Builders Solutions.
 - e. Pro-Poxy 100; Unitex
- B. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.
 5. Products:
 - a. Ardex K-15; Ardex Inc.
 - b. Econolevel; Dayton Superior Corporation.
 - c. MasterTop 110SL; Master Builders Solutions.
 - d. Skimflow ES; Dependable Chemical Co., Inc.
 - e. EZ Level; TEC Specialty Products.
 - f. Super FLO TOP; Euclid Chemical Co.
 - g. Levelex; L & M Construction Chemical.
 - h. Custom Building Products; CustomTech TechLevel 150
 - i. LEVELEZ; Maxxon Corp.
 - j. Schonox US; Schonox HPS North America

- C. Repair Overlayment (Traffic-Bearing): Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.
 5. Products:
 - a. Level Topping; Dayton Superior
 - b. Duracrete; L & M Construction
 - c. Wearflow; Dependable Chemical Co. Inc.
 - d. Ardex SD-T or K500; Arden Americas.
 - e. Custom Building Products; CustomTech TechLevel-HPT High Performance Topping.

2.13 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI SPEC-301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
 2. The installer and manufacturer shall coordinate to establish properties of the fresh concrete to facilitate placement and finishing with reduced potential for segregation and bleeding. Factors shall include but are not limited to slump or slump flow, setting time, method of placement, rate of placement, hot and cold weather placement, curing, and concrete temperature. Selection of fresh concrete properties shall be notified to the Engineer of Record in the submittal.
 3. Contractor shall indicate reportable changes in sources of materials and quantities when such changes are necessary to ensure constructability, performance of concrete and compliance with the specification requirements. The Contractor is permitted to make minor adjustments less than the reportable deviations noted in the original submittal to concrete mixtures to ensure uniformity of concrete without a resubmittal for review or approval.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent or other Pozzolans, unless otherwise recommended by ready mix manufacturer and approved in mix design by A/E.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cementitious materials.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing and accelerating admixture when required by low temperatures or cold-weather placement conditions.
 4. Use water-reducing admixture in pumped concrete, and concrete with a water-cementitious materials ratio below 0.50.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Exterior Concrete (Stoops): Proportion normal-weight concrete with following properties:
 - 1. Compressive Strength (28 days): Refer to Division 03 Section "Concrete Schedule".
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: Refer to Division 03 Section "Concrete Schedule".
 - 3. Slump Limit: 5 inches, plus or minus 1 inch.
 - 4. Air Content: Refer to Division 03 Section "Concrete Schedule".
- B. Footings: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: Refer to Division 03 Section "Concrete Schedule".
 - 2. Maximum Water-Cementitious Materials Ratio: Refer to Division 03 Section "Concrete Schedule".
 - 3. Slump Limit: Not less than one inch and not more than 3 inches.
- C. Foundation Walls: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: Refer to Division 03, Section "Concrete Schedule".
 - 2. Maximum Water-Cementitious Materials Ratio: Refer to Division 03, Section "Concrete Schedule".
 - 3. Slump Limit: Not less than one inch and not more than 3 inches.
 - 4. Air Content: Refer to Division 03 Section "Concrete Schedule".
- D. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: Refer to Division 03, Section "Concrete Schedule".
 - 2. Slump Limit: 4 inches, plus or minus 1 inch, before adding water-reducing or plasticizing admixtures, with maximum slump less than 6 inches.
 - 3. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

2.15 PROPORTIONING AND DESIGN OF MIXES

- A. Proportion mixes by either laboratory trial batch or field experience methods as specified in ACI SPEC-301, using materials to be employed on project for each class of concrete required.
- B. Submit written reports to A/E of each proposed mix for each type of concrete at least 15 days prior to start of Work. Indicate with each mix design items or structures for which it is to be used. Do not begin concrete production until mixes have been reviewed by A/E. Submit following information:
 - 1. Complete identification of aggregate source of supply.
 - 2. Tests of aggregates for compliance with specified requirements.
 - 3. Scale weight of each aggregate.
 - 4. Absorbed water in each aggregate.
 - 5. Brand, type, and composition of cement with product information.
 - 6. Brand, type, and amount of each admixture with product information.
 - 7. Amounts of water used in trial mixes.
 - 8. Proportions of each material per cu.yd., including fibrous secondary reinforcement, if used.
 - 9. Gross weight and yield per cu.yd. of trial mixtures.
 - 10. Measured slump, with and without water reducer, if used.
 - 11. Measured air content.
 - 12. Submit compressive strength results from tests performed by an independent testing agency on at least 30 consecutive strength tests or two groups of tests totaling at least 30 within past 12 months. Supply standard deviation and average strength in accordance with ACI SPEC-301.
 - 13. Identification number or name of mix to verify agreement with compression test reports.
 - 14. Water/Cementitious Materials Ratio

- C. 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 A/E. Laboratory test data for revised mix designs and strength results shall be submitted to and must be accepted by A/E before using in work.
- D. Maximum Water-Cementitious Materials Ratio: Concrete mixes shall be limited to water-cement ratios specified in Concrete Schedule in these Specifications (Division 03 Section "Concrete Schedule"). Water reducers and SCM's may be used to increase slump while maintaining or reducing water-cementitious materials ratio at or below maximums specified values, except where specifically prohibited in these specifications.

2.16 FABRICATING REINFORCEMENT

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

2.17 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - 1. Addition of water to batch will be permitted only to regain target slump for particular mix design or with verification that design water/cement ratio has not been exceeded and only under direct control of concrete testing agency field representative. All water added at site to be noted on concrete field inspection report. All tests on concrete to be performed after water is added.
 - 2. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
 - 3. Mix proprietary materials in accordance with manufacturer's instructions, including product data and product technical bulletins.
 - a. Once specific mix design and sequencing of raw materials have been established, do not alter. Consistency of raw materials in each phase of mixing is most important element in making quality concrete.
- B. Project-Site Mixing: Not permitted without prior approval of A/E in writing.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Preplacement Observation: Before placing concrete, observe and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other trades to permit installation of their work; cooperate with other trades in setting such work, as required.
 - 1. Observe soil at bottom of foundation systems, which will be subject to testing for soil bearing value by testing laboratory, as directed by A/E. Place concrete immediately after approval of foundation excavations.
 - 2. Observe underslab drainage course areas that were subject to testing for soil bearing value by testing laboratory as required by A/E. Place concrete immediately after approval of underslab compaction tests.
 - 3. Standing water shall be removed from place of deposit before concrete is placed.
 - 4. Do not use additives or salts to remove ice. Non-chloride deicers may be used.
- B. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 - 1. Daily access to the work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Security and protection for samples and for testing and inspection equipment at Project site.

- C. Material placement for interior slabs on grade and exterior concrete stoops.
 - 1. Install and properly support and anchor slab welded wire fabric.
 - 2. Position expansion joint fillers where indicated and as recommended by manufacturer. Special precautions shall be taken to avoid collapse during installation.
- D. Under slabs-on-grade, place drainage course on prepared subbase and as follows:
 - 1. Place drainage course on subgrades free of mud, frost, snow, or ice.
 - 2. Compact drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.2 FORMWORK INSTALLATION

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
 - 3. Contractor responsible for foundations is responsible to verify from Geotechnical Engineering Report included in this Project Manual that soil conditions allow use of earth-formed foundations. If soil conditions do not allow earth-forming, Contractor shall include cost of forming foundations in his bid.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- D. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- E. Chamfer exterior corners and edges of permanently exposed concrete, unless otherwise noted.
- F. Construction and Movement Joints
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - a. Where joints divide footings and walls, joints shall have keyway formed. Keyways shall be 1/3 of thickness of element, shall extend to within 3 inches of ends of element and shall be at least 1-1/2 inch thick, unless otherwise noted.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by A/E.
 - 3. Place joints perpendicular to main reinforcement.
- G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- I. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

- J. Earth Forming: Where footings are to be constructed in cohesive soils, Contractor may elect to earth form footings with approval of A/E. Earth forms shall be excavated to create vertical faces to detailed dimensions within a tolerance of plus 6 inches, minus 0 inch.

3.3 EMBEDDED ITEMS INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's 303 "Code of Standard Practice for Steel Buildings and Bridges."
 - 3. Conduits and pipes of aluminum shall not be embedded in structural concrete unless effectively coated to prevent aluminum-concrete reaction or electrolytic action between aluminum and concrete.
 - 4. Clean embedded items immediately prior to concrete placement.

3.4 VAPOR BARRIER INSTALLATION

- A. Vapor Barriers: Place, protect, and repair vapor barriers according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Place vapor barrier directly below slab and above drainage fill.
 - a. Install vapor barrier material with largest dimension parallel with direction of pour.
 - b. Face laps away from expected direction of concrete pour whenever possible.
 - 2. Extend vapor barrier over footings and seal to foundation wall, grade beam, or slab at an elevation consistent with top of slab or terminate at impediments such as water stops or dowels. Seal around penetrations such as utilities and columns to create a monolithic membrane between surface of slab and moisture sources below slab as well as at slab perimeter.
 - a. Seal top edge with continuous bead of high-grade mildew resistant silicone sealant or manufacturer's tape.
 - 3. Lap joints minimum 6 inches, or as instructed by manufacturer, and seal laps in accordance with manufacturer's recommendations in a manner consistent with ASTM E1643.
 - 4. Seal all penetrations (including pipes) with manufacturer's pipe boot or manufacturer's instructions.
 - 5. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged areas 6 inches and sealing all four sides with tape.

3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing and supplying reinforcement.
 - 1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.
 - 2. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars shall be lapped as indicated, placing bars in contact, and tightly tying wire.
 - 2. Stagger splices in accordance with ACI 318.
- G. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging.
 - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice".
 - 2. Lap edges and ends of adjoining sheets at least one mesh spacing plus 2 inches for plain wire and 8 inches for deformed wire.
 - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 - 4. Lace overlaps with wire.
- H. Provide enough supports and of strength to support reinforcement in correct position. Do not place reinforcing bars more than 2 inches beyond last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
- I. Reinforcing steel installed in continuous footings shall run continuous. This shall include specially shaped components with proper lap where corner reinforcing and step footings occur.
- J. Provide additional reinforcing around required openings in footings and slabs having a one foot least dimension.
- K. Support welded wire fabric in slabs-on-ground with precast concrete bricks at 2 feet spacing in both directions.
- L. Provide continuous chairs or bolsters to support welded wire fabric in elevated slabs at each line of support for steel deck (e.g., at centerline of supporting joists or beams) and as required to support reinforcing steel in correct position.
 - 1. It is not acceptable to lift mesh into place during concrete placements

3.6 INSTALLATION OF JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete. Place joints at ends of pours and where placement operations are stopped for more than 1/2 hour, except where such pours terminate at expansion joints.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 - 1. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by A/E.
 - 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints, unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 3. Locate horizontal joints in walls and columns at underside of floor and at top of footings or floor slabs.
 - 4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- C. Control (Contraction) Joints in Slabs-on-Grade: Form weakened-plane control (contraction) joints, sectioning concrete into areas as indicated. Construct control (contraction) joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form control (contraction) joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control (contraction) joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form control (contraction) joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades with a triangular arbor configuration. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random control (contraction) cracks.
 - a. For most concrete mixtures, this means sawing should be completed within first six to 18 hours and never delayed more than 24 hours. Early-entry saws are available which may allow cutting to begin within a few hours after placement.
 3. Control (contraction) joints shall be filled with self-leveling traffic grade sealant as specified in Division 07 Section "Joint Sealants" for following locations, unless otherwise noted:
 - a. Exposed and concealed concrete slabs on grade with no additional floor finish or sealed concrete finish only.
 - 1) Sealant color shall match sealed concrete color.
 4. Locate control (contraction) joints in slabs-on-ground, as indicated, if not shown, then to divide slab into sections with a maximum distance of 12 feet between control joints both directions, unless otherwise noted.
 5. Contractor may elect to omit all control joints, where slabs are to be covered with a finish material, provided that all cracks that develop at greater than 1/64-inch width be filled with epoxy crack injection adhesive 60 days or more after slab placement.
 - a. Exception: Do not omit control joints in slabs scheduled to be exposed.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
1. Install dowel bars and support assemblies at joints where indicated.
 2. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
- F. Dowel Plates: Install dowel plates at joints, where indicated on drawings.
- 3.7 INSTALLATION OF CAST-IN-PLACE CONCRETE
- A. General: Comply with ACI SPEC-301.
- B. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as work progresses.
- C. Notify A/E and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed amount indicated on concrete delivery ticket.

- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 2. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 3. Consolidate placed concrete with mechanical vibrating equipment according to ACI SPEC-301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
 4. Concrete shall be completely discharged within 1-1/2 hours after entering conveying drum.
 5. Pumping methods using steel or plastic pipelines will be permitted. Aluminum alloy lines shall not be used. Minimum pipe diameter allowed for pumping shall be 3 inches.
 6. Pumped Concrete: Comply with ACI 304R.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
 2. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 3. Maintain reinforcement in position on chairs during concrete placement.
 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 5. Level concrete, cut high areas, and fill low areas.
 6. Slope surfaces uniformly to drains where required.
 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on surface. Do not further disturb slab surfaces before starting finishing operations.
 8. Do not further disturb slab surfaces before starting finishing operations.

3.8 APPLICATION OF FINISHING FORMED SURFACES

- A. As-Cast Surface Finishes:
1. Rough-Formed Finish (SF-1.0): ACI SPEC-301 surface finish as-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
 - b. Remove projections larger than 1 inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI SPEC-117 Class D.
 - e. Apply to concrete surfaces not exposed to public view.
 2. Smooth-Formed Finish (SF-2.0): ACI SPEC-301 surface finish as-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - b. Remove projections larger than 1/4 inch.
 - c. Patch holes.
 - d. Surface Tolerance: ACI 117 Class B.

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

3.9 APPLICATION OF FINISHING FLOOR AND SLABS

- A. General Information (Slabs-on-Grade): Requirements indicated are based upon latest FF/FL method. Bids for this work shall reflect these requirements and enforcement can be expected.
 - 1. Comply with ACI 302.1R recommendations for screeding, restraighening and finishing operations for concrete surfaces. Do not wet concrete surfaces.
 - a. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Finished surface is to be free of trowel marks, uniform in texture and appearance and with surface leveled to tolerances indicated. Do not burnish trowel surface.
 - 2. Finish surfaces to the following tolerances, in accordance with ASTM E 1155.
- B. Float Finish (Flt-Fn):
 - 1. When bleed water sheen has disappeared and concrete has stiffened sufficiently to permit operation of specific float apparatus, consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots.
 - 2. Repeat float passes and restraighening, until surface is left with uniform, smooth, granular texture and complies with ACI SPEC-117 tolerances for conventional concrete.
 - a. Specified Overall Value: FF 20/FL 15.
 - b. Minimum Local Value: FF 14/FL 10.
 - 3. Apply float finish to monolithic slab surfaces that are to receive a trowel finish.
- C. Trowel Finish; General:
 - 1. After applying float finish, apply first troweling and consolidate concrete by hard or power-driven trowel.
 - 2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
 - 3. Grind smooth any surface defects that would telegraph through applied coatings or floor covering.
 - 4. Do not add water to concrete surface.
 - 5. Trowel Finish 1 (Tr-Fn1): Carpeted Floors, unless otherwise noted.
 - a. Specified Overall Value: FF 25/FL 20.
 - b. Minimum Local Value: FF 17/FL 14.
 - c. Apply trowel finish to monolithic slab surfaces that are to receive carpet and noncritical floors where slabs remain exposed, such as mechanical rooms, unless otherwise noted.
 - 6. Trowel Finish 2 (Tr-Fn2): Floors with improved flatness/levelness requirements.
 - a. Specified Overall Value: FF 35/FL 25.
 - b. Minimum Local Value: FF 24/FL 17.
 - c. Apply trowel finish to monolithic slab surfaces that are to receive resinous flooring and other flooring types, unless otherwise indicated.
 - 7. Exposed Surfaces: Use steel-reinforced plastic power trowel blades (in lieu of steel) to control dark burnish marks on plain concrete or surface to clear sealed.
- D. Nonslip Broom Finish (NsBrm-Fn): Apply nonslip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom, perpendicular to main traffic route. Coordinate required final finish with A/E before application.

3.10 MISCELLANEOUS CONCRETE ITEMS INSTALLATION

- A. Filling In:
1. Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place.
 2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
 3. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 2. Construct concrete base a minimum of 4-inches high unless otherwise indicated; and extend base not less than 6 inches in each direction beyond maximum dimensions of supported equipment unless otherwise indicated.
 3. Minimum Compressive Strength: 4,000 psi at 28 days, unless otherwise indicated.
 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of concrete base.
 5. For supported equipment, install anchor bolts that extend through concrete base, and anchor into structural concrete substrate.
 6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions and directions finished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.11 APPLICATION OF CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI SPEC-301 and ACI SPEC-306.1 for cold-weather protection and ACI SPEC-305.1 for hot-weather protection during curing.
 2. Maintain moisture loss no more than 0.2 lb./sq.ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Curing Formed Surfaces: Comply with ACI SPEC-308.1 as follows:
1. If forms remain during curing period, moist cure after loosening forms.
 2. If removing forms before end of curing period, continue curing for remainder of curing period as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheetting Materials: Cover exposed concrete surfaces with sheetting material, taping, or lapping seams.
- D. Curing Unformed Surfaces: Cure concrete according to ACI SPEC-308.1, by one or a combination of following methods:
1. Begin curing immediately after finishing concrete.

2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install pre-wetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12-inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, following:
 - a) Water.
 - b) Continuous water-fog spray.
 - 4) Do not use curing compounds.

3.12 TOLERANCES

- A. Conform to ACI 117.

3.13 SEALER INSTALLATION

- A. Anti-Spalling Sealer: All exterior slabs, unless otherwise noted, shall be sealed with specified penetrating anti-spalling sealer. Surface preparation of slabs and sealer application shall be in strict accordance with directions of manufacturer. Field service shall be provided, upon 5 days' notice, by manufacturer of sealer to assist contractor in obtaining maximum benefits of product under prevailing jobsite conditions. In addition, sealer representative shall attend pre-installation meeting with A/E and contractor to discuss proper equipment and procedures.

3.14 INSTALLATION OF JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

3.15 INSTALLATION OF CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
 1. Repair and patch defective areas when approved by A/E.
 2. Remove and replace concrete that cannot be repaired and patched to A/E's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins, and other projections on surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by A/E.
- D. Repairing Unformed Surfaces:
1. Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 2. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 3. After concrete has cured at least 14 days, correct high areas by grinding.
 4. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
 5. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - a. Treat nonmoving substrate cracks to prevent cracks from telegraphing (reflecting) through underlayment according to manufacturer's written recommendations.
 - b. Concrete Substrates: Mechanically remove laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond according to manufacturer's written instructions.
 6. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
 - a. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to A/E's approval, using epoxy adhesive and patching mortar.
1. Fill all cracks larger than 1/64 inch in both slabs-on-grade and elevated slabs with epoxy crack injection adhesive.
- F. Repair materials and installation not specified above may be used, subject to A/E's approval.

3.16 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Batch Tickets (Delivery): Comply with ASTM C94. For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added to Project site.
- C. Inspections: Refer to Structural Drawings for list of "Special Inspections".
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 150-cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change and as needed to monitor control of batches.
 - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture. Additional tests as needed to monitor control of batches.
 - 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 90 deg F and above, and one test for each composite sample.
 - 5. Concrete Density: ASTM C138
 - a. One test for each composite sample when strength test specimens are cast.
 - 6. Compression Test Specimens: ASTM C 31.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - 1) Strength test results at the designated age shall be the average of two 6 x 12 inch or three 4 x 8-inch specimens.
 - 2) Transport specimens to lab within 48 hours after casting and cure them in accordance with final curing requirements of ASTM C31 until tested.
 - 7. Compressive Strength Tests: ASTM C39.
 - a. Test specimens for compressive strength at 7 days or at an alternative early age as required and one set at 28 days.
 - b. Acceptance of concrete shall be based on strength test results of standard cured cylinders in accordance with ASTM C31 and tested at 28 days in accordance with ASTM C39. Strength test results at the designated age shall be the average of two 6 x 12 inch or three 4 x 8-inch specimens.
 - c. When strength cylinders are made, test of slump, air content, temperature and density shall be made and recorded with the strength test results.
 - d. Strength of each concrete class shall be deemed satisfactory when both of the following criteria are met:
 - 1) The average of three consecutive compressive-strength tests equal or exceeds specified compressive strength.
 - 2) Any individual compressive-strength test result does not fall below specified compressive strength, f'_c .
 - a) By more than 500 psi when $f'_c \leq 5000$ psi.
 - b) By more than 0.1 f'_c when $f'_c > 5000$ psi.
 - e. When compressive strength tests fail to meet the provisions of (d), follow procedure in ACI 301 for evaluation of concrete strength tests.

- f. When it is deemed necessary to evaluate the adequacy of concrete strength, at least 3 cores shall be obtained from the portion of the structure represented by the low strength tests. Cores shall be removed and conditioned in accordance with ASTM C42. The strength of cores shall comply with the following:
 - 1) Average strength of 3 cores ≥ 0.85 f'c.
 - 2) Individual core strength $\geq .75$ f'c.
 - 8. Test results shall be reported in writing to A/E, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 - 9. Nondestructive Testing: Rebound hammer, ultrasonic, or other nondestructive device may be permitted by A/E but will not be used as sole basis for approval or rejection of concrete.
 - 10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by A/E. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by A/E.
 - 11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 - 12. Correct deficiencies in Work that test reports and inspections indicate do not comply with Contract Documents.
- E. Contractor shall measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

3.17 CONCRETE WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess concrete materials are Contractor's property. At completion of work, remove from Project site.
- B. Excess Concrete Waste: Remove excess clean concrete waste that cannot be used as fill as described above, and other concreting operations waste, and legally dispose of off Owner's property.
 - 1. Comply with Division 01 requirement of Section "Temporary Facilities and Controls".

3.18 PROTECTION

- A. General, protect concrete surfaces as follows:
 - 1. Protect from petroleum stains.
 - 2. Diaper hydraulic equipment used over concrete surfaces.
 - 3. Prohibit vehicles from interior concrete slabs.
 - 4. Prohibit use of pipe-cutting machinery over unprotected concrete surfaces.
 - 5. Prohibit placement of steel items directly on concrete surfaces.
 - 6. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION 03 30 00

SECTION 04 20 00.00 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
1. Concrete masonry units (CMUs).
 2. Clay face brick.
 3. Structural-clay facing tile.
 4. Mortar and grout.
 5. Reinforcing steel bars.
 6. Masonry joint reinforcement.
 7. Ties and anchors.
 8. Embedded flashing.
 9. Miscellaneous masonry accessories.
- B. Related Sections include the following:
1. Division 06 Section "Sheathing".
 2. Division 07 Section "Boardstock Air Barrier" for air/vapor barrier and cavity insulation.
 3. Division 07 Section "Sheet Metal Flashing and Trim" for formed reglets and for additional requirements for solder and sealant for sheet metal flashing.
 4. Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.
 5. Division 07 Section "Preformed Joint Seals" for expansion joints 2 inches wide or greater.
 6. Division 08 Section "Hollow Metal Frames" for installation requirements.
 7. Division 09 Sections "Tiling" and "Resilient Base and Accessories" for coordination of bullnosed CMU with height of wall base.
- C. Products installed, but not furnished, under this Section include the following:
1. Steel lintels for unit masonry, furnished under Division 05 Section "Structural Steel Framing".
 2. Products furnished under Division 05 Section "Metal Fabrications", including post installed anchors.
 3. Nailing blocks furnished under Division 06 Section "Miscellaneous Rough Carpentry".
 4. Cavity wall insulation furnished under Division 07 Section "Boardstock Air Barrier".
 5. Hollow metal frames will be provided under Division 08 Section "Hollow Metal Frames".
 6. Conduits and plumbing will be provided under Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – Heating, Ventilating, and Air Conditioning, Division 26 – Electrical, Division 27 – Communications, and Division 28 – Electronic Safety and Security.

1.2 REFERENCES

- A. Definitions
1. General: Definitions, glossary and terminology used in this Section are from the National Concrete Masonry Association TEK 01-04.
 2. CMU(s): Concrete Masonry Units.
 3. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.
 4. Structural Glazed Tile: SGT, extruded and manufactured clay masonry unit with a ceramic glazed face that is a structural unit which can be loadbearing masonry.
- B. Applicable Standards
1. Brick Industry Association (BIA)
 2. Ceramic Glazed Masonry Institute (CGMI)
 3. Building Code Requirements for Masonry Structures (ACI S30)

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of masonry and masonry accessories with thermal and air barrier and other moisture protection work to provide a tested wall assembly.
- B. Coordinate installation of components that are to be embedded in concrete or masonry so as not to interfere with anchors or reinforcement.
- C. Furnish setting drawings, templates, and directions for installing anchorages, including 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.
- D. Pre-installation Meeting: Conduct meeting at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Note: As work progresses, additional pre-installation meetings might need to take place to coordinate installation of various components of exterior enclosure.
 - 1. Meet with Owner, A/E, testing and inspection agency representative, mason, and other installers whose work interfaces with or affect masonry.
 - 2. Review methods and procedures related to masonry installation, including manufacturers' requirements and recommendations.
 - 3. Review temporary protection requirements.
 - a. Walls are to be protected from moisture during construction.
 - 4. Review mockup and cleaning requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including but not limited to:
 - 1. Flexible flashing materials, including manufacturer's written installation instructions.
 - 2. Typical installation methods with requirements to accommodate specific site conditions.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes, including full return corner units.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI PRC-315, "Guide to Presenting Steel Design Details." Show elevations of reinforced walls.
 - 3. Fabricated Flashing: Detail corner units, end dam units, and other special applications.
- C. Samples for Verification: For each type and color of the following:
 - 1. Face brick, in the form of straps of five or more bricks.
 - 2. Glazed structural-clay tile.
 - 3. Pigmented mortar(s). Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
 - 4. Weep holes/vents.
 - 5. Accessories embedded in masonry.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of A/E and approved in writing.
- B. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units.
 - a. Provide material test reports substantiating compliance with requirements, if requested.
 - b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include material test report for efflorescence according to ASTM C 67, and the following:
 - 1) Compressive strength
 - 2) 24 hour cold water absorption
 - 3) 5 hour boil absorption
 - 4) Saturation coefficient
 - 5) Initial rate of absorption (suction)
 2. CMU: Upon regular presentation within past 12 months of representative units by approved manufacturer, a test report from an independent laboratory showing resultant weight, compressive strength (based on net area), and water absorption properties, as well as adherence to standards where so specified, for:
 - a. Each proposed type and size of concrete masonry units.
 - b. Test reports shall conform to ASTM C140 and shall include:
 - 1) Name of Manufacturer
 - 2) Date of Manufacture of Test Specimen
 - 3) Dimension Measurements (in.)
 - 4) Calculated Gross Area (sq.in.)
 - 5) Calculated Net Area (sq.in.)
 - 6) Total Load (lbs.)
 - 7) Net Unit Load (psi)
 - 8) Sample Weight (lbs.)
 - 9) Dry Weight (lbs.)
 - 10) Wet Weight (lbs.)
 - 11) Immersed Weight (lbs.)
 - 12) Density (pcf)
 - 13) Moisture Content (%)
 - 14) Absorption (%)
 - 15) Linear Shrinkage Coefficient (%)
 3. CMU: Submit compression test results from an independent testing laboratory showing the compressive strength of each type and size of concrete masonry units delivered to the construction site during the first fifteen days of masonry construction. Submit additional tests from each type and size of concrete masonry units for each 10,000 sq.ft. of concrete masonry wall constructed. The independent testing laboratory is to select units to be tested from materials stockpiled on the Project site.
 4. Cementitious materials. Include brand, type, and name of manufacturer.
 5. Mortar admixtures.
 6. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 7. Grout mixes. Include description of type and proportions of ingredients.
 8. Reinforcing bars.
 9. Joint reinforcement.
 10. Anchors, ties, and metal accessories.
 11. Flexible Flashing. Certification of compatibility by manufacturer, listing all materials on the Project with which the product and accessories may come into contact.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
 2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement. For both fine and course grouts including complete identities and proportions of ingredients.
 - a. Weight of each ingredient including water.
 - b. Measured slump.
 - c. Water/cement ratio.

d. Sieve analysis for aggregates.

- D. Certification: "Grouting and Reinforcing Certification" by the International Masonry Institute as a "Certified Grout Installer" or having successfully completed the IMI training and certification for "Grouting and Reinforcing Certification" or a similar program approved by A/E.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

A. Installer

1. Grouting and Reinforcing: All masonry grouting and reinforcing work shall be performed by masonry craft workers who have successfully completed the International Masonry Institute (1-800-IMI-0988) training course for Grouted and Reinforced Masonry Construction to similar program approved by A/E. Contractor may also perform work under the supervision of a "Certified Grout Installer" as long as supervisor is present at the time of each pour.
2. Flashing Assemblies: All masonry flashing assemblies shall be installed by masonry craft workers who have completed the International Masonry institute (1-800-IMI-0988) upgrade training course for "Masonry Flashing" or a similar program by flashing manufacturer approved by A/E.
 - a. Instructor/Flashing Manufacturer's Representative conducting training for flashing installation shall:
 - 1) Assist/review flashing at "mockup".
 - 2) Pay at least one other visit to the Project site at the A/E's direction.
3. At least one supervisory journeyman who shall be present at all times during execution of work, who shall be thoroughly familiar with design requirement, type of materials being installed, reference standards and other requirements, and who shall direct all work performed at jobsite.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not proceed with work prior to receipt of written acceptance of mock-up by A/E. In general, first-in-place masonry items and associated work i.e. openings shall be considered "mockups" and must be reviewed by A/E before similar work advances. Observation and evaluation of the mockup shall be by A/E, General Trades Contractor (mason), opening installer, and testing agency.

1. Build mockups for typical exterior wall(s) in sizes approximately 144 inches long by 120 inches high full and by full thickness, including face and backup wythes and accessories.
 - a. General, exterior wall mockup shall be constructed to verify wall performance. Mockup shall demonstrate how components will integrate into the assembly and exhibit how the thermal and air barrier transition to various components, for example, wall transition to roof. Coordinate mockup with testing requirements of Air Barrier.
 - b. Use step-back construction to expose the relationship of various wall components to each other. Components incorporated and exposed for observation shall include examples of:
 - 1) Facing units;
 - 2) Weeps, vents, cavity drainage material, and other accessories; including clean out ports;
 - 3) Mortar of the correct color(s) and strength(s);
 - 4) Backup wall construction;
 - a) Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup; with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - 5) Joint reinforcing;
 - 6) Structural reinforcing, grouting, and accessories;

- 7) Ties and anchors;
 - 8) Cavity insulation, air barriers and/or vapor retarders;
 - 9) Bond beams and lintels;
 - 10) Flashings (including terminations, plane changes, and end dams); and
 - a) Include metal studs, sheathing, air barrier, veneer anchors, flashing, cavity mortar protection, and weep vents in exterior masonry-veneer wall mockup, where applicable.
 - 11) Masonry expansion and control joints
 - 12) Include at least one switch or outlet box. If surface mounted items, such as exterior lighting, audio horns, or video cameras, will be installed in split-faced masonry, provide at least one example installation.
 - c. Include a sealant-filled joint at least 16 inches long in each exterior wall mockup.
 - d. Mockups shall include typical parapet/eave detail, transitions from wall to roof/roof to wall (flashing, thermal and air barrier transition details), and include the following typical wall penetrations:
 - 1) Entries/doors.
 - 2) Openings, i.e. storefront.
 - a) First in place of each type opening installed shall leave portions of the perimeter exposed for inspection of fasteners and air barrier transitions. Some portions of mockup shall receive final sealant so it can be tested for air barrier compliance.
 - b) Demonstrate blocking at openings, movement joints (sealant filled) minimum 1 to 4 inches.
 - c) Demonstrate installation of lower corner of opening at upper corner of exterior wall.
 - 3) Roof to wall transitions.
 - 4) Include an example of thru-wall penetration by each trade contractor including fire protection, plumbing, mechanical and electrical.
 - e. The mockup shall be photographed or recorded on video by the masonry contractor to be part of a presentation for groups of trade's people as they join project work force.
2. The mockup need not be fully constructed at one time, but construction and approval of each element shall precede the construction of its respective exterior wall components. The mockup shall mirror the building development starting with the foundation and ending at the top of the wall and its transition to the roof. Reviews will be scheduled around the weekly progress meetings. If required attendees are not present, then that phase will be delayed and rescheduled. Respective mockup phase shall be completed and approved before that portion of work starts at the building. Anticipated phasing:
- a. Phase One: Install the CMU backup wythe per the approved mockup drawing. The CMU backup wythe shall include rebar, centering clips, ladder reinforcing, grout, bond beam, and bearing plates.
 - b. Phase Two: Install the embedded flashing in the presence of A/E, flashing manufacturer, and Owner's Testing and Inspection Agency. Embedded flashing shall include the flashing, all sealants and adhesives, termination bar, fasteners, end dams, and inside and outside corners.
 - 1) Pre-Installation Meeting for masonry veneer will be held on this date.
 - 2) Flashing will be reviewed and will require approval by all present.
 - c. Phase Three: Review the exterior face of the CMU backup wythe prior to the installation of the air barrier insulation in the presence of A/E and Inspection Agency.
 - 1) Pre-Installation Meeting for air barrier will be held on this date.
 - 2) Air barrier will be reviewed and will require approval by all present.
 - d. Phase Four: Install the masonry veneer per the approved mockup drawing.
 - 1) Masonry veneer will be reviewed and will require approval by A/E and Owner.
 - e. Phase Five: Clean the mockup veneer.
 - 1) Pre-Installation Meeting for cleaning of masonry veneer will be held on this date.

- 2) Cleaning of mockup veneer will be reviewed and will require approval by A/E and Owner.
3. Prior to starting general masonry cleaning, prepare mock-up for cleaning using the same cleaning materials and methods proposed for the Work, and under same weather conditions to be expected during cleaning. Obtain A/E's acceptance of visual qualities before proceeding with masonry restoration. Record cleaning process and results of all testing.
 - a. Test materials and methods on samples of adjacent non-masonry materials for possible reaction with cleaning materials, except where materials and methods are known to have a deleterious effect on such materials.
 - b. Allow a waiting period of the duration indicated, but not less than 7 calendar days, after completion of sample cleaning to permit a study of sample panels for negative reactions.
4. Protect accepted mockups from the elements with weather-resistant membrane.
5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship. Panel shall be used as a standard of comparison for all masonry work built of same material.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by A/E in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by A/E in writing.
6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Assume responsibility for acceptance of masonry units delivered to Project site following specified ASTM requirements for chippage and dimensional tolerances.
 1. Inspect decorative units upon delivery to ensure color match with required materials and accepted mock-up panel.
- B. Structural Glazed Tile (SGT):
 1. Deliver SGT to jobsite as packaged by manufacturer. Offload SGT packages using equipment that will not damage SGT. No SGT is allowed to be in direct contact with the ground. Do not double stack cubes of SGT.
 2. Cover SGT with non-staining waterproof membrane covering. Keep units dry. Allow air circulation around stacked units. Installation of wet or stained SGT is prohibited.
 3. Keep SGT units in the individual cardboard packaging provided by the manufacturer until the unit is ready to be laid in the wall. Never use brick tongs or "pitch" the SGT to upper levels of the scaffolding.
- C. Store masonry units on elevated platforms in a dry location to prevent contamination by mud, dust or materials likely to cause staining or other defects. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
 1. Cover masonry units at all times.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
 1. Deliver cementitious and other packaged materials in unopened containers, plainly marked, and labeled with manufacturers' names and brands.
 2. Handle cementitious materials in a manner that will prevent the inclusion of foreign materials and damage by water or dampness.
- E. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

1. Stockpile and handle aggregates to prevent contamination from foreign materials. Store different aggregates separately.
 2. Store sand on tarps to keep ground water from wicking into sand.
- F. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- G. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.
1. Deliver flexible flashing materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
 2. Store flexible flashing materials as recommended by manufacturer. Keep away from open flame or sources of ignition.
 3. Protect insulation from physical damage. Handle boards carefully so corners are not broken off or boards otherwise damaged.

1.8 FIELD CONDITIONS

- A. Refer to Division 01 Section "Product Requirements".
1. Do not apply flexible flashing on wet or damp surfaces.
 2. Apply flashing to surfaces free of dirt, oils, lubricants, and other debris.
 3. Install flexible flashing materials at temperature above 40 deg. F. At temperature below 40 deg. F., apply primer in accordance with flashing manufacturer's recommendations, prior to installation of flashing.
 4. Do not use metal reinforcements or ties coated with loose rust or other coatings, including ice, which will reduce bond.
- B. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Temporary measures include application of self-adhered membrane or flashing with long UV exposure. Cover partially completed masonry when construction is not in progress. Refer to Section 1.8B ("Masonry Protection") in TMS 402/602. Note: Protection is required by Building Code.
1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
 3. Continue to cover walls until tie-in to roof is complete and top of wall is protected from water penetration.
- C. This structure is designed to be self-supporting and stable after the building is fully completed. Protect masonry walls against wind damage by bracing as required until support of walls is integral with the completed building structure. This includes the addition of whatever temporary bracing, guys, or tie-downs that might be necessary. Such material is not shown on the Drawings. If applied, they shall be removed as conditions permit, and shall remain the Contractor's property.
1. Safety: It is solely the Contractor's responsibility to follow all applicable safety codes and regulations governing this Work.
 2. Load application after building masonry columns, piers, or walls
 - a. Do not apply uniform design floor or roof loading for at least 12 hours.
 - b. Do not apply concentrated loads for at least 3 days.
- D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that meet such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- E. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with NCMA TEK 03-01C. Comply with cold-weather construction requirements contained in TMS 402/602 with special emphasis on the following:
1. Preparation
 - a. If snow or ice has formed on masonry bed, remove it by carefully applying heat not to exceed 120 degrees F until the surface is dry to the touch.
 - b. Remove any mortar that is frozen or damaged.
 2. Work in Progress
 - a. Air temperature 40 degrees F to 32 degrees F.
 - 1) Heat sand or mixing water to produce mortar temperatures that match air temperatures.
 - 2) Maintain temperature of mortar on boards above freezing.
 - 3) Installation in colder air temperatures will require heat sources on the wall and use of windbreaks or tents to create a controlled environment suitable for proper bonding and curing.
 3. Completed Work and Work not in Progress:
 - a. Main daily air temperature at 40 degrees F: Protect masonry from rain and snow for 24 hours by covering with a weather-resistive membrane.
 - b. Mean daily temperature of 32 degrees F to 25 degrees F: Cover masonry with a weather-resistive membrane for 24 hours.
 - c. Mean daily air temperature of 25 degrees F to 20 degrees F: Cover masonry with insulating blankets for 24 hours.
 4. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
 - a. To assure mortar temperatures between 40 degrees F and 120 degrees F until used, heat mixing water or aggregates when air temperature is between 32 degrees F and 40 degrees F. When the air temperature is between 25 degrees F and 32 degrees F, heat both water and aggregate.
 - b. Do not heat water or sand above 160 degrees F.
 5. Comply with the requirements of the governing code and with the "Construction and Protection Recommendations for Cold Weather Masonry Construction" of the Technical Notes of Brick and Tile Construction by the Brick Industry Association (BIA) and International Masonry Industry All-Weather Council, "Recommended Practices and Guide Specifications for Cold Weather Masonry Construction."
- F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602 and the following:
1. Masonry construction performed when ambient temperature exceeds 100 degrees F (or 90 degrees F with wind velocities greater than 8 mph) shall conform to the following requirements:
 - a. Store materials in cool, shaded location.
 - b. Cover aggregate stockpiles with black plastic sheet to retard the evaporation of moisture.
 - c. Cool reinforcing steel, metal accessories, wheelbarrows, mixers and mortar boards by flushing with water.
 - d. Wet high-suction brick.
 - e. Increase lime and/or cement content to maximum allowed under ASTM C270 for mortar type specified.
 - f. Increase water content of mortar and grout as needed.
 - g. Spread mortar beds no more than 4 feet ahead of masonry and set units within one minute of spreading mortar.
 - h. Moist cure masonry by water fog spray after tooled joints have set.

- i. Cover walls to retard evaporation.
- j. Schedule work to avoid hottest part of day.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany request for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate. Do not change source or brands of masonry mortar materials during the course of the Work.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:
 - 1. TMS 402/602 "Building Code Requirements and Specification for Masonry Structures."
 - a. Maintain one copy of the standard in project field office at all times during construction. Contractor's supervisory personnel shall be thoroughly familiar with this material as it applies to the project and shall be present at all times and direct work performed under this Section.
 - 2. National Concrete Masonry Association (NCMA)
 - a. NCMA TEK Bulletin 03-01C "All Weather Concrete Masonry Construction".
 - b. NCMA TEK Bulletin 03-02A "Grouting Concrete Masonry Walls".
 - c. NCMA TEK Bulletin 03-08A "Concrete Masonry Construction".
 - d. NCMA TEK Bulletin 03-4C "Bracing Concrete Masonry Walls Under Construction".
 - e. NCMA TEK Bulletin 08-02A "Removal of Stains from Concrete Masonry."
 - f. NCMA TEK Bulletin 08-03A "Control and Removal of Efflorescence."
 - g. NCMA TEK Bulletin 09-01A "Mortars for Concrete Masonry."
 - h. NCMA TEK Bulletin 10-01A "Crack Control in Concrete Masonry Walls".
 - i. NCMA TEK Bulletin 10-02D "Control Joints for Concrete Masonry Walls – Empirical Method".
 - j. NCMA TEK Bulletin 10-03 "Control Joints for Concrete Masonry Walls – Alternative Engineering Method.
 - k. NCMA TEK Bulletin 12-04D "Steel Reinforcement for Concrete Masonry".
 - l. NCMA TEK Bulletin 14-04B "Strength Design Provisions for Concrete Masonry."
 - m. NCMA TEK Bulletin 14-07C "Allowable Stress Design of Concrete Masonry (2012 IBC & 2011 MSJC)."
 - n. NCMA TEK Bulletin 19-04A "Flashing Strategies for Concrete Masonry Walls".
 - o. NCMA TEK Bulletin 19-05A "Flashing Details for Concrete Masonry Walls."

3. ASTM International:
 - a. ASTM C33 "Standard Specification for Concrete Aggregates."
 - b. ASTM C90 "Standard Specification for Loadbearing Concrete Masonry Units."
 - c. ASTM C91 "Masonry Cement."
 - d. ASTM C140 "Standard Test Methods of Sampling and Testing Concrete Masonry Units."
 - e. ASTM C144 "Standard Specification for Aggregate for Masonry Mortar."
 - f. ASTM C150 "Standard Specification for Portland Cement."
 - g. ASTM C207 "Standard Specification for Hydrated Lime for Masonry Purposes."
 - h. ASTM C270 "Standard Specification for Mortar of Unit Masonry."
 - i. ASTM C426 "Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units."
 - j. ASTM C 476 "Standard Specification for Grout for Masonry".
 - k. ASTM C780 "Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry."
4. International Masonry Industry All-Weather Council (IMIADC).
 - a. "Recommended Practices and Guide Specifications for Cold Weather Masonry Construction – 1993".
5. International Masonry Institute
 - a. "Internal Bracing Design Guide for Masonry Walls Under Construction".
 - b. Detailing Series.
6. Underwriters' Laboratory Inc. (UL)
 - a. UL "Building Materials Directory".
 - b. UL 618 "Standard for Concrete Masonry".
7. Brick Industry Association (BIA)
 - a. BIA Technical Notes No. 1 – Revised 1992: All weather construction.
 - b. BIA M1-88: Specifications for Portland Cement Lime Mortar for Brick Masonry.
 - c. BIA Technical Notes No. 7 – Water Penetration Resistance – Design and Detail.
 - d. BIA Technical Notes No. 18A – Accommodating Expansion of Brickwork.
 - e. BIA Technical Notes No. 20 – Revised 1990: Cleaning Brick Masonry.
 - f. BIA Technical Notes No. 27 – Revised 1994: Brick Masonry Rain Screen Walls.

- B. Corrosion and Staining Control: Prevent galvanic or other forms of corrosion as well as staining by isolation metals and other materials from direct contact with incompatible materials. Materials shall not stain exposed surfaces of veneer and joint materials.

2.3 MASONRY UNITS, GENERAL

- A. Masonry Standard: Comply with ACI/ASCE 6/TMS 602, unless modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.4 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:
 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide bullnose units for outside corners and at sills, unless otherwise indicated or sill is indicated to receive additional finish materials.
 - a. At base of wall and where indicated (first CMU course above floor), provide exposed square edge external corners. Above base transition square edge to the bullnose above by grinding.
 - b. Provide bullnose unit with 1 inch radius bullnose (BN1), unless otherwise noted.
 3. Provide two core type masonry units where required to receive vertical reinforcing.

4. Bond beam units shall be such that where two reinforcing steel bars are required in the bond beams, bars may be located not greater than 2-5/8 inch from both faces of the unit. Bond beam units that do not allow the two bars to be separated and to be within 2 5/8" of each face will not be acceptable.
- B. Concrete Masonry Units: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2600 psi.
 2. Weight Classification: Normal weight.
 3. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

2.5 MASONRY LINTELS

- A. Concrete Lintels: Not acceptable.
- B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from specially formed "U" shaped lintel units with reinforcing bars placed as indicated and filled with coarse grout. Open-bottom, bond-beam type units are not acceptable for use as reinforced lintels. Cure prefabricated lintels before handling and installing. Temporarily support built-in-place lintels until cured. Prefabricated lintels shall have a faux head joint pattern on their exposed faces and shall have their top side clearly marked in the factory. Prefabricated lintels are to be installed such that the faux head joint pattern aligns with that of the surrounding masonry.

2.6 BRICK

- A. General: Provide shapes indicated and as follows:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Clay Face Brick: ASTM C 216, Grade SW, Type FBS.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi.
 2. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 3. Utility: Size (Actual Dimensions): 3-5/8 inches wide by 3-5/8 inches high by 11-5/8 inches long.
 4. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.
 - a. Refer to Elevations for selections.

2.7 STRUCTURAL-CLAY FACING TILE

- A. General:
1. Provide solid, multicolored, or hollow units, with shape and direction of cores optional, unless otherwise indicated.
 2. Where reinforced masonry is indicated, provide multicolored units designed for use in reinforced, grouted masonry; either with vertical cores and with webs notched to receive horizontal reinforcement, or with horizontal cores and with holes in bed shells for placement of grout and to receive vertical reinforcement.
 3. Where indicated for exterior applications, provide units recommended by manufacturer for exterior use in Project's location.

4. Provide special shapes where required for corners, jambs, coved bases, sills, and other special conditions indicated, including applications that cannot be produced by sawing standard units.
- B. Glazed Structural-Clay Facing Tile: ASTM C 126, Grade SS (Select Sized or Ground Edged).
1. Basis-of-Design Product: Subject to compliance with requirements, provide one of the following.
 - a. Elgin Butler
 2. Flame Spread: Must meet ASTM C84 (UL 723) requirements and rated zero flame spread, zero smoke developed and zero fuel contribution. Also will not release any toxic or noxious fumes when burned at 2000 degrees F.
 3. Sizes: 8W Series with actual face dimensions of 7-3/4 inches high by 15-3/4 inches long by widths indicated.
 4. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and Type II (double-faced units) where two opposite finished faces are exposed when units are installed.
 5. Provide special units glazed on ends and tops, as well as faces for corners, jambs, sills, pilasters, columns, and other applications indicated, where glazed units are exposed on other surfaces and faces.
 6. Colors and Patterns: Refer to Elevations for color selection.

2.8 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color(s) indicated.
1. Alkali content shall not be more than 0.6 percent when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 270, Type S.
- D. Masonry Cement: ASTM C 91 veneer only.
1. Products:
 - a. Brixment or Velvet; Essroc, Italcementi Group.
 - b. Mortamix Masonry Cement or Rainbow Mortamix Custom Buff Masonry Cement or White Mortamix Masonry Cement; Holcim (US) Inc.
 - c. Magnolia Masonry Cement or Lafarge Masonry Cement or Trinity White Masonry Type S or Trinity White Masonry Type N; Lafarge North America Inc.
 - d. Lehigh Masonry Cement or Lehigh White Masonry Cement; Lehigh Cement Company.
 - e. Richmortar; CEMEX.
 - f. Miami Masonry Cement; Fairborn Cement Company.
- E. Mortar Cement: ASTM C 1329.
- F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Products:
 - a. Bayferrox Iron Oxide Pigments; Bayer Corporation, Industrial Chemicals Div.
 - b. True Tone Mortar Colors; Davis Colors.
 - c. MasterColor; Master Builders Solutions.
 - d. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.
 - e. Prism Pigments, a Division of Mix Manufacturing, Inc.
 - f. Euclid Chemical Company.
 - g. Lanxess Corp.
 - h. Acme-Hardesty Co., Acme-Shield Plus Admixture; Cargill.

- G. Colored Cement Product: Packaged blend made from Portland cement and lime, masonry cement, or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Products:
 - a. Colored Portland Cement-Lime Mix:
 - 1) Rainbow Mortamix Custom Color Cement/Lime; Holcim (US) Inc.
 - 2) Eaglebond; Lafarge North America Inc.
 - 3) Lehigh Custom Color Portland/Lime Cement; Lehigh Cement Company.
 - 4) Color Mortar Blend; Glen-Gery Corp.
 - 5) Salyor's PLUS; Essroc.
 - 6) PCL; CEMEX.
 - b. Colored Masonry Cement:
 - 1) Flamingo-Brixment; Essroc, Italcementi Group.
 - 2) Rainbow Mortamix Custom Color Masonry Cement; Holcim (US) Inc.
 - 3) Magnolia Masonry Cement; Lafarge North America Inc.
 - 4) Lehigh Custom Color Masonry Cement; Lehigh Cement Company.
 - 5) Coosa Masonry Cement; National Cement Company, Inc.
 - 6) Richcolor Masonry Cement; CEMEX.
 - 7) Miamicolor Masonry Cement; Fairborn Cement Company.
 2. Formulate blend as required to produce color(s) indicated or, if not indicated, as selected from manufacturer's standard colors.
 3. Pigments shall not exceed 10 percent of Portland cement by weight.
 4. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
- H. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- I. Aggregate for Grout: ASTM C 404.
1. Fine Aggregates: ASTM C404, clean, sharp, natural sand free from loam, clay lumps, or other deleterious substances.
 2. Coarse Aggregates: ASTM C404, clean, uncoated, pea gravel containing no clay, mud, loam, or foreign matter. Maximum aggregate size 3/4 inch.
- J. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of units); in color(s) indicated or, if not otherwise indicated, as selected by A/E from manufacturer's colors.
- K. Admixtures, General:
1. No air-entraining admixtures or material containing air-entraining admixtures.
 2. No antifreeze compounds shall be added to mortar.
 3. No admixtures containing chlorides shall be added to mortar.
- L. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, ASTM C 1384, and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Products:
 - a. Accelguard 80; Euclid Chemical Company.
 - b. Morset; GCP Applied Technologies.
 - c. MasterSet AC 534 or MasterSet FP 20; Master Builders Solutions.
- M. Water: Conform to ASTM C1602 for mixing water.

2.9 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60 (Grade 420).
1. Size, length, and spacing shall be as indicated.
 2. Where No. 3 and larger are indicated, they shall be deformed steel, conforming to ASTM A615, Grade 60.
 3. Use #4 spacer bars at 48 inch spacing connected to longitudinal reinforcing bars in concrete masonry bond beams to hold bars in proper location.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
1. Products:
 - a. No. 376, 377, 378, or 379 Rebar Positioner; Heckmann Building Products Inc.
 - b. #RB or #RB-Twin Rebar Positioner; Hohmann & Barnard, Inc.
 - c. Figure-8, Double Figure-8, O-Ring or Double O-Ring Rebar Positioner; Wire-Bond.
- C. Masonry Joint Reinforcement, General: ASTM A 951 and as follows:
1. Provide welded wire units prefabricated in straight lengths of not less than 10 foot, with matching corner ("L") and intersection ("T") units.
 2. Fabricate from cold-drawn steel wire complying with ASTM A82, with deformed or embossed continuous side rods and plain cross-rods, with unit width of 1-1/2 to 2 inches less than thickness of wall or partition.
 3. Wire shall be galvanized in accordance with the following:
 - a. Joint reinforcement, interior walls or exposed to relative humidity less than or equal to 75 percent.
 - 1) ASTM A641, mill galvanized (0.10 oz. per sq.ft.)
 - b. Wire ties or anchors in interior walls or exposed to relative humidity less than or equal to 75 percent
 - 1) ASTM A641 (0.35 oz. per sq.ft.)
 - c. Joint reinforcement, wire ties, or anchors in exterior walls or a mean relative humidity exceeding 75 percent
 - 1) ASTM A153, Class B (1.50 oz. per sq.ft.)
 - d. Sheet metal ties or anchors, interior walls or exposed to relative humidity less than or equal to 75 percent
 - 1) ASTM A653, G60 (0.60 oz. per sq.ft.)
 - e. Sheet metal ties or anchors in exterior walls or a mean relative humidity exceeding 75 percent
 - 1) ASTM A153, Class B (1.50 oz. per sq.ft.)
 - f. Steel plates and bars
 - 1) ASTM A153, Class B
 4. For single wythe interior CMU walls, provide ladder type joint reinforcing fabricated with two W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every other CMU joint or not more than 16 inches o.c.
 5. For multi-wythe interior walls consisting of two wythes of CMU, provide ladder type joint reinforcing fabricated with four W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every other CMU joint or not more than 16 inches o.c.
 6. Multi-wythe exterior walls consisting of CMU backup, insulated cavity, and exterior face brick or SGT veneer.
 - a. When both wythes are to be constructed simultaneously:
 - 1) Provide ladder type joint reinforcing fabricated with three W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every other CMU joint or not more than 16 inches o.c.

- b. When each wythe is to be constructed separately:
 - 1) Backup Wythe
 - a) Provide adjustable ladder type joint reinforcing fabricated with two W1.7 or 0.148 inch steel side rods, W1.7 or 0.148 inch cross rods, 3/16 inch eyes and 3/16 inch double legged pintles. Longitudinal rods shall be spaced for each face shell of CMU; eye sections shall extend into wall's cavity, and pintles shall rest upon bed joints of veneer. Joint reinforcing shall be placed in every other CMU joint or not more than 16 inches o.c.
 - 2) Veneer Wythe (SGT)
 - a) Provide ladder type horizontal joint reinforcing fabricated with two W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods continuous joint. Joint reinforcing shall be placed in every other SGT veneer joint or not more than 16 inches o.c.
- 7. For foundation walls consisting of two wythes of CMU, provide ladder type joint reinforcing fabricated with four W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every CMU joint or no more than 8 inches o.c. Side rods shall align with face shells of CMU.
- 8. For single wythe foundation walls, provide ladder type joint reinforcing fabricated with two W1.7 or 0.148 inch steel side rods and W1.7 or 0.148 inch cross rods. Joint reinforcing shall be placed in every CMU joint or no more than 8 inches o.c.
- 9. For joint reinforcing in walls, other than those described above, refer to Drawings for particular requirements.
- 10. All ladder type joint reinforcing shall have cross rods spaced at 16 inches o.c.
- 11. All ladder type joint reinforcing shall be lapped 6 inches minimum.
- 12. All ladder type joint reinforcing shall be discontinuous across movement joints.

2.10 TIES AND ANCHORS

- A. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
 - 1. Ensure components and materials are compatible with specified accessories and adjacent materials.
- B. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 1064; with ASTM A 641, Class 1 coating, provide in interior walls where humidity is less than 75 percent.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 1064; with ASTM A 153, Class B-2 coating, unless otherwise noted.
 - 3. Galvanized Steel Sheet: ASTM A 653, Commercial Steel, G60 (Z180) zinc coating, provide in interior walls where humidity is less than 75 percent.
 - 4. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153, unless otherwise noted.
 - 5. Steel Plates, Shapes, and Bars: ASTM A 36.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
 - 1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
 - 2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
 - 3. Wire: Fabricate from 3/16-inch diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls, except in spaces where relative humidity can be expected to exceed 75-percent relative humidity (showers) or where otherwise indicated.

- D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
 2. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.188-inch diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins, unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153.
- F. Adjustable Masonry-Veneer Anchors: Provide either screw-attached, masonry-veneer anchors with separate horizontal reinforcing or seismic masonry-veneer anchors.
1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 - b. Anchor shall meet or exceed requirements for air leakage and water penetration established for Project.
 2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - a. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch thick, steel sheet, galvanized after fabrication.
 - b. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch diameter, hot-dip galvanized steel wire.
 - c. Products:
 - 1) 315-D with 316 or Pos-I-Tie or 213-2X; Heckmann Building Products Inc.
 - 2) HB-213 with 2X Hook or Adjusto-Tie; Hohmann & Barnard, Inc.
 - 3) 1004, Type III or RJ-711; Wire-Bond.
 - 4) Thermal-Grip Masonry Veneer Anchor Pos-i-tie: TRUFAST Walls.
 3. Seismic Masonry-Veneer Anchors (Option): Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint. Seismic anchors may be used as horizontal reinforcing in SGT veneer in lieu of separate horizontal reinforcing. Provide one of the following:
 - a. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical leg of connector section.
 - b. Connector Section: Rib-stiffened, sheet metal bent plate with down-turned leg designed to fit in anchor section slot and with integral tabs designed to engage continuous wire. Size connector to extend at least halfway through veneer but with at least 5/8-inch cover on outside face.
 - c. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section. Size wire tie to extend at least 1-1/2 inches into veneer but with at least 5/8-inch cover on outside face.
 - d. Connector Section: Sheet metal clip welded to wire tie with integral tabs designed to engage continuous wire.

- e. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - f. Connector Section: Triangular wire tie and rigid PVC extrusion with snap-in grooves for inserting continuous wire. Size wire tie to extend at least halfway through veneer but with at least 5/8-inch cover on outside face.
 - g. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch thick, steel sheet, galvanized after fabrication.
 - h. Fabricate wire connector sections from 0.188-inch diameter, hot-dip galvanized, carbon-steel wire.
 - i. Products:
 - 1) 213-2X and 370 Seismic Hook Tab; Heckmann Building Products.
 - 2) HB-213-2X and Seismicclip; Hohmann & Barnard, Inc.
 - 3) RJ-711 with Wire-Bond seismic clip; Wire-Bond.
4. Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed, washer head or tape to protect hole in sheathing.
- a. Products
 - 1) Pos-I-Tie; Heckmann Building Products.
 - 2) SureTie; Wire Bond.
 - 3) X-Seal Anchor or 2 Seal Tie Veneer Anchor; Hohmann and Barnard.
 - 4) Thermal Grip MVA or Pos-i-tie: TRUFAST Walls.
5. Drill Screws: Provide either of the following types:
- a. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 diameter by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
 - 1) Products:
 - a) Teks Maxiseal with Climaseal finish; ITW Buildex.
 - b) Elco Dril-Flex with Stalgard finish; Textron Inc., Textron Fastening Systems.
 - c) 4000 with Climaseal finish; Wire-Bond.
 - b. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads.
 - 1) Products:
 - a) Scots long life Teks; ITW Buildex.
 - b) Teks Maxiseal with Climaseal finish; ITW Buildex.
 - c) Elco Dril-Flex with Stalgard finish; Textron Inc., Textron Fastening Systems.
 - d) SFS Stadler SX Fastener; Wire-Bond.
 - e) SDS Style; TRUFAST Inc.

2.11 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of dimensions indicated.
- B. Intersecting Masonry Wall Joint Reinforcing: Where interior masonry walls supported on slabs intersect masonry walls, provide hot dip galvanized 1/2 inch by 16-gauge mesh ties spanning horizontally.

1. Products:
 - a. #MWT Mesh Wall Tie; Hohmann & Barnard, Inc.
 - b. Wire Mesh 269; Heckman Building Products.
 - c. Wire Mesh Tie; Wirebond.
 - d. Mesh Tie; MasonPro.

2.12 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 1. Reglets/Receivers: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with mitered and welded corners and junctions. Formed reglets must comply with requirements of Division 07 Section "Sheet Metal Flashing and Trim".
 - a. Materials, provide one of the following:
 - 1) Stainless Steel: 0.0187 inch thick (fka 26 gauge).
 - 2) Aluminum-Zinc Alloy-Coated Steel: 0.0217 (fka 26 gauge).
 - 3) Galvanized Steel: 0.0217 inch thick (fka 26 gauge).
 - 4) Pre-Painted Metallic-Coated Steel: 0.0217 inch thick (fka 26 gauge).
 - b. Masonry Type: Provide extension leg to extend to face of inner CMU wythe (or sheathing with a veneer wall configuration) with an off-set top flange.
 2. Metal Terminations for Flexible Flashing: Fabricate from 26 or 28 gauge stainless steel. Extend into wall as indicated (but not less than 3 inches) and out to exterior face of wall. At exterior face of wall, bend metal down at an angle and back on itself for 3/4 inch to form a drip edge.
 - a. Provide a bead of elastomeric silicone sealant between lintel and drip edge to prevent water from wicking back onto lintel.
 - b. Provide hemmed edge turning back 180 degrees to be flush with face of veneer at base of wall only.
 3. Cavity Bridge: Stainless steel fabrication, Type 304 grade, 26 gauge. Provide pre-drilled holes as required for anchors to substrate.
 - a. Size and Configuration as indicated on Drawings.
 4. Stainless steel end dams may also be used in conjunction with flexible flashing.
- B. Flexible Flashing: For flashing not exposed to the exterior, coordinate with air barrier system and use the following, unless otherwise indicated:
 1. Provide one of the following:
 - a. York 304 SA Self-Adhered, Stainless Steel; York Manufacturing, Inc.
 - b. Gorilla Flash SS Peel and Stick Butyl; STS Coatings, Inc.
 - c. IPCO Self-Adhesive Stainless Steel; Illinois Products, Inc.
 - d. TK Self-Adhering Stainless Steel TWF; TK Products, Inc.
 - e. Mighty-Flash-SA; Hohmann and Barnard Inc.
 - f. Bond-N-Flash S.A.; Wire Bond
 2. Characteristics/Properties
 - a. Type: Stainless steel core with one stainless steel face with a butyl block co-polymer adhesive.
 - b. Stainless steel type: 304, ASTM A 167.
 - c. Adhesive: Block co-polymer.
 - d. Size: Manufacturer's standard width rolls.
 - e. Performance attributes
 - 1) Tensile strength, > 90,000 psi
 - 2) Puncture resistance, > 2,500 pounds average
 - 3) When tested as manufactured, product resists growth of mold pursuant to test method ASTM D 3273.
 3. Accessories: Products shall be as recommended by flashing manufacturer
 - a. Polyether Sealant
 - 1) UniverSeal US-100; York Manufacturing, Inc.
 - 2) GreatSeal LT-100; STS Coatings, Inc.
 - 3) R-Guard Joint Seam Sealer; Prosoco, Inc.

- 4) HB Sealant; Hohmann and Barnard Inc.
 - 5) Quick Set Sealant; Wire Bond
 - b. Splice Tape/Transition Flashing (Self Adhered)
 - 1) York 304SS; York Manufacturing, Inc.
 - 2) IPCO Self-Adhering Stainless Steel Flashing; Illinois Products, Inc.
 - 3) X-Seal Splice Tape; Hohmann and Barnard Inc.
 - 4) Anchorseal Tape: Wire Bond
 - c. Corner and End Dams: Use only 26 gauge stainless steel pre-manufactured corners.
 - d. Water-Based Primer: Provide when recommended by manufacturer for application indicated.
 - 1) Primer-SA; Hohmann and Barnard Inc.
 - 2) Aqua Flash Primer; Wire Bond
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section "Sheet Metal Flashing and Trim."
- 1. Solder for Stainless Steel: ASTM B 32, Grade Sn96, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - 2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight. Sealant shall be approved by flexible flashing manufacturer for use with flashing.
- D. Adhesives, Mastic, Sealant, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- E. Termination Bar: 26 gauge, minimum predrilled stainless-steel approximately 1-1/2 inch wide by 8-foot sections, 45 deg. lip at top for sealant, to be used at top of flashing to secure it to backup.
- 1. Acceptable Manufacturers/Products
 - a. T-2 Termination Bar; Hohmann & Barnard, Inc.
 - b. #4210 Termination Bar; Wire-Bond.
 - c. Stainless Steel Accessories 45; York Flashings.
 - d. Stainless Steel Termination Bar; IPCO.

2.13 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.
- 1. Products:
 - a. Neo-Seal IV 2218-3/Everlastic 1056 Joint Filler; Williams Products, Inc.
 - b. #NS-Closed Cell Neoprene Sponge; Hohmann and Barnard, Inc.
 - c. Neocell; IPCO.
 - d. #NS-Closed Cell; National Construction Materials Corp.
 - e. Sandell's Closed Cell Neoprene; Sandell Construction Solutions.
- B. Thermal Barrier (Break); Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- 1. Nominal density of 4.4 lb./cu.ft.
 - 2. Moisture Resistance; ASTM C 1104: Moisture Sorption, 0.03 percent.
 - 3. Thermal Resistance; ASTM C 518: R-value/inch at 75 deg. F., 4.2 hr.ft.². F/Btu.
- C. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

- D. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- E. Weep/Vent Products: Use one of the following, unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color(s) selected from manufacturer's standard.
 - a. Products:
 - 1) Mortar Maze weep vent; Advanced Building Products Inc.
 - 2) No. 85 Cell Vent; Heckmann Building Products Inc.
 - 3) Quadro-Vent; Hohmann & Barnard, Inc.
 - 4) Cell Vent, 3601; Wire-Bond.
 - 5) Sandell's Cell Vents; Sandell Construction Solutions.
 - 6) Cell Vent; MasonPro.
 - 7) Cell Vent; Mortar Net Solutions.
 2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color(s) selected from manufacturer's standard.
 3. Adjustable Weep Vent: IPCO.
 4. Stainless Steel Weep/Vent: Type 304 stainless steel.
 - a. York Manufacturing Inc.
- F. Cavity Mortar Protection Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. Installer shall select product thickness(es) in the field based on observed clear air space between cavity insulation and outer wythe. Clear air space shall not exceed selected product thickness by more than 0.40-inch. Where clear air space exceeds manufacturer's thickest available product by more than 0.40-inch, Installer shall insert a supplemental wythe of extruded polystyrene (XEPS) insulation on inner face, sized to make up the difference.
1. Provide one of the following types:
 - a. Profiled strips, 10-inches high, with dovetail shaped notches 7-inches deep that prevent mesh from being clogged with mortar droppings.
 - b. Rectangular strips, not less than 10-inches high, with or without dimpled surface, designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
 - c. Sheets or rectangular strips installed continuously from flashing to height indicated, to prevent weep holes from being clogged with mortar.
 2. Products:
 - a. Mortar Break; Advanced Building Products Inc.
 - b. CavClear Masonry Mat; Archovations, Inc.
 - c. Mortar Web/Trap; Hohmann & Barnard Inc.
 - d. Mortar Mitt; Sandell.
 - e. Driwal Mortar Deflection/Driwall Masonry Vent System; Keene Building Products.
 - f. Mason ProNet DT; MasonPro.
 - g. Mortar Net; Mortar Net Solutions.
 - h. Weep-Net; York Manufacturing Inc.
 3. Fabric Mesh to Prevent Clogging of Weep Holes (Option): Non-woven polyester fabric used as part of masonry cavity drainage systems with flashing, weep holes or weep vents. Drapes over interior side of weep holes/vents keeping them free of mortar and debris; routes water to flashing and to weeps by draining through body of product.
 - a. Materials: Recycled polyester, free-draining mesh, made from polymer stands that will not degrade within cavity wall.
 - b. Mold Growth Resistance: In compliance with ASTM D 3273 and ASTM G 21.
- G. Grout Sample Box: When approved by the A/E, grout sample box shall be proven by tests to yield comparable compressive strength values to samples cast by traditional methods regardless of CMU moisture content. Box shall perform as a mold and transport/shipping container in one as specified by ASTM C 1019.

- H. Column Isolation: Around all columns in masonry walls, provide 1/2-inch minimum isolation material to prevent the masonry from coming in contact with the displaced column during loading and to prevent mortar from being within the same joint.
 - 1. Products:
 - a. Ceramar Flexible Foam; W.R. Meadows, Inc.
 - b. Econ-O-Foam; Williams Products.
 - c. Nomaboard; Nomaco Inc.
 - d. Column Backboard; Williams Products.
 - e. Column Wrap; MasonPro.
- I. Grout Stop: Fiberglass, galvanized steel, or polypropylene screen.
 - 1. Products:
 - a. Metal Lath 268; Heckmann Building Products, Inc.
 - b. MGS - Mortar/Grout Screen; Hohmann & Barnard, Inc.
 - c. Grout Stop 3612; Wire-Bond.
 - d. Grout Stop; MasonPro.
- J. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 degrees F (minus 32 degrees C). Provide products with low compression set and of size and shape to provide a seal for compartmentalization.

2.14 CAVITY-WALL INSULATION

- A. Refer to Division 07 Section "Boardstock Air Barrier".

2.15 MASONRY CLEANERS AND ACCESSORIES

- A. Preformed Expansion Joint Filler: Provide closed cell sponge neoprene expansion joint filler conforming to ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated.
- B. Bituminous Coating: Cold applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D1187, Type II.
- C. Masonry Cleaners: Provide one of the following cleaning products expressly approved for intended use by cleaner manufacturer and manufacturer of unit being cleaned as verified on "mock-up".
 - 1. Job Mixed Detergent Solution: Solution of trisodium phosphate (1/2 cup dry measure) and laundry detergent (1/2 cup dry measure) dissolved in one gallon of water.
 - a. For SGT
 - 2. Proprietary Acidic Cleaner: Manufacturer's standard strength, general purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned. Do not use products containing hydrochloric (muriatic acid, hydrofluoric acid, or ammonium bifluoride).
 - a. For brick masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface acting acids, chelating, and wetting agents.
 - 1) Products:
 - a) Sure Klean No. 600 Detergent; ProSoCo., Inc.
 - b) 202 Detergent; Diedrich Technologies.
 - c) NMD 80 New Masonry Detergent; EaCo Chem, Inc.
 - b. For dark colored brick masonry not subject to metallic oxidation stains, use formulation consisting of a liquid blend of surface acting acids and special inhibitors.

- 1) Products:
 - a) ProSoCo., Inc.; Sure Klean No. 101 Lime Solvent.
 - b) Diedrich Technologies; 200 Lime Solv.
 - c) EaCo Chem, Inc., NMD 80 New Masonry Detergent.
- c. For brick masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic acids and special inhibitors.
 - 1) Products:
 - a) Sure Klean Vana Trol; ProSoCo., Inc.
 - b) 202 Vana-Stop; Diedrich Technologies.
 - c) NMD 80 New Masonry Detergent; EaCo Chem, Inc.
- D. Spray Equipment: Provide equipment for controlled spray application of water and chemical cleaners, if any, at rates indicated or recommended for pressure, measured at spray tip, and for volume. Adjust pressure and volume, as required, to ensure that damage to masonry does not result from cleaning methods.
 - 1. For chemical cleaner spray application, provide a low pressure tank or chemical pump suitable for the chemical cleaner indicated, equipped with a cone-shaped spray tip.
 - 2. For water spray application, provide a fan-shaped spray tip that disperses water at an angle of not less than 15 degrees.

2.16 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated. When specifically approved by the A/E, admixtures shall meet ASTM C1384 Standard Specification for Admixtures for Masonry Mortars.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Maintain workability of standard grey mortar by remixing or retempering. No mortar shall be used beyond 2-1/2 hours after mixing. Do not retemper colored pigmented mortar because color variations may result.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar Batching
 - 1. For each unit volume of cementitious materials, provide 2.25 to 3.5 volumes of aggregates.
 - 2. In a running mechanical paddle mixer, add 2/3 of the water and 1/2 of the aggregate (sand), then add the cementitious materials. Follow by adding the remaining water. Mix for a minimum of 5 minutes, adding water if required to produce a workable consistency.
 - a. Do not hand mix mortar, unless approved in writing by A/E.
- C. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- D. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade use Type M, where indicated only.
 - 2. For masonry, use Type S, unless otherwise noted.
 - 3. For non-load bearing interior partitions, use Type N or S, unless otherwise noted.
 - 4. For exterior, above-grade, masonry veneer, use Type N or S, unless otherwise noted.
- E. Use natural (noncolored) mortar for the following:
 - 1. Concrete masonry units
- F. Colored Pigmented Mortar: Select and proportion pigments with other ingredients to produce color indicated or, if not indicated, as selected from manufacturer's standard formulation to compliment adjacent units.

1. Use colored pigmented mortar for the following locations:
 - a. Clay face brick, as required to match existing.
 - b. Structural glazed facing tile
 2. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color(s) required. Limit pigments to the following percentages of cement content by weight:
 - a. For mineral oxide pigments and Portland cement lime mortar, not more than 10 percent.
 - b. For carbon black pigment and Portland cement lime mortar, not more than 2 percent.
 - c. For mineral oxide pigments and masonry cement mortar not more than 5 percent.
 - d. For carbon black pigment and masonry cement mortar, not more than 1 percent.
- G. Pointing mortar shall conform to ASTM C270, except that all sand shall pass a No. 16 sieve. Nonstaining and dirt resistant mortar shall be used to which ammonium stearate or calcium stearate is added to the amount equal to 3 percent of the weight of the cement used.
1. Pointing mortar shall be proportioned by volume with one part portland cement, 1/8 part Type S hydrated lime, and 2 parts graded (50 mesh or finer) sand to which ammonium stearate or calcium stearate is added in an amount equal to 2 percent of the weight of the cement used. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
 2. Add colored mortar pigment to produce mortar colors required.
- H. Grout for Unit Masonry (by Strength): Comply with ASTM C 476. Grout mixes shall be designed by strength, unless specifically noted otherwise in the Contract Documents.
1. Conventional Grout
 - a. General: Do not use admixtures, including pigment, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated. Do not lower the freezing point of grout by use of admixtures or anti-freeze agents.
 - 1) Admixtures containing chlorides in excess of 0.2 percent chloride ions are not permitted to be used.
 - 2) Antifreezes are prohibited for use in grouts.
 - 3) Flyash: ASTM C618-89a, Type C or F may be substituted for up to 20 percent of the total cementitious materials in the grout mix.
 - b. Grout mixes shall be plant mix or factory blended (dry mix with water added at Project site).
 - c. Field mixed grout designs are not acceptable.
 - d. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in TMS 402/602 for dimensions of grout spaces and pour height.
 - e. Provide grout with a slump of 8 to 10 inches as measured according to ASTM C 143.
 2. Self-Consolidating Grout
 - a. Jobsite proportioning of self-consolidating grout is not permitted. Do not add water at jobsite except in accordance with self-consolidating grout manufacturer's instructions.
 - b. Admixtures for Self-Consolidating Grout
 - 1) High-Range Water-Reducing Admixture
 - 2) Viscosity-Modifying Admixture
 - c. Slump Flow: 24 to 30 inches as determined in accordance with ASTM C1611.
 - d. Visual Stability Index (VSI): Less than or equal to 1 as determined in accordance with ASTM C1611, Appendix X.1.
 - e. Consolidation or reconsolidation is not required for self-consolidating grout.
- I. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.
1. Application: Use epoxy pointing mortar for patching holes in exposed mortar joints with the following units:

- a. Glazed structural-clay facing tile.

2.17 SOURCE QUALITY CONTROL

- A. Concrete Masonry Inspection
 - 1. Refer to Division 01 Section "Quality Requirements".
 - 2. Materials may require testing and retesting, as directed by the A/E, during the progress of the Work. Allow free access to material stockpiles, facilities and completed construction.
 - 3. See structural plans for special inspection requirements for masonry walls.
- B. Verification of Performance: Masonry Contractor shall water test cavity to verify all water is draining to the exterior through the weeps before continuing with exterior wythe and before capping wall.
 - 1. Contractor shall perform initial tests in the presence of A/E, testing lab representative, flexible flashing manufacturer, and General Trades Contractor. After successful initial tests have been performed additional testing shall be performed in the presence of the General Contractor and testing lab representative so tests can be witnessed and documented. A/E and General Trades Contractor shall be notified when testing is to occur, in case they too wish to witness the testing, otherwise testing lab will submit documentation to A/E as work progresses. General Trades Contractor may employ testing lab to document testing.
 - a. Do not precede more than 3 veneer courses above flashing without testing, observation and digital documentation by testing lab representative.
 - 2. Contractor shall hold water hose and with standard water pressure, force water into the cavity at a cell vent so water can be observed coming out adjacent weeps for a period of at least 5 minutes. Contractor shall continue down the wall to the next cell vent where a weep did not indicate water wicking out and continue this process until the entire length of flashing is tested.
 - 3. Where water is observed inside the building or outside the building away from the weeps, masonry units shall be removed and flashing reinspected and repaired.
 - 4. Water test shall be repeated where flashing was repaired.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work in accordance with TMS 402/602, Article 2.1.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify critical steel elevations to ensure flashing will be installed at proper locations.
 - 5. Verify dimensions, tolerances, and method of attachment to other work.
 - 6. Verify that substrates are ready to receive the work of this section.
- B. Before installation, examine rough-in and built-in construction for piping systems or conduit to verify actual locations of connections.
 - 1. Do not install anything in the cavity space of the exterior wall that:
 - a. Diminishes the designed R-Value of the cavity-wall insulation.
 - b. Encroaches on the required air gap.
- C. Verify substrate and surface conditions are in accordance with flexible flashing manufacturer recommended tolerances prior to installation.
 - 1. Review requirements for sequencing of installation of flexible flashing assembly with installation of windows, doors, louvers and wall penetrations to provide a weathertight flashing assembly.

2. Verify flexible flashing will be continuously supported by substrate, and not span any gaps or voids in excess of 1/2 inch.

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

3.2 PREPARATION

A. General

1. If ice or snow has formed on masonry bed, remove by carefully applying heat until top surface is dry to the touch.
2. Remove all masonry deemed frozen or damaged.
3. Provide items to be attached to substrate with setting templates.

B. Protect membrane roofing system. No masonry work is to be performed over an unprotected roof.

1. Loosely lay 1-inch minimum thick, molded expanded polystyrene (MEPS) insulation over the roofing membrane in areas indicated. Loosely lay 15/32-inch plywood or OSB panels over MEPS. Extend MEPS past edges of plywood or OSB panels a minimum of 1 inch.
 - a. Protection sheet or mat: Provide a sacrificial layer of matching membrane sheet extending minimum 6 inches beyond insulation in all directions or a woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.
2. Limit traffic and material storage to areas of roofing that have been protected.

C. Protect concrete floor from damage where floor will remain exposed.

D. Concrete Surfaces: Where masonry is to be placed, clean concrete of laitance, dust, dirt, oil, organic matter, or other foreign materials that would inhibit bond of mortar to the surface.

E. Furnish temporary bracing as required during installation of masonry work. Maintain in place until building structure provides permanent support.

F. Protection of SGT: Protect the surface of the installed SGT. Cover freshly laid weather exposed masonry at the end of each day or the start of each shut down period, with non-staining waterproof material in such a manner which will ensure that the covering will overhang the masonry not less than 2 inches on each side of the masonry. Anchor on each side of the wall. Finished walls to be covered with #15 felt paper and erect wooden barriers to protect walls at areas that are subject to large amounts of construction traffic or material movement. Protect glazed face from exposure to welding burns, stains, etc.

3.3 INSTALLATION, GENERAL

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

1. Note: In lieu of double wythe foundation walls, single wythe matching nominal overall width of double wythe may be provided.

B. Build chases and recesses to accommodate items specified in this and other Sections. Provide not less than 8 inches of masonry between chases or recesses and jamb of openings, and between adjacent chases and recesses.

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

1. Consult other trades and make provisions to permit installation of their work in a manner to avoid cutting and patching. Build in work specified under other Sections, as necessary, and as work progresses.

- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
 - 1. SGT Units: Cut units with masonry saw using a wet diamond blade. Do not use units less than 4 inches in length.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
 - 1. When units are above 32 deg. F, heat water above 70 deg. F.
 - 2. When units are below 32 deg. F, heat water above 130 deg F.
 - 3. Recommended procedure to insure that brick are nearly saturated, surface dry when laid is to place a hose on the pile of brick until the water runs from the pile. This should be done one day before brick are to be used. In extremely warm weather, place hose on pile several hours before brick are to be used.
- H. Do not wet concrete masonry units or SGT units.
- I. Cleaning Reinforcement: Before being placed, remove loose rust, ice, or other coatings from reinforcement.
- J. SGT Workmanship
 - 1. Lay only dry SGT units.
 - 2. Lay SGT units plumb, level and true to line.
 - 3. Lay in stack bond.
 - 4. Build in work of other trades indicated to be built-in with SGT as work progresses.

3.4 TOLERANCES

- A. General: Comply with construction tolerances in TMS 402/602 and the following:
- B. Dimensions and Locations of Elements:
 - 1. For dimension in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
 - 4. If the above condition, cannot be meet due to previous construction, notify the A/E.
- C. Lines and Levels
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet or 1/2 inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

D. Joints

1. Unless additional restrictions are indicated, horizontal mortar joints between masonry units shall be in the range of: 1/4 inch to 1/2 inch.
2. Vertical mortar joints between masonry units shall be in the range of: 1/8 inch to 3/4 inch.
3. For brick bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
4. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
6. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

E. Reinforcing Bars: Tolerances for placing reinforcing bars are:

1. Variation from d for flexural elements (measured from center of reinforcement to the extreme compressive face of masonry):
 - a. $d \leq 8$ inch $\pm 1/2$ inch
 - b. $8 \text{ inch} < d \leq 24$ inch ± 1 inch
 - c. $d < 24$ inch $\pm 1-1/4$ inch
2. For vertical bars in walls 2 inch from the location along the length of the wall indicated on the project drawings.
3. In addition, a minimum clear distance between reinforcing bars and the adjacent face of a masonry unit of 1/4 inch for fine grout or 1/2 inch for coarse grout must be maintained so that grout can flow around the bars.

3.5 LAYING MASONRY WALLS

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

1. Do not install cracked, broken, or chipped masonry units exceeding ASTM allowances.
2. Clean units of surface dirt and contaminants before placing in contact with mortar.
3. Lay-up walls plumb and true and with courses level, accurately spaced, within specified tolerances, and coordinated with other work. Do not wedge partitions tight against structural ceiling or beams, but provide an acoustical joint between masonry and the structural roof deck, structural steel framing or structural floor deck at nonrated conditions. Refer to Division 07 Section "Acoustical Joint Sealants". At rated walls, provide firestopping. Refer to Division 07 Section "Fire-Resistive Joint Systems."
 - a. Cut masonry as required to maintain 2 inches clearance between masonry and all steel or reinforced concrete structural members that pass through or above walls, but are not to be supported by the walls.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below, unless otherwise noted.
2. Lay SGT in stack bond.
3. Provide 1/3 running bond, where indicated and with utility size facing brick.
4. Provide special bonding as indicated on Drawings.

- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
 - 1. Align unit cells or cores that are to be grouted.

- D. Stopping and Resuming Work: Stop work at vertical control joints or by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
 - 1. Stop off horizontal run of masonry by racking back 1/2 length of unit in each course.
 - 2. Tothing is not permitted, except upon written acceptance of the A/E.

- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
 - 1. Install adjustable hollow metal frame anchors, locating anchors on jambs in horizontal bed courses near the top and bottom of each frame and at intermediate points not over 24 inches apart.
 - 2. Unless otherwise noted or thermal break is required, contractor may grout jambs of hollow metal door and window frames in accordance with ANSI 250.8.
 - a. Where grout is installed during masonry installation, frames shall be braced or fastened in such a way that will prevent the pressure of the grout from deforming the frame members. Grout shall be mixed to provide a 4 inch maximum slump consistency, hand troweled into place. Grout mixed to a thin "pumpable" consistency shall not be used.
 - 3. Rake joints around exterior side of exterior hollow metal door frames for sealant under Division 7.
 - 4. Protect inside (concealed) faces of door frames in exterior masonry walls, using fibered asphalt emulsion coating. Apply over shop primer approximately 1/8 inch thick and allow to dry before handling.
 - 5. Where hollow metal frames do not wrap around masonry jambs and heads, rub exposed corners of block to remove sharp, irregular edges.
 - 6. Take particular care to embed all conduits and pipes with concrete masonry without fracturing exposed shells and to fit units around switch, receptacle and other boxes set in walls. Where electric conduits, outlets, switch boxes, and similar items occur, grind and cut units before building in services. Prepare cutouts in such a manner that units can be installed plumb and flush.
 - 7. Install anchors, reglets, and nailers for flashing and related work built into masonry work, where indicated.

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

- G. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

- H. Where non-loadbearing, full-height masonry walls intersect structural framing above, provide a minimum 1/2 inch clear joint around the member. Do not build masonry solid around open-web steel joists.
 - 1. At acoustically rated partitions treat joint between top of partition and underside of structure above to comply with Division 07 Section "Acoustical Joint Sealants".

3.6 MORTAR BEDDING AND JOINTING

- A. Mortar Bedding; Brick and Concrete Masonry Units as follows:

1. Mix mortar ingredients for a minimum of 5 minutes in a mechanical batch mixer. Use water clear and free of deleterious materials that would impair the work. Each mortar batch is allowed only one retempering. Do not use mortar, which has begun to set after the first retempering, or if more than 2-1/2 hours has elapsed since initial mixing. Retempering will be permitted only within 1-1/2 hours of mixing, to replace moisture lost by evaporation. Discard any mortar or grout that is partially set.
2. Lay brick and other solid masonry units with completely filled bed and head joints. Do not deeply furrow bed joints. Butter ends with sufficient mortar to fill head joints and shove into place. Butter ends of brick in hand and in the wall at closures. Do not slush head joints. Rock closures into place with head joints thrown against adjacent brick in place.
 - a. Do not pound corners and jambs to fit stretcher units after they are set in position. Where an adjustment must be made after mortar has started to harden, remove mortar and replace with fresh mortar.
3. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells; also bed webs in mortar in starting course on footings and foundation walls, in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 - a. Construct bed joint of the starting course of foundation with a thickness not less than 1/4 inch and not more than 3/4 inch.
4. Remove mortar protruding into cells or cavities that will be grouted. Do not permit mortar droppings to fall into cells, cavities of multi-wythe walls or to block weep holes. Maintain clear cavity width between facing and backing material and keep clear of mortar droppings by back beveling the mortar bed to prevent excess from extruding into cavity. Clean any excess that does occur by parging it to back of unit.
5. Fill holes not specified in exposed and below grade masonry with mortar.

B. Lay structural-clay tile as follows:

1. Lay vertical-cell units with full head joints, unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
2. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 3/8-inch thick joints.
3. Remove and replace mortar with fresh mortar where adjustment must be made after mortar has started to set.
4. Keep bed and head units uniform in width, except for minor variations required to maintain bond and locate returns.

C. Joints: Maintain joint widths shown, except for minor variations required, to maintain bond alignment. Lay walls with 3/8 inch joints. Tool joints consistently with the same type round jointer when the mortar is thumb print hard. Use a jointer that is slightly larger than the joint width so that complete contact is made along the edges of the unit. Tool joints in exposed masonry walls at uniform moisture content to avoid color variations. Perform tooling so that the mortar is compressed and the joint surface is sealed. Cut joints flush for masonry walls that are to be concealed or to be covered by other materials. For exposed masonry, provide joints as follows:

1. Exterior Joints
 - a. Concave tooled, unless otherwise noted.
 - 1) For glazed masonry units, use a nonmetallic jointer 1-1/4 inch or more in width.
 - b. Provide tooled joints horizontal and vertical at exterior scored concrete masonry units, including score joint.
2. Interior (Room Side) Joints
 - a. Concave tooled, unless otherwise noted.
 - b. Rake vertical joints at interior masonry partitions abutting vertical structural framing members for application of joint sealants.

3.7 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide where indicated only. Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
 - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 - b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.
 2. Masonry Joint Reinforcement: Provide unless otherwise noted. Install in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes, if both wythes are concrete masonry and installed simultaneously. At no time shall a wythe be more than 16 inches higher than any other wythe being constructed concurrently.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align. Wythes may be laid up full height separate from facing wythe.
 - 1) Cavity width changes shall be accommodated by different sized wire ties; wire ties should not be bent or deformed to span the cavity space.
 3. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
1. Keep cavity clean of mortar droppings by suspending by wires a wooden strip the width of the air space. Strip shall be lifted as each course of joint reinforcement is laid in facing wythe. Install cavity mortar protection in cavity above through wall flashing and where indicated for additional protection.

C. Apply air barrier to face of backup wythe to comply with Division 07 "Air Barrier" sections.

3.8 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches o.c., unless otherwise noted.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
 - a. Reinforcement above is in addition to continuous reinforcement.
 4. Provide reinforcement in every other course of concrete masonry veneer, but not in the same course as the tie.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - 1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached and/or seismic anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed tie sections and/or connector sections and continuous wire in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and exterior face of inner wythe or sheathing.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
 - 5. Masonry veneer anchors shall be embedded a minimum of 1-1/2 inches into the mortar joint. Provide a minimum of 5/8 inch mortar coverage at veneer to the outside face.
- B. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing or insulation.
 - 1. Keep air space clean of mortar droppings and other materials during construction. Bevel beds away from air space, to minimize mortar protrusions into air space. Do not attempt to trowel or remove mortar fins protruding into air space.

3.11 CONTROL AND EXPANSION JOINTS (MOVEMENT JOINTS)

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Other than bond beams do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
 - 1. Install an elastomeric tubing sealant backer rod at each control joint to compartmentalize masonry cavity.
 - 2. Reinforcing and grout for masonry bond beams are to run continuous through vertical control joints.
 - 3. Keep joints clean from all mortar and debris.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 - 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

- C. Form expansion joints in brick made from clay or shale as follows:
1. Build in compressible joint fillers, unless otherwise noted.
- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.
- E. Control Joint Locations in CMU: Provide vertical control joints in reinforced CMU where called for on the Drawings. Provide vertical control joints in unreinforced CMU in accordance with NCMA TEK Bulletins 10-01A, 10-02D, 10-03, and 10-04, and at all offsets, returns, openings, and intersections with dissimilar materials and as follows to prevent cracking:
1. At change from wall setting on foundation to wall setting on floor slab.
 2. At change from exterior wall to interior wall.
 3. At walls setting on floors that cross floor construction.
 4. At columns within masonry walls.
 5. At changes in wall thickness.
 6. Stop joint reinforcement bars on either side of control joints. Extend reinforcing bars in bond beams continuously through control joints and sleeves for bond break 18 inches each side of joint.
 7. Install control joints in concrete masonry units with prefabricated shear key.
 8. At end of steel lintel bearing on one end of openings less than or equal to 6'-4" and at both ends of openings greater than 6'-4".
 - a. Do not provide control joints within 16 inches of bond beam lintels.
 9. Straight runs as indicated below, with spacing related to wall height as follows:
 - a. Walls less than 8 feet: Not more than 3 times wall height.
 - b. Walls 8 feet or higher: Maximum 25 feet.
 10. Distance between joints should not exceed the lesser of the following:
 - a. A length-to-height ratio of 3 to 2.
 - b. 25 feet.
- F. Expansion Joint Locations in Brick: Provide in accordance with BIA Technical Note No. 18A at vertical expansion joints in brick masonry at all offsets, returns, openings, intersections with dissimilar materials, and elsewhere as shown on Drawings and indicated hereinafter. For brick work without openings, space no more than 25 feet o.c.
1. Place as follows:
 - a. At or near corners
 - b. At offsets and setbacks
 - c. At wall intersections
 - d. At changes in wall height
 - e. Where wall backing system changes
 - f. Where support of brick veneer changes
 - g. Where wall function or climatic exposure changes
 - h. At one jamb of openings 12 feet or wider.
 2. Form open joint of width indicated but not less than 3/8 inch for installation of preformed expansion joint filler, and sealant and backer rod specified in Division 07 Section "Joint Sealants". Maintain joint free and clear of mortar.
- G. Building Expansion Joint Through Masonry
1. Form open joint of width indicated but not less than 3/8 inch for installation of preformed expansion joint filler, and sealant and backer rod specified in Division 07 Section "Preformed Joint Seals". Maintain joint free and clear of mortar.

3.12 LINTELS

- A. Install loose steel lintels furnished under Division 05.
 - 1. Shore steel lintels until the masonry has attained sufficient strength to carry its own weight. Limit the deflection of masonry during this period to $L/600$ or 0.3 inch (whichever is less). This shoring period should not be less than 24 hour. This minimum time period should be increased to three days when there are imposed loads to be supported. If the masonry is built in cold weather construction conditions, the length of cure should be increased.
- B. Provide masonry lintels where shown and wherever openings of more than 8 inches for brick size units and 16 inches for block size units are shown without structural steel or other supporting lintels. Provide prefabricated or formed-in-place masonry lintels. Do not use precast concrete lintels. Thoroughly cure prefabricated lintels before handling and installation. Temporarily support formed-in place lintels.
 - 1. For hollow masonry lintels, use specially formed "U"-shaped lintel units with solid bottom and reinforcing bars placed as shown, and filled with coarse grout. Bond beam block shall not be used to form masonry lintels.
 - 2. Bond pattern for masonry lintels shall match the pattern at the adjacent wall unless otherwise noted.
- C. Provide minimum 8 inch solid bearing at each end, unless otherwise noted. Provide solid masonry units or hollow units filled solid.
 - 1. Provide a slip plane in the form of flashing or other bond breaker between the lintel and masonry in unreinforced CMU walls.
- D. For steel lintels in exterior wythe, rake back mortar in preparation for sealant as specified in Division 07 Section "Joint Sealants".
- E. Where formed-in-place masonry lintels are supported by steel angles over the opening during installation, the angles shall not extend more than 2-1/2 inches into the masonry on each jamb of the opening. When the angles are removed, the void remaining shall be packed tightly with a moist mixture of Type S mortar.
- F. The reinforced masonry and lintel drawings are intended to show the major lintels required for windows, doors, louvers, and other major openings. Some lintels are shown for some mechanical duct and pipe openings, but the drawings are not intended to show all of these openings. The masonry contractor shall coordinate the size and location of openings required in masonry walls by the other contractors and provide steel or masonry lintels for these openings according to the lintel schedules in the Contract Documents whether shown on the Contract Documents or not.

3.13 FLASHING, WEEPS, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep vents in first course of masonry above ground level, at lintels, ledges, above doors, windows and other openings and under coping and sills, other obstructions to downward flow of water in wall. Flashing shall be installed longitudinally continuous or terminated with end dams. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities. Comply with NCMA recommendations for "drainage wall system" masonry construction.
 - 1. Install concealed through wall flashing in accordance with SMACNA "Architectural Sheet Metal Manual" Chapter 4 Flashing and with NCMA TEK Bulletins 19-04A and 19-05A details to ensure water resistant masonry construction.
 - 2. Apply primer, if required by manufacturer according to manufacturer's written instructions.
 - 3. Install preformed corners and end dams, cants, if required, under flexible flashing membrane, bedded in sealant in appropriate locations along wall.
 - 4. Starting at a corner, remove release sheet, if applicable, and apply membrane to primed, if required by manufacturer for substrate indicated.
 - 5. Extend membrane through wall and leave 1/4 inch minimum exposed.

6. Roll flashing into place. Ensure continuous and direct contact with substrate. Avoid trapping air and forming wrinkles.
 7. Lap ends and overlap preformed corners 4 inches minimum. Seal all laps with sealant.
 8. Trim exterior edge of flexible flashing membrane 3/4 inch and secure to metal drip edge per manufacturers written instructions, where drip edge is required.
 - a. Embedded flashing materials shall not be used for drip edges.
 9. Terminate flexible flashing membrane on vertical wall with a termination bar.
 10. Apply sealant bead at each termination.
 11. Protect installed flexible flashing from damage during construction.
 - a. Inspect before covering and make repairs as necessary. Remove and replace damaged material. Repair holes and tears by covering with cut patch of similar product overlapping damage 2 inches minimum. Seal perimeter of patch repair with sealant/mastic.
 - b. Cover flexible flashing as soon as possible after installation has been observed and tested. Do not expose longer than 60 days, unless otherwise approved by membrane manufacturer in writing.
- B. Install flashing as follows, unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - a. Install proprietary flashing/drainage system in accordance with manufacturer's installation instructions.
 2. At cavity walls, where wall intersects a roof or similar horizontal element, extend flashing through outer wythe, turn up 16 inches or a minimum of 6 inches above cavity mortar protection, and terminate on exterior face of inner wythe with termination bar and sealant. Install metal reglet/receiver, extending through cavity and turned up at exterior face of inner wythe, beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal reglet/receiver.
 - a. Note: Embedded flashing must terminate a minimum of 12 inches above roofing surface. Coordinate termination with roofing contractor.
 3. At cavity walls, where wall intersects grade, extend flashing through outer wythe, turn up 16 inches or a minimum of 6 inches above cavity mortar protection, and terminate on exterior face of inner wythe with termination bar and sealant. Cut flexible flashing off flush at face of wall after masonry wall construction is completed.
 4. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 16 inches or a minimum of 6 inches above cavity mortar protection, and terminate with a termination bar and sealant. Terminate flashing at outer wythe using the same methods used at multiwythe masonry walls as specified hereinbefore.
 5. At lintels extend flashing over top flange of angle across air space behind veneer and turn up a 16 inches or a minimum of 6 inches above cavity mortar protection, and terminate on exterior face of inner wythe or sheathing with termination bar and sealant. At outer wythe extend flashing at least 6 inches beyond end of lintel and turn up ends not less than 2 inches to form end dams. Install metal drip edges beneath flexible flashing at exterior face of wall and seal with sealant to lintel. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 - a. Where the lintel is bolt-mounted in place, cut-off excess bolt length at face of nut prior to installing the flexible flashing. After positioning the flexible flashing, cut a small "X" in the flashing to allow the flashing to fit over the nut and then apply compatible mastic to the flashing a minimum of 1 inch out from the "X" in all directions.
- C. Install weep vents in head joints in exterior wythes of first course of masonry immediately above embedded flashing (not mortar) and as follows:
1. Use specified weep/vent products to form weeps.

2. Space weep vents 16 inches o.c., unless otherwise indicated. (TMS 402:6.1.6.2).
 3. Keep weep holes and area above flashing free of mortar droppings.
- D. Place cavity mortar protection material in cavities to comply with configuration requirements for cavity mortar protection material in Part 2 "Miscellaneous Masonry Accessories" Article.
1. Option: Use geotextile drainage fabric as recommended by flashing manufacturer, and install to have the fabric reach the base of the flashing and covering the weep vents.
 - a. Inspect flashing for holes prior to installing fabric mesh. Coordinate repair of holes with installer of flashing.
 - b. Place a continuous row of fabric mesh one inch into the mortar joint of the third row of standard size exterior bricks in collar joints, cavity walls, or lintels. Drape excess material onto base of flashing. Ensure that flashing is clean of mortar droppings and debris. Adhesives and fasteners are not required; mortar need not have set.
 - c. If excessive droppings are expected, use a taller height fabric mesh and taller flashing.
 - d. Cut or tear to accommodate wall ties, conduit, plumbing or other materials that bridge or intrude into cavity between inner and outer walls.
- E. Install vents in head joints in exterior wythes at 32 inches o.c., unless otherwise indicated. Use specified weep/vent products to form vents.
1. Close cavities off vertically with elastomeric tube sealant back rod in manner indicated. Install through-wall flashing and weep vents above horizontal blocking.

3.14 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 402/602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in TMS 402/602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. The low-lift grouting procedure shall be used as described in the Drawings and in NCMA-TEK 03-02A Grouting Concrete Masonry Walls.
 - a. High-Lift Grouting: Do not use unless approved by A/E. If high-lift grouting is approved, limit lifts to 12'-0" and use super plasticizer in grout to reduce water content.
 3. Grout (slump 8 to 10 inches) shall be installed in the block cavities so as to completely fill each cavity with homogenous grout, extending from the lowest course to the top of the reinforced portion of the foundation or wall. Concrete or mortar shall not be used as grout for CMU.
 4. Between 5 and 20 minutes after the grout is placed, it shall be consolidated with a mechanical vibrator. The top of the grout filling shall be stopped 1-1/2 inches below the top of the concrete block to form a key, except for the top course in the wall where the grout shall be struck flush with the top.
 5. Aggregate used in the grout shall be small enough not to interfere with placement and plasticity.
 6. Caging devices and centering clips shall be spaced vertically such that 2 clips or devices, one near its top and one near its bottom restrain every section of vertical reinforcing bar.

7. Where grouted cores do not extend the full height of a wall, install grout stop mesh at the lower limit of the grout.
8. Where required on the plans, grouting operations shall be observed by an independent testing agency.

3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage qualified independent inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Minimum qualifications for the masonry inspector shall be 5 years of reinforced masonry inspection experience or acceptance by a State, municipality, or other governmental body having a program of examining and certifying inspectors for reinforced masonry construction. The masonry inspector shall be present during sampling and placing of masonry units, placement of reinforcement, inspection of grout space immediately prior to closing of cleanouts, and during grouting operations. The masonry inspector shall assure Contractor compliance with drawings and specifications, including flashing. The masonry inspector shall keep a complete record of all inspections and shall submit Masonry Inspection Reports and Special Inspection requirements set forth in the structural drawings for inspection requirements and a photographic documentation of flashing.
1. Masonry Inspection: Provide masonry construction inspection of concrete or brick masonry walls indicated as requiring inspection on the Masonry Plans to insure that masonry construction is in conformance with the Contract Documents. Masonry inspection is required for those masonry elements that must be constructed to attain high design strengths.
 - a. Inspection shall use NCMA-TEK 18-03B "Concrete Masonry Inspection" as a guideline.
 - b. The individual or individuals who will perform the masonry inspection shall be present for the Preliminary Masonry Meeting.
 - c. The masonry inspector shall prepare a written report or reports for each day of inspection. Masonry Inspection Report, following this Section, shall be used for all inspection reports. Inspecting reports shall be submitted to the A/E within 5 days of masonry inspection.
 - d. The masonry inspector shall be present and observe all masonry construction operations in walls requiring inspection. The masonry inspector shall be present at the Project site within sufficient time, in advance of grouting operations, to inspect the construction to insure its conformance to the Contract Documents and that grouting may proceed. No grouting shall be permitted unless the masonry inspector is present and has indicated that the masonry construction is properly prepared for the grouting operation.
 2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspection according to the "TMS 402," unless otherwise noted.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grouts only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Frequency: One set of tests for each 5000 sq.ft. of wall area or portion thereof.
- D. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140 for compressive strength.
- E. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.
1. Tests for Mortar: The Masonry Contractor shall coordinate with a qualified testing laboratory to perform field quality control testing during the masonry mortar work.

- a. For colored and noncolored mortars test for compressive strength by the methods of sampling and testing of ASTM C109 and ASTM C780.
 - 1) Provide a minimum of six cubes for testing per 5,000 sq.ft. of masonry wall construction and as directed by A/E. Test two cubes at 7 days, two cubes at 28 days, and reserve two cubes for future testing.
 - b. Submit written reports for each material sampled and tested. Provide the project identification name and number, date of report, name of contractor, name of testing service, source of aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate material is acceptable for intended use.
 - c. If the compressive strength tests fail to meet the minimum requirements specified; the mortar represented by such tests would be considered deficient in strength.
 - d. Deficient mortar shall be removed and replaced by the Contractor without additional cost to the Owner.
- F. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.
- 1. Place a piece of preservative-treated wood 1-5/8 inch thick and 3 inch square on a level surface. For masonry units with permeable paper, such as absorptive paper toweling, taped to one face shell are placed around the wood block to form the mold. The resulting mold is approximately 3 inches square by 6 inches high. Measure and record the slump of the grout in accordance with Test Method C143. Pour grout into the mold in two layers. Rod each layer 15 times with a tamping rod to eliminate air bubbles. Rod the bottom layer throughout its depth. Distribute the strokes uniformly over the cross-section of the mold. For the upper layer, allow the stick to penetrate about 1/2 inch into the underlying layer. After the second lift is puddled, level the top of the specimen with a straightedge and immediately cover the specimens with wet burlap or similar material to keep it damp. Protect the specimens against disturbance and extreme changes in temperature, and after 48 hours, remove the masonry units and carefully pack the specimens for transport to the laboratory where they will be stored in a moist room until tested.
 - 2. Cap the specimens in accordance with the applicable provisions of "Method of Capping Cylindrical Concrete Specimens," ASTM C617. The specimens shall be tested in a damp condition in accordance with the applicable provisions of ASTM C39 "Methods of Test for Compressive Strength of Molded Concrete Cylinders."
 - 3. Four test specimens shall be made and tested for each type of grout to be used in the work.
 - 4. As an alternate to the method of sampling described above, grout samples may be formed in grout sample boxes, when requested and approved by A/E.
 - 5. Tests for Grout: The Masonry Contractor shall coordinate with a qualified testing laboratory to perform field quality control testing during the masonry grout work.
 - a. Grout for filling reinforced or unreinforced concrete masonry cores or brick cavities: Test for compressive strength.
 - 1) Provide a minimum of 4 test specimens for testing per 5,000 sq.ft. of masonry wall construction or for each ready mix truckload of grout and as directed by the A/E. Test one cylinder at 7 days, two cylinders at 28 days, and reserve one cylinder for future testing.
 - b. Submit written reports for each material sampled and tested. Provide the project identification name and number, date of report, name of Contractor, name of testing service, source of aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, specific location where material represented by sample is used, slump and compression test results. Indicate whether material is acceptable for intended use.

3.16 REPAIRING, POINTING, AND CLEANING

A. Cleaning, General

- 1. Know your surface. Positively identify every substrate to be cleaned. Review all manufacturers literature for cleaning recommendations.

2. Always test before overall cleaning. Always test, and always clean under the same conditions you tested under. Retest if conditions change.
 3. Use the mildest cleaner and dilution that still gives effective results.
 4. Clean early:
 - a. Don't give mortar smears and films a chance to become as hard as the masonry. Get it off while it's still relatively soft. Clean masonry within 7 to 21 days of installation.
 - b. Clay brick maybe cleaned within 14 to 28 days.
 5. Use the right cleaner for the right job. Follow the masonry manufacturer's guidelines for cleaning each type of masonry.
 6. Never clean with raw acid.
 7. Cleaning basics
 - a. Don't spare the water. Pre-wetting masonry is recommended. Rise with 400 psi to remove stains and cleaner residue.
 - b. Clean bottom-to-top, and always keep lower areas wet to prevent streaking.
 - c. Follow all safety precautions in the product literature.
 - d. Cold weather
 - 1) Water-saturated masonry is vulnerable to freeze/thaw damage. Never clean if the masonry could freeze before drying.
 - 2) Chemical cleaners and rinse water rely on chemical reactions to dissolve and rinse away construction soiling. Cold temperatures slow these chemical reactions. Compensating for the cold by using a stronger cleaning solution may cause permanent damage to the masonry, especially colored concrete.
 - a) Instead, extend the dwelling time of the properly diluted cleaning solution by 10-20 percent. Scrub areas of heavy soiling with a masonry washing brush. Pre-wetting and rinsing with hot water warms surface and improves results.
 - 3) Schedule wet cleaning for when air and surface temperatures are 40 deg. F. and rising. In cold weather this means your wet-cleaning window may be only a few hours. Use the time before and after to dry-brush and scrape away heavy accumulations of excess mortar and job dirt from the next day's work area.
 - 4) If a limited cleaning window is impractical, enclose the work area with polyethylene and use approved heaters to warm masonry.
 - 5) Warm weather test panels won't work for cold weather cleaning. Test in cold clean in cold.
- B. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
1. Provide a 100 square foot area of patched CMU for A/E's review. Do not proceed with patching until area is approved. Wall shall appear uniform from a distance of 5 feet. If masonry units are colored, coordinate blend with unit manufacturer.
- C. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
1. Tuckpointing
 - a. Rake mortar joints to a depth of not less than 1/2 inch nor more than 3/4 inch.
 - b. Saturate joints with clean water.
 - c. Fill solidly with pointing mortar.
 - d. Tool joints.
- D. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints. Dry brush exposed masonry with bristle brushes at end of each work day.

- E. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes or use methods used on approved mock-up. Obtain A/E's approval of sample cleaning before proceeding with cleaning of masonry.
 - a. Where walls are a combination of CMU and brick only the less aggressive CMU cleaners shall be used.
 - b. Comply with applicable environment laws and restrictions.
 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - a. Remove efflorescence in accordance with brick manufacturer's recommendations. Cleaning agents may be used only with approval of masonry unit manufacturer. Cleaning agents must be same as those used on test area.
 - b. If chemical cleaners are to be sprayed on, the pressure shall not exceed 50 psi.
 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 08-02A and 08-03A, applicable to type of stain on exposed surfaces.
 - a. Water application method shall never exceed 400 psi without approval of A/E.
 8. SGT Cleaning
 - a. It is indicated that with careful adherence to this specification that extensive final cleaning will not be necessary. During construction, wipe glazed surface clean after tooling of joints or within 30 minutes after laying with course rag. Keep clean as work progresses to avoid more difficult clean up later. Use no metal scrapers, abrasive powders or authorized cleaning agents. Use wooden paddles or scrapers to clean away mortar residue or lumps. Wash with clean water. A mild detergent may be used. Rinse with clean water. Wipe with clean clothes, sponges or similar item.
 - b. In event of unexpected contaminations of SGT walls, perform any cleaning with other than a non-metallic scraper, stiff nylon or natural bristled brush or wooden paddle only after approval by manufacturer and necessary test to insure against any wall damage.

3.17 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00.00

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes structural steel framing, including, but not limited to, following:
1. Miscellaneous angles, channels, anchor bolts, bent plates, sleeves, sag rods, leveling plates, bearing plates for structural steel and steel joists, and other incidental items of structural steel required to be built into concrete or masonry shall be provided as indicated or specified and be furnished to respective trades at proper time; including instructions and templates for their installation.
 2. Provide, where specifically called for, loose lintels, steel shelf angles, perimeter angle closure, and accessories.
 3. For openings in metal deck 12 by 12 inches and larger, provide steel reinforcing members on all sides of opening, as indicated. Openings in deck shall be cut under Division 05, Section "Steel Decking".
 4. Shear stud connectors.
- B. Related Sections include following:
1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 2. Division 05 Section "Steel Decking" for field installation of shear connectors.
 3. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.
 4. Division 09 painting for surface preparation and priming requirements.

1.2 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's 303 "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
1. Furnish anchorage items to be embedded in or attached to other construction without delaying Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.
 2. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

1.4 ACTION SUBMITTALS

- A. Product Data:
1. Structural-steel materials.
 2. High-strength, bolt-nut-washer assemblies.
 3. Shear stud connectors.
 4. Anchor rods.
 5. Threaded rods.
 6. Shop primer.
 7. Galvanized-steel primer.
 8. Etching cleaner.
 9. Galvanized repair paint.
 10. Shrinkage-resistant grout.
- B. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemented fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Indicate areas to be left unprimed, surfaces primed and where members will be galvanized.
6. Structural steel shop drawings are to be submitted by complete phase or sequence including all beams and columns required for that area. Incomplete or partial shop drawings will not be reviewed. Subsequent phase or sequence submittals must be clearly delineated on erection plans from previous submittals.
7. Resubmitted shop drawings must have all revisions clearly marked. Resubmitted drawings which do not have revisions marked will not be reviewed.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Product Test Reports
 1. Bolts, nuts, and washers including mechanical properties and chemical analysis
 2. Direct-tension indicators.
 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 4. Shear stud connectors
 5. Shop primers
 6. Grout
- B. Qualification Data: For Installer, fabricator, professional engineer, and testing agency.
- C. Source quality-control test reports, when applicable.

1.6 QUALITY ASSURANCE

- A. Qualifications: Structural fasteners shall be manufactured in United States. Fabricator shall furnish proof of U.S. manufacturer. If it becomes necessary to use imported fasteners, each size, type, and each large quantity package (500 pcs. or more) shall undergo a random sampling of a minimum 5 pieces for testing. Test results are to be provided to A/E. Test shall be performed by an independent testing agency, and cost shall be included in Base Bid. If inferior fasteners are discovered, all fasteners of that type shall be removed and replaced with acceptable fasteners at no cost to Owner. If possible, fasteners shall be tested prior to use in construction.
- B. Fabricator Qualifications: A qualified fabricator who participates in AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspector Program for Structural Steel (Acceptance Criteria 172).
 1. Firms acceptable as fabricators for structural steel work under this Section shall be certified in category of "Standard for Steel Building Structures (BU)" by American Institute of Steel Construction or shall include in their bid amount of \$2000 to cover cost of inspections by an independent testing agency to verify that fabricator is capable of performing desired level of quality in work to be performed. Fabricator shall cooperate with and make available to testing agency records and documents which focus on general management, engineering and drafting, procurement, operations and quality control and shall allow access to facilities to allow testing agency to examine actual fabrication work in shop and drafting room at time of inspection. Inspection will be performed prior to signing of a contract between Owner and Fabricator and will be basis of recommendations from A/E to Owner as to qualifications of fabricator to perform work.
- C. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

- D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125, Grade 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide product by manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. "Substitution Request Form" and complete technical data for evaluation must accompany request for A/E's approval. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of following specifications and documents:
 - 1. ANSI/AISC 303.
 - 2. RCSC's "Specification for Structural Joints Using High-Strength Bolts".
- B. Connection Design Information
 - 1. Option 2: Fabricator's experienced steel detailer shall select or complete connections in accordance with ANSI/AISC 303.
 - a. Select and complete connections using schematic details and ANSI/AISC 360.
 - b. Use Allowable Stress Design; data are given at service-load level.

2.3 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992 or ASTM A 572, Grade 50.
- B. Channels, Angles, M, S-Shapes: ASTM A 36 or ASTM A 572, Grade 50.
- C. Plate and Bar: ASTM A 36, unless otherwise noted.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53, Type E or S, Grade B.

1. Weight Class: Standard, unless otherwise noted.
2. Finish: Black, except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.4 BOLTS AND CONNECTORS

- A. High-Strength A 325 Bolts, Nuts, and Washers: ASTM F 3125, Grade A 325, Type 1, heavy hex steel structural bolts; ASTM A 563, Grade DH, heavy hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
1. Use 3/4 inch bolts, unless otherwise noted.
 2. Finish: Plain, unless otherwise noted.
 - a. Provide hot-dip zinc coating, ASTM A 153, Class C, where indicated.
 3. Direct-Tension Indicators: ASTM F 959, Type 325-1 compressible-washer type may be used as Contractor's option.
 - a. Finish: Plain, unless otherwise noted.
- B. High-Strength A 440 Bolt-Nut-Washer Assemblies: ASTM F 3125, Grade A 490, Type 1, heavy hex or round head steel structural bolts or Grade F 2280 tension-control, bolt-nut-washer assemblies with splined ends; with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436, Type 1 hardened carbon-steel washers.
1. Finish: Plain, unless otherwise noted.
 2. Direct-Tension Indicators: ASTM F 959, Type 490-1 compressible-washer type and plain finish.
- C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125 Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.
1. Finish: Hot-dip zinc coated.
 2. Direct-Tension Indicators: ASTM F959, Type 325-1, compressible-washer type with mechanically deposited zinc coating finish.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

2.5 RODS

- A. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
1. Configuration: Straight, unless otherwise noted.
 2. Nuts: ASTM A 563 hex carbon steel.
 3. Plate Washers: ASTM A 36 carbon steel.
 4. Washers: ASTM F 436, Type 1, hardened carbon steel.
 - a. To be used with 3/4 inch diameter anchor rods with maximum 1-1/16 inch hole in base plate.
 5. Finish: Plain, unless otherwise noted.
 - a. Provide hot-dip zinc coating, ASTM A153, Class C, where indicated.
- B. Threaded Rods: ASTM A 36.
1. Nuts: ASTM A 563 hex carbon steel.
 2. Washers: ASTM A 36 carbon steel.
 3. Finish: Plain, unless otherwise noted.
 - a. Provide hot-dip zinc coating, ASTM A153, Class C, where indicated.

2.6 PRIMER

- A. Steel Primer:
1. Unless otherwise noted, provide fabricator's standard lead-and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI #79 or SSPC-Paint 23 and compatible with topcoat.

2.7 SHRINKAGE-RESISTANT GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
 - 1. Products:
 - a. Five Star Fluid Grout 100; Five Star Products, Inc.
 - b. Crystex; L&M Construction Chemicals, Inc.
 - c. Sure-Grip High Performance Grout; Dayton Superior Corp.
 - d. Sealtight Pac-it Grout; W. R. Meadows, Inc.
 - e. Enduro 50; Conspec Marketing & Manufacturing Co., Inc.
 - f. NS Grout: The Euclid Chemical Company

2.8 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's 303 and AISC's 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning", unless otherwise noted.
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
- H. Masonry Bearing Plates
 - 1. All joists shall bear on masonry bearing plates with anchor rods or headed studs embedded in masonry below. Weld joists to bearing plates in accordance with SJI Specifications. See Framing Details and Plans for bearing plate sizes.
 - 2. All beams shall bear on masonry bearing plates with anchor rods or headed studs embedded in masonry below. Do not weld beams to bearing plates unless otherwise noted. See Framing Details and Plans for bearing plate sizes.
 - 3. Set bearing plates under Work of Division 04 Section "Unit Masonry".

2.9 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 not less than 8 inches, unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.10 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.

2.11 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, unless otherwise noted.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

2.12 SHOP PRIMING

- A. Shop prime steel surfaces except following:
 - 1. Interior members permanently concealed (enclosed) in finished construction.
 - a. All interior steel not exposed to view in final structure shall be shipped with no paint and no surface prep, unless otherwise noted.
 - b. All interior stock, exposed to be painted, shall receive a primer compatible with topcoats as specified in Division 09 Section "Interior Painting".
 - 2. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - a. Bituminous coating shall be applied to all steel encased in concrete and/or masonry below grade.
 - 3. Surfaces to be field welded.
 - 4. Surfaces to be high-strength bolted with slip-critical connections.
 - 5. Galvanized surfaces.
 - a. All exterior steel that is exposed to weather shall be galvanized, unless a high performance finish system is required.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning," unless otherwise noted or recommended by paint manufacturer for application indicated.
 - 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP16.

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

2.13 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by hot-dip process to structural steel according to ASTM A 123.
 - 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 2. Fill vent holes and drain holes that are exposed in finished work unless they function as weep holes by plugging with zinc solder and filling off smooth.
 - 3. Galvanize all steel (both beams and angles, including lintels and shelf angles) located in exterior walls.
 - 4. Galvanize all exterior steel exposed to weather, unless otherwise noted.

2.14 SOURCE QUALITY CONTROL

- A. Owner shall engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports when fabricator is not certified. Cost of tests and inspections shall be paid by Owner and deducted from \$2000.00 allowance.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 - 2. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A490 Bolts."
 - 3. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
 - 4. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
 - a. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - b. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
 - 5. Correct deficiencies in Work that test reports and inspections indicate do not comply with Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedment, with steel erector present, for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedment showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to:
 - 1. AISC 303 and AISC 360
 - 2. OSHA Construction Industry Standards (29 CFR 1926)
 - 3. Specified requirements
- B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed, unless otherwise noted. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
 - 1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
 - 2. Refer to Division 03 of these Specifications for anchor bolt installation requirements in concrete, and Division 04 for masonry installation, if required.
 - 3. Where anchor bolts are broken after installation, concrete shall be removed around remaining portion of bolt in concrete to a depth of 1/2 inch below top of bolt. A new segment of bolt of same steel strength shall be full penetration welded to remaining bolt in concrete. New segment of bolt shall be tapered on welded end to a 30-degree bevel all around to leave a thickness at beveled end of 1/4 inch.
 - 4. Where anchor bolts are incorrectly located in concrete or masonry that encases them, following procedures shall be used.
 - a. For bolt misalignment less than 5/16 inch: offset column with base plate as required to locate column correctly. 5/16 inch oversized holes in column base plates will allow this movement without modification to column or anchor bolts.
 - b. For bolt misalignment more than 5/16 inch and less than 2 inches: cut and remove base plate from column, relocate base plate and reweld to column.
 - c. For bolt misalignment more than 2 inch and less than 6 inches: cut off anchor bolts flush with surface of concrete or masonry and install adhesive anchor bolts.
- D. Lintels: Weld or bolt members together where indicated.
 - 1. Lintels shall have 8 inch bearing at each end, minimum, unless shown otherwise. Bearing pressures shall not exceed allowable stress for masonry.
 - 2. Where shelf angles are attached to concrete with bolts and adjustable inserts, provide slotted holes of proper size and spacing in vertical leg of shelf angles.
- E. Maintain erection tolerances of structural steel within AISC's 303.

- F. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- G. Splice members only where indicated.
- H. Do not use thermal cutting during erection.
- I. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, unless otherwise noted.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC's 303 and 360 for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform following special inspections.
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connection.
- B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
 - 1. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 2. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
 - a. In addition to visual inspection, field welds may be tested according to AWS D1.1 and following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E 165.
 - 2) Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3) Ultrasonic Inspection: ASTM E 164.
 - 4) Radiographic Inspection: ASTM E 94.
- C. Correct deficiencies in Work that test reports and inspections indicate does not comply with Contract Documents.

3.6 ERECTION ALIGNMENT

- A. Framing: Framing shall be built up true, plumb, and level within a tolerance of 1:500; and temporary bracing shall be introduced, wherever necessary, to take care of loads to which structure may be subjected, including erection equipment and its operation. Such bracing shall be left in place as long as may be required for safety. Contractor as part of his equipment shall finally remove it. As erection progresses, Work shall be securely connected to take care of dead load, wind, and erection stresses.

3.7 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
 - 3. Cleaning and touchup painting are specified in Division 09 Section "Exterior Painting".

END OF SECTION 05 12 00

SECTION 05 21 00 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. K-series steel joists.
 - 2. KCS-type K-series steel joists.
 - 3. Joist accessories.
 - a. The Work includes bridging and bridging anchors, sag rods, wall anchors, and beam anchors.
- B. Related Sections include the following:
 - 1. Division 04 Section "Unit Masonry" for installing bearing plates in unit masonry.
 - 2. Division 05 Section "Structural Steel Framing" for bearing plates.
 - 3. Division 05 Section "Metal Fabrications" for adhesive anchor bolts

1.2 DEFINITIONS

- A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product indicated.
- B. Shop Drawings:
 - 1. Show layout, designation, number, type, location, and spacings of joists.
 - 2. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.
 - 3. Indicate locations and details of bearing plates to be embedded in other construction.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Manufacturer Certificates: Signed by manufacturers stating that work was performed in accordance with approved construction documents and with SJI standard specifications.
- B. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.
- C. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.
 - 1. Submit design calculations with a cover letter bearing seal and signature of the joist manufacturer's registered design professional. In addition to standard calculations under seal and signature, submittal of the following shall be included:
 - a. Joists with special loading conditions.
 - b. Non-SJI standard bridging details (e.g., for cantilevered conditions, net uplift, etc.).
- D. Qualification Data: For manufacturer and professional engineer.
- E. Steel-joist placement plans: Shall include, at a minimum, the following:
 - 1. Listing of all applicable loads as used in the design of the steel joists and joist girders as specified in the construction documents.
 - 2. Profiles of nonstandard joist and girder configurations.

3. Connection requirements for:
 - a. Joist supports;
 - b. Bridging attachments.
4. Deflection criteria for live and total loads for non-SJI standard joists.
5. Size, location, and connections for all bridging.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance.
 1. A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."
 2. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements. This responsibility includes preparation of shop drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally authorized 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 installation of joists that are similar to those indicated for this Project in material, storage, and extent.
- C. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.
- D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Canam Steel Corporation; Canam Group, Inc.
 2. Gooder-Henrichsen Co.
 3. New Millennium Building Systems, LLC
 4. Structures of U.S.A., Inc.
 5. Valley Joist
 6. Vulcraft; Nucor Corporation.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
 1. Use basic load cases shown on drawings.
 2. Design special joists to withstand design loads with live load deflections no greater than the following:
 - a. Roof Joists: Vertical deflection of 1/240 of the span.

2.3 MATERIALS, GENERAL

- A. Steel: Comply with SJI, Federal Register 29 CFR 1926 and with AISC "Standard Specifications."
 - 1. Yield strength used as a basis for the design stresses shall be as follows:
 - a. Chords = 50,000 psi
 - b. Webs = 36,000 psi or 50,000 psi
 - 2. Evidence that the steel furnished meets or exceeds the design yield strength shall be provided, on A/E's request, in the form of certified test reports.
 - 3. Deduct the area of holes in chords from the area of the chord when calculating the strength of the member.

2.4 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.5 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: K-series steel joists and KCS-type K-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- D. Provide holes in chord members for connecting and securing other construction to joists.
- E. Top-Chord Extensions and Extended Ends: Provide cantilevered ends of joints with either Type S-top chord extensions or Type R extended ends as required for the loads indicated. Unless indicated otherwise, design cantilevered ends for the same pound-per-linear-foot capacity as the main span of the joist.
- F. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- G. Camber joists according to SJI's "Specifications."
- H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.6 JOIST ACCESSORIES

- A. Bridging: Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.
- B. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
 - 1. Finish: Plain, uncoated, unless otherwise noted.
 - a. Provide hot-dip zinc coating, ASTM A 153, Class C, where indicated.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain, uncoated, unless otherwise noted.
 - a. Provide hot-dip zinc coating, ASTM A 153, Class C, where indicated.

D. Welding Electrodes: Comply with AWS standards.

E. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.7 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or SSPG-SP3, unless otherwise noted or required by paint manufacturer.

B. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing 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 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
1. Before installation, splice joists delivered to Project site in more than one piece.
 2. Space, adjust, and align joists accurately in location before permanently fastening.
 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

- D. Bolt joist to supporting steel framework using carbon-steel bolt, where indicated.
1. Provide high-strength structural bolts, where indicated. Comply with Research Council on Structural Connections' "Specification for Structural Joints Using ASTM F 3125, Grade A325 or A490 Bolts" for high strength structural bolt installation and tightening requirements.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

F. Anchors: Bridging shall extend to walls or beams and shall be anchored thereto before construction loads are placed on the joists.

- G. Support of Other Work: Suspension wires, straps, chains, etc. used to support lights, ceiling grid, ductwork piping conduit, etc. shall be hung from top or bottom chord panel points.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.
- B. Field welds will be visually inspected according to AWS D1.1.
 - 1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following procedures, as applicable:
 - a. Radiographic Testing: ASTM E 94.
 - b. Magnetic Particle Inspection: ASTM E 709.
 - c. Ultrasonic Testing: ASTM E 164.
 - d. Liquid Penetrant Inspection: ASTM E 165.
- C. Bolted connections will be visually inspected.
 - 1. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."
- D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- E. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

- A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories.
 - 1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 21 00

SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes following:
 - 1. Roof deck.
- B. Related Sections include following:
 - 1. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors and for framing deck openings 12 inch square and larger with miscellaneous steel shapes .

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated, including dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
 - a. Provide calculations in accordance with IIC-ES AC43 or SDI design method verifying allowable diaphragm shear strength and stiffness.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with applicable provisions of the following specifications:
 - 1. AISI S100-16, North American Specification for the Design of Cold-Formed Steel Structural Members.
 - a. ANSI/SDI RD, Standard for Steel Roof Deck.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:
 - 1. AWS D1.1.
 - 2. AWS D1.3.
- C. Installer Qualifications:
 - 1. All steel roof deck welders AWS certified for welding of sheet steel.
 - 2. All mechanical fasteners installers certified or licensed by fastener and tool system manufacture on project site in accordance with ANSI A10.3 requirements. Certification or licensing includes all training necessary for proper tool operation, fastener selection, maintenance and troubleshooting.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
 - 1. Do not rack, bend or mar steel roof deck sheets.

- B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. If ground storage is needed, the deck bundles must be stored off the ground, with one end elevated to provide drainage. Bundles must be protected against condensation with a ventilated waterproof covering. Bundles must be stacked so there is no danger of tipping, sliding, rolling, shifting or material damage. Bundles must be periodically checked for tightness, and retightened as necessary.
 - 2. Deck bundles placed on the building frame must be placed near a main supporting beam at a column or wall. In no case are the bundles to be placed on unbolted frames or an unattached and/or unbridged joists. The structural frame must be properly based to receive the bundles.
- C. Store welding electrodes, mechanical fasteners and powder-actuated cartridges in original packages in a cool, dry location until final installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products of deck manufacturers certified by Steel Deck Institute will be considered, providing their products equal or exceed quality specified; and they can provide products of type, size, function, and arrangement as indicated.
 - 1. Units shall be capable of supporting design loads shown.
- B. In other Part 2 articles where titles below introduce lists, following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide product by manufacturers specified.
- C. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. "Substitution Request Form" and complete technical data for evaluation must accompany request for A/E's approval. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Design Requirements
 - 1. Compute properties of metal roof deck sections on basis of effective design width as limited by provisions of SDI specifications. Provide deck section properties, including section modulus and moment of inertia per foot of width.
 - 2. Allowable Deflection: Design and fabricate deck for a maximum deflection of 1/240 of clear span under uniform live load.
 - 3. The deck shall be selected to provide the load capacities shown on drawings and as determined using the ANSI/SD RD construct loading criteria.
 - 4. The deck type provided shall be capable of supporting the superimposed live loads as shown on the plans.
- B. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for Design of Cold-Formed Steel Structural Members."

2.3 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI RD" and with following:
 - 1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 G60 zinc coating, unless otherwise noted.

- a. Do not pre-treat surface with chromates or other passivating treatments where deck is to be painted.
- b. Prime-painted deck is not acceptable.
2. Deck Profile: Type WR, wide rib, unless otherwise noted.
3. Profile Depth: 1-1/2 inches, unless otherwise noted.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more, unless otherwise noted.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.
7. Ridge and valley plates, flat plates at changes of deck direction, sump pans and side closures shall be the standard type provided by the deck manufacturer, unless indicated otherwise on the drawings.

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
 1. Products:
 - a. X-ENP-19 L15 or X-HSN-24 pins, Hilti.
 - b. TEKS, ITW Builders.
 - c. D100; MKT Fastening, LLC.
 2. Design Requirements: ICC-ES AC43 or SDI method for diaphragm shear strength and stiffness.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
 1. Design Requirements: ICC-ES AC43 or SDI method for diaphragm shear strength and stiffness.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

PART 3 - EXECUTION

3.1 EXAMINATION/PREPARATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Layout: Place steel roof deck sheets ensuring bearing on supporting steel framing. Sheets shall be true and straight with horizontal deviations less than ¼ inch in 100 feet. Minimum end laps 2 inches.
- C. Marking: Mark steel roof deck at centerline of supporting steel members to prevent weld burn through or mechanical fastener punch trough. Use a chalk line or indelible marker.
- D. Test Fastenings:
 1. Welds: Perform project specific test welds prior to final installation per AWS D1.3. Test welds are considered examples or representative work.
 2. Mechanical fasteners: gauge powder-activated tool systems to base material steel type, steel deck type and thickness prior to final installation. Confirm appropriate power regulation and powder-activated cartridge type prior to final installation.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks. Attach firmly to the supports immediately after placement in and or to form a safe working platform.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
 - 1. Trades that subsequently cut unscheduled openings through the deck are responsible for reinforcing the openings.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as indicated.
 - 1. Weld Diameter: 5/8 inch, minimum.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches apart in field of roof and 6 inches apart in roof corners and perimeter, based on roof area definitions in FMG Loss Prevention Data Sheet 1-28, unless otherwise indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated.
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws or fasten with a minimum of 1-1/2 inch long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum, unless otherwise noted.
 - a. End joints of 3 inch roof deck may be butted over center of supports.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- E. Support of Other Work: Suspension wires, straps, chains, and metal framing such as those used to support following shall not be attached to or through steel roof decks.

1. Bulkheads.
2. Suspended ceilings.
3. Fire-suppression systems.
4. Ductwork.
5. Lighting.
6. Similar items.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Tests and Inspections:
 1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SID QA/AC.
 - a. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and A/E.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.
 1. Before placement of roof insulation and roof covering, the deck shall be inspected for tear, dents or other damage that may prevent the deck from acting as a structural roof base. The need for repair of damaged deck shall be determined by the A/E based on structural performance.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair of Blow Holes in Deck: All holes require sheet metal plate patches fastened to deck in accordance with SDI Deck Damage and Penetrations.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.
 1. Do not use deck units as a working platform or storage area until units are in position and permanently attached to the structure.
 2. Construction loads must not exceed load carrying capacity of the deck.

END OF SECTION 05 31 00

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Non-axial load-bearing
 - a. Exterior non-load-bearing wall framing and accent detail .
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications".
 - 2. Division 06 Section "Sheathing" for sheathing.
 - 3. Division 07 Section "Boardstock Air Barrier" for coordination.
 - 4. Division 09 Section "Gypsum Board Assemblies" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings:
 - 1. Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated-Design Submittal: For cold-formed steel framing.
 - 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Shop drawings must either prepared or reviewed and approved by manufacturer before issued to A/E.

1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
 - 1. Steel sheet
 - 2. Expansion anchors
 - 3. Mechanical fasteners
 - 4. Vertical deflection clips
 - 5. Horizontal drift deflection clips
 - 6. Miscellaneous structural clips and accessories.
- C. Research Reports:
 - 1. For cold-formed steel framing.
 - 2. Steel framing manufacturer to have a third-party evaluation report for its products that are reviewed to the codes indicated on drawings and AISI S100.

1.4 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of shop drawings, design calculations, and other structural data by a qualified professional engineer.

- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Manufacturer
 - 1. Product Tests: Mill certificates or data from a qualified independent testing agency or in-house testing with calibrated test equipment per ICC AC46 Acceptance Criteria for Cold-Formed Steel Framing Members indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
 - 2. Provide full time quality control over fabrication and erection complying with applicable codes, ordinances, rules and regulations of government agencies having jurisdiction.
- D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 1. Quality welding processes and welding operations in accordance with AWS "Standard Qualification Procedure".

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect and store cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling, per requirements of AISI's "Code of Standard Practice".
 - 1. Store materials protected from exposure to rain, snow, and other harmful weather conditions, at temperature and humidity conditions per ASTM C955.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - 1. Clark Dietrich
 - 2. SCAFCO Steel Stud Company
 - 3. MarinoWARE
 - 4. MBA Building Supplies
 - 5. Telling Industries
 - 6. The Steel Network
 - 7. All Steel and Gypsum Products, Inc.
 - 8. MRI Steel Framing, LLC
 - 9. Jaimes Industries
 - 10. State Building Products
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany request for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design cold-formed metal framing.
- B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design steel in accordance with AISI S100, current addition, unless otherwise noted.

2. Design Loads: As indicated.
 3. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height.
 - b. Horizontal deflection shall be 1/600 or less when framing supports masonry.
 4. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 5. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1 inch.
- C. Cold-Formed Steel Framing, General: Design according to AISI's S100 and AISI S200 and ASTM C956, Section 8 (Screw Penetration Test).
1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- D. Cold-Formed Steel Framing Design Standards: AISI S240.

2.3 MATERIALS

- A. Framing Members, General: Comply with AISI S200 and ASTM C955, Section 8, for conditions indicated.
- B. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: As required by structural performance.
 2. Coating: CP 60: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90) minimum.
 - a. CP90: G90 (Z275), AZ50 (AZM150), or GF45 (ZGF135) where framing backs up masonry, and where indicated.
- C. System Components, General: With each type of metal framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for applications indicated, as needed to provide complete metal framing system.
 1. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:
 - a. Grade: As required by structural performance.
 - b. Coating: CP 60: G60 (Z180), A60 (ZF180), AZ50 (AZM 150), or GF30 (ZGF90) per AISI S200 and ASTM C955, unless otherwise noted.
 - 1) Provide CP 90: G90 (Z275), AZ50 (AZM 150), or GF45 (ZGF135) per AISI S200 and ASTM C955, where indicated and as required to match coatings used for framing.
- D. Stud Punch-Outs: Minimum 10 inches between end of member and near edge of web punch-out and 24 inches on center thereafter.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING (NON-AXIAL)

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base- Steel Thickness: 0.0428 inch (fka 18 gauge).
 2. Minimum Flange Width: 1-5/8 inches .

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base- Steel Thickness: 0.0428 inch (fka 18 gauge).
 - 2. Minimum Flange Width: 1-1/4 inches.
- C. Deflection Track (Slotted): Manufacturer's single, deep-leg, U-shaped steel track; punched with vertical slots in both legs. Studs should be positively attached to deep-leg track using vertical slots while allowing free vertical movement. Legs designed to support horizontal and lateral loads and transfer them to the primary structure.
 - 1. Leg Dimension: 3 inches with 2-inch slot.
- D. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, structural grade, Type H, metallic coated, of same grade and coating weight used for framing members, complying with ASTM C 955 and AISI 200.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Anchor clips.
 - 4. Foundation clips.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153, Class C.
- C. Post-Installed Anchors: Refer to Division 05 Section "Metal Fabrications" for post-installed anchor requirements.
- D. Power-Actuated Anchors: fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
 - 1. Powder-actuated pins are not acceptable.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, MIL-P-21035B, or ASTM A 780.

- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- E. Sill Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.
- F. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type 1 (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- G. Minimum 20 gauge 6 inch strap to secure the flashing termination bar.

2.8 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding or screw fastening as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sill sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.
- C. Do not install any materials with signs of "red rust". It is progressive and will continue to spread. "White rust is okay. It is considered a wet storage stain and is not progressive. It is just the zinc coating reacting to moisture.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's S200 "Standard for Cold-Formed Steel Framing - General Provisions, AISI S202," and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
 - 2. Do not weld or mechanically fasten to or through steel roof deck.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

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

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION (NON-AXIAL)

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to bottom track, unless otherwise indicated. Space studs as follows:
 1. Maximum Stud Spacing: 16 inches
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Connect vertical deflection clips to bypassing and infill studs and anchor to building structure.
 3. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection. Provide one of the following:
 1. Channel Bridging: Cold-rolled steel channel welded or mechanically fastened to webs of punched studs.
 2. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 3. Install solid blocking at 96-inch centers.
 4. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 5. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 INSTALLATION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and A/E.

- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. General: The extent of metal fabrications includes items fabricated from iron and steel shapes, plates, bars, strips, tubes, pipes, and castings which are not a part of structural steel systems in these Specifications.
 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. Post-installed, torque-controlled expansion anchors
 5. Adhesive anchor bolts
 6. Metal ladders
 7. Metal bollards
- B. Products furnished, but not installed, under this Section include the following:
1. Anchor bolts, steep pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 2. Loose steel lintels
- C. Related Sections include the following:
1. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
 2. Division 05 Section "Structural Steel Framing" for lintels and loose bearing and leveling plates.
 3. Division 06 Section "Plastic-Laminate-Faced Architectural Cabinets" for uniform storage shelf.
 4. Division 09 painting Sections for surface-preparation and priming requirements.

1.2 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Adhesive anchor bolts.
 2. Post-installed, torque-controlled expansion anchors.
 3. Paint products.
 4. 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. Provide Shop Drawings for the following:
 - a. Steel framing and supports for mechanical and electrical equipment.
 - b. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - c. Metal ladders
 - 1) Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
 - 2) Provide templates for anchors and bolts.

- 3) Provide reaction loads for each hanger and bracket.
2. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Performance Requirement Verification: Provide verification that installation of products will result in compliance with "Performance Requirements" indicated. This may include: calculations, testing results, manufacturer installation, and attachment requirements, fastener information for indicated substrate, or other means necessary to demonstrate compliance.
 1. Ladders: Include certified letter attesting to compliance with ANSI A14.3

1.4 QUALITY ASSURANCE

- A. Qualifications:
 1. Structural fasteners shall be manufactured in the United States. Fabricator shall furnish proof of U.S. manufacturer. If it becomes necessary to use imported fasteners, each size, type, and each large quantity package (500 pcs. or more) shall undergo a random sampling of a minimum 5 pieces for testing. Test results are to be provided to A/E. Test shall be performed by an independent testing agency, and the cost shall be included in the Base Bid. If inferior fasteners are discovered, all fasteners of that type shall be removed and replaced with acceptable fasteners at no cost to the Owner. If possible, fasteners shall be tested prior to use in construction.
 2. Ladders: Product design shall comply with OSHA 1910.27 minimum standards.
- B. 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."
- C. Post-Installed Torque-Controlled expansion Anchors and Adhesive Anchor Bolts: Installers of post-installed anchors shall undergo a manufacturer's training program or be provided with on-site instruction for proper installation from a manufacturer's representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, 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.

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.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
 3. Basis-of-Design Product: The design for each product type is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany request for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 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.

2.3 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.

2.4 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- D. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 inch wide single and double channels as required.
 - 2. Material: Steel complying with ASTM A 1008, structural steel, Grade 33; 0.0528-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
 - a. Galvanized steel complying with ASTM A 653, structural steel, Grade 33, with G90 coating; 0.079-inch nominal thickness, where indicated.
 - 3. Fittings: Fabricate from steel that meets or exceeds the physical requirements of ASTM A1011 SS Grade 33 and conforms to one of the following ASTM specifications:
 - a. A1011 SS Grade 33
 - b. A575
 - c. A576
 - d. A36
 - e. A635
 - f. Fittings as required to create grid indicated on Drawings without grid being constructed as overlapping members. Fittings shall include but not be limited to in-channel joiners.
 - 4. Supplemental Framing: Slotted channel framing, threaded rods, system connectors, beam clamps, and other connectors to structural steel as required to suspend system from the structural steel framing.
- E. Cast Iron: Either gray iron ASTM A 48, or malleable iron, ASTM A 47, unless other indicated or required by structural loads.

2.5 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- C. Aluminum Castings: ASTM B26, Alloy 443.0-F.

2.6 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, or ASTM F 1941 Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners, unless otherwise noted.
- B. High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A 325, Type 3, heavy-hex steel structural bolts; ASTM A 563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 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.
- G. Lag Bolts: ASME B18.2.1.
- H. Wood Screws: Flat head, ASME B18.6.1.
- I. Plain Washers: Round, ASME B18.22.1.
- J. Lock Washers: Helical, spring type, ASME B18.21.1.
- K. 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 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM F 2329.
- L. Post Installed, Torque-Controlled Expansion Anchors: Anchor bolt and sleeve assembly satisfying the cracked concrete requirements of ICC-ES AC 193 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. Products:
 - a. Kwik Bolt TZ Concrete of Kwik Bolt 3 (Masonry); Hilti, Inc.
 - b. Strong Bolt II; Simpson Strong-Tie Company, Inc.
 - c. Powder-Stud +302 (Concrete) Power-Stud 301 (Masonry); Powers Fasteners
 - 2. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5 or ASTM F 1941, Class Fc/Zn5, unless otherwise indicated. .
 - 3. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.
- M. Adhesive (Chemical) Anchor Bolts (In Concrete): Chemically grouted adhesive (chemical) anchor bolts satisfying the cracked concrete requirements of ICC-ES AC 308. Subject to compliance with requirements, provide one of the following:
 - 1. Products:
 - a. HY 200 Safe Set system or RE 500 V3 Safe Set; Hilti, Inc.

- b. Powers PE 1000+; Powers Fasteners
 - c. Epcon G5, ITW Rod Head
 - d. Simpson Set Epoxy-Tie Adhesive Anchors; Simpson Strong-Tie Company, Inc.
2. Anchors to be ASTM A36 or A307, zinc plated steel threaded rods (Fy = 36 ksi) unless otherwise noted.
 3. Where noted on the drawings anchors to be ASTM F593, Condition CW stainless steel threaded rods (Fy = 65 ksi for diameters 3/8 inch through 5/8 inch and Fy = 45 ksi for diameters 3/4 inch through 1-1/4 inch).
 4. Anchors to be installed in strict conformance to manufacturer's installation instructions.
 5. Adhesive Anchors shall have the following minimum allowable load capacities: (Based on embedment in 4000 psi concrete and a minimum safety factor on ultimate load capacities of 3.5. Use proportional allowable loads for other strengths of concrete. Note: Actual anchor load capacity varies with spacing and edge distance.)

<u>Size</u>	<u>Allowable Shear</u>	<u>Allowable Tension</u>	<u>Minimum Embedment</u>
3/8 inch	1000 lbs.	2100 lbs.	3-3/8 inch
1/2 inch	1850 lbs.	3300 lbs.	4-1/4 inch
5/8 inch	2900 lbs.	5100 lbs.	5 inches
3/4 inch	4200 lbs.	6800 lbs.	6-5/8 inch
1 inch	7500 lbs.	11,000 lbs.	8-1/4 inch

N. Adhesive Anchor Bolts (In Masonry)

1. In hollow CMU: Chemically grouted adhesive anchor systems with nylon or stainless steel screen inserts.
 - a. Products:
 - 1) HIT HY270 Adhesive Anchors, Hilti, Inc.
 - 2) AC100+ Gold; Powers Fasteners
 - 3) Simpson Set Epoxy-Tie Adhesive Anchors, "AT-HP" Simpson Strong-Tie Company, Inc.
2. In solid grouted CMU: Chemically grouted adhesive anchor systems. If voids in grout are encountered, use adhesive anchor bolts specified above for hollow CMU.
 - a. Products:
 - 1) HIT-ICE (Cold Weather) or HY270 (Hot Weather) Adhesive Anchors, Hilti, Inc.
 - 2) AC100+ Gold; Powers Fasteners
 - 3) Simpson Set Epoxy-Tie Adhesive Anchors, "AT-XP" Simpson Strong-Tie Company, Inc.
3. Anchors to be ASTM A36 or A307 zinc plated steel threaded rods (Fy = 36 ksi) unless otherwise noted.
4. Where noted on the drawings, anchors to be ASTM F593, Condition CW stainless steel threaded rods (Fy = 65 ksi for diameters 3/8 inch through 5/8 inch and Fy = 45 ksi for diameters 3/4 inch through 1-1/4 inch).
5. Anchors to be installed in strict conformance to manufacturer's installation instructions.
6. Adhesive anchors shall have the following minimum allowable load capacities: (Based on F'm = 1500 psi , grout with f'c = 2500 psi at 28 days and a minimum safety factor on ultimate load capacities of 3.5. Note: Actual anchor load capacity varies with spacing and edge distance.)

a. In Hollow CMU:

<u>Size</u>	<u>Allowable Shear</u>	<u>Allowable Tension</u>	<u>Minimum Embedment</u>
3/8 inch	600 lbs.	500 lbs.	2 inch
1/2 inch	900 lbs.	500 lbs.	2 inch

b. In Solid Grouted CMU:

<u>Size</u>	<u>Allowable Shear</u>	<u>Allowable Tension</u>	<u>Minimum Embedment</u>
1/2 inch	1200 lbs.	1400 lbs.	4-1/4 inch
5/8 inch	1600 lbs.	1800 lbs.	5 inch
3/4 inch	1600 lbs.	2900 lbs.	6-5/8 inch

7. Adhesive anchor bolt suppliers shall submit product data, including certified test results showing the ultimate and allowable shear and tension load capacities for all anchors sizes and types to be furnished.

2.7 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79, unless otherwise noted.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187 or SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert type noncorrosive compound free of asbestos fibers, sulfur compounds, and other deleterious impurities.
- E. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- 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. 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 4,500 psi.

2.8 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work 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.

2.9 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.
- C. Galvanize miscellaneous framing and supports where indicated.

2.10 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3
 - 2. Space siderails 18 inches apart, unless otherwise indicated.
 - 3. Rungs shall withstand a 1,000 pound load without deformation or failure.
 - 4. Support each ladder at top and bottom and not more than 10 feet o.c. with welded or bolted brackets, made from same metal as ladder.
- B. Interior Steel Ladders:
 - 1. Siderails: Continuous, 3/8 by 2-1/2 inch steel flat bars, with eased edges, unless otherwise noted.
 - 2. Rungs: 3/4-inch- square steel bars, unless otherwise noted.
 - a. Surfaces shall be free of sharp edges, splinters, or burrs.
 - 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. Prime interior ladders, including brackets and fasteners, with zinc-rich primer, unless otherwise noted.
- C. Aluminum Ladders (Contractor's Option):
 - 1. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
 - 2. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
 - a. Surfaces shall be free of sharp edges, splinters, or burrs.
 - 3. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.

2.11 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe.

- B. Prime steel bollards with zinc-rich primer.

2.12 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123, for galvanizing steel and iron products.
 - 2. ASTM A 153, for galvanizing steel and iron hardware.
 - 3. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items, not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer, unless zinc-rich primer is otherwise indicated.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning".
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning".
 - 3. Other Steel Items: SSPC-SP3, "Power Tool Cleaning".
 - 4. Galvanized-Steel Items: SSPC-SP16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals".
- D. 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.
 - 1. Paint items embedded in concrete with two coats of bituminous paint.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Installer shall examine areas and conditions under which miscellaneous metal items shall be installed. Notify Contractor in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.2 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 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. Coat concealed surfaces of steel embedded in concrete with two coats of bituminous paint.

3.4 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.

3.5 INSTALLING LADDERS

- A. Examination:
 - 1. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural leads for fastener resistance.
 - 2. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.
- B. Installation, General: Install in accordance with "Performance Requirements" manufacturer's instructions, if applicable, and in proper relationship to adjacent construction.
 - 1. Install in compliance with ANSI A14.3 and OSHA 1910.R7.
 - 2. Position ladder such that side rails end minimum 3 inches above roof and center of rungs are 7 inches from wall.
 - a. Note: Where indicated at interior ladders, ladders may contact floor.

3.6 INSTALLING METAL BOLLARDS

- A. Anchor bollards in place with concrete footings. Center and align bollards in holes 4 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.7 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe and tube railings.
- B. Related Sections include the following:
 - 1. Division 09 painting sections for field painting of railing and components.
 - 2. Division 32 Section "Concrete Paving" for coordination with concrete.

1.2 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Grout, anchoring cement, products.
- B. Shop Drawings: For all railing systems, including:
 - 1. Splices and attachments.
 - 2. Identify location of all railing systems.
 - 3. Indicate railing systems in related and dimensional position, with elevations at scale of 1/4 inch equals 12 inches and details at scale of 3 inch equals 12 inch (1:5) or larger.
 - 4. Show all details and dimensions not governed by field conditions.
 - 5. Indicate all required field measurements.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Engineer Qualifications: Professional engineer legally authorized to practice in the jurisdiction where Project is located and experienced in providing engineering services of the kind indicated for handrails and railing systems similar to this Project in material, design, and extent, and that have a record of successful in-service performance.

1.6 FIELD 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 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.
- C. Storage on Site
 - 1. Store material in a location and in a manner to avoid damage. Stacking shall be done in a way which will prevent bending.
- D. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of materials.
 - 1. Refer to NAAMM Manual AMP 555-92, Code of Standard Practice for the Architectural Metal Industry, Sections 6 and 7.

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.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, posts, and attachments to adjoining construction, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings and posts to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Steel: 72 percent of minimum yield strength.
- C. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. 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, ambient; 180 deg F, material surfaces.

2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.4 STEEL AND IRON

- A. Pipe: ASTM A 53, 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.

2.5 FASTENERS

- A. General: Provide the following:
 - 1. Hot-Dip Galvanized Railings: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153 or ASTM F2329 for zinc coating.
 - 2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: 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.

2.7 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. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces equally spaced per code requirements between top rail and finish floor or nosing line of tread.
 - 3. Locate intermediate rails.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.

- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water or condensation may accumulate.
 - 1. Weeps should be set such that the post base does not hold water. A pourable sealer can be used within the post to fill the hollow portion of the post up to the level of the weep or provide condensation sleeves or diverters.
 - F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
 - G. Connections: Fabricate railings with nonwelded connections, unless otherwise indicated.
 - H. 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.
 - I. Form changes in direction as follows:
 - 1. By bending or by inserting prefabricated elbow fittings.
 - J. 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.
 - K. Close exposed ends of railing members with prefabricated end fittings.
- 2.8 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
 - 2. Hot-dip galvanize indicated steel and iron railings, including hardware, after fabrication.
 - 3. Comply with ASTM A 123 for hot-dip galvanized railings.
 - 4. Comply with ASTM A 153 for hot-dip galvanized hardware.
 - 5. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 6. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 2. Fit exposed connections together to form tight, hairline joints.
 - 3. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 - 4. 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.
 - 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 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.

3.3 ANCHORING POSTS

- A. Tolerance: Set posts plumb and aligned to within 1/4 inch in 12 feet.
- B. Setting Posts, General:
 1. Clean dust and foreign matter from sleeves/holes.
 2. Moisten interior of holes and surrounding surfaces with clean water.
 3. Prepare and use grout in accordance with manufacturer's directions.
 4. Place posts in position and brace until grout sets.
 5. Pour mixture into annular space until it overflows the hole.
 6. Wipe off excess and leave 1/8 inch build-up sloped away from post.
- C. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
 1. Exterior Locations: Use anchoring cement.
- D. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.

3.4 ADJUSTING AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.5 PROTECTION

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

END OF SECTION 05 52 13

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Wood blocking and nailers.
 - 3. Miscellaneous plywood panels.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for post-installed anchors.
 - 2. Division 06 Section "Sheathing" for sheathing.
 - 3. Division 26 Section "General Electrical Panels" for plywood backing panels.

1.2 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NHLA: National Hardwood Lumber Association.
 - 3. NLGA: National Lumber Grades Authority.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Indicate type of preservative used and net amount of preservative retained.
 - a. Indicate compliance with AWPA requirements.
 - b. Indicate products contain no arsenic or chromium.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

- B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 WOOD 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.
- B. Maximum Moisture Content of Lumber: 19 percent.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS (WPTM)

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, where exposed.

2.3 FIRE-RETARDANT-TREATED MATERIALS (FRTM)

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Concealed blocking, i.e. at parapet caps.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 15 percent maximum moisture content of any species.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine, No. 2 grade; SPIB.
 - 2. Hem-fir or hem-fir (north), Construction or 2 Common grade; NLGA, WCLIB, or WWPA.
 - 3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
 - 1. Provide No. 2 grade Douglas Fir or Southern Yellow Pine nailers associated with roofing and roof flashing.

2.5 MISCELLANEOUS PLYWOOD PANELS

- A. General: Where plywood panels will be used for the following concealed types of applications, provide APA performance rated panels complying with requirements indicated for grade designation, span rating, exposure durability classification, edge detail (where applicable), and thickness.
- B. Plywood Shims, Nailers, and Blocking for Roof Insulation Stops: Shall be APA UNDERLAYMENT C-C PLUGGED EXT.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153 or Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Wood Screws: ASME B18.6.1.

- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
 - 1. ASTM C 1002 may be used for non-load-bearing steel framing 20 gauge or less.
- 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.
- I. Post-Installed Anchors: Refer to Division 05 Section "Metal Fabrications".

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Do not splice structural members between supports, unless otherwise indicated.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- F. 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.
- G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- H. 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; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION 06 10 53

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wall sheathing.
- B. Related Sections include the following:
 - 1. Division 04 Section "Unit Masonry" for masonry ties.
 - 2. Division 05 Section "Cold-Formed Metal Framing" for coordination.
 - 3. Division 06 Section "Miscellaneous Rough Carpentry" for miscellaneous plywood panels.
 - 4. Division 07 Section "Weather Barrier" for weather barrier over plywood sheathing.
 - 5. Division 07 Section "Boardstock Air Barrier" for coordination.
 - 6. Division 07 Section "Miscellaneous Thermal Insulation" for insulation within framing.
 - 7. Division 07 Roofing Sections for coordination of parapet insulation provided as part of roofing.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination Meeting: Schedule before start of each major segment or wall construction area. Be aware of all contract work that interfaces with wall assemblies as they are being erected. Contractor shall participate in various trade preconstruction meetings that interface with exterior wall assemblies. Educate and advise all workers concerning protection, and cutting and patching procedures.
 - 1. Attendance: All trades whose work interfaces with wall assemblies.
 - 2. Verify all openings and penetrating items, pipe, ducts, conduits, and the like and ensure sleeves are properly sized and located and capable of being secured.
 - 3. Review transitions, special penetrations details, proposed openings, structural elements, and conditions of the other construction that will affect wall assembly.
 - 4. Review temporary protection requirements.
- B. Sequencing
 - 1. Coordinate with installation of weather and air barrier systems.
 - 2. Ensure that products of this Section are supplied to affected trades in time to prevent interruption of construction progress.
 - 3. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product, including manufacturer's data sheets and installation guides on wall panels and fasteners to be used including. Indicate component materials and dimensions and include construction and application details.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Wall Sheathing Product Test Reports: Submit evaluation reports published by independent laboratory indicating evidence of compliance with specified criteria.
 - 1. NFPA 285 Compliance: Submit documentation showing components in wall assembly are in compliance with NFPA 285.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly, 150 sq.ft., incorporating backup wall construction, window, storefront, door frame and sill, ties and other penetrations, and flashing to demonstrate crack and joint treatment and sealing of gaps, terminations, and penetrations of air-barrier sheathing assembly.
 - a. Include junction with roof membrane, building corner condition.
 - b. If A/E determines mockups do not comply with requirements, reconstruct mockups until mockups are approved.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers between each bundle to provide circulation. Provide for air circulation around stacks and undercoverings. Protect sheathing from weather by covering with waterproof sheathing, securely anchored.

PART 2 - PRODUCTS

2.1 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 product by the manufacturers specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire Resistance: Exterior wall system and component materials part of cold-formed metal framing assembly shall comply with the following requirements:
 1. System complies with one of the following: NFPA 285, FM 4800, UL 1040, or UL 1715; Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load Bearing Wall Assemblies Containing Combustible Components using the Intermediate Scale, Multi-Story Test Apparatus.
 2. Firestopping measures, per requirements of authorities with jurisdiction, shall be included at the floor line in the cold-formed stud cavity when the wall assembly extends beyond the floor line.

2.3 WOOD PANEL PRODUCTS, GENERAL

- A. Plywood: Either DOC PS1 or DOC PS2.
 1. Thickness: 5/8 inch minimum.
 2. Factory mark panels to indicate compliance with applicable standard.

2.4 WALL SHEATHING

- A. Plywood Wall Sheathing: Exterior, Structural I sheathing (CDX).
 1. Span Rating: Not less than 24/0.

2. Nominal Thickness: Not less than 5/8 inch.
- B. Glass-Mat Gypsum Sheathing: ASTM C1177
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed; Saint Gobain
 - b. Continental Building Products, LLC
 - c. Georgia-Pacific Gypsum LLC
 - d. National Gypsum Company
 - e. USG Corporation
 2. Type and Thickness: Provide Type X, 5/8 inch thick.
- C. Polyisocyanurate-Foam Parapet Sheathing: Refer to Division 07 Section "Thermoplastic Membrane Roofing".

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
1. For parapet, and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153 or Type 304 stainless steel.
 2. Composite nailable insulated sheathing fasteners shall be approved by panel manufacturer. Fasteners are a corrosion resistant type with oversized heads. Length of fasteners shall be as recommended by the panel manufacturer.
 - a. Engineering Evaluations for fastening patterns (DrJ 1202-01 or DrJ TER 1508-01).
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.
1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C1002.
 2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C954.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and installation conditions for compliance with requirements for installation conditions affecting performance of the work.
1. Verify that metal wall studs, opening framing, bridging, bracing, and other framing support members and anchorage have been installed within wall system alignment tolerances and requirements.
 - a. Verify that all exterior wall assembly construction has been completed to the point where the sheathing may correctly be installed.
 2. Verify that items required to penetrate the wall system are placed and penetration gaps and cracks can be sealed to prevent water penetration.
 3. Verify that mechanical and electrical services in walls have been installed and tested and, if appropriate, verify that adjacent materials and finishes are dry and ready to receive sheathing.
- B. Do not proceed with wall system installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION, GENERAL

- A. General: Install in accordance with manufacturer's instructions.
- B. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
 - 1. Install in exterior spaces without gaps or voids. Do not compress insulation.
- C. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
 - 1. Fit tight in spaces and tight to exterior code of mechanical and electrical services within place of insulation.
- D. Securely attach to substrate by fastening as recommended by the manufacturer's Installation Guide.
- E. Coordinate wall and parapet sheathing installation with flashing installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.4 WOOD STRUCTURAL PANEL INSTALLATION

- A. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall/Accent Sheathing
 - a. Screw to cold-formed metal framing.
 - b. Space panels 1/8 inch apart at edges and ends.

3.5 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written installations.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install boards with a 3/8 inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install boards with a 1/4 inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing boards, but do not cut into facing.
- C. Vertical Insulation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

3.6 PROTECTION

- A. Protect installed products until finish materials can be applied.
 - 1. Protect sheathing/insulation work from exposure to moisture damage and deterioration, primarily by prompt installation of the roofing, sheet metal and waterproofing work.
- B. Cover the top and edges of unfinished roof panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.
 - 1. Do not leave panels exposed to moisture. Wet panels shall be removed prior to application of cladding.

END OF SECTION 06 16 00

SECTION 06 41 16 – PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Plastic-laminate architectural (custom) cabinets.
 - a. Office casework (alternate).
 - b. Laundry casework, including storage racks.
 2. Plastic-laminate countertops.
 3. Cabinet hardware and accessories.
 4. Wood furring, blocking, shims, and hanging strips for installing architectural (custom) plastic-laminate-faced cabinets, unless concealed within other construction before cabinet installation.
- B. Contractors Option: Unless otherwise noted, Contractor has option of providing either Division 06 Section "Plastic-Laminate-Faced Architectural Cabinets" or Division 12 "Manufactured Plastic-Laminate-Faced (Educational) Casework." While a mixture complying with referenced standards is permitted, do not mix fabrication methods in individual room or spaces, unless specifically approved by A/E.
- C. Related Sections include the following:
1. Division 01 Section "Alternates" for description of alternate(s) affecting this Section.
 2. Division 05 Section "Metal Fabrications" for supports.
 3. Division 06 Section "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
 4. Division 07 Section "Joint Sealants".
 5. Division 10 Section "Visual Display Units" for Tackable wall panels.
 6. Division 12 Section "Educational Casework" for coordination with modular casework.
 - a. At a minimum, casework scheduled in the same rooms, spaces, and areas shall have coordinated:
 - 1) Plastic laminate selections.
 - 2) Working surface heights.
 - 3) Edge treatments.
 - 4) Backsplash/end splash conditions.
 - 5) Hardware finishes.
 7. Division 22 Section "Plumbing Fixtures" for sinks.

1.2 DEFINITIONS

- A. General: Definitions in Architectural Woodwork Institutes (AWI) "Architectural Woodwork Quality Standards" apply to the work of this Section, unless otherwise noted herein.
- B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
- C. Exposed Portions of Casework: Include surfaces visible when doors and drawers are closed. Bottoms of casework more than 4 feet above floor and tops less than 6 feet 6 inches above floor shall be considered as exposed. Visible members in open cases or behind glass doors also shall be considered as exposed portions. Any unit exterior side surface that is visible after installation.

- D. Semi-Exposed Portions of Casework: Includes those members behind opaque doors, such as shelves, divisions, interior faces of ends, case back, drawer sides, backs and bottoms, and back face of doors. Tops of casework 6 feet 6 inches or more above floor shall be considered semi-exposed.
- E. Concealed Portions of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
 - 1. Coordinate layout and installation of framing and reinforcements for support of casework.
 - a. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.
 - 2. Coordinate casework installation with size, location, and installation of service utilities. Sequence installation to accommodate required utility connections.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 2. Show locations and sizes of cutouts and holes for electrical switches and outlets, plumbing fixtures, and other items installed in architectural woodwork.
- C. Samples for Initial Selection: For each type of exposed finish, not indicated on drawing or "List of Finishes."
- D. Samples for Verification:
 - 1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
 - 2. Thermally Fused Laminate (TFL) Panels: 8 by 10 inches, for each color, pattern, and surface finish, with edge banding on one edge.
 - 3. Exposed Cabinet Hardware and Accessories: One full-size for each type and finish.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Coordination Submittals:
 - 1. Copy same materials to other trades and other Contractors who have connected or adjacent works for coordination review and for locating their work connected to or adjacent to the equipment specified herein.
 - 2. Distribute review "Field Use" copies to all affected trades when casework manufacturer and affected Contractors have completed coordination necessary for complete installation.

1.6 QUALITY ASSURANCE

- A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
- B. Manufacturer's Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose product have a record of successful in-service performance.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.
- B. Keep finished surfaces of products covered with polyethylene film or other protective covering during handling and installation.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating or temporary facilities are capable of maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- 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.
- C. 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.

PART 2 - PRODUCTS

2.1 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 product by the manufacturers specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 SYSTEM DESCRIPTION

- A. Accessibility Requirements: Millwork shall be provided to conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
- B. Performance Requirements
 - 1. Countertops shall not deflect more than 1/4 inch when a load of 100 pounds per linear foot is applied.
 - a. Unsupported countertop spans shall not exceed 48 inches and must be reinforced to prevent deflection in excess of 1/4 inch.

2.3 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
 - a. Grade: Custom.

2.4 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.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
 - 2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde or Grade M-2-Exterior Glue.
 - 3. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Environ Biocomposites Manufacturing LLC; Bio Fiber Wheat.
 - 2) Sorm Incorp.; Primeboard Premium Wheat.
 - 4. Softwood Plywood: DOC PS 1, medium-density overlay.
- C. Thermally Fused Laminate (TFL) Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with requirements of NEMA LD3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
 - 1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed edges. Match color and pattern of thermoset decorative panels.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABET Inc.
 - b. Formica Corporation
 - c. Laminate LLC
 - d. Pionite; a Panolam Industries International, Inc. brand
 - e. Wilsonart LLC

2.5 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.
 - 1. Manufacturers: Subject to compliance with requirements, or otherwise noted, provide products by one of the following:
 - a. Accuride International
 - b. Blum, Julius and Co., Inc.
 - c. Comp X International, Inc.
 - d. Knape & Vogt Manufacturing Company

- e. Grass America
 - f. Hardware Resources
 - g. Hettich America L.P.
- B. Hardware Standards: Comply with ANSI/BHMA A156.9 for items indicated by referencing ANSI/BHMA numbers or items referenced to this standard.
- C. Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095 inch thick metal with hospital tip, and as follows:
- 1. Semi-concealed Hinges for Overlay Doors: ANSI/BHMA A156.9, B01521.
- D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter, unless otherwise noted, comply with ANSI/BHMA A156.4, B02011.
- E. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141, roller catches, ANSI/BHMA A156.9, B03071, or ball friction catches, ANSI/BHMA A156.9, B03013.
- 1. Catches shall comply with ADA requirements for pounds of pull required to open doors.
 - 2. Provide two (2) catches on doors more than 48 inches high.
 - 3. Chain Stops
 - a. Install on the following:
 - 1) Operable doors of tall wardrobe units and cabinets.
 - 2) Other operable doors that are restricted from swinging 180 degrees.
 - b. Length of chain shall allow doors to open 90 degrees minimum.
 - 1) Exception: Shorten chain if required to prevent door or door handles from hitting obstructions.
 - 4. Provide push-in magnetic catches, ANSI/BHMA A156.9, B03131, where indicated.
- F. Adjustable Shelf Supports: Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 1-inch centers. Each shelf support has 2 integral support pins, to interface pre-drilled holes, and to prevent accidental rotation of support. Support also provides non-tip feature for shelving.
- 1. Structural load to support 1200 lbs. without failure.
- G. Drawer Slides: ANSI/BHMA A156.9, B05091.
- 1. Standard Duty (Grade 1): Side mounted and extending under bottom edge of drawer; partial-extensions type; epoxy-coated steel with polymer rollers.
 - 2. Heavy Duty:
 - a. Grade 1HD-100: Side mounted; full extension type; zinc-plated steel ball-bearing slides.
 - b. Grade 1HD-150: Side mounted; full-overtravel-extension type; zinc-plated.
 - c. Grade 1HD-200: Side mounted, full-overtravel-extension type, zinc-plated.
 - 3. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
 - a. For paper storage provide 150 pound load rated slides.
 - 4. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.
 - 5. Lateral file drawers more than 6 inches high and more than 24 inches but not more than 30 inches wide, provide 150 lb. load capacity.
 - 6. Lateral file drawers more than 6 inches high and more than 30 inches wide, provide 200 lb. load capacity.
 - 7. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches high and 24 inches wide.
- H. Drawer and Hinged Door Locks:
- 1. Cylindrical (cam) or mortise type, 5-pin tumbler, brace with chrome-plated finish, and complying with ANSI/BHMA A156.11, Grade 1.
 - 2. Provide locks on all doors and drawers, unless otherwise noted.

- I. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- J. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
 - 1. Satin Stainless Steel: ANSI/BHMA 630.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
- D. Shelf Brackets and Rod Support: BHMA A156.16, B04051; prime-painted formed steel.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A & M Hardware, Inc.
 - b. EPCO, Engineered Products Co.
 - c. Knappe and Vogt Manufacturing Company
- E. Clothes Rods: 1-5/16 inch diameter, aluminum tubes.

2.7 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Unless indicated otherwise, ease edges as follows:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch radius.
 - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch radius.
- D. 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.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.8 PLASTIC-LAMINATE CABINETS

- A. Type of Construction: Face Frame.
- B. Cabinet, Door, and Drawer Front Interface Style: Reveal overlay.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 1. Horizontal Surfaces Other Than Tops: Grade HGS.
 2. Vertical Surfaces: Grade HGS or VGS.
 3. Edges: PVC edge banding 3mm thick, through-color in satin finish matching laminate in color and pattern, as indicated.
 - a. Provide PVC tape, 0.018 inch minimum thickness, matching laminate in color, pattern, and finish, where indicated.
- D. Materials for Semi-exposed Surfaces:
 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS, High-pressure decorative laminate, Grade CLS, or Thermally Fused Laminate (TFL).
 - a. Edges of Plastic-Laminate Shelves: 0.018-inch, matching laminate in color and pattern as indicated.
 - 1) Plastic laminate matching adjacent surfaces only where indicated
 - b. Impact resistant PVC edge-banding, 1mm thick, through-color in satin finish.
 - 1) Unless otherwise indicated, provide specified edge-banding on all semi-exposed edges.
 - c. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS or CLS.
 2. Drawer Sides and Backs: Solid-hardwood lumber or thermoset decorative panels.
 3. Drawer Bottoms: Hardwood plywood or thermoset decorative panels.
- E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 1. Refer to "List of Finishes".
- G. Drawer Construction: Fabricate with exposed fronts fastened to sub-front with mounting screws from interior of body.
 1. Join sub-fronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

2.9 PLASTIC-LAMINATE COUNTERTOPS

- A. High-Pressure Decorative Laminate Grade: HGS.
- B. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 1. Refer to "List of Finishes".
- C. Grain Direction: Parallel to cabinet fronts.
- D. Edge Treatment: Provide on front edge of top, on top edges of backsplashes and endsplashes, and on ends of tops and splashes.
 1. PVC edge-banding 3mm thick, through-color with satin finish, matching laminate in color and pattern.
 2. Barbed T-edging will not be acceptable.

- E. Core Material: Particleboard made with exterior glue.
- F. Core Material at Sinks: Particleboard made with exterior glue or exterior-grade plywood.
- G. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.
- H. Backsplashes: 4 inch high, unless otherwise noted, square-set, color matching and mechanically attached, with endsplashes.
 - 1. Provide at locations where countertops abut walls and where otherwise indicated.
 - 2. Backsplashes shall have a moisture-resistant core.
- I. Fabrication
 - 1. Fabricate countertops to dimensions, profiles and details indicated. Provide front and end overhang of 1 inch over base cabinets, unless otherwise noted.
 - 2. Complete fabrication, including assembly, 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.
 - 3. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - a. Seal edges of openings in countertops with a coat of varnish.
 - 4. Concealed Surfaces: Edges of countertop exposed to moisture, such as those adjacent to exterior concrete or concrete masonry unit walls, etc., shall be back primed.

2.10 SPECIALTY ITEMS

- A. Support Members: Furniture grade, epoxy powder coated steel, of size and configuration as detailed, indicated or required by "performance standards". Exposed welds shall be ground smooth.
 - 1. Cantilevered Work Top Support Bracket: 1-1/2 inch by 1-1/2 inch 12 gauge steel vertical, welded and ground smooth to 1-1/2 inch wide by 2-1/2 inch deep 12 gauge horizontal, of the overall size as indicated on contract documents, or as designated by product number. Provide molded cap inserts at wall and countertop fastener holes.
 - 2. Angular Work Top Support Bracket: Factory welded 1-1/2 inch by 1/4 inch flat steel of vertical, horizontal, and angular design according to size indicated on contract documents, or designated by product number.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas for not less than 72 hours.
- B. 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. Architectural Wood Standards Grade: Install cabinets and woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble cabinets and woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

- C. Install cabinets and woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets and woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 - a. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
 - 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 3. Scribe tops and backsplashes to walls and other adjoining vertical surfaces.
 - 4. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
 - 5. Caulk space between backsplash and wall with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.
- H. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

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

END OF SECTION 06 41 16

SECTION 07 21 53 – MISCELLANEOUS THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber blanket or mineral wool blanket insulation.
 - 2. Miscellaneous spray polyurethane foam insulation to seal miscellaneous voids not part of exterior wall assemblies to maintain thermal barrier.
- B. Related Sections:
 - 1. Division 07 Section "Boardstock Air Barrier" for insulating and sealing non-accessible part of wall assembly.
 - 2. Division 07 Section "Thermoplastic Membrane Roofing" for insulation specified as part of roofing construction.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate with other thermal assemblies and air barrier assemblies to provide a complete thermal envelope.
 - 1. Fill gaps around penetrations to prevent gaps in thermal envelope.
- B. Sequence: Sequence installation of insulation so materials can be installed for optimum performance.
- C. Sequence and coordinate application of sprayed-on insulation with other related Work specified in other Sections to comply with following requirements:
 - 1. Ensure that insulating material is installed prior to installation of enclosing or concealing work, with sufficient time allowed for observation, testing, and correction of defective insulation work.
 - 2. Plumbing, wiring (including telephone and other low-voltage work) shall be completely roughed in stud cavities before beginning insulation work.
- D. Ducts, piping, conduit, or other suspended equipment that interfere with uniform application of insulation material shall be positioned after application of sprayed insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Certification: Certify materials contain less than one percent asbestos or polychlorinated biphenyls (PCB).
- B. Code Research Reports including: ICC-ESR (International Code Council Evaluation Service Report).
- C. Certifications: If manufacturers published data sheets do not indicate compliance with all specification requirements, provide letter of certification that all products comply with the requirements; include primers (if required), foam, vapor retarder and thermal barriers.

- D. Evaluation Reports: Upon request, submit the following:
 - 1. For intumescent coating, documentation from an independent testing laboratory that demonstrates that it satisfies the Acceptance Criteria for Spray-Applied Foam Plastic Insulation (AC 377) to serve as the code-mandated thermal barrier over polyurethane foam.

1.5 QUALITY ASSURANCE

- A. Polyurethane Foam Installer Qualifications: An authorized representative who is trained and approved by manufacturer or certified by Spray Polyurethane Foam Alliance through SPFA-PCP as an insulation installer or higher certification.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Materials to be delivered to site in original labeled and unopened packages, clearly labeled with manufacturer's name, product identification, safety information, and batch or lot numbers, where appropriate. Where materials are covered by a referenced specification, the labels shall bear the specification number, type and class, as applicable.
- B. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
 - 1. Bonding adhesives must be kept from freezing at all times.

1.7 FIELD CONDITIONS

- A. Environmental Conditions: Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
 - 1. Do not install sprayed-on insulation when ambient or substrate temperatures may fall below 40 degrees F or rise above 85 degrees during application and drying processes.
 - 2. Ventilate sprayed insulation by means of natural or forced air circulation during and after application until it dries thoroughly.
 - a. In enclosed areas, ventilation shall not be less than 4 complete air changes per hour.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass or 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 air velocity.
 - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to effects of high humidity, after inoculation with *Chaetomium globosum* on all surfaces and storing for 60 days at 100 percent relative humidity in dark.
- B. Reference Standards:
 - 1. NFPA: Foam plastics left exposed to interior occupied space must be covered by a thermal barrier or show compliance to NFPA 286 for flame spread classifications for specific materials or assemblies.
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- C. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E84.
- D. Labeling of Building Envelope Insulation: The rated-R-value shall be clearly identified by an identification mark applied by the manufacturer to each piece of building envelope insulation.
 - 1. When insulation does not have such an identification mark, the installer of such insulation shall provide a signed and dated certification for the installed insulation listing the type of insulation, the manufacturer, the rated R-value, and where appropriate, the installed thickness and the coverage area.
- E. Compliance with Manufacturer's Requirements: Insulation materials shall be installed in accordance with manufacturer's recommendations and in such a manner as to achieve rated R-value of insulation.

2.3 MINERAL-WOOL BLANKET INSULATION

- A. Design Requirements: Products that have been manufactured, fabricated, and installed to the following criteria:
 - 1. Fire Test Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing protocol required to achieve UL classified rated per UL 723 or by testing identical products according to ASTM E84 by a qualified testing agency acceptable to authorities having jurisdiction. Identify products with appropriate marking of applicable testing agency.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of following:
 - 1. Thermafiber, an Owens Corning Co.
 - 2. Johns Manville
 - 3. Rockwool Manufacturing
- C. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Thermal Resistance: R-Value; 3.8 per inch.
- D. Mineral-Wood Board Insulation, Types 1A and 1B, Unfaced: ASTM C612, Types 1A and 1B; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway Company.
 - b. Rockwool International.
 - c. Thermafiber, Inc.; an Owens Corning Company.
2. Nominal Density: 4 lb./cu.ft.
3. Flame-Spread Index: Not more than 15 when tested in accordance with ASTM E84.
4. Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.
5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.4 GLASS-FIBER BLANKET INSULATION

- A. Design Requirements: Products that have been manufactured fabricated and installed to the following criteria:
 1. Fire Test Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing protocol required to achieve UL Classified rated per UL 723 or by testing identical products according to ASTM E84 by a qualified testing agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. CertainTeed Corporation
 2. Johns Manville
 3. Knauf Insulation
 4. Owens Corning
- C. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per UL 723 or ASTM E 84; passing ASTM E 136 for combustion characteristics.
- D. Thermal Resistance
 1. R-value: 1.3 hr/ft²/f Btu
 2. RSI value: 2.3
 3. Thickness: 3-1/2 inches, minimum.
- E. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.5 SPRAY POLYURETHANE FOAM INSULATION/THERMAL BARRIER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of following:
 1. Bayer Material Science: Bayseal with one of following thermal barriers:
 - a. Bayseal IC Intumescent Coating; Bayer.
 - b. Flame Seal TB; Flame Seal Products.
 - c. TPR² Fireshell BMS-TC; TPR² Corporation.
 - d. DC 315; International Fireproof Technology.
 2. Icynene Inc.: Icynene ProSeal Eco with following thermal barrier:
 - a. DC 315; International Fireproof Technology.
 3. Henry Company: Permax 2.0X with one of following thermal barriers:
 - a. Flame Seal TB; Flame Seal Products.
 - b. TPR² Fireshell BMS-TC; TPR² Corporation.
 - c. DC 315, International Fireproofing Technology.
 4. MBCC Group: Spraytite, Comfort Foam and Walltite with one of following thermal barriers:
 - a. Aldocoat 800; Aldo Products
 - b. Noburn Plus; No-Burn Inc.

- c. Spraycoat 1920; MBCC Group.
 - d. Flame Seal TB; Specialty Products.
 - e. DC 315; International Fireproof Technology.
 - 5. Johns Manville: Corbond III with one of following thermal barriers:
 - a. JM TC Thermal Barrier Intumescent Coating; Johns Manville.
 - b. Flame Seal TB; Flame Seal Products.
 - c. TPR² Fireshell BMS-TC; TPR² Corporation.
 - d. DC 315; International Fireproofing Technology.
 - 6. NCFI Polyurethane: InsulBloc with following thermal barrier.
 - a. DC 315; International Fireproofing Technology.
 - 7. Huntsman Building Systems: Heatlok XT with one of following thermal barriers.
 - a. Blazerox TBX.
 - b. DC-315 Fireproof Paint.
- B. Closed-Cell Polyurethane Foam Insulation with Thermal Barrier: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
- 1. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F., when tested in accordance with ASTM D1622 and ASTM C518.
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 3. Thermal Barrier: Provide an intumescent coating that has been qualified as code-mandated thermal barrier over polyurethane foam by room corner tests conducted in accordance with NFPA 286 or UL 1715 as acceptable to authorities with jurisdiction.
 - a. Fire resistant assemblies shall be tested in accordance with UL 263.
- C. Primers (if recommended by manufacturer): The primer to be specifically selected for the given substrate to be primed and must be compatible with the spray polyurethane foam.
- 1. Wood: Chlorinated rubber, modified alkyds, and others as recommended by manufacturer.
 - 2. Steel: Modified alkyds, epoxy, acrylics, other as recommended by manufacturer, typically including rust inhibitors.
 - 3. Galvanized Metal: Vinyl copolymer acrylic vinyl wash primer, modified alkyds, and others as recommended by manufacturer.
 - 4. Concrete/Masonry: Chlorinated rubber, vinyl copolymer acrylic and others as recommended by manufacturer.

2.6 ACCESSORIES

- A. Wire/Poultry Netting: 1 inch hexagonal, 20-gauge galvanized wire netting.
- B. Welded Wire Fabric: Cold drawn 10-gauge steel wire, electrically welded at intersection of transverse and longitudinal wires, which are both spaced 6 inches apart. Fabric shall conform to ASTM A 185 and be identified as 6 x 6-10 WWF.
- C. Sprayed Polyurethane Foam Sealant (Insulation for Miscellaneous Voids): 1 or 2 component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu.ft. density; flame spread index of 25 or less according to ASTM E162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
 - 1. Provide single-component polyurethane sealant low expansion pressure specifically designed for sealing perimeter of openings.
 - 2. Use one-component foam for cracks or openings 1/4-inch to 2-inch wide. Use two-component foam sealant for gaps over 2-inches wide and for voids in hidden cavities.

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.
- B. Examine sizes and conditions of voids to be sealed to establish correct thicknesses and installation of materials per manufacturer's recommendations.
- C. Verify that surfaces are ready to accept work of this Section and penetrating elements are securely fixed, properly located and with required space allowance between penetrants and openings.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.
- B. Clean substrate surfaces to remove moisture, dirt, dust, grease, oil, loose material, or other matter which may affect bond of foam sealant material. Ensure surfaces are dry before proceeding with installation.
 - 1. Remove incompatible materials that may affect bond.
 - 2. Install backing and damming materials for foam sealant to arrest material leakage and for support.
 - 3. Mask, using masking tape, where necessary to avoid spillage and over coating onto adjoining finish surfaces; remove stains on adjacent surfaces. Remove tape as soon as possible without disturbing foam sealant.
- C. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under project conditions.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.
- E. 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.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using following materials:
 - 1. Loose-Fill Insulation (Interior Assemblies): Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
 - 2. Spray Polyurethane Insulation or Foam Sealant (Exterior Walls): Apply according to manufacturer's written instructions.
 - a. Apply sealants within recommended application temperature ranges. Consult manufacturer when sealants cannot be applied within recommended ranges.
 - 1) In low humidity, mist area with water to aid cure of one-component sealant.
 - b. Provide continuity of thermal barrier by sealing following areas within construction and construction assemblies. Note that these areas are typical in nature and do not limit application of these products to these noted areas, but any and all details within construction that present similar characteristics should receive similar applications.
 - 1) Opening perimeters, including head, jamb and sill.
 - 2) Roof/Wall Junctions: Inspect roof/wall perimeter for thermal gaps in areas such as fluted deck itself, truss and structural beam penetrations above and below top of wall, open joints, and conduit and pipe penetrations.
 - a) Where deck flutes run perpendicular to wall, foam open flutes completely out to fascia.
 - b) Where closed flutes occur, punch flutes and inject foam through holes. Locate holes as close to wall as possible so that plane of injected and cured foam within closed flute is level with plane of exposed foam in open flutes.
 - c) Where steel deck is parallel to wall, fill void with either one-component or two-component material, depending on gap size.

3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 53

SECTION 07 25 00 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Building wrap, mechanically attached water-resistive weather barrier membrane.
- B. Related Requirements:
 - 1. Division 06 Section "Sheathing" for plywood sheathing.
 - 2. Division 07 Section "Boardstock Air Barrier" for transition membranes.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Building Wrap:
 - a. Include data on air and water-vapor permeance based on testing according to referenced standards.
 - b. Include details of building wrap at terminations, openings, and penetration. Show details of flexible flashing applications.
 - c. Manufacturer's Instructions: Provide manufacturer's written installation instructions.
- B. Shop Drawings: Show details of building wrap at terminations, openings, and penetrations. Show details of flexible flashing applications.

1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Evaluation Reports: For water-resistive barrier from ICC-ES. AC38 – Acceptance Criteria for Water-Resistive Barriers.

1.4 QUALITY ASSURANCE

- A. Pre-Installation Meeting
 - 1. Hold a pre-installation meeting two weeks prior to start of weather barrier installation. Attendees shall include Contractor, A/E, Installer, and Weather Barrier Manufacturer's Designated Representative. All contractors responsible for creating a continuous plane of water tightness shall be present.
 - 2. Review all related product requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of air/weather barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.5 MOCK-UP

- A. Provide mock-up of specified water-resistive weather barrier materials.
 - 1. Where directed by Architect, construct typical exterior wall panel 6 foot long by 6 foot wide minimum incorporating the sheathing board or substrate, window frame and attachment method, masonry ties, attachment of sheathing and detailing of weather-resistive barrier application.
- B. Allow 72 hours for inspection by A/E before proceeding with water-resistive weather barrier work. Mock-up may remain as part of the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
- B. Store roll materials on end in original packaging. Protect rolls from direct sunlight and inclement weather until ready for use.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E 1677, Type I with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Tyvek Commercial Wrap; DuPont (E. I. du Pont de Nemours and Company).
 - b. Barricade Wrap Plus; Barricade Building Products.
 - c. Alpha Protech
 - d. Benjamin Obdyke Incorporated
 - e. Dorken Systems Inc.
 - f. Kingspan Insulation LLC
 - g. Typar Geosynthetics
 - 2. Water-Vapor Permeance: Not less than 10 perms per ASTM E 96, Desiccant Method (Procedure A).
 - 3. Allowable UV Exposure Time: Not less than three months.
 - 4. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.
- B. Accessories
 - 1. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.
 - 2. Fasteners: Corrosion-resistant stainless steel screws with preformed head caps.
 - a. Selection of fastener type is subject to substrate type.
 - 1) Place screws sized to penetrate sheathing through to solid backing or framing by 3/4 inch in conjunction with preformed screw head caps.
 - 3. Sealants recommended by the weather barrier manufacturer.
 - 4. Adhesives: Provide as recommended by weather barrier manufacturer.
 - 5. Primers: Provide flashing manufacturers recommended primer to assist in adhesion between substrate and flashing.

2.2 ACCESSORIES

- A. Requirements: Provide primers, fasteners, seam tapes, flashing, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by weather barrier manufacturer to produce a complete weather barrier assembly and that are compatible with primary weather barrier material and adjacent construction to which they may seal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examination: Verify that surfaces and conditions are ready to accept the Work of this Section.
 - 1. Notify A/E in writing of any discrepancies. Commencement of the Work or any parts there of shall mean acceptance of the prepared substrates.

- B. All surfaces must be sound, clean and free of oil, grease, dirt, excess mortar or other contaminants detrimental to the adhesion of flashings. Fill voids, gaps in substrate to provide an even surface.
- C. Ensure all preparatory work is complete prior to applying weather barrier.
- D. Mechanical fasteners used to secure sheathing shall be set flush with sheathing and fastened to solid backing.

3.2 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier 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.
- C. Building Wrap: Comply with manufacturer's written instructions.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.

3.3 ACCESSORY INSTALLATION

- A. Install weather barrier accessories for a complete installation with weather barrier in accordance with manufacturers written instructions.

END OF SECTION 07 25 00

SECTION 07 27 23 - BOARDSTOCK AIR BARRIER

PART 1 - GENERAL

1.2 SECTION INCLUDES

- A. This section includes following:
1. Boardstock air barrier – rigid cellular thermal insulation board located in non-accessible part of wall.
 - a. Masonry cavity wall applications.
 - b. Cold-formed metal veneer applications.
 2. Air sealing materials to supplement and provide continuity of main or primary air barrier assembly including, but not limited to following:
 - a. Connections of walls to roof air barrier.
 - b. Expansion and control joints.
 - c. Openings and penetrations of door and storefront.
 - d. Piping, conduit, duct and similar mechanical and electrical penetrations.
 - e. Masonry ties, screws, bolts and similar penetrations.
 - f. All other air leakage pathways in building envelope.
- B. Related Work in other Sections includes following:
3. Division 04 Section "Unit Masonry" for requirement that backup masonry joints are flush and completely filled with mortar, and that excess mortar on brick ties will be removed; requirement for gap at deflection joints and fillers; coordination with sequencing of through-wall flashing.
 4. Division 05 Section "Cold-Formed Metal Framing" for load-bearing, metal exterior wall framing assemblies to support boardstock air barrier, including a 6 inch strap to secure the flashing termination bar.
 5. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking at openings.
 6. Division 06 Section "Sheathing" for coordination with boardstock air barrier.
 7. Division 07 Section "Thermoplastic Membrane Roofing" for requirement for coordination with sequencing of membrane roofing; requirement to seal roof membrane to wall air barrier.

1.3 REFERENCES

- A. NFPA: Foam plastics left exposed to interior occupied space must be covered by a thermal barrier or show compliance to NFPA 286 for flame spread classifications for specific materials or assemblies.
1. In edition show compliance with NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- B. For rough openings of fenestrations sealants must conform to AAMA 812-04.
- C. Sealants must have ASTM E84 or UL723 standard testing for surface burning characteristics of building materials.
- D. Sealants must be UL classified for foamed plastics as per UL 723 for caulking and sealants.
- E. ICC-ES AC 377 acceptance criteria for spray applied foam plastic insulation.

1.4 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to movement of air.
- B. Air-Barrier Accessory: A transitional component of air barrier that provides continuity.

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

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination Meeting: Conduct meeting at Project site in accordance with requirements of Division 01 Section "Project Management and Coordination". Schedule before start of each major segment or wall construction area. Be aware of all contract work that interfaces with wall assemblies as they are being erected. Contractor shall participate in various trade preconstruction meetings that interface with exterior wall assemblies. Educate and advise all workers concerning protection and cutting and patching procedures.
 - 1. Attendance: All trades whose work interfaces with wall assemblies.
 - 2. Verify all openings and penetrating items, pipes, ducts, conduits, and like and ensure sleeves are properly sized and located and capable of being secured.
 - 3. Review transitions, special penetration details, proposed openings, structural elements, and conditions of other construction that will affect wall assembly.
 - 4. Review temporary protection requirements. Walls are to be protected from moisture during construction.
 - 5. Coordinate installation of insulation and accessories with cladding attachment system, air barrier, and other moisture protection work.
- B. Pre-Installation Meeting: Conduct meeting at Project Site.
 - 1. Attendees: A/E, Owner, Contractor, Installer, agent of manufacturer, testing agency representative, and any installer whose work interfaces with or affects exterior envelope, including installers of "openings".
 - 2. Review air barrier requirements and installation, special details, mockups, air leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.
 - 3. Review construction schedule and confirm availability of products, applicator personnel, equipment and facilities.
 - 4. Review governing regulatory requirements, and requirements as applicable and field quality control procedures.
 - 5. Review field quality control procedures.
- C. Sequencing
 - 1. Do not install air barrier material before roof assembly has been sufficiently installed to prevent a buildup of water in interior of building.
 - 2. Do not install work of this Section until work of other trades having an effect on this Section of work has been completed.
 - 3. Schedule work of other trades so that foam sealants can be inspected prior to being covered by subsequent construction.

1.6 ACTION SUBMITTALS

- A. Product Data: Submit Manufacturer's product data, manufacturer's instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.
 - 1. Submit letter from primary materials Manufacturer indicating approval of products not manufactured by primary manufacturer.
 - 2. Include statement that materials are compatible with adjacent materials proposed for use.
 - 3. Submit letter from sealant Manufacturer indicating sealant adhesion to air barrier material meet requirements of project.
- B. Shop Drawings: Submit shop drawings showing locations and extent of air barrier assemblies and details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in construction will be bridged, how inside and outside corners are negotiated, how materials that cover materials are secured with air-tight condition maintained, and how miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed. Provide project specific details where manufacturers standard details do not cover condition.

1. Include VOC content of each material, and applicable legal limit in jurisdiction of project.
2. Include statement that materials are compatible with adjacent materials proposed for use.
3. Include details of interfaces with other materials that form part of air barrier.
4. Shop drawings shall be prepared by air barrier manufacturer or submitted to air installer for use in application and inspection.

1.7 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS:

- A. Quality Assurance Program: Submit evidence of current Contractor accreditation and Installer certification under Air Barrier Association of America's (ABAA) Quality Assurance Program or manufacturer's quality assurance plan approved by A/E.
 1. Submit accreditation number of Contractor and certification number(s) of ABAA Certified Installer(s), if applicable.
- B. Product Test Reports: Submit evaluation reports published by independent laboratory indicating evidence of compliance with specified criteria.
 1. NFPA 285 Compliance: Contractor must submit documentation showing all components in wall assembly are in compliance with NFPA 285.
- E. Compatibility: Submit letter from Manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from Manufacturer stating that cleaning materials used during installation are chemically compatible with adjacent materials proposed for use.

1.8 QUALITY ASSURANCE

- A. Manufacturer: Obtain primary ABAA listed materials from a single ABAA Evaluated Manufacturer regularly engaged in manufacturing specified rigid cellular thermal insulation board. Obtain secondary materials from a source acceptable to primary materials Manufacturer.
- B. VOC Regulations: Provide products which comply with applicable regulations controlling use of volatile organic compounds.
- D. Mock-Ups: Build mock-ups to set quality standards for materials and execution. Refer to Division 04 Section "Unit Masonry" for mock-up wall assembly.
 1. Build integrated mockups of exterior wall assembly, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Coordinate construction of mock-ups to permit inspection of air barrier, if required before external insulation and cladding are installed.
 - b. If Architect determines mock-ups do not comply with requirements, reconstruct mock-ups and apply air barriers until mock-ups are approved.
 2. Approval of mock-ups does not constitute approval of deviations from Contract Documents contained in mock-ups, unless A/E specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mock-ups may become part of completed work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original packages with seals unbroken, labeled with Manufacturer's name, product, date of manufacture, and directions for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by boardstock air barrier Manufacturer. Protect stored materials from direct sunlight.

- C. Handle materials in accordance with Manufacturer's recommendations.

1.10 FIELD CONDITIONS

- A. Environmental Requirements: Install air barrier system work only when weather conditions are in compliance with manufacturer's specific environmental requirements and conditions will permit work to be performed in accordance with manufacturer's recommendations and requirements.
 - 1. Compatibility. Do not allow boardstock to come in contact with chemically incompatible materials.
 - 2. Ultra-violet exposure. Do not expose boardstock air barrier to sunlight longer than as recommended by Manufacturer of material.
- B. Spray Polyurethane Foam (Cold-Formed Metal Stud Cavity)
 - 1. Do not proceed with insulation of spray polyurethane foam until sheathing substrate construction is complete and openings and penetrating items have been installed and sealed.
 - 2. Do not proceed with installation of spray polyurethane foam until substrate surface temperatures accepting spray polyurethane are above manufacturer's recommended minimum surface temperatures.
 - 3. Verify that substrate surfaces to receive spray polyurethane foam are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.
 - 4. Do not apply spray polyurethane after 6 months expiration date printed on label of each container.
 - 5. Ventilate area to receive spray polyurethane foam by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions.
 - 6. Provide temporary enclosures to prevent spray and noxious vapors from contaminating air beyond application area.
 - 7. Protect workers as recommended by spray polyurethane foam manufacturer.
 - 8. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting or insulation materials.
 - 9. Dispose of waste foam daily in location designated and employ drums in accordance with foam manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Boardstock Air Barrier assemblies are based on products described herein as manufactured by DuPont. Subject to compliance with requirements, provide named product or options indicated.
- B. Products of other manufacturers systems will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified system. Request for A/E's approval must be accompanied by "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by Project Manager and specification department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum. Manufacturers must submit following:
 - 1. ABAA approval letter.
 - 2. Manufacturer details of system, including penetrations, and impact on details within Construction Documents.

2.2 PERFORMANCE REQUIREMENTS

- A. Material Performance: Provide materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.004 cfm/ft² @ 1.57 psf), when tested in accordance with ASTM E 2178 (unmodified).

- B. The water vapor permeance Desiccant method, (Procedure A) and Water method (Procedure B) shall be determined in accordance with ASTM E96 and shall be declared by the material manufacturer.
- C. Assembly Performance: Provide a continuous air barrier in form of an assembly that has an air leakage not to exceed 0.04 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.04 cfm/ft² @ 1.57 psf) when tested in accordance with ASTM E 2357. Assembly shall accommodate movements of building materials by providing expansion and control joints as required. Expansion / control joints, changes in substrate and perimeter conditions shall have appropriate accessory materials at such locations.
 - 1. Assembly shall be capable of withstanding combined design wind, fan and stack pressures, both positive and negative, on envelope without damage or displacement and shall transfer load to structure.
 - 2. Assembly air barrier material shall not displace adjacent materials in assembly under full load.
 - 3. Assembly shall be joined in an airtight and flexible manner to air barrier material of adjacent assemblies, allowing for relative movement of assemblies due to thermal and moisture variations, creep and anticipated seismic movement.
- D. Connections to Adjacent Materials: Provide connections to prevent air leakage at following locations:
 - 1. Foundation and walls, including penetrations, ties and anchors.
 - 2. Walls, windows, storefronts, louvers and doors.
 - 3. Different assemblies and fixed openings within those assemblies.
 - 4. Wall and roof connections.
 - 5. Floors over unconditioned space.
 - 6. Walls, floor and roof across construction, control and expansion joints.
 - 7. Walls, floors and roof to utility, pipe and duct penetrations.
 - 8. Expansion joints.
 - 9. All other potential air leakage pathways in building envelope.
- E. Water Penetration: When tested in accordance with ASTM E331, no uncontrolled water penetration shall occur at a minimum differential pressure of 6.24 psf for minimum test duration of 2 hours.
- F. Mold Resistance: Thermal wall and air barrier system components shall provide non-food source for fungal growth (no organic materials).
- G. Thermal Performance: Rigid closed cell extruded polystyrene foam insulation (cavity wall assembly): ASTM C 518, stabilized R-value of 5.6 at one inch of thickness (measured at 75 degrees F.).
 - 1. Thickness/R-Value: 2.5 inches and R-14.00, minimum.
- H. NFPA 285: Assembly shall comply with Standard Method of Testing for Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies containing combustible components using Intermediate Scale, Multi-Story Test Apparatus.

2.3 AIR BARRIER MATERIALS

- A. Boardstock Air Barrier – Rigid Cellular Thermal Insulation Board: Air Barrier at Cold-Formed Metal Veneer Applications. Subject to compliance with requirements, provide one of following:
 - 1. Material: Thermax Wall System by DuPont. Glass-fiber-reinforced enhanced polyisocyanurate foam core sheathing faced with nominal 4 mil embossed grey acrylic-coated aluminum on one side and 1.25 mil embossed aluminum on other side (THERMAX XARMOR). Thickness as indicated on construction drawings.
www.dow.com
 - a. Air Barrier Material Properties:

- 1) Air permeance for this material has been tested and reported as being 0.0002 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0002 cfm/ft² @ 1.57 psf), when tested in accordance with ASTM E2178 (unmodified).
 - 2) Water vapor permeance for this material has been tested and reported as being 2.29 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential 0.04 US perms at 1.0" when tested in accordance with ASTM E96 (desiccant method - unmodified).
 - 3) Maximum Use Temperature: 250 degrees F.
- b. Air Barrier Accessory Materials:
- 1) Fasteners: Provide insulated sheathing manufacturer's recommended polymer or other corrosion-protective coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness.
 - a) Acceptable Products: Grip-Deck Self Drilling Ceramic Screws with Thermal-Grip washer by Rodenhouse, Inc.
 - 2) Insulation Flashing Flashing: Provide insulation manufacturer's recommended board joint flashing for sealing joints, seams and veneer tie penetrations through insulation layer.
 - a) LIQUIDARMOR CM acrylic based flashing and sealant with spray or brush application and LIQUIDARMOR LT silicone based flashing and sealant with trowel or caulk application.
 - 3) Wall Opening Flashing: Provide insulated sheathing manufacturer's recommended flashing sealing window and door wall openings.
 - a) LIQUIDARMOR CM acrylic based flashing and sealant with spray or brush application and LIQUIDARMOR LT silicone based flashing and sealant with trowel or caulk application.
 - b) WEATHERMATE Straight Flashing 6 inch and 9 inch, with butyl rubber adhesive, at straight opening heads, jambs, and sills.
 - 4) Penetration Filler: Provide insulated sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.
 - a) Acceptable Products: DuPont (fka The Dow Chemical Company) "Great Stuff™ Pro Gaps & Cracks" single-component polyurethane insulating foam sealant.
 - b) Acceptable Products: DuPont (fka The Dow Chemical Company) "Great Stuff™ Pro Window & Door" single-component polyurethane low-pressure foam sealant.
 - 5) Gap Air Infiltration Filler: Two Component, Quick Cure Polyurethane Foam:
 - a) Acceptable Products: DuPont (fka The Dow Chemical Company) FROTH-PAK™ Foam Insulation two component, quick-cure polyurethane foam.
 - .1 NFPA 286 Approval for Exposed use to interior of building without need for a 15-min thermal barrier.
 - .2 ASTM E-84 Class A.
 - 6) Facer Repair: Provide insulating sheathing manufacturer's recommended flashing for repairs of damaged facer.
 - a) Acceptable Products: Dow Chemical Company "LIQUIDARMOR CM" spray flashing and sealant or "LIQUIDARMOR LT" flexible single component silicone flashing.
 - 7) Flexible polyethylene foam gasketing strip to reduce air infiltration between a concrete foundation and sill plate.
 - a) Acceptable Products: The DuPont "WEATHERMATE SILL SEAL" Foam Gasket.
2. Material: AP Foil-Faced by Johns Manville: The boards can be installed in horizontal or vertical orientation. Thickness as indicated on the construction drawings.

- a. Air Barrier Material Properties:
 - 1) Air permeance for this material has been tested and reported as being 0.00013 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.00013 cfm/ft² at 1.57 psi), at 1.0 inch when tested in accordance with ASTM E2178 (unmodified).
 - 2) Water vapor permeance for this material has been tested and reported as being 3 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential 0.06 US perms at 1.0 inch when tested in accordance with ASTM E96 (desiccant method – unmodified).
 - b. Air Barrier Accessory Materials
 - 1) Fasteners: Provide insulated sheathing manufacturer's recommended polymer or other corrosion-protective coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness.
 - a) Acceptable Products: JM Ultrafast CI Plates and JM Ultrafast CI Phillips screws or equivalent as approved by boardstock manufacturer.
 - 2) Insulation Flashing Tape: Provide insulation manufacturer's recommended board joint tape for sealing joints, seams and veneer tie penetration through the insulation layer.
 - a) Acceptable Products: 3M™ All Weather Flashing Tape 8067 or equivalent as approved by boardstock manufacturer.
 - 3) Wall Opening Flashing: Provide insulated sheathing manufacturer's recommended flashing sealing window and door wall openings.
 - a) Acceptable Products: 3M™ All Weather Flashing Tape 8067 or equivalent.
 - 4) Penetration Filler: Provide insulated sheathing manufacturer's recommended material for sealing penetrations of insulated sheathing.
 - a) Acceptable Products: Tremco Spectrem® 1 or equivalent.
 - 5) Flashing: Provide insulated sheathing manufacturer's recommended material for counterflashing for masonry through-wall flashings, through-wall flashings and shelf angle flashings.
 - a) Acceptable Products: Sheet metal.
3. Material: ECOMAXci™ Wall Solution using ECOMAXci™ FR Air Barrier rigid polyiso boardstock by Rmax. R-value per the construction documents. Boards installed horizontally or vertically, Rmax Solution shield logo facing the exterior, typically 48 inch wide by 96 inch to 192 inch long.
- a. Air Barrier Material Properties:
 - 1) Air permeance for this material has been tested and reported as being 0.0001 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0001 cfm/ft² @ 1.57 psf), at 0.75 inch when tested in accordance with ASTM E2178 (unmodified).
 - 2) Water vapor permeance for this material has been tested and reported as being 0.88 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential 0.02 US perms at 2 inch when tested in accordance with ASTM E96 (desiccant method – unmodified).
 - b. Air Barrier Accessory Materials:
 - 1) Insulation Fasteners: Provide self-taping steel screws with minimum 2 inch diameter solid plastic washer.
 - a) Acceptable Products: Rodenhouse Inc. THERMAL-GRIP® ci Prong Washer and Grip-Deck® corrosion resistant. Self-drilling screw or equivalent, as determined by component manufacturer.
 - b) Insulation Tape: Provide insulation manufacturer's recommended tape for sealing joints, fasteners, seams, and minor facer repair penetrations through the insulation layer.

- .1 Required Products: Rmax R-SEAL 3000 dead soft aluminum foil tape with cold weather acrylic pressure sensitive adhesive, 4 or 5 inch wide.
- c) Insulation Flashing: Provide insulation manufacturer's recommended flashing for sealing at corners, ceiling and floor transitions, windows, doors, rough openings, control joints, and other through wall penetrations.
 - .1 Required Products: Rmax R-SEAL 3000 dead soft aluminum foil tape with cold weather acrylic pressure sensitive adhesive, 4 or 5 inch wide.
- d) Insulation Liquid Flashing: Provide insulation manufacturer's recommended liquid flashing for sealing joints, fasteners, seams, sealing at corners, ceiling and floor transitions, windows, doors, rough openings, other through wall penetrations, and minor facer repair penetrations through the insulation layer.
 - .1 Required Products: Rmax R-SEAL 3000 dead soft aluminum foil tape with cold weather acrylic pressure sensitive adhesive, 4 or 5 inch wide.
- e) Insulation Caulk: Provide insulation manufacturer's recommended caulk for sealing small penetrations and anchors.
 - .1 Accepted Products: Rmax R-SEAL 2000 LF, Liquid Flashing or equivalent.
- f) Brick Ties: Provide insulation manufacturer's recommended brick ties and sealing washers.
 - .1 Required Products: BLOK-LOK BL-607, Heckmann Building Products Pos-I-Tie or equivalent, used in conjunction with Rodenhouse Thermal-Grip Brick-Tie Washer or equivalent.

B. Boardstock Air Barrier at Masonry Cavity Wall Applications

1. Material: Ultra Wall Rigid Board Air Barrier System by DuPont. Extruded-Polystyrene Board Insulation with increased r-value; ASTM C 578, Type IV, but with an aged thermal resistance (R-value) for 1 inch thickness of 5.6 deg F x h x sq.ft./Btu at 75 deg. F at 5 years; closed-cell product with carbon-black filler and extruded with an integral skin. Boards installed horizontally, typically 15-3/4 inch by 96 inch orientation.
 - a. Air Barrier Material Properties:
 - 1) Air permeance for this material has been tested and reported as being 0.00023 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.00023 cfm/ft² @ 1.57 psf), at 1.0" when tested in accordance with ASTM E2178 (unmodified).
 - 2) Water vapor permeance for this material has been tested and reported as being < 62.9 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential 1.1 US perms at 1.0" when tested in accordance with ASTM E96 (desiccant method - unmodified).
 - b. Air Barrier Accessory Materials:
 - 1) Adhesive: Type recommended by insulation manufacturer.
 - a) Acceptable Products:
 - .1 "Contech Brands PL 300 Foam Board Adhesive"; ChemRex, Inc.
 - .2 "Contech Brands Premium Foam Board Adhesive"; ChemRex, Inc.
 - .3 "Foamgraph PS"; Dacar Products, Inc.
 - 2) Insulation Gap/Perimeter Filler: Single component insulating foam sealant.
 - a) Acceptable Product

- .1 DuPont (fka Dow) Chemical Great Stuff Pro Gaps and Cracks.
- 3) Insulation Flashing Tape: Provide insulation manufacturer's recommended board joint tape for sealing joints, seams and veneer tie penetrations through insulation layer.
 - a) LIQUIDARMOR CM acrylic based flashing and sealant with spray or brush application and LIQUIDARMOR LT silicone based flashing and sealant with trowel or caulk application.
 - b) "WEATHERMATE" Straight Flashing 6 inch and 9 inch, with butyl rubber adhesive, at straight opening, heads, jambs and sills.
- 4) Wall Opening Flashing: Provide insulated sheathing manufacturer's recommended flashing sealing window and door wall openings.
 - a) LIQUIDARMOR CM acrylic based flashing and sealant with spray or brush application and LIQUIDARMOR LT silicone based flashing and sealant with trowel or caulk application.
 - b) "WEATHERMATE" Straight Flashing 6 inch and 9 inch, with butyl rubber adhesive, at straight opening, heads, jambs and sills.
- 5) Penetration Filler: Provide insulated sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.
 - a) Acceptable Products: DuPont (fka The Dow Chemical Company) "Great Stuff™ Pro Gaps & Cracks" single-component polyurethane insulating foam sealant.
 - b) Acceptable Products: DuPont (fka The Dow Chemical Company) "Great Stuff™ Pro Window & Door" single-component polyurethane low-pressure foam sealant.
 - c) Acceptable Product: FROTH-PAK Foam Insulation two component, quick-core polyurethane foam.
- 6) Building Gap Air Infiltration Filler: Two Component, Quick Cure Polyurethane Foam:
 - a) Acceptable Products: DuPont (fka The Dow Chemical Company) FROTH-PAK™ Foam Insulation two component, quick-cure polyurethane foam.
 - b) NFPA 286 Approval for Exposed use to interior of building without need for a 15-min thermal barrier.
 - c) ASTM E-84 Class A.
- 7) Through Wall Flashing: Refer to Division 04 Section "Unit Masonry".
- 8) Liquid Spray Flashing: Provide insulation manufacturers recommended board joint commercial liquid spray flashing and sealant for sealing joints, seams, window openings, door openings, counterflashing, and penetrations through insulation layers.
 - a) Acceptable Product: DuPont (fka The Dow Chemical Company) "LIQUIDARMOR CM" spray flashing and sealant.
 - .1 Make ASTM 2357 standard test method for determining air leakage of air barrier assemblies, as part of an approved assembly with continuous foam insulation.
 - .2 Meets ASTM 331 water penetration of existing windows by uniform static air pressure differences, as part of an approved assembly with continuous foam insulation.
 - .3 Meets ASTM D412 tensile strength – 340 psi.
 - .4 Meets ASTM E96 water transmission – 4 perms at typical application thickness.
 - .5 Density – 11.4 pounds/gallons as liquid.
 - .6 Application Temperature: 35 degrees F to 120 degrees F.
 - .7 3" ± 1" coverage required at board joints.

- .8 UV resistance: 180 days.
 - .9 Recommended Thickness of Spray Sealant: 50 ± 5 wet mils around screws, veneer anchors and wall penetrations.
 - .10 Passes ASTM D1970/AAMA 714 requirements for nail sealing ability.
- B. Extruded-Polystyrene Board Insulation (for vertical applications below floor line and horizontal application at stops): ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kingspan Insulating, LLC
 - b. DuPont
 - c. DiversiFoam Products
 - 2. Type IV, 25 psi.
 - 3. Thermal resistance of 1-inch thickness, min. F-ft² h/Btu (75 deg F): 5.0
 - 4. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 5. Smoke-Developed Index: No more than 450 when tested in accordance with ASTM E84.
 - 6. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 7. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions under which air barrier assembly will be installed, with manufacturer's representative, for compliance with requirements.
- 1. Confirm site access logistics and scheduling requirements, including but not limited to use of scaffolding, lifts and staging.
 - 2. At end of each working day Contractor shall provide weather protection at top of parapet walls and non-finished roofs to prevent moisture migration into walls and damage to installed air barrier systems.
 - a. Protecting the walls from moisture during construction is the most effective means in preventing damage to the installed air barrier. Proceeding with installation of the air barrier assembly when walls have not been protected from moisture ingress from above is taking a huge gamble on the performance and durability of installed system.
 - 3. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 4. Ensure that following conditions are met:
 - a. Surfaces are sound, dry, even, and free of excess mortar or other contaminants
 - b. Inspect concrete surfaces to be smooth without large voids or sharp protrusions. Inform General Contractor if substrates are not acceptable to be repaired by concrete sub-trade.
 - c. Inspect masonry joints to be reasonably flush and completely filled, and ensure all excess mortar sitting on masonry ties has been removed. Inform Contractor if masonry joints are not acceptable to be repaired by mason sub-trade.
 - 5. Notify A/E in writing of anticipated problems using boardstock air barrier over substrate prior to proceeding.
 - 6. Verify sealants are compatible with boardstock air barrier material proposed for use.

3.2 PREPARATION

- A. Clean substrate surfaces to remove moisture, dirt, dust, grease, oil, loose material, or other matter which may affect bond of foam sealant or air seal material.
- 1. Ensure surfaces are dry before proceeding with installation.

2. Prepare surfaces by brushing, scrubbing, scraping, grinding, or compressed air to removal loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants.
 3. Wipe down metal surfaces to remove release agents or other noncompatible coatings using clean sponges or with a material chemically compatible with the primary air material.
- B. Remove incompatible materials which may affect bond.
- C. Install backing and damming materials for air seal to arrest liquid material leakage and support.
- D. Mask, using masking tape, where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces. Remove tape as soon as possible without disturbing air seal or air seal with substrates.

3.3 INSTALLATION

- A. General: Installation Instructions for Boardstock Air Barrier – Rigid Cellular Thermal Insulation Board: Install boardstock air barrier in a way that provides continuity throughout building envelope. Install materials in accordance with manufacturer's recommendations.
- B. Provide continuity with air barrier systems be sealing following areas with construction and construction assemblies. These areas are typical in nature and do not limit application of these products to those noted areas, but any and all details within construction that present similar air leakage characteristics should receive similar applications. Note following:
1. Window head, jamb, and sill areas.
 2. Junction of roof air/vapor barrier and wall air/vapor barrier.
 3. Floor-to-floor construction.
 4. Glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings.
- C. Inspect roof perimeter for air leakage paths such as fluted deck itself, truss and structural beam penetrations above and below top of wall. Use smoke tester kits to identify and locate leakage.
1. Use both one-component and two-component foam sealants in combination to create a continuous foamed-in-place seal between wall and roof air/vapor barrier.
 2. Where deck flutes run perpendicular to wall, foam open flutes completely out to fascia.
 3. Where closed flutes occur, punch flutes and inject foam through holes. Locate holes as close to wall as possible so that plane of injected and cured foam within closed flute is level with plane of exposed foam in open flutes.
 4. Where steel deck is parallel to wall, fill void with either one-component and two-component material, depending on gap size.
- D. Flashing and Sealant
1. Apply material within application limits of product manufacturer.
 2. Do not apply product on surfaces with standing water or frost.
 3. Avoid installing on days with a high probability of significant rainfall.
 4. Seal gaps greater than 1/4 inch in width with penetration filler prior to applying flashing.
 - a. If facer on board insulation is damaged, make note of affected area and apply additional spray over damaged area.
 - b. Replace damaged insulation, or repair facer flows with appropriate flashing as recommended by insulation manufacturer.
 5. Apply flashing and sealant to board joints, penetrations and other fenestration openings as required at material required application thickness.
 - a. Apply flashing 3 inches, plus or minus 1 inch wide over board insulation joints, with at least 1 inch of spray covers each side of joint.
 - b. Apply flashing and fasteners and washers along board insulation joints.
 - c. Install façade attachment system after flashing has been applied.
 6. Rough Openings: Apply flashing and sealant at least 3 inches onto face of insulation panel sheathing, and completely cover edge of insulation board; also spray at least 3 inch back onto rough opening substrate.

- a. It is recommended to cover back into rough opening at least 1 inch past the interior weatherseal.
- 7. Board Insulation or Substrate Penetrations: Apply flashing and sealant at least 2 inches onto face of insulation sheathing and at least 2 inches onto penetration or primary flashing substrate.
- 8. Use wet mil thickness gauge to ensure proper installation thickness.
 - a. Where consistently below minimum thickness, apply another layer to achieve proper thickness requirements.
- 9. Visually inspect for any areas missed and trowel on sealant as necessary.

3.4 INSTALLATION OF THERMAL AND AIR BARRIER AT COLD-FORMED METAL FRAMING

A. Insulation Installation (Polyisocyanurate Foam Board)

- 1. Install insulation in accordance with manufacturer's recommendations. Fasten to exterior face of exterior metal stud wall framing using sheathing manufacturer's recommended type and length screw fasteners and washers. Abut panels tightly together and around openings and penetrations.
 - a. Install sheathing panels horizontally with blue aluminum facing to exterior. Use maximum lengths to minimize number of joints. Locate edge joints parallel to and on framing. Center end joints over supports and stagger in each course. Provide additional framing wherever panel joints do not bear against framing, plates or sill members.
 - b. Fasten panels to each support with fasteners spaced 12 inches on center at perimeter and 16 inches on center in panel field. Set back perimeter fasteners 3/8 inch from edges and ends of panel units. Drive fasteners to bear tight and flush with surface of installation. Do not countersink. Perimeter fasteners can be detailed to bridge gap of abutting board joints due to 1.75 inch diameter washer used to fasten board to studs. Maximum of two board joints may be bridged per fastener. Install flashing joint tape at end and edge joints with sufficient hand pressure to ensure seal and in accordance with sheathing manufacturer's joint sealing recommendations.
 - c. Install flashing tape behind wall tie and mechanical fastening assemblies for rain screen claddings.
 - d. Seal sheathing joints and penetrations of sheathing in accordance with sheathing manufacturer's joint and penetration sealing recommendations.
 - e. After base flashing, which may include a termination bar running horizontally along top edge of flashing, is installed on exterior of insulated sheathing, install WEATERMATE Flashing 6 inch or 9 inch, with butyl rubber adhesive to exterior sheathing and lapped over top edge of base flashing.
 - f. Install self-adhered flashing or sealant tape in a shingle fashion over all joints. Overlap the joints in the tape by the width of the tape (i.e. 4 inch tape is overlapped 4 inch).
 - g. Repair all damage to boardstock air barrier. If the repair is large, cut out a section of the boardstock air barrier the width of the stud spacing. Install a section of new boardstock the same size as cut out. Seal any gaps with sealant foam. Install self-adhered flashing or sealant tape in a shingle fashion over all joints. For small holes, fill the small hole first with sealant foam then cover with self-adhered flashing, or sealant tape in a shingle fashion over all joints.

B. Spray Polyurethane Foam Installation

- 1. Preparation
 - a. Mask and cover adjacent areas to protect from overspray.
 - b. Apply primers for special conditions as recommended by manufacturer.
 - c. Cover wide joints with transition sheet membrane.
 - d. Clean work area prior to application of sprayed insulation.
 - e. Ensure that all stud cavity firestopping/blocking is installed prior to application of spray foam.
- 2. Application: Spray apply polyurethane foam in accordance with ASTM C1029 and manufacturer's installation guidelines; complying with preparation method.

- a. Apply spray polyurethane foam by picture framing around interior studs at insulated sheathing – cold-formed metal framing interface and one pass across all board joints and penetrations.
- b. Finish applying spray polyurethane foam with one pass not exceeding 1.5 inches in thickness. Two passes are acceptable to reach maximum thickness of 1.5 inch.
- c. If more than one layer is being applied, allow layer applied first to cool to max. Substrate temperature or less recommended by STYROFOAM Spray Polyurethane Foam CM Series.
- d. Avoid formation of sublayer air pockets.
- e. Avoid spray polyurethane foam in overlapping layers, in a manner to obtain a smooth, uniform surface. Total thickness 1.5 inches.
- f. Maintain 3-inch clearance around heating vents, steam pipes, recessed lighting fixtures and other heat sources.
- g. Do not spray polyurethane foam to inside of electrical junction boxes.
- h. Maintain a continuous layer of spray foam from floor to floor to roof to complete air barriers.
- i. Site Tolerances: Maximum variation in applied thickness – minus 1/4 inch, plus 5/8 inch.

3.5 INSTALLATION OF THERMAL AND AIR BARRIER AT MASONRY CAVITY WALL APPLICATIONS

- A. General: Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
 1. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- B. Insulation (Extruded-Polystyrene)
 1. Apply 2-inch diameter daubs of adhesive at each of 4 corners of board with one approximately in middle (total of 5) on inside face of insulation board.
 2. Fit insulation between wall ties and other obstructions with joints staggered providing 1/4 inch to 1/2 inch spacing at end joints.
 - a. Press units firmly against inside wythe of masonry or other construction.
 - b. Make insulation continuous.
 3. Extend insulation of envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- C. Fill all voids between insulation boards with single component insulating foam sealant to provide continuous air and vapor barrier.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Representative Inspections: Allow access to work areas and staging. Notify manufacturer in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Do not cover Work of this Section until testing and inspection is accepted. Arrange for site inspections to verify conformance with Manufacturer's instructions, and this section of project specification.
 1. Inspections and testing shall be carried out by manufacture to verify conformance with manufacturer's instructions and Quality Assurance Program. Inspections shall be at 5, 50, and 95% completion with written report.

3.7 PROTECTING AND CLEANING

- A. Protect air barrier materials from damage during installation and remainder of construction period, according to manufacturer's written instructions.
 1. Coordinate with installation of materials which cover air barrier assemblies, to ensure exposure period does not exceed that recommended by air barrier manufacturer.

- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to primary material manufacturer.

END OF SECTION 07 27 23

SECTION 07 42 13.23 – METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes metal composite (fire resistive) material wall panels (MCM), joints, attachment system components and miscellaneous materials as appropriate for the design of the project to provide a weather-resistant exterior cladding system.
- B. Related Sections:
 - 1. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal-faced composite wall panels.
 - 2. Division 07 Section "Sheet Metal Flashing and Trim" for field-formed flashings and other sheet metal work not part of metal-faced composite wall panel assemblies.
 - 3. Division 07 Section "Roof Specialties" for coordination with metal drip edge.
 - 4. Division 07 Section "Joint Sealants" for:
 - a. Silicone adhesive to secure retaining clip to face of composite wall panel.
 - b. Joint sealant between perimeter trim and surrounding materials.

1.2 DEFINITION

- A. Metal-Faced Composite Wall Panel Assembly: Metal-faced composite wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate metal-faced composite wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, sheathing, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
- B. Pre-installation Meeting: A/E will schedule and conduct meeting at Project site.
 - 1. Meet with Owner, A/E, testing and inspecting agency representative, metal-faced composite wall panel Installer, metal-faced composite wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal-faced composite wall panels including installers of metal roof assembly and soffits.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal-faced composite wall panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal-faced composite wall panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal-faced composite wall panel assembly during and after installation.
 - 8. Review wall panel observation and repair procedures after metal-faced composite wall panel installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal-faced composite wall panel and accessory.

- B. Shop Drawings: Submit shop drawings showing elevations and layouts, profiles, and product components, including anchorage, accessories, finish colors, and textures.
 - 1. Include details showing thickness and dimensions of the system parts, details of edge conditions, attachment system, corners, fastening and anchoring methods, locations of joints and gaskets, location and configuration of joints necessary to accommodate thermal movement and all trim and flashings.
 - 2. Provide signed and sealed drawings by a qualified Design Professional in the Project jurisdiction, of the MCM System showing conformance with the performance requirements and design criteria identified for this project.
 - 3. Accessories: Include details of following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.
 - b. Anchorage systems.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Metal-Faced Composite Wall Panels: 8-inches long by actual panel width. Include fasteners, closures, and other metal-faced composite wall panel accessories.
 - a. Composite Panels: Include four-way joint.
- D. Delegated-Design Submittal: For metal-faced composite wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.
 - 1. Show governing MCM types, mounting system including anchorages, connections, and fasteners. Indicate location, type magnitude, and direction of loads imposed on building structural frame.
 - 2. Analysis/calculations shall be signed and sealed by a qualified Design Professional in project jurisdiction that MCM system shows conformance with performance requirements and design criteria identified for this project.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Coordination Drawings: Exterior elevations, drawn to scale, on which following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Wall panels and attachments.
 - 2. Stud framing/furring/girts.
- B. Qualification Data: For Installer, professional engineer, and testing agency.
- C. MCM Manufacturer's Material Test Reports: Certified test reports showing compliance with specified performance requirements, and a third party listing documenting compliance to a comparable code section.
- D. MCM System Fabricator's Certified System Test Reports: Certified system test reports showing system compliance with specific performance characteristics or a third party listing documenting compliance to a comparable code section. Performance requirements shall be based on type of MCM systems provided:
 - 1. Wet System
 - a. Tested to AAMA 501 standard.
- E. Manufacturer's Instructions: Manufacturer's installation instructions.
- F. Sample Warranty: Copy of manufacturer's warranty stating obligations.

1.6 CLOSEOUT SUBMITTALS:

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Maintenance Data: For metal wall panels to include in maintenance manuals.

2. Warranties: Samples of special warranties.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 1. Installer shall have experience with similar sized MCM system projects. MCM system installer must be capable of providing field service representation during construction.
 2. MCM System Installer must be approved installer by a MCM Certified Fabricator for installation of their MCM System and have undergone proper training for specified system thereof.
- B. Regulatory Code Agencies Requirements: Provide composite fire rated panels which have been evaluated and are in compliance with local authorities with jurisdiction.
- C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Build mockup of typical wall and corner panel, as shown on Drawings; approximately one bay wide by one story high by full thickness, including supports, attachments, and accessories.
 - a. Include four-way joint for metal-faced composite wall panels.
 2. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.
 3. Approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal-faced composite wall panels, and other manufactured items so as not to be damaged or deformed. Package metal-faced composite wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal-faced composite wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg. F.
- D. Retain strippable protective covering on metal-faced composite wall panel for period of panel installation.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal-faced composite wall panels to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal-faced composite wall panel fabrication and indicate measurements on Shop Drawings.
- C. Project Schedule: Provisions in project schedule must accommodate time interval between field measurements and fabrication/installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-faced composite wall panel assemblies that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 1) Anodized Finish: Five plus 1 years from date of shipment.
 - c. MCM Material Integrity: Five (5) plus 1 years from date of shipment.
 2. Warranty Period: Two years from date of Substantial Completion, unless otherwise noted.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal-faced composite wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal-faced composite wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Design metal-faced composite wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Structural Performance: Provide metal-faced composite wall panel assemblies capable of withstanding effects of following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
1. Wind Loads: Determine loads based on following minimum design wind pressures:
 - a. Uniform pressure of 30 lb/sq. ft. unless otherwise indicated on Drawings.
 2. Deflection Movement: Provide installed MCM systems that have been designed to resist to wind loading, acting inward and outward, defined for project:
 - a. Perimeter Framing Deflection: Deflection of panel perimeter framing member shall not exceed $L/175$ normal to plane of wall where "L" is unsupported span of perimeter framing member.
 - b. Panel Deflection: Deflection of panel face shall not exceed $L/60$ at design load where "L" is unsupported span of panel.
 - c. Anchor Deflection: At connection points of framing members to anchors, anchor deflection in any direction shall not exceed 0.0625 inch.
 - d. At 150 percent pressure, no permanent deformation exceeding $L/1000$ or failure to structural members is permitted.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): Minus 20 to plus 180 deg. F ambient; 180 deg. F material surfaces.
 2. Fabrication, assembly and erection procedures shall take into account ambient temperature range at time of respective operation.

- E. System Requirements: (System Type Dependent)
 - 1. Wet System – (Tested to AAMA 501 Standard)
 - a. ASTM E 283 – Air Leakage: Not more than 0.06 cfm per ft² of wall area when tested at 6.24 psf.
 - b. ASTM E 331 – Static Water Penetration: When tested under static pressure at 12.0 psf minimum, for a time period of 15 minutes. MCM systems must have:
 - 1) No uncontrolled water leakage to room side of assembly when tested as defined by process.
 - c. AAMA 501.1 – Dynamic Water Penetration: When tested with a wall pressure equivalent to 12.0 psf for a time period of 15 minutes, MCM system must have:
 - 1) No uncontrolled water leakage to room side of assembly when tested as defined by assembly.
 - d. ASTM E330 – Structural Performance – MCM system must be engineered to meet project design loads, however MCM system must meet or exceed following criteria when tested to a minimum pressure of 30.psf:
 - 1) Deflections do not exceed limitations defined within section on Deflection and Thermal Movement.
- F. Fire-Resistive Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

- G. Fire Propagation Characteristics: Metal composite material wall panel system passes NFPA 285 testing.

2.2 METAL-FACED COMPOSITE WALL PANELS

- A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal-faced composite wall panels fabricated from two metal facings bonded to solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.
 - 1. Fire-Retardant Core: Noncombustible, with following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. Flame-Spread Index: 15 or less.
 - b. Smoke-Developed Index: 120 or less.
 - c. Flammability, Exterior, Non-Load-Bearing wall assemblies and panels, NFPA 285: Pass.
 - 2. Products: Subject to compliance with requirements, provide one of following:
 - a. Alucobond Plus; 3A Composites USA Inc.
 - b. Reynobond FR; Alcoa Inc.
 - c. Larson by Alucoil; Alucoil North America
 - d. Alcotex; Alcotex/FR.
 - 3. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for A/E's approval must be accompanied by "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch thick, coil-coated aluminum sheet facings.
 - 1. Panel Thickness: 0.157 inch, minimum.
 - 2. Core: Fire retardant, unless otherwise noted.
 - 3. Exterior Finish(s):
 - a. Two-coat fluoropolymer, where indicated.
 - 1) Color: As indicated on drawing Elevations.

4. Fire Performance: (Class A Material)
 - a. ASTM E 84: MCM shall have a flame spread index of not more than 25 when tested in maximum thickness intended for use.
 - b. ASTM E 84: MCM shall have a smoke developed index of not more than 450 when tested in maximum thickness intended for use.
 - c. Surface Flammability modified ASTM E108: Pass.
5. Bond Integrity: Test for resistance to delamination as follows:
 - a. MCM panels with a solid core of extruded thermal plastic.
 - 1) Peel Strength (ASTM D 1781): 22.5-inch lb/in minimum as manufactured.
 - 2) No degradation in bond performance after 8 hours of submersion in water at 212 degrees F or 21 days of immersion in water at 70 degrees F.
 - 3) Thermally bonded to core material in a continuous process under heat, pressure, and tension.
 - b. MCM panels with a high pressure injected liquid plastic core.
 - 1) Average Flatwise Tensile Strength (ASTM C 297): 400 psi. Individual values within a test group shall be within 154 percent of group average, or lowest test value is used.
- C. Attachment System Components: Formed from extruded aluminum.
 1. Include manufacturer's standard perimeter extrusions panel stiffeners, panel clips, and anchor channels.
- D. Attachment Assembly: Clip.

2.3 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653, G90 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panels systems.
- B. Subgirts: Manufacturer's standard C- or Z-shaped sections 0.064-inch nominal thickness.
- C. Zee Clips: 0.079-inch nominal thickness.
- D. Base or Sill Angles or Channels: 0.079-inch nominal thickness.
- E. Cold-Rolled Furring Channels: Minimum 1/2-inch-wide flange.
 1. Nominal Thickness: As required to meet performance requirements.
 2. Depth: As indicated.
 3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch.
 4. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch diameter wire.
- F. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous metal framing members to substrates.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide fabricator's standard MCM system accessories, including fasteners, clips, anchorage devices, and attachments for specific applications indicated on contract documents.
- B. Wall Panel Accessories: Provide components required for a complete metal-faced composite wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.

- C. Flashing and Trim: Formed from same material as metal composite materials panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal-faced composite wall panels.
- D. Fasteners/Attachment System Components: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal-faced composite wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
 - 1. Attachment System Components: Formed from extruded aluminum to meet specified design loads and system test performance according to each MCM System Fabricator's design. Galvanized cold formed steel clips or staggered aluminum angles are not acceptable for panel-to-panel attachment.
- E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain watertight; and as recommended in writing by metal composite material panel manufacturer.

2.5 FABRICATION

- A. Fabricators: Must be a Certified MCM Fabricator by Metal Construction Association (MCA) or be listed as an approved fabricator.
 - 1. Basis-of-Design: Design of metal composite wall panel is based on system type; EC-100, caulked-joint route and return barrier metal composite wall panel system, fabricated by East Coast Metal Systems, Inc. or a comparable product by one of the following:
 - a. Miller Clapperton, Inc.
 - b. Sobotec Ltd.
 - 2. Fabricators Requirements: To be listed as an approved fabricator provide following supporting documentation ten days prior to bid.
 - a. MCM System Fabricator shall demonstrate and offer within attested certification by at least one specified MCM manufacturer that they have fabricated; a minimum of 150,000 square feet of architectural walls per year, that are used as building weathering envelope, utilizing MCM of at least 4mm (0.157 inch) thickness.
 - b. System components shall be shop fabricated.
 - c. Fabrication of other types of panels or fabricator's goods is not considered as meeting above requirement.
 - 3. Product of other fabricators will be considered for acceptance provided they comply with material requirements and functional qualities of this Section. "Substitution Request Form" and complete technical data must be received by A/E at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- B. General: Fabricate and finish metal-faced composite wall panels and accessories at factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- C. Fabricate metal-faced composite wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- D. Metal-Faced Composite Wall Panels: Factory form panels in a continuous process with no glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
 - 1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
 - 2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.

3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
 4. Dimensional Tolerances:
 - a. Length: +/-0.079 inch @ 70 degrees F.
 - b. Width: +/-0.079 inch @ 70 degrees F.
 - c. Thickness: Plus or minus 0.008 inch.
 - d. Squareness: +/-0.079 inch @ 70 degrees F.
- E. System Type
1. Wet System: System must provide a wet seal (caulked) panel joints and must feature provisions to drain to exterior face of wall any leakage of water at joints and any condensation that may occur within wall cavity as tested per AAMA 501. Sealant type shall be as approved by MCM manufacturer.
- F. Attachment System Components
1. Formed from extruded aluminum as indicted to meet the specified design loads and system test performance according to each MCM System Fabricator's design.
 2. Panel stiffeners as required, shall be positively engaged in the perimeter extrusion or mechanically fastened to the perimeter extrusion and shall be secured to the rear face of the composite panel with silicone or high-strength double-sided bonding tape of sufficient size and strength to maintain panel's specified deflection under load. Structural calculations shall be provided to show the adequacy of this connection to resist the applied loads. Galvanized steel and MCM are not to be used as stiffener elements. Only panel stiffeners composed of extruded aluminum, or 300 Series stainless steel shapes shall be adequate.
- G. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal-faced composite wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal-faced composite wall panel manufacturer for application, but not less than thickness of metal being secured.

2.6 GENERAL FINISH REQUIREMENTS

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

D. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal-faced composite wall panel supports, and other conditions affecting performance of Work.
1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal-faced composite wall panel manufacturer.
 - a. Unless otherwise required by panel manufacturer, in writing, substrate shall be with a tolerance of 1/4 inch in 20.0 feet, on level, plumb, and location control lines as indicated and within 1/8 inch offset of adjoining faces of alignment of matching profiles tolerances are noncumulative.
- B. Examine roughing-in for components and systems penetrating metal-faced composite wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.
- C. For record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal-faced composite wall panel manufacturer's written instructions.

3.3 METAL-FACED COMPOSITE WALL PANEL INSTALLATION

- A. General: Install metal-faced composite wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of Work securely in place, with provisions for thermal and structural movement.
1. Commence metal-faced composite wall panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
 2. Shim or otherwise plumb substrates receiving metal-faced composite wall panels.
 3. Flash and seal metal-faced composite wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
 4. Install screw fasteners in predrilled holes.
 5. Locate and space fastenings in uniform vertical and horizontal alignment.
 6. Install flashing and trim as metal-faced composite wall panel work proceeds.
 7. Locate panel splices over, but not attached to, structural support. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 8. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 10. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

- B. Fasteners:
 - 1. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal-faced composite wall panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal-faced composite wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.
 - 1. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- E. Attachment System Installation, General: Install attachment system required to support metal-faced composite wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 - 1. Include attachment to supports, panel-to-panel joinery, and panel-to-dissimilar-material joinery, and panel-system joint seals.
 - 2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.
- F. Clip Installation: Attach panel clips to supports at each metal-faced composite wall panel joint at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-returned flanges of wall panels to panel clips with manufacturer's standard fasteners.
 - 1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants."

3.4 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal-faced composite wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal-faced composite wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Fabricator's Field Services: Provide fabricator's field service consisting of products use recommendations and periodic site visit for inspection of product installation in accordance with fabricator's instructions.
 - 1. Site Visits: At minimum provide following:
 - a. Pre-installation meeting.
 - b. For first 10 sq.ft. installed.
 - c. Final inspection of completed work.

3.7 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal-faced composite wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal-faced composite wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.
- B. After metal-faced composite wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal-faced composite wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
 - 1. Repair components of MCM system with minor damage such that repairs are not discernible at a distance of 10 feet from surface at a 80 degree angle per AAMA 2605.
- D. Verify weep holes and drainage channels are unobstructed and free of dirt and sealants.

END OF SECTION 07 42 43

SECTION 07 54 00 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Adhered thermoplastic membrane roofing system.
 - 2. Vapor retarder.
 - 3. Roof insulation.
 - 4. Cover board.
 - 5. Walkways.

- B. Related Sections include the following:
 - 1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Division 06 Section "Sheathing".
 - 3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
 - 4. Division 07 Section "Roof Specialties" for roof edge terminations.
 - 5. Division 07 Section "Joint Sealants" for sealants not directly associated with roofing.
 - 6. Division 22 Section "Facility Storm Drainage Piping" for roof drains.

1.2 REFERENCES

- A. American Society of Civil Engineers: Document ASCE 7, Minimum Design Loads for Buildings and Other Structures.

- B. American Society of Testing and Materials (ASTM)
 - 1. ASTM C168 – Standard Terminology Relating to Thermal Insulation.
 - 2. ASTM C177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 3. ASTM C209 – Methods of Testing Insulating Board, Structural and Decorative.
 - 4. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 5. ASTM C1289 – Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 6. ASTM C1303 – Standard Test Method for Estimating the Long Term Change in the Thermal Resistance of Unfaced Closed Cell Plastic Foams by Slicing and Scaling Under Controlled Laboratory Conditions.
 - 7. ASTM D1079 – Standard Terminology Related to Roofing and Waterproofing.
 - 8. ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 - 9. ASTM D2126 – Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
 - 10. ASTM D2842 – Standard Test Method for Water Absorption for Rigid Cellular Plastics.
 - 11. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 12. ASTM E96 – Standard Test Method for Water Vapor Transmission of Materials.
 - 13. ASTM E108 – Standard Test Methods for Fire Tests of Roof Coverings.

- C. National Roofing Contractors Association (NRCA) – Roofing and Waterproofing Manual.

- D. Sheet Metal and Air Conditioning Contractors National Association, Inc., (SMACNA) – Architectural Sheet Metal Manual.

- E. Underwriters Laboratories (UL) – Roofing Materials and Systems Annual Directory.

- F. ANSI/SPRI WD-1: Wind Design Standard Practice for Roofing Assemblies.

- G. ANSI/SPRI ES-1: Wind Design Standard for Edge Systems used with Low Slope Roofing Systems.
- H. National Fire Protection Association (NFPA): NFPA 241-Safeguarding Building Construction Operations.
- I. Environmental Protection Agency (EPA): EPA Method 9045.

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. Positive Drainage: The drainage condition in which consideration has been made during design for all loading deflections of the deck, and additional roof slope has been provided to ensure drainage of the roof area within 48 hours of rainfall, during ambient drying conditions.
- C. Roof System: A system of interacting roof components generally consisting of a membrane, roof insulation and air or vapor retarder (if present) (not including the roof deck) designed to weatherproof a structure and improve thermal resistance.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Conduct meeting at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." A/E will schedule and conduct meeting. Review methods and procedures related to roofing system including, but not limited to, the following:
 - 1. Meet with Owner; A/E, 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.
 - 10. Deviations from the project specifications or the approved shop drawings are not permitted without prior written approval by roofing membrane manufacturer, the Owner, and the A/E.
- B. Sequencing
 - 1. Work shall begin only after openings and penetrations are in place and adjacent work required for a complete tie-in is in place. This includes masonry with special attention being given to roof-to-wall transitions. Work shall not begin:
 - a. Before the "Preinstallation Meeting" has occurred
 - b. Until conditions exist necessary for successful completion of roofing.
 - c. Without presence and approval of manufacturer's representative.
 - 2. Prior to and during application, all dirt, devices and dust shall be removed from surfaces by vacuuming, sweeping, blowing with compressed air or similar methods.

3. Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Applicator shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas.
4. After work on roof is started, no traffic will be permitted on the roof other than necessary for the roofing application and inspection. Materials shall not be piled on to the roof to the extent that design live loads are exceeded. Roofing materials shall not be transported over unfinished or finished roofing or existing roofs.
 - a. Work shall begin at the furthest point from the designated spot where materials are shipped to the roof.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Submit specifications, installation instructions, and general recommendations from roofing materials manufacturer for type of roofing required. Include data substantiating that materials comply with requirements of this specification, inclusive of accelerated weathering data.
 1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing or SPRI's Directory of Roof Assemblies listing.
 2. Storage and handling requirements and recommendations.
- B. Shop Drawings: Submit to membrane manufacturer for review and comments before issuing to A/E. Include plans, elevations, sections, details, and attachments to other Work.
 1. Layout and thickness of insulation, fastener type and length.
 2. Perimeter and penetration details, including base flashings and membrane terminations.
 3. Tapered insulation, including slopes.
 4. Insulation fastening patterns for corners, perimeter, and field-of-roof locations.
 5. Flashing Conditions: Show all roofing conditions, include location and type of all penetrations, including but not limited to drains, perimeter conditions, roof penetration conditions, expansion joints, etc. The shop drawings must be reviewed and approved by the roof system manufacturer to assure the completed installation will meet the manufacturer's warranty requirements.
 6. Wind Uplift Securement: Provide roof plan(s) marked-up to indicate extent of roof corner and roof perimeter areas, inclusive of fastener spacing/density, indicating compliance with wind uplift performance requirements. This drawing must be reviewed and approved by the roof system manufacturer to assure the completed installation will meet the manufacturer's warranty requirements and the "Performance Requirements" listed in this specification.
 7. Tie-in with air barrier, where air barrier is required.
- C. Samples: For the following products:
 1. Walkway pads or rolls, of color required.

1.6 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Installer Qualification Data/Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system and qualifies to receive manufacturer's 20 year, no-dollar-limit warranty.
- B. 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, including uplift resistance.
 2. Submit insulation fastening patterns for corner, perimeter, and field-of-roof locations to meet performance requirements.
 3. Submit an intent to warrant, executed by authorized representative of system manufacturer, indicating that manufacturer has reviewed drawings, specifications, and conditions affecting the work and, and proposes to provide warranties as referenced herein without further stipulation.

4. Submit a letter from the roof membrane manufacturer certifying the proposed roofing assembly, compatibility of materials and total R-value of insulation.
- C. Sample Executable Warranty: Copy of manufacturer's warranty stating obligations, remedies, limitations, and exclusions before starting work.
 1. Contractor shall submit manufacturers approved "Pre-Installation Notice" (PIN) to A/E.
- D. Reports: Copy of roofing system manufacturer's inspection report of complete roof installation including any "Punch List" items.

1.7 CLOSEOUT SUBMITTALS:

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 1. Maintenance Data: For roofing system to include in maintenance manuals.
 - a. Roofing membrane manufacturer shall submit a Roof Maintenance and Inspection Manual with warranties and project closeout submittals. (Final payment will not be made until roof maintenance manual is submitted.)
 - b. Roof Maintenance and Inspection Manual shall include:
 - 1) Cover letter recommending to the Owner that 2 roof maintenance inspections should be conducted per year.
 - 2) Table of Contents.
 - 3) Visual observation checklist indicating specific flashings and details to be observed. Include items such as base flashing seams, reglets and counterflashings, roof edge flashings, roof penetration flashings, roof curb flashings, boot flashings, roof drain areas, parapet wall flashings, copings, roof membrane seams, skylight flashings, etc. Applicable items shall be listed per project.
 - 4) Copies of "Project Record" roofing details.
 - 5) Roof plan indicating penetrations, detail locations, roof drains, and seams.
 - 6) Final inspection report.
 2. Warranties: Special executable warranties specified in this Section. When warranties are delivered to the Owner, a cover letter shall be included directing the Owner to inform (copy) the manufacturer as well as the Contractor, when reporting roofing problems, regardless of when they occurred during the warranty period, including any "Punch List" items.
 - a. Contractor shall submit manufacturers approved "Pre-Installation Notice" (PIN) to A/E.
 3. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.8 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer Qualifications: A qualified manufacturer that is UL listed or listed in FM Approvals' RoofNav or listed in SPRI's Directory of Roof Assemblies for roofing system identified to that used for this Project.
 - a. Manufacturer must be in addition to attending Pre-Installation Meeting and final inspection participants in Field Quality Control inspections to verify products are being installed as recommended. Inspections shall be schedule at critical points to verify membrane perimeter and penetrations are properly terminated per written instructions and submittal documents. Refer to "Field Quality Control" article for additional manufacturers inspections.
 - 1) Manufacturer's inspector shall be a field technical inspector employed by the manufacturer not engaged in the sale of products. Inspector shall be experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and to determine installer's compliance with the requirements for the Project and the manufacturer's warranty certification.

- 2) Manufacturer's inspector services shall include examination of substrates and conditions prior to membrane installation including verification of fastening of substrate to structure. Inspections shall also include observation of membrane installation, detailing, flashing, in progress work, and complete portions of the work.
 - 3) Manufacturer's inspector may not approve a roof installation as warrantable or acceptable if any current condition of the application of the new system does not meet the current published manufacturer's standards or submittals without review by A/E. The warrantability issue is part of the Contract Documents and does not take precedent over all contract requirements.
 - 4) Manufacturer's inspector shall provide a written report to the A/E, roofing contractor, existing conditions on day of inspection, work occurring, observation of work, workmanship and materials stored at the project site. A minimum of 5 pictures of roofing work shall be included in the reports. Reports shall be submitted within 7 days of the site visit.
2. 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 install and receive a manufacturer's 20 year (or manufacturer longest period for specified product) no-dollar-limit warranty. Installer must verify this approval with a letter from manufacturer and supply letter even if a lesser warranty is specified.
- a. The Contractor shall obtain from the roofing manufacturer copies of each roof inspection and furnish a copy to the A/E. The Contractor shall inform the roofing manufacturer, with regard to warranties, that warranties shall be issued, based upon the acceptance of the roofing work, and that deficiencies noted on inspection reports have been corrected. The manufacturer shall not refuse or restrict the provisions of its warranty, based upon deficiencies noted on inspection reports, especially any report that may not have been furnished to the A/E. Inspections shall be a minimum of 3 and scheduled randomly (no prior notification) and selection of the roofing manufacturer's inspector(s) shall not be influenced by the roofing subcontractor's preferences. The A/E will not approve final payment of roofing work until final and interim inspection reports and warranty are in hand. The A/E's representative shall accompany the manufacturer's inspector and Roofing Installer during final inspection prior to issuing manufacturer's warranty.
 - b. The roofing installer shall have on the job whenever roofing work is being done, a foreman/supervisor with a minimum 3 years experience in the type of roofing specified or the roofing manufacturer's technical field representative and provide adequate number of experienced workman regularly engaged in this type of work who are skilled in the application techniques of the materials specified.
3. Roofing and associated work shall be performed by a single firm called the "Installer" in this Section, so that there will be undivided responsibility for the specified performance of components parts including, but not limited to, the following (even through some parts may be subcontracted to others):
- a. Division 06 Section "Miscellaneous Rough Carpentry": For wood insulation shops, wood nailers, and blocking required for installation of new roof and sheet metal.
 - b. Division 07 Section "Sheet Metal Flashing and Trim."
 - c. Division 07 Section "Roof Specialties."
- B. Source Limitations: Obtain components, including roof insulation and fasteners, for membrane roofing system from or approved by roofing membrane manufacturer in writing.
- C. There shall be no deviations made from this specification or shop drawing without prior written approval of the A/E. Any deviation from the manufacturer's installation procedures must be supported by a written certification on the manufacturer's letterhead and presented for the A/E's consideration.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
 - 1. All materials delivered from manufacturers and suppliers should be carefully inspected at the time of delivery and examined during unloading. Manufacturers' product labels should be intact. Any damaged or unsuitable material should be rejected. Material that has been exposed to weather in transit or storage should be examined carefully for deterioration and damage.
- 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.
 - 2. Lids should be secured on cans of stored material.
 - 3. Water-based materials such as asphalt emulsions, acrylic coatings and water-based adhesives should be protected from freezing.
 - 4. Solvents, adhesives, and sealants should be stored at proper temperature. Read instructions contained on adhesive canister for specific storage instructions.
 - 5. Store seam tapes and adhesives above 60 degrees F, unless otherwise recommended by manufacturer.
- 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.
 - 1. When moisture-sensitive materials are stored outside, they shall be placed on pallets or platforms that are raised off the ground or roof deck (at least 4 inches). Materials sensitive to moisture should be covered with water-resistant coverings that have been properly secured. Coverings that are "breathable," such as water resistant canvas tarpaulins are preferred. Factory applied shrouds used for shipping alone are not acceptable. Cover top and sides of materials and secure cover. Remove wet products from project site.
 - a. During inclement seasons, or extended periods (two weeks) it is suggested that moisture sensitive materials be stored in vans or enclosed areas protected from moisture or elevated humidity.
 - b. Materials determined by A/E to be damaged or to have been subjected to adverse conditions shall be removed and replaced at contractor's expense.
 - 2. Protect insulation against concentrated loads, and standing loads exerting a force in excess of 50 percent of the materials compressive strength.
 - 3. Do not expose foam core to excessive heat, sparks, or open flame.
- D. Single-ply sheet materials may be stored as shipped with rolls laying horizontally or as recommended by manufacturer.
 - 1. When rolled materials are stored, the storage substrate should be swept to rid the surface of loose gravel, sharp objects and other debris that could damage the membrane material.
 - 2. Cover with tarps so moisture does not gather in the rolls. Unvented polyethylene tarpaulins are not accepted due to the accumulation of moisture beneath the tarpaulin in certain weather conditions that may affect the ease of membrane weld ability.
- E. Provide continuous protection of products during delivery, storage, handling, and application.
- F. Do not store roofing materials in concentrated areas of roof deck.
 - 1. Stored material should be raised up off the roof surface out of any standing water.
- G. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1. Average live loads on the roof during the work shall not exceed twenty pounds per square foot at any time.

H. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Closely follow precautions/instructions outlined on container or supplied by manufacturer/supplier.

1. Liquid propane (LP) gas containers shall be in an upright position at all times.
 - a. Comply with NFPA 58 "Standard for the Storage and Handling of Liquefied Petroleum Gases" as well as appropriate publications of the National LP Gas Association.

1.10 FIELD CONDITIONS

A. Weather Condition Limitations

1. Proceed with roofing and associated work only when weather conditions will permit unrestricted use of materials and quality control of the Work being installed, complying with the requirements and with the recommendations of the roofing materials manufacturer.
 - a. Proceed only when the Installer is willing to guarantee the work as required and without additional reservations and restrictions.
2. Apply in dry weather on a dry deck only. Where rain or inclement weather occur during application, the Work shall stop and not resume until the weather has cleared and the deck is dry.
 - a. When membrane roofing materials are applied, entrapment of moisture should be prevented. Moisture in or on materials may cause membrane problems. If precipitation occurs before completely installing the roof membrane, the membrane surface in the immediate work area and the substrate should be dried or allowed to dry before work resumes.
3. Only as much roofing as can be made weathertight each day, including all flashing and detail work, shall be installed.
 - a. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.
4. Cold Weather
 - a. When the outside temperature is below 40 deg F, certain combinations of temperature and humidity may cause condensation on the surface of solvent-based adhesives and primers. If this condition occurs, discontinue the application. When the ambient air conditions no longer cause condensation on adhesive surfaces and the membrane is clean and dry then re-apply additional adhesive or primer and proceed.
 - b. The consistency of sealants, adhesives and primers will begin to thicken as the temperature drops. To minimize this, the following is recommended:
 - 1) Start work with sealants, adhesives and primers that have been stored between 60 and 80 deg. F. Insulated and heated boxes may be helpful.
 - 2) Complete test areas to determine if conditions will cause problems such as condensation with the application of the materials.
 - 3) Stop the operation or change to another warm container when material becomes too thick to properly apply.
 - c. When the outside temperature is below 40 deg., installation of the roofing system may require additional application procedures, consult with manufacturer:
 - 1) Ensure that the roof surface is dry. Moisture, even trace amounts, may cause poor adhesion, and may lead to moisture entrapment within the roofing system.

B. All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.

- C. The applicator shall follow all safety regulations as required by OSHA and any other applicable authority having jurisdiction.
- D. Precautions shall be taken when using adhesives at or near rooftop vents or air intakes. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odor while ventilating the building. Keep lids on unused cans at all times.
- E. Membranes are slippery when wet or covered with snow, frost, or ice. Working on surfaces under these conditions is hazardous. Appropriate safety measures must be implemented prior to working on such surfaces. Always follow OSHA and other relevant fall protection standards when working on roofs.
- F. Construction Traffic: Construction site traffic from all trades should be limited to designated areas and walkways. Completed roof membranes are not suitable as work platforms or staging areas for other trades. If construction traffic is anticipated or inevitable, the use of temporary roofs can act as a sacrificial traffic surface, allowing for construction traffic and abuse until the primary weatherproofing membrane is installed.

1.11 WARRANTY

- A. Special Total System 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 membrane accessories, roof insulation, fasteners, cover boards, substrate board, vapor retarder, and other components of membrane roofing system, including metal work i.e. coping and roof edge-specialties.
 - 2. The warranty shall guarantee the roof membrane system at wind speeds up to 90 mph measured at 10 meters above ground.
 - 3. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
 - 4. Warranty Period: 20 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 for product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Obtain components, including roof insulation and fasteners, for membrane roofing system from or approved by roofing membrane manufacturer in writing.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacturer, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
1. Accelerated Weathering: Roofing system shall withstand 2,000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272 or the "Resistance to Foot Traffic Test" in Section 5.5 of FM 4470.
- 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. Roofing System Design: Provide a membrane roofing system that is listed on IBC ES-Reports or is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7 and also tested in accordance with FM 4474, UL 580, or UL 1897.
- D. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1987;
1. Field-of-Roof Uplift Pressure (Zone 1): 40.1 lbf/sq.ft.
 2. Perimeter Uplift Pressure (Zone 2): 67.3 lbf/sq.ft.
 3. Corner Uplift Pressure (Zone 3): 101.2 lbf/sq.ft.
- E. Polyisocyanurate Insulation
1. Compressive Strength: 20 psi min.
 2. Dimensional Stability – maximum dimensional change after installation (inches).
 - a. Length: +/- 1/8
 - b. Width: +/- 1/8
 - c. Thickness: +/- 1/16
 - d. Squareness: 1/16
 - e. Flatness: 1/16
 3. Moisture Vapor Transmission: ASTM E96, <1 perm.
 4. Water Absorption: ASTM C209, <1 percent by volume.
 5. Flame Spread: ASTM E84, <50.
 6. Service Temperature: Minus 100 degrees to 250 degrees F.
 7. Smoke Developed: ASTM E84, <450.
 8. Acidity: EPA Method 9045, 6 pH minimum, 8 pH maximum.
 9. Aged R-Value per Inch: ASTM C177 and C518, 5.6 R.
- F. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency, unless otherwise noted.

2.3 PVC ROOFING MEMBRANE

- A. PVC Sheet: ASTM D 4434, Type III, fabric reinforced, unless otherwise noted.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. SureFlex PVC; Carlisle SynTec Systems.
 - b. EverGuard PVC; GAF Materials Corporation.
 - c. Versiflex PVC; Versico.
 - d. JM PVC SD Plus; Johns Manville, Inc.
 - e. Sikaplan; Sika-Sarnafil Inc.
 - f. Sentinel P-Series; Soprema
 - g. Duro-Tuff; Duro-Last Roofing, Inc.
 2. Membrane Thickness: 60 mils.

3. Exposed Face Color: White.

2.4 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: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane, unless otherwise noted.
- C. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- D. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
 1. Use only where indicated. In areas where metal counterflashing or surface mounted reglets are used they must be sealed with a sealant to prevent moisture migration behind the flashing.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals Corrosion Test, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
 1. Mixing metal types and methods of contact shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. All concrete fasteners and anchors shall have a minimum embedment of 1-1/4 inch and shall be approved for such use by the fastener manufacturer. All miscellaneous wood fasteners and anchors used for flashings shall have a minimum embedment of 1 inch and shall be approved for such use by the fastener manufacturer.
 2. Pullout Value: Fastener shall provide a minimum pullout of 450 pounds.
 3. Static Backout Resistance: Fastener shall provide a minimum static backout resistance of 10 inch pounds.
 4. Where fasteners will be in contact with wood treated with preservative chemicals, provide fasteners and anchorage with hot dip zinc coating of G90 complying with ASTM A153 or of Type 304 or 316 stainless steel.
- F. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.
 1. Water Cut-Off Sealant: Butyl-based, non-curing, non-hardening sealant.
 - a. Manufacturers:
 - 1) Sikalastomer – 511; Sika Corporation.
 - 2) Acryl-R SM 5430; Schnee-Morehead.
 - 3) Rubex Non-Skinning Butyl Sealant; Edge Adhesives.
 2. Sealant: 1 or 2 component polyurethane-based sealant meeting ASTM C 920, Type S, Grade NS, Class 35, Use NT, M, A, G, and I. Manufacturer-approved primers are required. Color to match adjacent material.
 - a. Manufacturers
 - 1) MasterSeal NP 1; MBCC Group.
 - 2) Permathane; Schnee-Morehead.
 - 3) Sikaflex-1a; Sika Corporation.
 3. Sealant Primers: Sealant primer is a quick-drying solvent-based primer for priming joints and substrates before the application of sealants.
 - a. Manufacturers
 - 1) Sonolastic Primer 733; MBCC Group.
 - 2) Sikaflex Sealant/Admixture Primer; Sika Corporation.
 - 3) Primer; Schnee-Morehead.
 4. High Temperature Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, A, and O with a service temperature up to 300 degrees F. For use in through-penetration firestops.

2.5 AIR AND VAPOR BARRIER

- A. Air and Vapor Barrier: Provide one of the following as recommended by membrane manufacturer for compatibility in roofing assembly indicated.
1. Self-Adhering-Sheet Air and Vapor Retarder: ASTM D 1970, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil-total thickness; maximum water vapor permeance rating of 0.1 perm and air permeability of less than 0.04; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
 2. Self-Adhering-Sheet Air and Vapor Retarder: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil total thickness; maximum water vapor permeance rating of 0.1 perm and air permeability of less than 0.04; cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
 3. A 106 mil thick self-adhered SBS polymer modified bitumen vapor retarder/air barrier with a non-woven polyester mat reinforcement and fine mineral aggregate (sand) topside.
- B. Provide adhesive/primer supplied by air and vapor barrier manufacturer for adhesion to concrete or masonry surfaces.

2.6 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.
1. Insulation must be manufactured by or approved in writing by membrane manufacturer for system specified. Insulation must meet requirements for manufacturers total system warranty requirements and comply with FM 4450 or UL 1256 and approved for use in FM Approvals' RoofNav listed roof assemblies or approved for use in SPRI's Directory of Roof Assemblies listed roof assemblies.
- B. Polyisocyanurate Board Insulation: ASTM C 1289-11A, Type II, Class 2 Grade 2 min., coated polymer bonded glass fiber mat facer on both major surfaces. Facers shall be non-organic biological growth resistant. Provide Grade 3 when required by manufacturer to meet Performance and Warranty requirements.
1. (LTTR) Thermal resistance of insulation shall be calculated as 5.6 per inch.
 2. Nominal total thickness, 4 inches minimum, unless otherwise noted.
 - a. Bottom Layer: 2 inch, minimum.
 3. Size: Restrict boards installed in adhesive to 4 foot by 4 foot.
- C. Tapered Insulation (Field-of-Roof): Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.
1. Material: Match roof insulation.
 2. Polyisocyanurate Insulation
 - a. Minimum Thickness: 4 inches, unless otherwise noted.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
1. Slope: 1/2 inch per foot, unless otherwise indicated on Drawings.

2.7 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

- B. Fasteners: Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FM Approvals Corrosion Test, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer. The type of fastener shall be appropriate for the substrate to achieve maximum withdraw and anti-corrosion characteristics. The membrane manufacturer approved fasteners shall also meet the following requirements:
1. FM 4470 SPRI Corrosion Test Procedure and Guidelines for Roofing Fasteners. To pass, the fasteners shall not accumulate more than 15 percent red rust after the "required number cycles" in the Kesternich cabinet.
 - a. FM and SPRI recommended number, but in no case shall it be less than 15.
 2. Pullout Value: Fastener shall provide a minimum pullout of 450 lbs.
 3. Static Backout Resistance: Fastener shall provide a minimum static backout resistance of 10-inch pounds.
 4. Steel Deck
 - a. Fasteners to have self-drilling tip. Fastener tip shall be capable of cutting steel deck material of 20 gauge thickness at point of steel deck segment overlap without damage to the fastener tip.
 - b. Fasteners shall be installed in high flute of metal deck with a minimum of three-quarter inch (3/4 inch) penetration. Fasteners shall not extend past the bottom of the metal deck.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
1. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- D. Cover Board: Provide one of the following coverboards as approved by roofing manufacturer for system specified:
1. ASTM C 1177, glass mat, water resistant gypsum substrate (primed). Facers shall be non-organic biological growth resistant).
 - a. Manufactures:
 - 1) DensDeck Prime with EONIC Technology; Georgia-Pacific Gypsum.
 - 2) DEXcell FA; National Gypsum.
 - 3) GlasRock Roof Board; CertainTeed Corporation.
 - 4) Securock UltraLight Coated Glass-Mat Roof Board; USG
 2. High-Density Polyisocyanurate: ASTM C1289, Type II, Class 4, Grade 2. High-density polyisocyanurate technology bonded-in-line to mineral-surfaced, fiber glass reinforced facers with greater than 120 lbs. of compressive strength.
 - a. Thickness: 1/4-inch minimum. Provide 1/2-inch thickness where required to meet assembly or warranty requirements.
 3. Not Acceptable: Do not substitute either cellulosic fiber (ASTM C208), Oriented Strand Board, or fiber-reinforced gypsum roof board (ASTM C1278).
- E. Sprayed-Polyurethane Foam Sealant: 1 or 2 component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 16/cu.ft. density; flame spread index for 25 or less according to ASTM E 162; with primer and non-corrosive substrate cleaner, if recommended by foam sealant manufacturer.
1. Provide single-component polyurethane sealant low-expansion sealing gaps less than 1/2 inch.
 2. Provide one component foam for voids from 1/4 to 2 inches.
 3. Manufacturers
 - a. Dow Chemical Company
 - 1) Great Stuff Pro Gaps and Cracks; gap \leq 1/2 inch
 - 2) Froth Pak Foam Sealant; gap \leq 1/2 inch
 - b. Convenience Products
 - 1) Home Seal; gap \leq 1/2 inch
 - c. FOMO Products
 - 1) Extreme; gap \leq 1/2 inch
 - 2) Handi Foam; gap \leq 1/2 inch

- d. Hilti Corporation
 - 1) CF810; gap \leq 1/2 inch
- F. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resistant, surface-textured walkway pads or rolls, approximately 30- to 39-inches wide by at least 0.072-inch thick, and acceptable to membrane roofing system manufacturer.
 - 1. Color: Contrasting with roof membrane.

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. Material manufacturers printed installation instructions are available for information and review.
 - 2. Safety precautions and safety data sheets (SDS's) are available during application.
 - 3. Specified materials and specified quantities, as verified by on-site inspection of product labels, are at the project site and are usually suitable for application (e.g., packaging not damaged, labels intact).
 - 4. Materials are stored according to the manufacturers recommendations (e.g., proper temperature, covered, off ground, on pallets).
 - 5. Equipment is in good working order and functioning properly.
 - 6. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 7. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation and have been installed in areas to receive roofing.
 - 8. Verify work required for complete tie-in is in place. This includes masonry with special attention given to roof to wall transitions.
 - a. Verify that all counterflashing receivers, curbs, etc., are constructed in such a manner as to provide a minimum 8 inch base flashing height measured from the finished roof's surface to the top of the base flashing membrane.
 - 9. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Division 05 Section "Steel Decking."
 - 10. Drainage patterns for proper roof membrane installation have been identified.
 - 11. Verify all surfaces are smooth and free of dirt, debris and incompatible materials and free of water, ice and snow.
 - 12. Verify and damaged sections of cementitious wood-fiber decks have been repaired or replaced.
 - 13. Verify against cementitious wood-fiber panels are vertically aligned to within 1/8 inch.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Review "Performance" and "Warranty" requirements with membrane manufacturer to ensure compliance before beginning roofing work.
- B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- C. 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.
 - 1. Roof deck must be free of ponding water within 48 hours of rainfall. Use corrective measures to provide positive drainage.

- D. 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.
 - 1. When completion of flashings and terminations is not completed by the end of each workday, provisions must be provided to temporarily close the membrane to prevent water infiltration. Phased roofing is not acceptable.
 - 2. Temporarily seal loose membrane edge down slope so that the membrane edge will not buck water. Caution must be exercised to ensure that membrane is not temporarily sealed near drains in such a way as to promote water migration below membrane.

3.3 APPLICATION, GENERAL

- A. Application of the roofing products for installation shall be in accordance with the roofing material manufacturer's written instructions, for installation procedures and requirements not addressed in manufacturer's written instructions comply additional requirements of the project specifications and drawings, including recommendations of NRCA, SMACNA, including FM Approvals' RoofNav SPRI's Directory of Roof Assemblies listed assembly requirements, and FM Global Properties Loss Prevention Data Sheet 1-29. Material manufacturer's recommendations related to weather (temperature, moisture, and humidity), surface preparation, and shelf life must be observed.
- B. Only install as much roofing as can be made weathertight each day, including all flashing work.
 - 1. Where possible, roof membrane panels shall be installed in such a manner as to create water-shedding seams.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing systems at end of work day or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie into existing roofing to maintain weathertightness of transition.
- D. Dry Surfaces: All surfaces to receive new insulation, membrane, or flashings shall be thoroughly dry.
 - 1. Metal deck surface to receive substrate board or insulation shall be thoroughly dry. Should surface moisture occur, the Contractor shall provide the necessary equipment to dry deck surface prior to application of roofing components.
 - a. This is acceptable for metal roof deck only. Drying of roofing components including substrate board, insulation, and cover boards is not acceptable. If any of these products have moisture in them, or have had moisture on them they shall be removed and replaced.
 - b. Roof decks shall be rigid, tight, dry, and clean of dust or debris. Now work shall start without testing of deck dryness at the beginning of each work day or period. It shall be the responsibility of the Contractor to maintain the deck in the proper and acceptable condition of application of the roof covering.
 - 1) Installer shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Applicator shall report any such blockages.
- E. All new and temporary construction, including equipment and accessories, shall be secured in such a manner, at all times, as to preclude wind blow-off or wind damage.
- F. Temporary water stops shall be installed at the end of each day's work, and shall be removed before proceeding with the next day's work. Temporary water stops shall be constructed to withstand protracted periods of inclement weather. Water stops shall be compatible with all materials and shall not emit dangerous or incompatible odors.

- G. The Contractor is cautioned that the roof membrane may be incompatible with certain substances. Such materials shall not come into contact with the roof membrane at any time. If such contacts occur, the material shall be cut out and discarded. The Contractor shall consult material manufacturer with respect to material compatibility precautions, and recommendations.
- H. If any unusual or concealed condition is discovered, stop the work and notify the A/E immediately in writing.
- I. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified.
- J. Quality Control (During Application) Checklist
 1. Weather and job conditions are suitable for the application.
 2. Substrate is sufficiently dry and suitably prepared to receive the insulation and roof membrane.
 3. Insulation and cover boards, if applicable, are butted together, as required, with joints staggered and offset if more than one layer is being used.
 4. Insulation is firmly attached with specified type and number of fasteners, or embedded in adhesive to substrate or underlying insulation as specified.
 5. Temporary water cut-offs are installed at the end of each day's work as required.
 6. Membrane sheets are installed to side laps and end laps that buck water are minimized.
 7. Perimeter membrane fastening complies with specifications and manufacturers' requirements.
 8. Membrane flashings are installed along with each day's completed roof area.
 9. In high-traffic areas, protection board is being used over newly completed membrane.
 - a. Roof is not being abused by other trades.

3.4 AIR AND VAPOR BARRIER INSTALLATION

- A. Air and Vapor Barrier Installation
 1. All surfaces must be clean, sound, dry, and free of loose materials or contaminants with as water, frost, ice, oil, and grease that would interfere with proper adhesion and compromise the performance of the product.
 2. Apply air and vapor barrier from high to low points in a shingle fashion, so that the laps will shed water. Overlap edges by at least 2-1/2 inches. End laps should be staggered. Position membrane carefully so as to avoid fish-mouths and wrinkles. Immediately after installation, roll the membrane with a 100 pound roller wrapped in a resilient material.
 - a. On steel decks install a 6 inch by 42 inch metal plate under the end lap to support the membrane between the steel flutes. Stagger the end laps by at least 12 inches.
 3. Inspect all membranes for tears, punctures, fish-mouths, blisters, and voids due to misalignment at seams. Remove damaged membrane. Apply a new section of membrane extending at least 6 inches on to underlying adhered membrane on all sides. Firmly roll repaired area with a 2 inch hand roller to ensure a good seal.
- B. Completely seal vapor retarder at terminations (perimeter), obstructions, and penetrations to prevent air movement into membrane roofing system.
 1. Turn vapor retarder up parapet, prime and adhere to substrate.
 2. Apply manufacturer's mastic to seal around penetrations, T-joints, and fishmouths. Use a trowel to mound the mastic around the penetrations to seal the opening. Do not apply mastic where it may come into direct contact with the membrane.

3.5 INSULATION AND COVER BOARD INSTALLATION

- A. Comply with roofing system manufacturer's written instructions for installing roof insulation, including warranty requirements for installing insulation.
 1. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

2. Size: Restrict boards installed in adhesive to 4 foot by 4 foot.
- B. Roof Insulation – General: Lay in multiple layers. Edges shall be butted to provide moderate contact but not deformed or placed in surface compression. Neatly cut and fit insulation around projections and vertical surfaces. Edges shall be mitered at ridges and elsewhere to prevent open joints or irregular surfaces. Stagger end joints not less than 12 inches in adjoining courses of base course. Stagger joints in succeeding layers with joints of layer below, stagger joints not less than 24 inches in adjacent rows.
1. Insulation shall be installed in multiple layers except a single layer may be used for one board width, around drains, if thickness at drain is 2-1/2 inches or less.
- C. Install tapered insulation under area of roofing to conform to slopes indicated. Tapered insulation combined with tapered saddles and drainage crickets shall achieve positive drainage. Tapered saddles at a 1/2 inch per foot slope shall be placed between drains, and crickets shall be placed on the up slope side of mechanical, skylight, and other curbs to provided positive drainage. Mechanical units should not restrict flow of runoff water.
1. Refer to NRCA Roofing and Waterproofing Manual – 2011, Figure 10-7, “Guide for Crickets and Saddles” and Figure, “Guide for "Crickets.”
 2. Tapered insulation shall be installed between the bottom and top layer of flat stock insulation. This will prevent stepped transitions from occurring at the edge of tapered insulation boards.
 3. Tapered insulation should originate at the valley line/low point of the roof in lieu of the center of the roof drains. The structure often causes the roof drains to be offset from the valley line/low point of the roof. Saddles/crickets shall provide positive slope towards drains and not allow ponding to occur in valley lines.
 4. Use tapered insulation to provide a 4 by 4 foot square minimum sump centered on drains. 8 by 8 foot square sump centered on drains is preferred.
 - a. 8 by 8 foot sump is preferred, where sump is not limited by penetrations.
 - b. Do not field taper insulation.
- 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 with insulation or low-rise urethane adhesive.
1. Support the two opposite sides of each board on steel deck flanges, as close as practical to the center of the flange with a minimum bearing width of 1 inch. Trim board edges if they veer off the flange center.
 2. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 3. Fill remaining gaps around projections, penetrations, and perimeter with low-rise urethane adhesive (foam), including but not limited to:
 - a. Between perimeter of insulation boards and nailers.
 - b. Between nailers and vertical walls.
 - c. Between penetrations and insulation boards.
 - d. Between voids in insulation boards, inclusive of roof system slope transition conditions.
 4. All voids to be filled to match full thickness of insulation boards.
 5. Provide urethane foam sealant produced or acceptable to the roofing system/installation system manufacturer.
- E. Installation Over Metal Decking:
1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.
 - a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - b. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - c. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
 - 1) Trim insulation so that water flow is unrestricted.
 - d. Fill gaps exceeding 1/4 inch with insulation.
 - e. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

- f. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
 - 1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification or SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
 - 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
- 2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
 - f. Trim insulation so that water flow is unrestricted.
 - g. Fill gaps exceeding 1/4 inch with insulation.
 - h. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - i. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification or SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification or SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 ADHERED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. In addition, the corner and perimeter areas shall have enhanced fastening in accordance with FM1-29. Unroll roofing membrane and allow to relax before installing.
 - 1. Install sheet according to ASTM D 5036.
- B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel, A/E, and testing laboratory representative, if required.
- 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 at rate required by manufacturer and immediately install roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
 - 1. The membrane adhesive shall be installed per the membrane manufacturer's requirements. Note: Differing insulation facers require specific application methods and quantities of adhesives. Water-based adhesives should be utilized (unless cold conditions require the use of solvent-based adhesives); inclusive of manufacturer's required fasteners and additional fastener requirements as required to meet performance requirements.
 - a. Conversion to the solvent-based adhesive shall be only with permission from the A/E.
 - b. Bidder is cautioned to include the type of bonding adhesive that the membrane manufacturer will warrant based on the conditions under which the roof will be installed.
- E. Fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing. The roofing membrane shall be secured to nailers.
 - 1. Membrane shall be secured at the perimeter of each roof level, roof section, expansion joint, curb, skylight, interior wall, penthouse, etc., at any angle change which exceeds 2 inches in one horizontal foot and at all other penetrations in accordance with manufacturer's details.
 - 2. Terminate membrane under a termination bar, metal fascia or coping, unless otherwise noted or approved as part of submittal process.
 - 3. Provide premolded accessories and corners, unless otherwise noted or approved as part of the submittal process.
- F. Apply roofing membrane with side laps shingled with slope of roof deck where possible. Determine the direction of water drainage and the low point of the deck. The orientation of both ends and side laps shall be such that the direction of water flow (slope) changes to avoid backwater laps.
 - 1. Allow sufficient membrane to cover parapet walls and flashing details at roof edge.
- G. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.
- H. Install roofing membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and not to void warranty of existing roof system, if applicable.

3.8 HOT-AIR WELDING OF SEAM OVERLAPS

- A. General:
 - 1. All seams shall be hot-air welded. All membrane to be welded shall be clean and dry.
 - a. All mechanics interceding to use hot-air welding equipment shall have completed a training course provided by either the membrane or welding equipment manufacturer prior to welding.
 - 2. Hot-air welding equipment shall be allowed to warm up as directed by manufacturer prior to welding.
 - 3. Seam overlaps shall be minimum 3 inches wide when automatic machine-welded and 4 inches wide when hand-welding, except for certain approved details.
 - a. Width of membrane seams shall not be less than 1-1/2 inches regardless of seaming technique.
- B. Hand-Welding
 - 1. The back edge of the seam shall be welded with a narrow, but continuous weld to prevent loss of hot air during the final welding.
 - 2. The nozzle shall be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to "flow", the hand roller is positioned perpendicular to the nozzle and rolled lightly. For straight seams, the 1-1/2 inch wide nozzle is recommended for use. For corners and compound connections, the 3/4 inch wide nozzle shall be used.

C. Machine Welding

1. Machine welded seams are achieved by the use of approved automatic welding equipment. When using this equipment, all instructions shall be followed and local codes for electric supply, grounding and over current protection observed. Dedicated circuit house power or a dedicated portable generator is recommended. No other equipment shall be operated simultaneously off the generator.
2. Metal tracks may be used over the deck membrane and under the machine welder to minimize or eliminate wrinkles.

D. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation. Sealing of seams of overlapping adjacent roof membrane sheets, or overlap seams between flashing components and roof membrane sheets must be accomplished using hot air equipment specified by the membrane manufacturer for the specific membrane type, in strict compliance with roof membrane manufacturer's requirements and specifications. Width of membrane seams shall be not less than 1.5 inches regardless of seaming technique.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane. Following are guidelines for seam probing to identify cold welds, voids or other deficiencies:
 - a. Allow seams to cool to ambient temperature before probing after approximately 30 minutes.
 - 1) Seams may be probed using tools such as a cotter key extractor that has been filled down, a blunted or dull awl or any round-tipped tool. Continuous probing will tend to sharpen the tip of the probe, so blunting the tip will need to be done on a regular basis.
 - b. Draw the probing tool along the edge of the seam. Apply firm pressure to the seam, but not into the bottom membrane sheet. The tool will not penetrate the edge of a properly welded seam. Seams should be the specified width and free of voids.
 - c. Mark deficiencies with a water-soluble marker.
 - d. Probe repaired seams after they have cooled completely. If repair is acceptable, wipe off the marker.
2. Test Cuts
 - a. On-site evaluation of welded seams shall be made daily by the Contractor to ensure membrane seam weld quality. One inch wide cross-section samples of welded-seams shall be taken at least three times per day. Test cuts shall be taken at each start-up of welding equipment, midpoint, and at each completion of the welding process. Correct welds display failure from shearing of the membrane prior to separation of the weld. Weld quality is essential. Adjust equipment settings as necessary to assure quality welds. Based on test cut findings, appropriate membrane seam remedies must be instituted. All membrane test cut locations shall be documented and membrane test cut samples shall be labeled and provided with the required daily construction reports.
 - b. Test cuts or seam samples may not represent the overall membrane seam construction. If test can or seam samples indicate defects, further sampling must be performed to establish the scope of corrective action.
 - c. Additional test cuts of suspect membrane seams shall be taken at the direction of the A/E or manufacturer's representative.
 - d. Each test cut shall be patched by Contractor at no additional cost to the Owner.
3. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
4. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.
5. Where 3 or more membrane sheets overlap, the T-joints shall be treated with a handheld hot air seaming tool, or other methods as approved by the roof membrane manufacturer to ensure continued seam integrity at this point.

6. Caution: Where solvents are used to clean membrane seams, ensure presence of adequate safety and first aid information. Instruct welding operator as to appropriate amounts of heat to be used. Excessive solvent/heat will cause damage to roof membrane and certain types of insulation material. Minimize solvent dispersion of top of roof membrane.
 - a. Voltage fluctuations and climate conditions will affect the temperature of the heat welding equipment and subsequent quality of the seam. Contractor must take all necessary precautions to ensure seal quality. Contractor shall continuously monitor seam quality.

3.9 BASE FLASHING INSTALLATION

- A. General: All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of A/E and membrane manufacturer. Approval shall only be for specific locations and dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Contractor/Applicator's expense. Flashing shall be adhered to compatible dry, smooth, and solvent-resistant surfaces. Use caution to ensure adhesive fumes are not drawn into the building.
- B. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
 1. All flashing membranes should extend a minimum of 12 inches above roof level, and extend up and over top of parapet walls, unless otherwise detailed. If in question, submit in writing (RFI) to A/E and membrane manufacturer's technical department for signed approval.
- C. 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.
- D. Flash penetrations and field-formed inside and outside corners with sheet flashing and hot-air weld into place.
- E. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
- F. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars, covered by counterflashing. Do not tightly butt the termination bars or cross expansion joints with a solid bar.
- G. Flashing
 1. Walls, Parapets, and Curbs:
 - a. Secure deck membrane at angle change before bonding the membrane to the vertical surface. Membrane must be fully adhered to vertical surfaces.
 - b. Secure flashing membrane with fasteners in horizontal rows for additional securement when flashing height exceeds 30 inches or as required by the roof membrane manufacturer.
 - c. All wood nailers exposed to the interior of the building shall be enclosed with 24 gauge, aluminum-zinc alloy-coated sheet steel.
 2. Metal Edge Terminations: Approved by ANSI/SPRI ES-1
 - a. The width of the perimeter wood nailer to which the metal edge is to be secured shall extend beyond the width of the metal edge deck flange.
 - b. Secure the metal edge to the wood nailer as specified by the manufacturer.
 - c. All perimeter wood nailers shall be totally concealed by extending the deck membrane to completely cover the nailers and extend past the bottom edge of the nailers a minimum of 3/4 inch.
 - d. Prior to flashing, scrub the metal edge deck flange and membrane with splice cleaner to remove field contaminants.

3. Expansion Joints:
 - a. Secure the deck membrane on both sides of expansion joints with reinforced universal securement strip. Refer to expansion joint details for proper securement details.
4. Roof Drains:
 - a. During the flashing operation, drain openings shall be protected against debris, etc. Prior to roofing activities A/E and Roofing Contractor shall jointly review the roof drainage system to ensure proper drainage.
 - b. Provide a smooth transition from the roof surface to the drain-clamping ring. Prepare the substrate around each roof drain to avoid membrane bridging (Minimum 12 inch) at the sump area and possible distortion at the drain clamping ring.
 - c. The mating surfaces between the clamping ring and drain base shall be clean and have a smooth finish.
 - d. Located field splices at roof drains at least 6 inches outside the drain sump.
 - e. Cut the membrane so it extends approximately 1 inch minimum beyond the attachment points of the drain clamping ring.
 - 1) Under no circumstances shall the hole in the membrane restrict water flow or be smaller than the drain tube.
 - f. The seal between the membrane and the drain base shall be provided using Water Cut-Off Mastic under compression.
 - g. Remove all existing flashing, cement, and lead in preparation for the membrane seal (application of Water Cut-Off Mastic).
 - h. All bolts and/or clamps shall be in place to provide compression on the Water Cut-Off Mastic.
 - i. Upon completion of roofing activities, check drain pipe to ensure that drain line is free of obstruction. Any obstructions shall be removed.
5. Vent Pipes: Refer to Division 07 Section "Roof Accessories" for preformed flashing sleeves.
 - a. Flash pipes with Molded Pipe Flashing where their installation is possible.
 - 1) Use stainless steel clamps to seal at top.
 - b. Molded pipe flashing shall not be cut and patched; deck flanges shall not overlap or be installed over angle changes.
 - c. Where Molded Pipe Flashing cannot be installed, apply field fabricated pipe seals using flashing sheet.
 - 1) Never use a wrap around detail or molded pipe flashing on a hot or warm penetration.
6. Penetration (Pipes, Conduits, etc.)
 - a. Flash pipes with molded pipe flashing where their installation is possible.
 - 1) Use stainless steel clamps to seal at top.
 - 2) Mold pipe flashing shall not be cut and patched; deck flanges shall not overlap or be installed over angle changes.
 - 3) Where molded pipe flashing cannot be installed, apply field fabricated pipe seals using uncured flashing.
 - 4) Never use a wrap around detail or molded pipe flashing on a hot or warm penetration.
 - b. Flexible penetration (electrical and braided cable, etc.): Pre-molded and field-fabricated must not be installed around flexible pipes or conduits. Flexible penetrations must be installed in a sheet metal gooseneck or other boxed out structure.
 - c. Penetration packets are required at the following locations:
 - 1) Rigid pipes with an outside diameter less than 1 inch.
 - 2) Clusters of pipes.
 - 3) Unusual shapes, e.g., structural beams, channels, or angles.
7. Mechanical Units and other Raised Curbs: Refer to Division 07 Section "Roof Accessories."
 - a. Sheet metal counterflashing shall be installed to cover the top edge and overlap the upper portion of membrane base flashings unless the integral flange of the curb mounted with adequately covers the top of the membrane flashing.
 - 1) Provide a 4-inch coverage of roof flashings with counterflashings.

2) Refer to Division 07 Section "Roof Accessories."

3.10 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.11 FIELD QUALITY CONTROL

- A. Manufacturers Roof Inspections: Roofing Contractor shall notify roof manufacturer in writing of schedule for Work of this Section to allow sufficient time for inspecting. Do not modify details shown in the contract documents or shop drawings without consent of manufacturer's representative and A/E. Arrange for site inspections to verify conformance with written material manufacturer's instructions, submittals, and the Contract Documents including this section of the project specifications.
 - 1. In addition to the pre-installation meeting and final roof inspection the manufacturer shall perform inspections at the following minimum rate:
 - a. Up to 10,000 sq.ft. of roof contract requires one (1) inspection.
 - b. 10,000 to 35,000 sq.ft. of roof contract requires two (2) inspections.
 - c. 35,001 to 75,000 sq.ft. of roof contract requires three (3) inspections.
 - d. 75,001 to 125,000 sq.ft. of roof contract requires four (4) inspections.
 - e. 125,001 to 200,000 sq.ft. of roof contract requires five (5) inspections.
 - f. 200,001 sq.ft. and over of roof contract requires six (6) inspections.
 - 2. Forward written reports to A/E within 10 working days of the inspection and any testing performed.
 - 3. If the inspection reveals any defects, promptly remove and replace defection work at no additional cost to Owner.
- B. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 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 A/E and Owner.
 - 1. Protect existing membrane roofing system and new roof areas where continued construction traffic is anticipated.
 - a. Lay protection sheet or mat over existing membrane then loose lay 1-inch minimum thick, polyisocyanurate insulation over sheet or mat and cover with loosely laid plywood or OSB panels.
 - b. Protection sheet or mat: Provide a sacrificial layer of matching membrane sheet extending a minimum 6 inches beyond insulation in all directions or a woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.
- B. Limit traffic and material storage to areas of roofing that have been protected.
- C. 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.

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

3.13 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to inspect and maintain roofing system. Refer to Division 01 Section "Demonstration and Training."
- B. Demonstration and Training: Provide a minimum of two hours of instruction, including but not limited to the following items:
 - 1. Review warranty requirements.
 - 2. Review Maintenance data.
 - 3. Review inspection procedures including:
 - a. Where to look, e.g., roof access points, walkways, rooftop mechanical units, and litter.
 - b. What to look for: cuts and punctures and compressed or crushed insulation.
 - c. Remedial actions, emergency repair procedures.
 - d. Preventative actions.

END OF SECTION 07 54 00

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sheet metal flashing and trim:
 - 1. Formed reglets and counterflashing.
 - 2. Formed low-slope roof sheet metal fabrications.
 - 3. Miscellaneous sheet metal fabrications

- B. Contractor has option of forming reglets and counterflashing and equipment support flashing or providing prefabricated materials per Division 07 Section "Roof Specialties." Copings and roof edge flashings i.e. drip edge that terminate the roof membrane must be manufactured and meet ANSI/SPRI ES-1 Wind Design Standard for Edge Systems used with low-slope.
 - 1. Where manufactured systems only are specified, other field fabricated or shop/field fabricated substitutions will not be accepted, unless approved by A/E in writing.

- C. 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 "Miscellaneous Rough Carpentry" for coordination with wood blocking.
 - 3. Division 07 Section "Metal Composite Material Wall Panels" for
 - a. Preinstallation meeting.
 - b. Factory-formed metal wall panels and flashing and trim not part of sheet metal flashing and trim.
 - 4. Division 07 Section "Thermoplastic Membrane Roofing" for:
 - a. Preinstallation meeting.
 - b. Installing sheet metal flashing and trim integral with roofing membrane.
 - 5. Division 07 Section "Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
 - 6. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 7. Division 07 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.2 REFERENCES

- A. American Society of Testing and Materials (ASTM)
 - 1. ASTM A 792 – Standard Specification for Steel Sheet, 55 percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

- B. National Roofing Contractors Association (NRCA)
 - 1. NRCA Guidelines for Architectural Metal Flashings.

- C. Sheet Metal and Air Conditioning Contractors National Association, Inc., (SMACNA).
 - 1. Architectural Sheet Metal Manual.

1.3 DEFINITIONS

- A. Shop or Field Formed Sheet Metal: Include components that will be formed or fabricated in the field or at the fabricator's shop. Fabrication of sheet metal flashing and trim roofing is predominantly by press brake forming.
 - 1. Shop or field formed roof membrane termination are not acceptable.

- B. Prefabricated or Manufactured Roof Specialties: Items that will be plant manufactured ready for installation on a roof or parapet. Edge securement for low-slope roofs shall demonstrate compliance with ANSI/SPRI ES-1.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
 - 1. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
 - 2. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leak-proof, secure, and noncorrosive installation.
- B. Pre-installation Meeting: Conduct meeting at Project site in conjunction with roofing meeting.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review roof details, roof drainage, roof penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates, if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including sealants. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of sheet metal flashing and trim.
 - 1. Including plans, elevations, sections, and attachment details.
 - 2. Detail fabrication and installation layouts, expansion joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 - 3. Identify material, thickness, weight, and finish for each item and location in Project.
 - 4. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 5. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 - 6. Include details of termination points and assemblies.
 - 7. Include details of expansion joints and expansion joint covers, including showing direction of expansion and contraction from fixed points.
 - 8. Include details of roof penetration flashing.
 - 9. Include details of special conditions.
 - 10. Include details of connections to adjoining work.
 - 11. Detail formed flashing and trim at scale of not less than 1-1/2-inches, including reglet (through wall flashing) details of corners, end dams, and other special applications.

1.6 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.8 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. Do not store sheet metal flashing and trim materials in contact with other materials that cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- 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.
- D. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Complete sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
 - 1. Sheet metal flashing and trim used to terminate roof membrane must be provided part of Division 07 Section "Roof Specialties" and comply with roof manufacturer's "Total Warranty" requirements.
 - 2. If there is a discrepancy between these references and the project specification or drawings, the more stringent requirements shall govern as verified by A/E.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
 - 1. Comply with through wall flashing requirements of Brick Industry Association (BIA) "Technical Note No. 7 – Water Penetration Resistance – Design and Detail."
- 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, ambient; 180 deg F, material surfaces.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.3 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14; with smooth, flat surface.
 - 1. Thickness: 0.040 inch minimum as recommended by "SMACNA's Architectural Sheet Metal Manual" for application indicated.
 - 2. Surface: Smooth, flat
 - 3. Anodized Finish: Apply the following coil-anodized finish:
 - a. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
 - 4. Concealed Finish: pretreated with manufacturers' standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- C. Stainless-Steel Sheet: ASTM A 240, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Nominal Thickness: 0.0250 inch minimum and as recommended by "SMACNA's Architectural Sheet Metal Manual" for application indicated.
 - 2. Surface: Smooth, flat.
 - 3. Finish: No. 4 (fine reflective, polished directional satin).
 - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and is recommended by manufacturer of primary sheet metal or manufactured item, unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and as recommended by manufacturer.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Aluminum Sheet: Series 300 stainless steel.
- C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape.
- D. Elastomeric Sealant, where indicated only: 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.

1. Provide where sealant is exposed, or movement exceeds butyl sealant movement capability.
- E. Butyl Sealant, unless otherwise noted: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- H. Laminated Metal: Roof membrane manufacturer's minimum 0.0247-inch thick (fka 25 gauge) galvanized steel with minimum 17-mil polyvinyl-chloride (PVC) coating.
- I. Reglets: Unit of type, material, and profile required to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and welded corners and junctions and with interlocking counterflashing on exterior face, of same material as reglet.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cheney Flashing Company
 - b. Fry Reglet Corporation
 - c. Heckmann Building Products, Inc.
 - d. Hohmann and Barnard, Inc.
 - e. Keystone Flashing Company, Inc.
 - f. Metal-Era, Inc.
 - g. OMG Roofing Products; a division of OMG, Inc.
 2. Material: Aluminum, 0.024 inch thick, unless otherwise noted.
 - a. Stainless steel, 0.0188 inch thick where embedded in mortar joint and where indicated.
 3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 5. Accessories
 - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - b. Counterflashing Wind-Resistant Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" and NRCA's "The NRCA Roofing Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
1. Shop fabricated items where practicable.
 2. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 3. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 4. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

- B. Fabrication Tolerances:
 1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on drawings.
- D. Sealant Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.
- F. Seams
 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.
- G. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. General: Roof edge flashing and coping that terminate roof membranes shall be as specified in Division 07 Section "Roof Specialties" and not custom fabricated, unless otherwise noted and approved by A/E in writing.
- B. Counterflashing: Fabricate in lengths not exceeding 12 feet designed so that it is removable. Counterflashing shall be fabricated so that 4 inches of roof membrane is covered. Counterflashing is to be notched and lapped at joints. Shop fabricates interior and exterior corners.
 1. Counterflashing: Fabricate from one of the following material:
 - a. Aluminum: Minimum of 0.0320 inch thick.
 - b. Stainless Steel: Minimum of 0.0187 inch thick.
 2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing louver edge.
- C. Roof-Penetration Flashing: Fabricate from the following material:
 1. Stainless Steel: Minimum of 0.0187 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 2. Verify compliance with requirements for installation tolerances of substrates.
- B. 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.
 - 1. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 2. Torch cutting of sheet metal flashing and trim is not permitted.
 - 3. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 4. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of butyl sealant.
 - 5. Anchor sheet metal flashing and trim and other components of the work securely in place, with provisions for thermal and structural movement.
 - 6. 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.
 - a. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 - 8. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. Coat side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - a. Exception: Bituminous coating is not required where stainless-steel sheet metal flashing is embedded in mortar.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
 - 1. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.
 - 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 3. Use lapped expansion joints only where indicated on drawings.
- D. Fasteners: Use fasteners of sizes that will penetrate wood blocking or sheathing not less than 1-1/4 inches for nails, not less than 3/4 inch for wood screws and not less than recommended by fastener manufacturer to achieve maximum pullout resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints with butyl sealant as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, and SMACNA's "Architectural Sheet Metal Manual" and NRCA's "The NRCA Roofing Manual."
 - 1. Provide concealed fasteners where possible, set units true to line, and level as indicated.
 - 2. Install work with laps, joints, and seams that will be permanently watertight.
- B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric or butyl sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
 - 1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 - 2. Extend counterflashing 4 inches over base flashing.
 - 3. Lap counterflashing joints a minimum of 4 inches.
 - 4. Secure in a waterproof manner by means of snap-in installation and sealant or wedges and sealant, interlocking folded seam or blind rivets and sealant, or anchor and washer at 36-inch centers.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
 - 1. Seal with butyl sealant and clamp flashing to pipes penetrating roof except for flashing on vent piping.

3.4 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealant.

3.5 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed.
- B. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing.
- C. Maintain sheet metal flashing and trim 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 07 62 00

SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following manufactured roof specialties:
1. Copings.
 2. Counterflashings and reglets.
 3. Roof-edge specialties.
 4. Accessories, including all chips, sealant, fasteners, and joining to make weathertight and watertight. Components and accessories shall be factory fabricated and supplied by a specified manufacturer.
- B. Contractor has option of forming reglets and counterflashing and equipment support flashing or providing prefabricated materials per Division 07 Section "Sheet Metal Flashing and Trim." Coping and roof edge flashing i.e., drip edge that terminate the roof membrane must be manufactured and meet ANSI/SPRI ES-1 Wind Design Standard for Edge Systems used with low-slope.
1. Where manufactured systems are specified, other field fabricated or shop/field fabricated substitutions will not be accepted, unless otherwise noted or approved by A/E in writing.
- C. Related Sections include the following:
1. Division 04 Section "Unit Masonry" for installing reglets and for masonry through-wall flashing with receiver for counterflashing.
 2. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 3. Division 07 Section "Metal Composite Material Wall Panels" for formed coping, color and coordination.
 4. Division 07 Section "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
 5. Division 07 Section "Roof Accessories" for set-on-type curbs, roof hatches, vents, and other manufactured roof accessory units.
 6. Division 07 Section "Joint Sealants" for field-applied sealants.

1.2 DEFINITIONS

- A. Shop or Field Formed Sheet Metal: Includes components that will be formed or fabricated in the field or at the fabricator's shop. Fabrication of sheet metal flashing and trim roofing is predominantly by press brake forming.
1. Shop or field formed roof membrane termination are not acceptable.
- B. Prefabricated or Manufactured Roof Specialties: Items that will be plant manufactured ready for installation on a roof or parapet. Edge securement for low-slope roofs shall demonstrate compliance with ANSI/SPRI/FM 4435/ES-1.
- C. SPRI: Sheet membrane and component suppliers to the commercial roofing industry (address: 411 Waverly Oaks Road, Suite 331B, Waltham, MA 02452-8422, URL: www.spri.org, voice: 781-647-7026).

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate installation of manufactured roof specialties with roofing system, exterior wall system, air barrier, flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
1. Performance Coordination: Coordinate with the work of roofing and exterior wall sections to ensure that roof specialties provide under the work of this Section meet or exceed specified roofing and exterior wall design performance requirements.

2. Verify that other trades and related work are complete before mounting coping covers.
 - a. Ensure that information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
 - b. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
 3. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
 4. Refer to the construction documents, shop drawings and manufacturer's installation instructions.
 5. Coordinate installation with roof membrane manufacturer's installation instructions before starting.
 6. Confirm and coordinate compatibility of materials and comply with warranty requirements of roofing system manufacturer.
 7. Coordinate roof specialties layout and seams with sizes and locations of joints and seams in adjacent materials.
- B. Pre-installation Meeting: Conduct meeting at Project Site in conjunction with roofing meetings.
1. Meet with Owner, A/E, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
 2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Include preparation instructions and recommendations, storage and handling requirements and recommendations and installation methods.
 3. Include installation instructions.
- B. Shop Drawings: For roof specialties.
1. Show layouts of manufactured roof specialties, including plans and elevations. Identify factory- vs. field-assembled work. Include the following:
 - a. Indicate profile and pattern of seams and layout of fasteners, joining, supporting, and anchoring manufactured roof specialties including fasteners, clips, cleats, and attachments to adjoining work.
 - b. Details for expansion and contraction, locations of expansion joints, including direction of expansion and contraction.
 - c. Details of termination points and assemblies, including fixed points.
 - d. Details of special conditions, including accessory locations.
 - e. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
- C. Samples for Verification: For roof-edge flashings i.e. drip edge made from 12 inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, verifying compliance of copings and roof edge flashings with performance requirements and showing compliance with ANSI/SPRI/FM 4435/ES-1.

1.6 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
1. Warranty: Special warranty specified in this Section.

2. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are ANSI/SPRI/FM 4435/ES-1 tested to specified design pressure.
- B. Mockups: Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.
 1. Build mockup of typical roof edge as part of Integrated Exterior Mockup specified in Division 01 Section "Quality Requirements".
 2. First-in-place, approximately 10 feet long or to first expansion joint of typical roof edge, including supporting construction, seams, attachments, underlayment, and accessories shall serve as mockup.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

1.8 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. Store roof specialties away from uncured concrete and masonry.
- D. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.9 SEQUENCING

- A. Ensure that information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- B. Ensure that products of this Section are supplied to affected trades in time to prevent interruption of construction progress.
- C. Coordinate installation with roof membrane manufacturer's installation instructions.

1.10 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Division 07 Section "Thermoplastic Membrane Roofing".
- B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace manufactured roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Products: Subject to compliance with requirements, provide one of the products specified and approved by roof membrane manufacturer for "Total System Warranty".
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified and approved by roof membrane manufacturer for "Total System Warranty".
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Obtain roof specialties approved by manufacturer providing roof-system warranty specified in Division 07.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressures:
 1. Zone 2 (roof edge perimeter, vertical load direction): 67.3 pounds per square foot.
 2. Zone 3 (roof edge corners, vertical direction): 101.2 pounds per square foot.
 3. Zone 4 (wall edge perimeter, horizontal load direction): 43.5 pounds per square foot.
 4. Zone 5 (wall edge corners, horizontal load direction): 53.7 pounds per square foot.
- C. Thermal Movements: Provide manufactured roof specialties 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 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, ambient; 180 deg F, material surfaces.
- D. Water Infiltration: Provide manufactured roof specialties that do not allow water infiltration to building interior.
- E. Roof Specialties: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
 1. If there is a discrepancy between these references and the project specifications and drawings, the more stringent requirements shall govern as verified by the A/E.

2.3 EXPOSED METALS

- A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 1. Surface: Smooth, flat finish.

2. Anodic Finish: Apply the following finish, unless otherwise noted.
 - a. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
 1. High-Performance Organic Finish, where indicated: 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 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specialty formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 2. Anodic Finish: Apply the following finish, unless otherwise noted:
 - a. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

- C. Stainless-Steel Sheet: ASTM A 240 or ASTM A 666, Type 304, No. 4 (fine reflective, polished directional satin) finish.

2.4 CONCEALED METALS

- A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for use and structural performance indicated, mill finished.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- C. Stainless-Steel Sheet: ASTM A 240 or ASTM A 666, Type 304.

2.5 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 2. Fasteners: Series 300 stainless steel, unless otherwise noted.
- C. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- E. Elastomeric Sealant where indicated only; 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.
 1. Provide where sealant will be exposed or movement exceeds butyl sealant movement capacity.

- F. Butyl Sealant unless otherwise noted: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- G. Bituminous Coating: Cold-applied asphalt mastic, ASTM D 1187 or SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 COPINGS

- A. Metal Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage, concealed splice plates with same finish as coping caps, mitered corner units, and end cap units. Splice plates shall include butyl sealant strips capable of providing a weathertight seal. Provide endwall flashing splice plates where parapet terminates into wall.
 - 1. Products: Approved by roof manufacturer for "Total System Warranty".
 - 2. Coping Caps: Snap-on, fabricated from the following exposed metal:
 - a. Formed Aluminum: In thickness that will satisfy calculated wind-load requirements and NRCA guidelines.
 - 3. Surface: Smooth, flat.
 - 4. Coping Cap Color: Clear anodized, unless otherwise noted on elevations.
 - 5. Corners: Factory continuously welded or mechanically clinched and sealed watertight.
 - 6. Accessories: End wall flashing, concealed splice plates, 8-inch minimum wide, finished to match finish of coping cap with factory applied butyl sealant strips.
 - 7. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
 - 8. Fabrication: Taper coping from front to back, unless otherwise noted. Coping may be masonry attached or attached to a nailer as recommended by the roof specialty manufacturer for application indicated.

2.7 ROOF EDGE SPECIALTIES

- A. Fascia System: Basis-of-Design "Anchor-Tite Drip Edge; Metal Era". Subject to compliance with requirements, provide either the named products or comparable products by one of the other manufacturers specified.
 - 1. Comparable manufacturers:
 - a. OMG Edge Systems (fka Hickman Co., W.P.)
 - b. Architectural Products Co.
 - c. Applied Fabricators, Inc.
 - d. Drip Edge Fascia; ATAS International
 - 2. Description
 - a. Fascia with extruded aluminum anchor bar.
 - b. For single-ply roofing.
 - 3. Face Size: 3 inch, unless otherwise noted.
 - 4. Roof Flange: Flat
 - 5. Approvals
 - a. ANSI/SPRI/FM 4435/ES-1 up to 98 psf horizontal
 - 6. Extruded Anchor Bar
 - a. Material: Aluminum
 - b. Thickness: As recommended by manufacturer based on face height.
 - c. Extruded Lengths: 12'-0"
 - d. Fastener Holes: Pre-punched
 - 7. Anchor Bar Spices
 - a. Material: Aluminum
 - 8. Lap Joints
 - a. Material: Same as exterior fascia covers.
 - b. Finish and Color: Match exterior fascia covers.
 - c. Width: 1 inch
 - 9. Color: Match color of Division 07 Section "Metal Composite Material Wall Panels".

2.8 COUNTERFLASHINGS AND REGLETS

- A. Manufacturers: Subject to compliance with requirements, provide one of the following:
1. Cheney Flashing Company.
 2. Fry Reglet Corporation.
 3. OMG Edge Systems (fka Hickman, W. P. Company).
 4. Keystone Flashing Company.
 5. Metal-Era, Inc.
 6. Castle Metal Products.
 7. Heckmann Building Products Inc.
 8. ATAS International Inc.
 9. Drexel Metals
 10. EXCEPTIONAL Metals
- B. Counterflashings: Manufactured units in lengths not exceeding 12 feet designed to snap into reglets or through-wall-flashing receiver and compress against base flashings or roof membrane with joints lapped, from the following exposed metal in thickness indicated:
1. Formed Aluminum: 0.032 inch thick
 2. Stainless Steel: 0.0187 inch thick (fka 26 gauge)
- C. Reglets/Receivers: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashings indicated with factory-mitered and -welded corners or mechanically clinched and sealed watertight, and junctions, from the following exposed metal in thickness indicated:
1. Stainless Steel: 0.0187 inch thick
 2. Formed Aluminum: 0.024 inch (surface mounted only).
 3. Corners: Factory mitered and continuously welded or mechanically clinched and seal watertight.
- D. Types
1. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 2. Masonry Type: Refer to Division 04 Section "Unit Masonry Assemblies".
- E. Accessories:
1. Counterflashing wind-restraint clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing louver edge.
 2. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.

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. Examine walls, roof edges, and parapets for suitable conditions for manufactured roof specialties.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. If substrate preparation is the responsibility of another installer, notify A/E of unsatisfactory preparation before proceeding.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best results for the substrate under the project conditions.
- C. Verify the manufacturer's roof edge details for accuracy to fit the assembly prior to fabrication.

3.3 INSTALLATION, GENERAL

- A. General: Install manufactured roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.
 - 1. Remove protective vinyl film immediately before installation.
 - 2. Install manufactured roof specialties with provisions for thermal and structural movement.
 - 3. Torch cutting of manufactured roof specialties is not permitted.
 - 4. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 5. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 6. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 7. Do not use graphite pencils to mark metal surfaces.
 - 8. Install water cut-offs, as recommended by membrane manufacturer, under the anchor bar.
 - 9. Review lengths of straight pieces of exterior fascia covers before cutting to avoid creating relatively short sections.
- 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 manufacturer.
 - 1. Coat concealed side of uncoated aluminum or stainless-steel manufactured roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
- C. Expansion Provisions: Provide for thermal expansion of exposed manufactured roof specialties.
 - 1. Space movement joints at a maximum of 12 feet with no unplanned joints within 18 inches of corners or intersections.
 - 2. When ambient temperature at time of installation is between 40 and 70 degrees Fahrenheit, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
 - 3. Create gap between retainer sections and between fascia sections in accordance with manufacturer's instructions to allow for thermal expansion.
- D. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws or as recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints with butyl sealant as required by manufacturer of roofing specialties.
- F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 degrees Fahrenheit.

3.4 COPING INSTALLATION

- A. Install coping to comply with coping manufacturer's installation guide to meet performance requirements.

1. Review lengths of straight pieces of coping cap before cutting to avoid creating relatively short sections adjacent to full-length sections.
- B. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- C. Anchor copings to resist uplift and outward forces according to performance requirements.
 1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's recommended spacing to comply with "Performance Requirements".
- D. Install accessories, including but not limited to coping miters, end caps, splice plates, endwall flashing, and transitions as required for water tight installation.

3.5 ROOF EDGE FLASHING INSTALLATION

- A. Install cleats, cant dams, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings to resist uplift and outward forces according to performance requirements.
- C. Install accessories, including but not limited to edge flashing miters, splice plates, and transitions as required for water tight installation.

3.6 COUNTERFLASHING AND REGLET INSTALLATION

- A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Embedded Reglets: Installation of reglets is specified in Division 04 Section "Unit Masonry".
- C. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.
- D. Counterflashings: Coordinate installation of counterflashings with installation of base flashings. Insert counterflashings in reglets or receivers and fit tightly to base flashings. Extend counterflashings 4 inches over base flashings. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric or butyl sealant.

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Remove temporary protective coverings and strippable films as manufactured roof specialties 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.
- C. Replace manufactured roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 71 00

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Roof curbs.
 2. Roof hatches.
 - a. Safety railing.
 - b. Safety post.
 - c. Railing gate.
 3. Preformed flashing sleeves.
 4. Miscellaneous materials.
- B. Related Sections:
1. Division 05 Section "Structural Steel Framing" for:
 - a. Supplemental roof framing supporting equipment and pipe supports.
 - b. Supplemental roof framing for openings at:
 - 1) Roof curbs for HVAC equipment.
 - 2) Roof hatches.
 2. Division 05 Section "Metal Fabrications" for metal vertical ladders, for access to roof hatches.
 3. Division 05 Section "Pipe and Tube Railings" for safety railing systems not attached to roof-hatch curbs.
 4. Division 06 Section "Miscellaneous Rough Carpentry" for roof sheathing and wood nailers.
 5. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
 6. Division 07 Section "Roof Specialties" for manufactured and counterflashing.
 7. Division 08 Section "Door Hardware" for locks furnished by others.
 8. Division 09 Section "Exterior Painting" for field painting of roof accessories.
 9. Division 22 ("Plumbing") sections for coordinating pipe supports furnished and installed in this Section with plumbing piping furnished and installed by Plumbing Contractor.
 10. Division 23 ("HVAC") sections for roof curbs furnished and installed by HVAC Contractor for HVAC equipment.
 - a. Coordinate roof curbs and equipment and pipe supports furnished and installed in this Section with equipment and piping furnished and installed by HVAC Contractor.

1.2 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory indicated.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Include details showing mounting type, relationships to surrounding construction, hatch and vent type construction and locking features.
 3. Manufacturer's Installation Instructions: Indicate preparation, instructions, and installation requirements and rough openings.

- B. Samples for Initial Selection: For each type of exposed factory-applied color finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.
- C. Performance Requirement Verification: Provide verification that installation of products will result in compliance with "Performance Requirements" indicated. This may include calculations, testing results, manufacturer installation and attachment requirements, fastener information for indicated substrate, or other means necessary to demonstrate compliance.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 1. Size and location of roof accessories specified in this Section.
 2. Method of attaching roof accessories to roof or building structure.
 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 4. Required clearances.

1.5 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 1. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.
 2. Warranties.

1.6 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.
- B. NRCA "Roofing and Waterproofing Manual" details for installation of units.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.
- B. Storage:
 1. Store in accordance with manufacturer's instructions in well-ventilated area.
 2. Do not store roof accessories in contact with other materials that might cause staining, denting, or other surface damage.
 3. Store materials off ground in dry location.
 4. Store and protect roof accessories from nicks, scratches, and blemishes.
- C. Handling: Exercise proper care in handling of work so as not to disrupt finished surfaces.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-accessory substrates by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed in other Part 2 articles.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Wind-Restraint Performance: As indicated on Drawings.

2.3 METAL MATERIALS

- A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheer complying with minimum ASTM A653, G90 coating designation or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792, Class AZ50 coating designation; structural quality.
 - 1. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- B. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- C. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.

- D. Stainless-Steel Sheet and Shapes: ASTM A 240 or ASTM A 666, Type 304.
- E. Steel Shapes: ASTM A 36, hot dip galvanized according to ASTM A 123 unless otherwise indicated.
- F. Steel Tube: ASTM A 500, round tube.
- G. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123.
- H. Steel Pipe: ASTM A 53, galvanized.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.
- C. Wood Nailers: Provide No. 2 grade Douglas Fir or Southern Yellow Pine nailers, treated wood
 - 1. Treatment: Use one of the following formulations of inorganic boron:
 - a. Sodium-octaborate (SBX) or disodium – octaborate-tetrahydrate (DOT).
 - b. Zinc borates (ZB) for treated engineered wood or wood composites during the manufacturing process.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners: Series 300 stainless steel, unless otherwise noted.
- F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- G. Elastomeric Sealant where indicated: ASTM C 920, elastomeric polyurethane or silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
 - 1. Provide where sealant is exposed or movement exceeds butyl sealant movement capacity.
- H. Butyl Sealant unless otherwise noted: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- I. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.

2.5 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units with integral spring-type vibration isolators and capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ATAS International, Inc.
 - b. AES Industries, Inc.
 - c. Air Balance; a division of MESTEK, Inc.
 - d. Conn-Fab Sales, Inc.
 - e. Curbs Plus, Inc.
 - f. Custom Solution Roof and Metal Products, a division of Colony Heating
 - g. Greenheck Fan Corporation
 - h. KCC Manufacturing
 - i. Kingspan Light + Air, LLC
 - j. Lloyd Industries, Inc.
 - k. LMCurbs
 - l. Louvers & Dampers, Inc.; a division of Mestek, Inc.
 - m. Metallic Products Corp.
 - n. Pate Company (The)
 - o. Plenums of Florida Incorporated
 - p. RCS Fabrications, Inc.
 - q. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
 - r. Roof Products, Inc.
 - s. Thybar Corporation
 - t. Vent Products Co., Inc.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Local Capacity: Unless otherwise noted on drawings, coordinate load capacity with information on Shop Drawings of equipment to be supported.
- D. Materials: Provide one of the following as standard with manufacturer:
- 1. Steel: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.052 inch thick (fka 18 gauge), minimum.
 - a. Finish: Concealed.
 - 2. Aluminum sheet, 0.090 inch thick.
 - a. Finish: Mill.
- E. Construction:
- 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 - 2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 - 3. Fabricate curbs to minimum height of 12 inches above roofing surface, unless otherwise indicated.
 - 4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange or use leveler frame.
 - 5. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
 - 6. Insulation: Factory insulated with 2 inch thick, minimum, polyisocyanurate board insulation.
 - 7. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 - 8. Nailer: Factory-installed wood nailer under top flange on side of curb, unless otherwise indicated, continuous around curb perimeter.
 - 9. Wind Resistant Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connections and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
 - 10. Metal Counterflashing: Manufacturer's standard removable fabricated of same metal and finish as curb.

2.6 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acudor Products, Inc.
 - b. AES Industries, Inc.
 - c. Architectural Specialties, Inc.
 - d. Babcock-Davis
 - e. BILCO Company (The)
 - f. Dur-Red Products
 - g. JL Industries, Inc.; a division of the Activar Construction Products Group
 - h. KCC International Inc.
- B. Type and Size: Single-leaf lid, 30 by 36 inches.
- C. Performance Characteristics:
1. Cover shall be reinforced to support a minimum live load of 40 psf with a maximum deflection of 1/150th of the span or 20 psf wind uplift.
 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 3. Operation of the cover shall not be affected by temperature.
 4. Entire hatch shall be weathertight with fully welded corner joints on cover and curb.
- D. Cover: 14 gauge paint bond G-90 galvanized or 11 gauge aluminum with a 5 inch beaded flange with formed reinforcing members. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
1. Cover Insulation: Fiberglass or polyisocyanurate of 1-inch thickness, fully covered and protected by a metal liner 22 gauge paint bond G-90 galvanized steel or 18 gauge aluminum.
 - a. R-Value: 4.3
 2. Finish
 - a. Steel: Powder coat.
 - b. Aluminum: Powder coat.
 3. Color: As selected by Architect from manufacturer's full range.
- E. Curb: 12 inch (minimum) in height and of 14 gauge paint bond G-90 galvanized steel or 11 gauge aluminum. The curb shall be formed with a 3-1/2 inch flange with 7/16 inch holes provided for securing to the roof deck. The curb shall be equipped with an integral metal cap flashing of the same gauge and material as the curb with fully welded corners.
1. Curb Insulation: Rigid, high-density fiberboard or glass-fiber board of 1 inch thickness on outside of curb.
 - a. R-Value: 4.3.
- F. Lifting Mechanism: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe.
- G. Hardware
1. Heavy pintle hinges shall be provided.
 2. Cover shall be equipped with spring hatch and interior and exterior turn handles.
 3. Roof hatch shall be equipped with interior and exterior padlock hasps.

4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1 inch diameter red vinyl grip handle to permit easy release for closing.
6. Compression spring tubes shall be an anti-corrosive composite material and all door hardware shall be zinc plated and chromate sealed.
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

H. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch, meets OSHA required compliance for safe egress and ingress through roof hatch openings while hatch is in use, complies with OSHA CFR 29-1910.28 and CFR 29-1910.29 and authorities having jurisdiction.

1. Railing system shall be designed to withstand a 200 pounds test load.
2. Height: 42 inches above finished roof deck.
3. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter. or aluminum 1-1/2-inch OD schedule 40.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
5. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
6. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
8. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
9. Fabricate joints exposed to weather to be watertight and free of sharp edges and snag points.
10. Fasteners: Manufacturer's standard, finished to match railing system.
11. Finish: Manufacturer's standard.
 - a. Color: Safety yellow powder coat.

I. Ladder-Assist Safety Post (Extendable): Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches above finished roof deck.
3. Material: Steel tube or aluminum.
4. Post: Telescoping tube.
5. Post Finish: Safety yellow.

2.7 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted or perforated metal collar.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Solution Roof and Metal Products; a division of Colony Heating
 - b. Menzies Metal Products.
 - c. Thaler Metal Industries Ltd.
2. Metal: Aluminum sheet, 0.063 inch thick.
3. Diameter: As indicated.
4. Finish: Manufacturer's standard.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Solution Roof and Metal Products, a division of Colony Heating

- b. Menzies Metal Products.
- c. Milcor Inc.; Duravent Group
- d. Thaler Metal Industries, Ltd.
- 2. Metal: Aluminum sheet, 0.063 inch thick.
- 3. Height: 12 inches minimum.
- 4. Diameter: As indicated.
- 5. Finish: Manufacturer's standard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Verify that deck, curbs, roof membrane, base flashing, and other items effecting work of this section are in place and positioned correctly.
- E. Verify tolerances and correct improper condition.
- F. Identify conditions detrimental to providing proper quality and timely completions of work.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks. Separate metal from incompatible metal or corrosion substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals. Coordinate installation of sealant with work of this section to ensure watertightness.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum or stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

3.3 INSTALLATION OF ROOF ACCESSORIES

- A. Roof Curb Installation: Install each roof curb so top surface is level.
- B. Roof-Hatch Installation:
 - 1. Install roof hatch so top surface of hatch curb is level, plumb, true to line and elevation, and without warping, jogs in alignment, buckling, or tool marks.

- a. Anchor roof hatches secure in place so they are capable of resisting indicated loads.
 - b. Use fasteners, separating sealants and other miscellaneous items as required to complete installation of roof hatches and fit them to substrates.
 - c. Install roof hatches to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 3. Attach safety railing system to roof-hatch curb.
 4. Attach ladder-assist post according to manufacturer's written instructions.
- C. Preformed Flashing-Sleeve and Flashing Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.

3.4 ADJUSTING

- A. Adjust moveable parts for smooth operation.
- B. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.5 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Division 09 painting Sections.
- C. On completion of installation, clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Remove temporary protective coverings and strippable films as roof accessories are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof accessories in a clean condition during construction.
- F. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

SECTION 07 84 13 – PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Tested or engineering judgment based firestopping materials and systems to retain the integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and/or hot gases through penetrations. Section includes firestopping for the following:
1. Penetrations in horizontal assemblies, including through fire resistance rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 2. Penetrations through fire resistance rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
 4. Penetrations through partitions that are not required to be fire-resistance-rated due to the presence of automatic fire-extinguishing systems – but are still required to resist the passage of smoke.
 5. Exposed penetration firestopping systems.
- B. Related Work: Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that relate directly to Work of this Section include, but are not limited to:
1. Division 07 Section "Miscellaneous Thermal Insulation" for floor-to-wall joints indicated as perimeter fire-containment systems between perimeter edge of fire-resistance-rated floor assemblies and back of non-fire-resistance-rated exterior curtain walls.
 2. Division 07 Section "Joint Sealants" for joint sealants used at penetrations through non-fire-resistance-rated construction.
 3. Division 09 Section "Interior Painting" for paint requirements.
 4. Division 21 Sections specifying fire-suppression piping penetrations.
 5. Division 22 and 23 Sections specifying duct and piping penetrations.
 6. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

1.2 DEFINITIONS

- A. Firestopping: Material or combination of materials to retain integrity of fire rated construction by maintaining an effective barrier against the spread of flame, smoke, and gases through penetrations in fire rated wall and floor assemblies.
1. Exception: When used in non-fire-resistance-rated partitions firestopping shall be applied to the exposed face of mineral wool, glass fiber, or other approved non-rigid materials to maintain an effective resistance to the passage of smoke.
- B. Through-Penetration Firestop Systems: An assemblage of specific materials or products that are designed, tested and fire-resistance-rated to resist for a prescribed period of time the spread of fire, the passage of hot gases, and the transfer of heat through penetrations.
- C. Through-Penetration Firestop Devices: Factory built products designed to resist fire spread. Complete when delivered to site ready for installation.
- D. Assembly: Particular arrangement of materials specific to a given type of construction described or defined in referenced documents.
- E. Engineering Judgment: Evaluations that are developed by a manufacturer for a new firestop system that complies with similar UL approved designs or tests that are acceptable to the code enforcing authorities.

- F. Intumescent: Materials that expand with heat to seal around objects threatened by fire.
- G. Penetration: Opening or foreign material passing through a floor, wall or ceiling barrier such that the full thickness of the rated material(s) is breached either in total or in part.
- H. Sleeve: Metal fabrication or pipe section that is part of a system that extends through a barrier.
- I. Annular Space: The opening around the penetrating item. Since the penetrating item cannot be perfectly centered in the hole, the annular space has a minimum and maximum dimension.
- J. Approved: Acceptable to the code official or authority having jurisdiction.
- K. F-Rating: The time period that the through-penetration firestop system limits the spread of fire through the penetration when tested in accordance with ASTM E 814.
- L. Fire Barrier: A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.
- M. Fire Partition: A vertical assembly of materials designed to restrict the spread of fire in which openings are protected. Fire partitions are used as wall assemblies to enclose corridors.
- N. Fire Wall: A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall. A fire wall is commonly used to divide a structure into separate buildings – or to separate a new addition from the existing portion of a structure.
- O. Fireblocking: Building materials installed to resist the free passage of flame, gases, heat, smoke, and other products of combustion to other areas of the building through concealed spaces. The term “draftstopping” is also used to define building materials installed to resist the movement of smoke, gases, and flames to other areas – but through relatively larger concealed spaces. Examples of fireblocking materials include – but are not limited to – the following:
 - 1. 2-inch nominal lumber.
 - 2. Two thicknesses of 1-inch nominal lumber with broken lap joints.
 - 3. One thickness of 0.75-inch particleboard with backed-up joints.
 - 4. Gypsum board.
 - 5. Cement fiber board.
 - 6. Batt-type or roll-type blankets of mineral wool, glass fiber, or other approved non-rigid materials installed in such a manner as to be securely retained in place. Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.
- P. Horizontal Assembly: A fire-resistance-rated floor or roof assembly of materials designed to restrict the spread of fire in which continuity is maintained.
- Q. L-Rating: The quantitative indication of a through-penetration firestop system’s ability to resist the passage of smoke when tested in accordance with UL 2079.
- R. Membrane-Penetration: An opening made through one side (wall, floor or ceiling membrane) of an assembly.
- S. Smoke Barrier: A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed to restrict the movement of smoke.
- T. Smoke Partition: A non-fire-resistance-rated wall designed to resist the spread of fire and the unmitigated movement of smoke for an unspecified period of time. A smoke partition is not required to be continuous through ceilings and other concealed spaces.

- U. T-Rating: The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325 degrees Fahrenheit (163 degrees Celsius) above its initial temperature through the penetration on the non-fire side when tested in accordance with ASTM E 814.
- V. Through-Penetration: An opening that passes through an entire assembly.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.
 - 1. American Society for Testing and Materials (ASTM).
 - a. E 84 Test Method for Surface Burning Characteristics of Building Materials.
 - b. E 119 Test Method for Fire Tests of Building Construction and Materials.
 - c. E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg. F.
 - d. E 814 Fire Tests of Through-Penetration Fire Stops.
 - e. E 1349 Cyclic Movement and Measurement Minimum and Maximum Joint Widths.
 - f. E 1966 Test Method for Resistance of Building Joint.
 - g. E 2174 Standard Practice for On-Site Inspection of Installed Fire Stops.
 - h. E 2307 Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate – Scale, Multi-Story Test Apparatus (ISMA).
 - i. E 2393 Standard Practice for On-Site Inspection of Installed Fire Stop Joint Systems.
 - 2. Factory Mutual (FM) Approvals: FM Approval Standard of Firestop Contractors – Class 4991.
 - 3. Firestop Contractors International Association (FCIA): MOP – FCIA Firestop Manual of Practice.
 - a. FM Approval Standard of Firestop Contractors – Class 4991.
 - 4. International Firestop Council (IFC):
 - a. Ref. 1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments (April 2001).
 - b. Ref. 2 Inspectors Field Pocket Guide.
 - c. Ref. 3 IFC Recommended Guidelines for Performing Destructive Testing for Installed Penetration Firestop Systems, Fire Resistive Joint Systems, or Perimeter Fire Barrier Systems.
 - 5. National Fire Protection Association (NFPA):
 - a. NFPA 70 – National Electric Code.
 - b. NFPA 101 – Life Safety Code.
 - c. NFPA 221 – Fire Walls and Fire Barriers.
 - d. NFPA 251 – Fire Tests of Building Construction and Materials.
 - 6. Underwriters Laboratories, Inc. (UL):
 - a. UL 263 Fire Tests of Building Construction and Materials.
 - b. UL 723 Surface Burning Characteristics of Building Materials.
 - c. UL 1479 Fire-Tests of Through-Penetration Fire Stops.
 - d. UL Building Materials Directory:
 - 1) Through-Penetration Firestops Systems (XHEZ).
 - 2) Firestop Devices (XHJI).
 - 3) Forming Materials (XHKU).
 - 4) Wall Opening Protective Materials (CLIV).
 - 5) Fill, Void or Cavity Materials (XHHW).
 - 7. International Building Code (IBC 2015)

1.4 SEQUENCING

- A. Coordinate this Work as required with work of other trades. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

1. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.
 2. Schedule firestopping after installation of penetrants but prior to concealing the openings.
- B. Do not cover up those firestopping installations that will become concealed behind other construction until Owner's inspection agency and authorities having jurisdiction, if required, have examined each installation.
- 1.5 PREINSTALLATION MEETINGS
- A. Preinstallation Meeting: Conduct meeting at Project Site.
- 1.6 ACTION SUBMITTALS
- A. General: Comply with requirements of Division 01 Section "Submittal Procedures."
1. Note: Penetration firestopping submittals are indicated as "Expedited Submittals" and must be issued to A/E within 60 days of the Notice to Proceed.
- B. Product Data: For each product type.
1. Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL or other nationally recognized independent testing laboratories firestop systems to be used, and manufacturer's installation instructions. Product characteristics, typical uses, installation procedures, performance, and limitation criteria.
 - a. Unlisted Firestopping Systems: Obtain an Engineering Judgement (EJ) from firestopping manufacturer where no UL, FM Approvals, or other listed assembly is available for particular firestop configuration. Follow International Firestop Council (IFC) recommended guidelines for evaluating firestopping systems in EJ's.
 2. Storage and handling requirements and recommendations.
- C. Through-Penetration Firestop System Location Plan and Schedule (All Prime Contractors): Indicate locations of each through-penetration firestop system, along with the following information:
1. Types of penetrating items.
 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 - a. Systems shall be submitted and reference system numbers in the UL Fire Reference Directory or Online Certification Directory, under product categories XHEZ, XHDG, or XHBN.
 - b. Engineering Judgments: Where project conditions require modification to a qualified testing and inspecting agencies illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturers fire protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal. Engineering judgement must include both project name and contractor's name who will install firestop system as described in document.
- 1.7 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS
- A. Qualification Data: For firms and persons specified in the "Quality Assurance" article, to demonstrate their capabilities and experience, include a list of names and addresses of completed projects, A/E's and Owners, and other information specified.
- B. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.8 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION or INFORMATIONAL SUBMITTALS.
1. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.9 QUALITY ASSURANCE

A. Qualifications

1. Installer Qualifications: Engage an experienced Installer (including individual trades people such as: electrical, mechanical, insulators, etc.) who is qualified by having at least 3 firestop projects similar in type and size to that of this project and has the necessary experience, staff, and training to install manufacturer's products per specified requirements, plus the following:
 - a. Acceptable to or licensed by state or local authority, where applicable.
 - b. Establish a record of successful in-service experience with firestop systems or completion of manufacturer's certified product installation training.
 - c. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged in does not in itself confer qualification on the buyer. Each individual engaged in performing the firestopping work shall have a certification card from the manufacturer acknowledging their completion of the manufacturer's firestop installation training.
 - d. Any firm that has been approved by FM according to FM 4991, "Approval of Firestopping Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractors Program Requirements" shall be acceptable as well.
2. Single Source Responsibility: Obtain through-penetration firestop systems for kind of penetration and construction condition indicated from a single manufacturer.
 - a. Materials of different manufacturer than allowed by the testing and listed system shall not be intermixed in the same firestop system or opening.
 - b. Tested and listed, classified firestop systems are to be used. If another manufacturer has a tested and listed system, then that system shall be used prior to an Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFRA).
3. Manufacturer Qualifications: Entity that has received UL's "Firestop Movement Certification," which demonstrates that manufacturer's firestopping products designated with M-Ratings are based on exposure to cyclic movement and UL 1479 fire test evaluation when tested in accordance with ASTM E3037.
4. Provide firestopping 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" or ASTM D6620.
5. Do not use any product containing solvents that require hazardous waste disposal or which after curing dissolve in water.

B. Regulatory Requirements

1. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
2. Meet requirements of ASTM E814, UL1479, UL2079, or ASTM E2307 tested assemblies that provide a fire rating equal to that of construction being penetrated and other ASTM Standards as applicable for the installation.
 - a. ASTM E84 "Test Method for Surface Burning Characteristics of Building Materials."
 - b. ASTM E119 "Test Methods for Fire Tests of Building Construction and Materials."
3. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" article:

- a. A qualified testing and inspection agency shall perform firestopping tests. A qualified testing and inspecting agency is UL or another agency performing test and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - b. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
 - 1) Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - 2) Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system listed by the following:
 - a) UL in "Fire Resistance Directory".
 - b) Intertek ETL SEMKO in its "Directory of Listed Building Products".
 - c) FM Global in its "Building Materials Approved Guide".
 - 4. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirement set forth by the International Firestop Council (September 7, 1994, as may be amended from time to time).
- C. Field Constructed Mockup: Prior to installing firestopping, erect mockups for each different firestop system indicated to verify selections made and to demonstrate qualities of materials and execution. Building mockups to comply with the following requirements, using materials indicated for final installations.
- 1. Locate mockups on site in locations indicated or, if not indicated, as directed by A/E. Include mockup for each type of system.
 - 2. Notify A/E in advance of the date and times when mockups will be installed.
 - 3. Build mockup of each penetration firestopping system type required for Project, including supporting construction substrates, attachments, and accessories.
 - 4. Where one penetration firestopping system type may be used for different penetrating items or in different wall or floor constructions, install one assembly for each different combination.
 - 5. Obtain A/E and AHJ's acceptance of mockups before start of Work.
 - 6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging completed unit of Work. Accepted mockups in an undisturbed condition at time of Substantial Completion may become part of completed unit of work.
 - 7. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 8. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestopping undamaged products to project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacturer; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
 - 1. Comply with recommended procedures, precautions, or remedies described in material safety data sheets as applicable.
- B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
- C. Do not use damaged or expired materials.

1.11 PROJECT CONDITIONS

- A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials or manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.
- C. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.
- D. Existing Conditions: Verify the condition of the substrates and correct unsatisfactory conditions before installing products. Follow manufacturers' instructions.
- E. Protection: Provide masking and drop cloths to prevent contamination of adjacent surfaces, if required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products from one of the manufacturers specified.
 - 1. Hilti Inc.
 - 2. Specified Technologies, Inc., (STI)
 - 3. 3M Fire Protection Products
 - 4. Balco; a CSW Industrials Company
 - 5. Tremco, Inc.; Tremco Fire Protection Systems Group
 - 6. STC Sound Control
 - 7. Grabber Construction Products
 - 8. HOLDRITE, a division of Reliance Worldwide Corporation
 - 9. Passive Fire Protection Partners
 - 10. NUCO Inc.
 - 11. Everkem Diversified Products, Inc.
 - 12. International Fireproof Technology Inc.
 - 13. Roxtec Inc.
 - 14. Unique Fire Stop Products
 - 15. FireShield; Fire Rated Solutions LLC
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Obtain joint firestop systems for each type of joint opening indicated from a single manufacturer.

2.2 SYSTEM DESCRIPTION

- A. General, Through-Penetration Firestop Systems: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Systems shall once installed to the tested and listed system or engineered judgment become firestop systems that are produced to resist the spread of fire, and the passage of smoke through breaches, gaps, openings, in fire-resistance, rated and smoke resistant assemblies according to requirements indicated.

1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers, and smoke barriers as indicated on "Code Drawing."
 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies as indicated on "Code Drawing."
 3. Install complete through penetration firestop systems that have been tested and/or listed by recognized testing agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of site conditions.
 4. Provide firestop products that are flexible enough to allow for pipe vibration in a through penetration application.
 5. Provide products that are compatible with each other, with the substrates forming openings, and with the items, if any, penetrating the firestopping, under the conditions represented by this Project, based on testing and field performance demonstrated by manufacturer.
 6. For firestopping exposed to view, traffic, moisture, and physical damage, provide firestop systems for these conditions that meet conditions expected as communicated through construction documents.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
1. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated as determined per ASTM E814, UL 1479 but not less than that equaling or exceeding the fire resistance rating of the constructions penetrated.
 2. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E814 and ASTM E119, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where specified by codes or where the following conditions exist:
 - a. Where firestop systems protect penetrations located outside of wall cavities.
 - b. Where firestop systems protect penetrations located outside fire resistive shaft enclosures.
 - c. Where firestop systems protect penetrations located in construction containing doors required to have a temperature rise rating.
 - d. Where firestop systems protect penetrating items larger than a 4-inch diameter nominal pipe or 16 square inch in overall cross-sectional area.
 3. L-Rated Systems: Provide firestop systems with L-ratings indicated, as determined per ASTM UL1479, where systems maintain a barrier to smoke at:
 - a. Penetrations.
 - b. Connections with other surfaces.
 - c. Separations required to permit building movement.
 - d. Sound or vibration absorption, and.
 - e. Other construction gaps.
 4. For firestopping exposed to traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions and will meet load requirements.
 - a. For piping penetrations for plumbing and wet pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - b. 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.
 - c. For penetrations involving insulated piping, provide through-penetration firestop systems not required removal of insulation.
 5. For through-penetration firestop systems exposed to view, provide products with flame spread of less than 25 and smoke developed ratings of less than 450, as determined per ASTM E 84.
 6. For piping penetration for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 7. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2.3 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems installed with products bearing the classification marking of a qualified product certification agency in accordance with listed system designs published by a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory".
 - 2) Intertek Group in its "Director of Listed Building Products".
 - 3) FM Approval in its "Approval Guide".
- B. Provide components for each penetration firestopping system that, upon curing do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristics during and after construction.
- C. Provide components for each penetration firestopping system that to not contain ethylene glycol.
- D. Provide components for each penetration firestopping system that are sufficiently flexible to accommodate movement, such as pipe vibration, water hammer, thermal expansion, and other normal building movement without damage.
- E. Provide components for each penetration firestopping system that are appropriately tested for the thickness and type of insulation utilized.

2.4 PENETRATION FIRESTOPPING, GENERAL

- A. Penetration Firestopping Systems: Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 1. Systems listed by approved testing agencies, may be used, providing they conform to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barriers, and fire partitions.
 - 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
 - 3. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.
 - 4. M-Rating: Provide penetration firestopping systems meeting specified F-Rated after being tested in accordance with ASTM E3037.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
 - 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 - 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 - a. Those within the cavity of a wall.

- b. Floor, tub, or shower drains within a concealed space.
 - c. 4 inch or smaller metal conduct penetrating directly into metal-enclosed electrical switchgear.
- D. Penetrations through Smoke Barriers, Smoke Partitions, and partitions that enclose that are not required to be fire-resistance-rated due to the presence of automatic fire-extinguishing systems – but are still required to resist the passage of smoke: Provide penetration firestopping with ratings determined per UL 1479.
- 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures and no more than 50-cfm cumulative total for any 100 sq.ft. at both ambient and elevated temperatures.
- E. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G 21.
- F. Firestopping materials are either “cast-in-place” (integral with concrete placement) or “post installed”. Provide cast-in-place firestop devices prior to concrete placement.
- G. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- H. Accessories: Provide components for each penetration firestopping systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated, including but not limited to:
- 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or 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

2.5 FILL MATERIALS

- A. Use only firestop products that have been UL 1479, ASTM E 814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- 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. Cast-in-place devices for use with only noncombustible penetrants shall be red in color.
- C. Fire Rated Cable Management Devices: Factory-assembled round metallic sleeve device for use with cable penetrations, containing an integrated smoke seal fabric membrane that can be opened and closed for re-penetration.
- D. Drop-In Firestop Devices: Factory-assembled devices for use with combustible or noncombustible penetrants in cored holes within concrete floors. Device shall consist of galvanized steel sleeve lined with an intumescent strip, an extended rectangular flange attached to one end of the sleeve for fastening to concrete floor, and neoprene gasket.
- E. Latex Sealants: Simple-component latex formulations that do not pre-emulsify after cure during exposure to moisture.

- F. Acrylic Sprayable Mastic: Acrylic (water) based sprayable fire-rated mastic containing no halogens, solvents, or asbestos.
- G. Firestop Collars/Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- H. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- I. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- J. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side for use around combustible penetrants.
- K. 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 non-shrinking, homogeneous mortar.
- L. Pillows/Blocks/Plugs: Intumescent flexible block/plug suitable for reuse in re-penetration of openings. Blocks shall allow up to 12 inches of unreinforced annular space. Compressible, removable, and reusable intumescent pillows encased in fire-retardant polyester or glass-fiber cloth. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- M. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
- N. Silicone Sealants: 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 non-sag formulation for openings in vertical and other surfaces, unless indicated firestop system limits use to non-sag grade for both opening conditions.
- O. Fire-Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls to accept standard accessories.
- P. Thermal and Endothermic Wraps: Flexible, insulating, and fire-resistant protective wraps tested and listed for up to 2-hour fire-ratings in accordance with ASTM E814 or UL 1479; for protecting membrane penetrations of utility boxes, critical electrical circuits, communications lines, and fuel lines, and for thermal barrier and circuit integrity protection in accordance with ASTM E1725 or UL 1724.
- Q. Fire-Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls which accept standard accessories.
- R. Fire-Rated Cable Pathways: Single or gangable device modules composed of a steel raceway with integral intumescent material and required no additional action in the form of plugs, twisting closure, putty, pillows, sealant, or otherwise to achieve fire and air-leakage ratings.
 - 1. Fire-rated cable pathway devices are the preformed product for data, video, and communications cable penetrations. Install these devices in locations where frequent cable moves, add-ons, and changes will occur. Such devices must be:
 - a. Capable of retrofit around existing cables.
 - b. Designed so that two or more devices can be ganged together.
 - c. Maintenance-free so no action is required to activate the smoke- and fire-sealing mechanism.
 - 2. Where fire-rated cable pathway devices are not practical, openings within walls and floors designed to accommodate data, video, and communications cabling must be provided

with re-enterable products specifically designed for retrofit, such as retrofit devices for cable bundles, firestopping putty, plugs, or pillows.

- S. Retrofit Device for Cable Bundles: Factory-made, intumescent, collar-like device for firestopping existing over-filled cable sleeves and capable of being installed around projecting sleeves and cable bundles.
- T. Wall-Opening Protective Materials: Intumescent, non-curing putty pads or self-adhesive inserts for protection of electrical switch and receptacle boxes.
- U. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use around rectangular steel HVAC ducts without fire dampers.
- V. Firestop Plugs: Flexible, re-enterable, intumescent, foam-rubber plug for use in blank round openings and cable sleeves.
- W. Fire-Rated Cable Grommet: Molded two-piece grommet made of plenum-grade polymer and foam inner core for sealing small cable penetrations in gypsum walls up to 1/2 inch diameter.
- X. Closet Flange Gasket: Molded, single-component, flexible, intumescent gasket for use beneath a water closet (toilet) flange in floor applications.

2.6 MIXING

- A. Penetration Firestopping Materials: 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

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 1. Verify penetrations are properly sized and in suitable condition for application of materials.
 - 2. Conduct tests according to firestop systems manufacturer's written recommendations to verify that substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt or other foreign substances capable of impairing bond of fire resistive materials.
 - 3. Verify objects penetrating firestop materials, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 4. Verify substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire resistive materials.
- B. Verify that environmental conditions are safe and suitable for installation of firestop materials.
- C. Do not proceed with installation of firestop system until the Contractor in a manner acceptable to the A/E has corrected unsatisfactory conditions.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

1. Remove all foreign materials from surfaces of openings and from penetrating items that could interfere with adhesion of firestopping.
 2. Clean openings and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form release agents from concrete.
 4. Do not apply firestopping and smoke seals to surfaces previously painted or treated with sealers, curing compounds, water repellent or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- B. Verify that field dimensions are as tested and listed, classified systems, Engineering Judgments, EFRRA's and as recommended by the manufacturer's installation instructions.
- C. 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.
- D. Ensure that anchoring devices, back-up materials, clips, sleeves, and supports and other related materials used in the actual fire tests are provided.
- E. 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 systems seal with substances.

3.3 INSTALLING THROUGH-PENETRATION FIRESTOPS

- A. General: Comply with the "Performance Requirements" in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
1. Coordinate with other trades to assure that all pipes, conduit, cable, and other items, which penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.
 2. Schedule the Work to assure that partition and all other construction that conceals penetrations are not erected prior to the installation of firestop and smoke seals.
- B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through- penetration firestop systems.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire-resistance ratings.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
 4. Through Penetration Sealants with a Fungicide. Sealants must meet the requirements of ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

3.4 IDENTIFICATION

- A. Penetration Identification: Identify penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels or with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestop systems use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning – Through-Penetration Firestop System – Do Not Disturb. Notify Building Management of Any Damage".
 - 2. Contractor's name, address, and phone number.
 - 3. Through-penetration firestop system designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Through-penetration firestop system manufacturer's name.
 - 6. Installer's name.

- B. Wall Identification: In addition to identification of firestop systems, fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
 - 1. Be in accessible concealed floor, floor-ceiling, or attic spaces at 15 feet from end of wall; and
 - 2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
 - 3. Include lettering not less than 3 inches in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS." Other wording must be pre-approved by Authorities with Jurisdiction.

3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials and sealants adjacent to openings as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products 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 system complying with specified requirements.

3.6 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections of mockups in accordance with ASTM E2174.

- B. Keep areas of work accessible until inspection by applicable code authorities.

- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or another recognized standard.

- D. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

- E. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 07 84 13

SECTION 07 91 00 – PREFORMED JOINT SEALS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes
 - 1. Preformed joint sealants.
- B. Related Sections include the following:
 - 1. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
 - 2. Division 07 Section "Joint Sealants" for liquid sealants applied over preformed seals in dual seal system.
 - 3. Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.2 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive test performed by a qualified testing agency, indicating that sealants comply with requirements.
- B. Sample Warranties: For special warranties.

1.4 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
 - 1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.
 - a. Division 04 Section "Unit Masonry".
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 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, pot life, curing time, and mixing instructions for multiple-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.

1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
- B. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this section.

1.8 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: 2 years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

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

- B. 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.

2.3 PREFORMED JOINT SEALANTS

- A. General: Preformed foam sealants are to be used at exterior building expansion joints up to 2 inches where 1 inch of movement is anticipated.
- B. Preformed Foam Sealant: Manufacturer's standard preformed, pre-compressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; is factory produced in pre-compressed sizes in roll or stick form to fit joint widths indicated; is coated on one side with a pressure-sensitive adhesive and covered with protective wrapping; develops a watertight and airtight seal when compressed to the degree specified by manufacturer; and complies with the following:
 - 1. Products:
 - a. Emseal 25V; EMSEAL Joint Systems, Ltd.
 - b. Willseal 150 or 250; Willseal USA, LLC.
 - c. Polytite B/Polytite Standard; Dayton Superior Specialty Chemicals.
 - d. Polyseal; Sandell Manufacturing Co., Inc.
 - e. Sealtite or Sealtite 50N; Schul International, Inc.
 - f. EIF, EIS, or SIF; MM Systems Corp.
 - g. Wake Seismic WeatherSeal; Watson Bowman Acme Corp.
 - h. Iso-Flex Hydroseal; LymTal Int., Inc.
 - 2. Properties: Permanently elastic, mildew resistant, nonmigratory, non-staining, and compatible with joint substrates and other joint sealants.
 - a. Density: Minimum density of 10 lb./cu.ft.
 - b. Movement Capacity: -25 percent/+ 25 percent.
 - c. Nominal Joint Width: As indicated on Drawings.
 - 3. Joint Seal Color: As selected by A/E from full range of industry colors.

2.4 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.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, 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. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 3. Remove laitance and form-release agents from concrete.
 4. Clean 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. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
- B. Joint Priming: Prime joint substrates, where 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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with preformed joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
1. Apply joint sealants prior to applying penetrating water repellents. Joint sealants need to cure 7 days prior to application of penetrating masonry sealers.
- B. Installation of Preformed, Foam Joint Seals
1. Install each length of seal immediately after removing protective wrapping.
 2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
 3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
 4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

3.4 PROTECTION

- A. Protect preformed 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.
- B. Cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 91 00

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes joint sealants for the applications indicated in the Joint-Sealant Schedule at the end of Part 3.
 - 1. Silicone joint sealants
 - 2. Urethane joint sealants
 - 3. Silyl-terminated polyether (STPE) joint sealants
 - 4. Butyl joint sealants
 - 5. Latex joint sealants

- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for sealing of joints in slabs-on-grade or below grade.
 - 2. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
 - 3. Division 07 Section "Preformed Joint Seals" for preformed compressible foam and procured joint seals.
 - 4. Division 07 Section "Acoustical Joint Sealants" for sealing joints in sound rated construction.
 - 5. Division 08 Section "Glazing" for glazing sealants.
 - 6. Division 09 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
 - 7. Division 09 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.
 - 8. Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of joint sealants with cleaning of joint sealant substrates and other operations that may impact installation or finished joint sealant work.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated, including backing materials that include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which laboratory adhesion and/or compatibility testing is required.
 - 6. Substrates for which use of primer is required.
 - 7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.

- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.4 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Warranties: Special warranties specified in this Section.
 - a. Manufacturer's special warranties.
 - b. Installer's special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's recognized and recommended installer for installation of elastomeric sealants required for this Project, as required by terms of warranty.
- B. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
 - 1. Refer to Division 04 Section "Unit Masonry" for additional mockup requirements.

1.6 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, pot life, curing time, and mixing instructions for multiple-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.

1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
- B. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this section.

1.8 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 2 years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which silicone sealant manufacturer agrees to furnish silicone joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Obtain joint sealants from a single manufacturer for each sealant type.

2.2 PERFORMANCE REQUIREMENTS

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

2.3 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. Liquid-Applied Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- C. Additional Movement Capability: Where additional movement capability is specified, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.
- D. Colors of Exposed Joint Sealants: As selected by A/E from manufacturer's full range, unless otherwise noted.
 1. Provide tintable silicones where custom silicones are indicated.

2.4 SILICONE JOINT SEALANTS

- A. Single-Component, Non-sag, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. 790 or NS Parking Structure Sealant; DuPont Corporation.
 - b. SilPruf LM SCS2700; GE Construction Sealants; Momentive Performance Materials, Inc.
 - c. 301 NS, 311 NS, 890NST, or 890FTS; Pecora Corporation.
 - d. Sikasil WS-290 or Sikasil 728 NS; Sika Corporation.
 - e. Spectrem 1 or Spectrem 800; Tremco Incorporated.
 - f. ADSEAL LM 4600 Series; ADFAST.

- B. Single-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. 756 SMS, 791, 795, or 995; DuPont Corporation.
 - b. SilGlaze II SCS2800, SilPruf NB SCS9000, or SilPruf SCS2000; GE Construction Sealants; Momentive Performance Materials, Inc.
 - c. PCS; Pecora Corporation.
 - d. Whitford Worldwide; PSI-641; Polymeric Systems, Inc.
 - e. Sikasil WS-295 or Sikasil N+; Sika Corporation.
 - f. Spectrem 2 or 3; Tremco Incorporated.
 - g. ADSEAL Production 4580 Series; ADFAST.

- C. Multiple-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type M, Grade NS, Class 50, for Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. 890FTS-TXTR; Pecora Corporation.
 - b. Sikasil WS-295 FPS; Sika Corporation.
 - c. Spectrem 4-TS; Tremco Incorporated.

- D. Single-Component, Nonsag, Traffic-Grade, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, for Use T.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. 790 or NS Parking Structure Sealant; DuPont Corporation.
 - b. 301 NS or 311 NS; Pecora Crporation.
 - c. Spectrem 800; Tremco Incorporated.
 - d. SikaSil 728 NS; Sika Corporation.

- E. Single-Component, Pourable, Traffic-Grade, Silicone Joint Sealant: ASTM C920, Type S, Grade P, Class 100/50, for Use T.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. 890-SL or SL Parking Structure Sealant; DuPont Corporation.
 - b. 300 SL or 310 SL; Pecora Corporation.
 - c. Spectrem 900 SL; Tremco Incorporated.
 - d. SikaSil 728 SL; Sika Corporation.

- F. Mildew-Resistant, Single-Component, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. 786 Mildew Resistant; DuPont Corporation.
 - b. Sanitary SCS1700; GE Construction Sealants; Momentive Performance Materials, Inc.
 - c. Tremsil 200 Sanitary; Tremco Incorporated.
 - d. 898; Pecora Corporation.
 - e. White Lightning Silicone Ultra Low Odor All Purpose Sealant; Sherwin-Williams.
 - f. Sikail-GP; Sika.
 - g. ADSEAL KB 4800 Series; ADFAST.

2.5 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Sonolastic NP1, Sonolastic TX1, or Sonolastic Ultra; MBCC Group.
 - b. Chem-Calk GPS1, 900, 915, or 916 Textured; Bostik, Inc.
 - c. Elasto-Thane 230; Pacific Polymers Division, ITW.
 - d. Dynatrol I-XL; Pecora Corporation.
 - e. Flexiprene 1000; Polymeric Systems, Inc., Whitford Worldwide.
 - f. Sikaflex – 1A+ or Sikaflex Textured; Sika Corporation, Construction Products Division.
 - g. Vulkem 116; Tremco Incorporated.
 - h. EP-1000; Henkel (fka OSI).
 - i. Stampede 1 Polyurethane Sealant; Sherwin-Williams.
- B. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C920. Type S, Grade NS, Class 25, for Use T.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Sonolastic NP1 or Sonolastic Ultra; MBCC Group.
 - b. Elasto-Thane 230; Pacific Polymers Division, ITW.
 - c. Sikaflex – 1A+; Sika Corporation, Construction Products Division.
 - d. Vulkem 116; Tremco Incorporated.
 - e. Stampede 1 Polyurethane Sealant; Sherwin-Williams.
- C. Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type S, Grade P, Class 25, for Use T.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Sonolastic SL 1; MBCC Group.
 - b. Chem-Calk 950; Bostik, Inc.
 - c. NR-201; Pecora Corporation.
 - d. Flexiprene PSI- 952; Polymeric Systems, Inc., Whitford Worldwide.
 - e. Sikaflex-1CSL; Sika Corporation, Construction Products Division.
 - f. Vulkem 45; Tremco Incorporated.
 - g. Stampede 1SL Polyurethane Sealant; Sherwin-Williams.
- D. Multi-component, Nonsag, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.
1. Products: Subject to compliance with requirements.
 - a. Dynatrol II; Pecora Corporation.
 - 1) For traffic-grade applications, install per guidelines in manufacturer's technical bulletin.
 - b. Dymeric 240 or Dymeric 240 FC, Tremco Incorporated.
- E. Multi-component, Nonsag, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Sonolastic NP 2; MBCC Group.
 - b. Chem-Calk 500; Bostik, Inc.
 - c. Elasto-Thane 227 High Shore Type II, Elasto-Thane 227 R Type II or Elasto-Thane 227 Type II; Pacific Polymers Division, ITW.
 - d. Dynatred; Pecora Corporation.
 - e. Sikaflex – 2c NS or Sikaflex – 2c NS EZ Mix; Sika Corporation, Construction Products Division.
 - f. Vulkem 227; Tremco Incorporated.
- F. Multi-component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Sonolastic NP 2; MBCC Group.
 - b. Iso-Flex 885 SG; LymTal International, Inc.
 - c. Elasto-Thane 227 High Shore Type II or Elasto-Thane 227 Type II; Pacific Polymers Division, ITW.
 - d. Dynatred; Pecora Corporation.
 - e. Sikaflex – 2c NS or Sikaflex – 2c NS EZ TG; Sika Corporation, Construction Products Division.
 - f. Vulkem 227; Tremco Incorporated.

2.6 SILYL-TERMINATED POLYETHER (STPE) JOINT SEALANTS

- A. STPE, S, NS, 50, NT: Single-component, non-sag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MBCC Group.
 - b. GE Construction Sealants; Momentive Performance Materials, Inc.
 - c. Pecora Corporation.
 - d. Sherwin-Williams Company.
 - e. Sika Hyflex 150LM; Sika Corporation.
 - f. Dymonic FC; Tremco.
 - g. ADSEAL DWSP 1940 Series; ADFAST.

2.7 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Chem-Calk 300; Bostik, Inc.
 - b. BC-158; Pecora Corp.
 - c. General Purpose Butyl Sealant; Tremco Incorp.
 - d. B-100 Butyl Rubber Sealant; ADCO.

2.8 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Sonolac; MBCC Group.
 - b. Chem-Calk 600; Bostik, Inc.
 - c. AC-20+ Silicone; Pecora Corporation.
 - d. SM 8200; Schnee-Morehead, Division, ITW.
 - e. Tremflex 834; Tremco Incorporated.
 - f. 950A Siliconized Acrylic Latex Caulk; Sherwin-Williams.
 - g. Titebond Kitchen and Bath Sealant; Franklin International.
 - h. ADSEAL DWM 1090; ADFAST.
- B. Paintable Mildew-Resistant Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Sonolac; MBCC Group.
 - b. AC-20+Silicone; Pecora Corporation.
 - c. Sherwin-Williams:
 - 1) Powerhouse 1110A Siliconized Acrylic Latex Sealant.
 - 2) White Lightning Kitchen and Bath Latex Ultra Sealant.
 - d. Tremflex 834; Tremco.

2.9 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.10 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
 - 1. Verify that joints are ready to receive work.
 - 2. Verify that backing materials are compatible with sealants.
 - 3. Verify that backing rods are of the correct size.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- B. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, 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 nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- C. Joint Priming: Prime joint substrates, where 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.
- D. 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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
1. Mix and apply multi-component sealants in accordance with manufacturer's printed instructions.
 2. Apply joint sealants prior to applying penetrating water repellents. Joint sealants need to cure 7 days prior to application of penetrating masonry sealers.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
1. Joints or gaps that require sealant are to be filled with one of the specified sealants even though the note may read "Caulked".
 2. Joints to be filled shall be thoroughly dry and free from dust, dirt, oil, and grease at the time of application of sealants.
 3. Expansion and control joints in exterior walls shall have the joint filler material built into the wall, or between wall and slab, at the time of construction.
 4. Masking: Metal shall be masked with masking tape, as well as other surfaces where it's required to prevent the sealant smearing the adjacent surface. Upon completion of the sealants, remove the tape.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Non-sag 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. Avoid "over-tooling" or "stretching" sealant material during application.
3. Dry tool only, no wet tooling permitted.
4. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.
5. Provide flush joint profile where indicated per Figure 8B in ASTM C1193.
6. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 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. Remove excess sealant using materials and methods approved by sealant manufacturer that will not damage joint substrate materials.
 1. Remove masking tape immediately after tooling joint without disturbing seal.
 2. Remove excess sealant from surfaces while still uncured.

3.5 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.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and non-traffic horizontal surfaces.
 1. Joint locations such as, but not limited to:
 - a. Construction joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - 1) Provide joint sealants slightly darker than the adjacent masonry units. Provide multiple colors as may be required for match.
 - 2) Provide sealant over expanding foam secondary sealant where a 2 inch building expansion joint is indicated.
 - c. Perimeter joints between masonry and frames of doors, storefronts, louvers, and similar openings.
 - d. Lintels to masonry construction.
 - e. Control and expansion joints in ceiling/soffit and similar overhead surfaces.
 - f. Exterior joints between dissimilar materials where the joining of the two surfaces leaves a gap between the meeting materials or components as may be dictated by various methods of construction to make building watertight.
 - g. Other joints as indicated on Drawings.
 2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Neutral-Curing Silicone Joint Sealant:
 - 1) Single-Component, Non-sag: ASTM C920, Type S, Grade NS, Class 100/50, for Use NT.
 - 2) Single-Component, Non-sag: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
 - 3) Multi-Component, Non-sag: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
 3. Color: Custom color to match A/E's sample of adjacent materials.
- B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 1. Joint locations such as, but not limited to:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.

- b. Joints between different materials listed above.
 - c. Other joints as indicated on Drawings.
 - 2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Neutral-Curing Silicone Joint Sealant:
 - 1) Single-Component, Non-sag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 100/50, for Use T.
 - 2) Single-Component, Pourable, Traffic-Grade: ASTM C920, Type S, Grade P, Class 100/50, for Use T.
 - b. Urethane Sealant:
 - 1) Single-Component, Pourable, Traffic-Grade: ASTM C920, Type S, Grade P, Class 25, for Use T.
 - 2) Multi-Component, Non-sag, Traffic-Grade: ASTM C920, Type S, Grade P, Class 50, for Use T.
 - 3) Multi-Component, Non-sag, Traffic-Grade: ASTM C920, Type S, Grade P, Class 25, for Use T.
 - 3. Color: As selected by A/E from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - 1. Joint locations such as, but not limited to:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Perimeter of floor slabs or concrete curbs which abut vertical surfaces.
 - c. Areas around all piping systems that penetrate the slab or foundation walls below grade (utility trenches, electrical conduits, plumbing penetrations, etc.).
 - d. Other joints as indicated on Drawings.
 - 2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Neutral-Curing Silicone Joint Sealant: Single-Component, Non-sag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 100/50, for Use T.
 - b. Urethane Joint Sealant:
 - 1) Single-Component, Pourable, Traffic-Grade: ASTM C920, Type S, Grade P, Class 25, for Use T.
 - 2) Multi-Component, Non-sag, Traffic-Grade: ASTM C920, Type S, Grade P, Class 50, for Use T.
 - 3) Multi-Component, Non-sag, Traffic-Grade: ASTM C920, Type S, Grade P, Class 25, for Use T.
 - 3. Color: As selected by A/E from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces, subject to movement, unless otherwise noted.
 - 1. Joint locations such as, but not limited to:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Interior joints where interior partitions meet exterior walls of dissimilar materials and components.
 - c. Other joints as indicated on Drawings.
 - 2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated.
 - a. Urethane Joint Sealant:
 - 1) Single-Component, Non-sag: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
 - 2) Multi-Component, Non-sag: ASTM C920, Type M, Grade NS, Class 25, for Use NT.
 - b. Silyl-Terminated Polyester
 - 1) Single-Component, STPE, S, NS, 50, NT.
 - 3. Color: Custom to match A/E's sample.
- E. Joint-Sealant Application: Interior joints in vertical surfaces not subject to movement.
 - 1. Joint locations such as, but not limited to:
 - a. Interior perimeter joints of exterior openings.

- b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - c. Interior joints between dissimilar materials where a gap is created where materials meet, unless otherwise noted.
 - 2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
 - 3. Color: As selected by A/E from manufacturer's full range.
- F. Joint-Sealant Application: Mildew-resistant interior joints in non-painted vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint locations such as, but not limited to:
 - a. Interior joints between plumbing fixtures and adjoining floors and counters.
 - b. Joints between countertops and backsplashes.
 - c. For interior joints in non-painted vertical and horizontal surfaces where incidental food contact may occur.
 - d. Tile control and expansion joints where indicated.
 - e. Other joints as indicated on Drawings.
 - 2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Mildew-Resistant, Single-Component, Acid-Curing, or Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Use NT.
 - 3. Color: As selected by A/E from manufacturer's full range of colors.
- G. Joint-Sealant Application: Mildew-resistant interior joints in painted vertical surfaces and horizontal non-traffic surfaces.
 - 1. Joint locations such as, but not limited to:
 - a. Interior joints between plumbing fixtures and adjoining painted walls.
 - b. Joints where countertops or backsplashes intersect painted walls.
 - 2. Provide the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Mildew-Resistant Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF or better.
 - 3. Color: As selected by A/E from manufacturer's full range of colors.
- H. Joint-Sealant Application: Interior or exterior joints in vertical surfaces between laps in fabrications of sheet metal.
 - 1. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated:
 - a. Urethane Joint Sealant:
 - 1) Single-Component, Non-sag: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
 - 2) Single-Component, Non-sag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 25, for Use T.
 - 2. Color: Not applicable.
- I. Joint-Sealant Application: Exterior joints under metal thresholds and saddles, sill plates, or as bedding sealant for sheet metal flashing and frames of metal or wood.
 - 1. Provide one of the following acceptable sealants as approved by manufacturer for substrates and use indicated.
 - a. Neutral-Curing Silicone Joint Sealant:
 - 1) Single-Component, Non-sag: ASTM C920, Type S, Grade NS, Class 100/50, for Use NT.
 - 2) Single-Component, Non-sag: ASTM C920, Type S, Grade NS, Class 50, for Use NT.
 - 3) Multi-Component, Non-sag: ASTM C920, Type M, Grade NS, Class 50, for Use NT.

- b. Urethane Joint Sealant:
 - 1) Single-Component, Non-sag: ASTM C920, Type S, Grade NS, Class 25 or 35, for Use NT.
 - 2) Single-Component, Non-sag, Traffic-Grade: ASTM C920, Type S, Grade NS, Class 25, for Use T.
 - c. Butyl-rubber based sealant.
2. Color: Not applicable.

END OF SECTION 07 92 00

SECTION 07 92 19 – ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes acoustical joint sealants.
- B. Related Sections include the following:
 - 1. Division 07 Section "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for non-acoustical applications.
 - 2. Division 09 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
 - 3. Division 09 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants, showing full range of available colors for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive test performed by a qualified testing agency, indicating that sealants comply with requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Warranty Documentation
 - 1. Installer's special warranties.

1.5 WARRANTY

- A. Installer's Special Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from the date of Substantial Completion.

1.6 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, pot life, curing time, and mixing instructions for multiple-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. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained between 40 and 95 degrees F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. 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. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Acoustical sealant to maintain STC ratings of sound rated partitions as indicated on the drawings.
 - 2. Acoustical sealant has flame-spread and smoke-developed ratings of less than 25 as tested in accordance with ASTM E 84.
 - 3. Acoustical sealant shall be mold and mildew resistant per ASTM G 21 with a rating of zero (0), "no growth".

2.3 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 A/E from manufacturer's full range.

2.4 ACOUSTICAL JOINT SEALANTS

- A. Acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies in accordance with ASTM E90.
- B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, paintable, non-staining latex acoustical sealant complying with ASTM C 834 and ASTM C 919.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. RCS 20 Acoustical; GE Construction Sealants.
 - b. Acoustical Sealant GSC; Grabber Construction Products.

- c. OSI Pro-Series SC-175 Acoustical Sound Sealant; Henkel Corp.
 - d. AC-20 FTR or AIS-919; Pecora Corp.
 - e. Smoke-N-Sound Acoustical Sealant; Specified Technologies, Inc.
 - f. Quiet Seal Pro; Pabco Gypsum.
 - g. SHEETROCK Acoustical Sealant; USG Corp.
 - h. CP 506 Smoke and Acoustical Sealant; Hilti.
 - i. Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant; Franklin International.
- C. Acoustic Spray for Exposed and Concealed Joints: Provide manufacturer's standard sprayable latex material complying with ASTM C 919 and the following:
- 1. Spray effectively reduces airborne sound transmission through head-of-wall joints in building construction as demonstrated by testing representative assemblies in accordance with ASTM E 90.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. CP 572 Smoke and Acoustic Spray; Hilti.
 - b. Flamesafe 3000; Rectorseal.
 - c. Fire Dam Spray 200; 3M.
 - d. A/D Firebarrier Spray Acrylic.

2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are non-staining; 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.

2.6 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: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
 - 1. Install acoustic sealant backings of type indicated to support sealant and spray during application in accordance with manufacturer's written installation instructions.
 - 2. Install acoustic sealant and spray free of air pockets, embedded foreign matter, sags and ridges.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM D 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

3.4 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.

3.5 PROTECTION

- A. Protect acoustical 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.

END OF SECTION 07 92 19

SECTION 08 12 13 - HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hollow metal frames
- B. Furnish materials and equipment necessary for complete installation by the following Sections:
 - 1. Division 04 Section "Unit Masonry": For installing anchors in masonry construction.
- C. Related Sections:
 - 1. Division 07 Section "Joint Sealants": For caulking between metal frames and adjacent materials.
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Door Hardware" for coordination and for testing and inspection.
 - 4. Division 08 Section "Glazing".
 - 5. Division 09 Section "Interior Painting".
 - 6. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.
 - a. Exception: Low-voltage wiring for security/access control and for automatic door operator switches is pulled by the Division 28 ("Electronic Safety and Security") security/access control contractor.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI A250.8.

1.3 COORDINATION

- A. Coordinate installation of anchorages for standard steel frames. 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 requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of frame specified, including details of construction, materials, dimensions, hardware preparation, fire-resistance ratings, label compliance, and finishes.
- B. Shop Drawings:
 - 1. Provide schedule of frames using same reference numbers for details and openings as those on Contract Drawings and Schedules.
 - 2. Elevations of each door frame type.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 7. Details of anchorages, joints, field splices, and connections.

8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal frames, 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver frames cardboard wrapped or crated to provide protection during transit and job storage.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store frames at building site under cover. Place units on minimum 4 inch high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber. Provide minimum 1/4 inch space between each stacked door to permit air circulation.

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Products: Subject to compliance with requirements, provide one of the products specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - a. Ceco Door Products; Div. of Assa-Abloy Group Company
 - b. Steelcraft; Div. of Ingersoll-Rand
 - c. Curries; Div. of Assa-Abloy Group Company
 - d. Mesker Door Inc.
 - e. The MPI Group, LLC
 - f. Deansteel Manufacturing Company
 - g. Security Metal Products.
 - h. Door Components, Inc.
 - i. Pioneer Industries
 - j. Republic Doors and Frames.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Openings shall be provided to conform with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. Where openings, in the opinion of the supplier/manufacturer, do not conform, the A/E shall be notified.

2.3 MATERIALS

- A. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A1008, Drawing Steel, Type B; stretcher-leveled standard of flatness.
- B. Frame Anchors: ASTM A879, Commercial Steel (CS), 40z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel complying with ASTM A 1008A or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.
- C. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot dip zinc coated items to be built into exterior walls, complying with ASTM A153, Class C or D as applicable.
- D. Shop Applied Paint: For steel surfaces, use rust-inhibitive enamel or paint, either air drying or baking, suitable as a base for specified finish paints.
 - 1. Comply with ANSI A250.10 for acceptance criteria.
- E. Corrosion-Resistant Coating: Spray-applied rubber- or asphalt-based automotive undercoating.

2.4 FRAME TYPES

- A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Frames for interior door openings and borrowed lights shall be fabricated with 2 inch face at jambs, heads and mullions, unless otherwise indicated.
 - 1. 0.053 inch thick (fka 16 gauge) steel, cold rolled, factory applied baked on primer, for Level 2 and Level 3 steel doors and wood doors.
 - 2. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - 3. Construction: Full profile welded, unless otherwise noted.
 - 4. Exposed Finish: Prime.

2.5 FRAME ASSEMBLIES

- A. Stops and Beads: Furnish minimum 0.032 inch thick (fka 20 gauge) sheet steel glazing beads with the hollow metal frames at transoms, side lights, interior glazed panels, and other locations where beads are indicated in pressed steel frames. Glazing beads for exterior frames shall be on the interior side of transoms and sidelights. Glazing beads for interior frames shall be located on the secure side of opening.
- B. Mortar/Plaster Guards: Provide minimum 0.016 inch thick (fka 26 gauge) steel plaster guards or mortar boxes, welded to the frame, at back of door hardware cutouts where mortar or other materials might obstruct hardware operation.
- C. Provide minimum 0.1495 inch thick (fka 9 MSG) hinge reinforcement, including all doors with continuous-type hinges.
- D. Provide minimum 0.1046 inch thick (fka 12 MSG) frame head reinforcement for closers, surface, and concealed overhead stop and holders, removable mullions, flush bolts, and top latch of vertical rod exit devices.
- E. Door Silencers: Drill stops and install 3 silencers on strike jambs of single swing frames and 2 silencers on heads of double swing frames.

- F. Hollow metal frames requiring continuous gear hinges or pin-and-barrel hinges shall have a continuous mortar guard of foam or cardboard by the frame height, applied with construction adhesive or a minimum 0.016-inch thick (fka 26 gauge) steel, welded to frame, the full height of the door. Mortar guards shall be shop applied by frame supplier.
- G. Exterior door frames shall be furnished with a mortar box installed, as a junction box for door security monitoring contracts. Install junction box in frame head 12 inches from strike edge of frame to centerline of box. Weld junction box to inside of 1-15/16 inch frame rabbet.
 - 1. Mortar Box
 - a. 10 inch by 1-3/4 inch by 1-3/4 inch inside dimensions.
 - b. Serves as mortar shield.
 - c. Knock outs at each end for standard conduit fittings.
- H. Frames installed in masonry shall be furnished with a field-or-shop applied corrosion-resistant coating the full depth of the frame.

2.6 FRAME ANCHORAGE

- A. Wall, Floor, and Head Anchors
 - 1. Frames Set in New Masonry: Provide metal anchors of shapes and sizes required for the adjoining wall construction. Provide a minimum of 3 wall anchors per jamb. Frames over 7'-6" shall be provided with one additional anchor for each 24 inch or fraction thereof.
 - a. Provide adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inches thick (fka 18 gauge), with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch in diameter (fka 7 WMG).
 - 2. Provide head anchors at door or window heads over 5 feet wide at minimum 3 feet o.c.
 - 3. Provide 0.067 inch thick (fka 14 gauge) minimum angle shaped floor clips welded to jambs and punched for two 3/8 inch diameter bolts each.
 - 4. Provide adjustable length clip angles as required.

2.7 FABRICATION

- A. Fabricate steel door frame units to comply with ANSI A250.8 and be rigid, neat in appearance, and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at the Project site.
- B. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold rolled or hot rolled steel (at fabricator's option).
- C. Clearances for Non-Fire Rated Doors: Not to exceed 1/8 inch at jambs and heads, 3/32 inch between pairs of doors, and 3/4 inch at bottom.
- D. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- E. Door Hardware Preparation: Factory prepare hollow-metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Prepare hollow metal units to receive mortised and concealed door hardware, including cutouts, steel reinforcing, drilling, and tapping in accordance with final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A250.6 and ANSI/BHMA A156.115 for preparation of hollow-metal work for hardware.
 - 2. Reinforce hollow metal units to receive nontemplated, mortised, and surface mounted hardware. Hardware installer shall drill and tap for surface applied hardware.

2.8 STEEL FINISHES

- A. General: Comply with recommendations in "Metal Finishes Manual" by Architectural and Metal Products Division of National Association of Architectural Metal Manufacturers (NAAMM) for applying and designating finishes.
- B. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning".
- C. Factory Priming for Field Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
 - 1. Shop Primer: Manufacturer's standard, fast curing, lead and chromate free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field applied finish paint system indicated; and providing a sound foundation for field applied topcoats 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 standard steel frames.
 - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory prior to setting frames. Restore exposed finish by grinding, fitting, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Prior to installation and with Contractor-installed installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured on jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install steel frames and accessories according to shop drawings, manufacturer's data, and as specified.
- B. Standard Steel Frames: Install standard steel frames for doors, sidelights, transoms, borrowed lights, and other openings, of size and profile indicated. Comply with ANSI A250.11 or NAAMM HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire protection rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections due to 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 plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field-apply corrosion-resistant coating to backs of frames that are installed in masonry or concrete walls, where coating has not been shop applied. coverage rate, or in the case of automotive undercoating, to a minimum 1/8-inch thickness.
2. Floor Anchors: Provide floor anchors for each jamb and mullions that extends to floor and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on shop drawings.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout as specified in Division 04 Section "Unit Masonry."
 - a. Where grout is installed during masonry installation, frames shall be braced or fastened in such a way that will prevent the pressure of the grout from deforming the frame members. Grout shall be mixed to provide a 4 inch maximum slump consistency, hand troweled into place. Grout mixed to a thin "pumpable" consistency shall not be used.
 - 1) Refer to ANSI A 250.8 for additional information.
4. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

3.4 CLEANING

- A. Prime Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air drying primer.

3.5 PROTECTION

- A. After installation, protect frames from damage during subsequent construction activities.

END OF SECTION 08 12 13

SECTION 08 13 16.13 - ALUMINUM DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Aluminum doors.
 - 1. Hardware for aluminum doors will be furnished under Division 08 Section "Door Hardware", except continuous hinges and door bottom sweeps, but installed under this Section.
- B. Related Sections:
 - 1. Division 07 Section "Joint Sealants": For sealant between aluminum frames and adjacent materials.
 - 2. Division 08 Section "Aluminum-Framed Storefront."
 - 3. Division 08 Section "Door Hardware" for coordination for testing and inspection.
 - 4. Division 08 Section "Glazing": For glazing of doors and windows.

1.2 DEFINITIONS

- A. Definitions: For fenestration industry standard terminology and definition refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA-AG).

1.3 PRE-INSTALLATION MEETING:

- A. Pre-installation Meeting: Conduct meeting at project site in conjunction with door hardware meeting.

1.4 ACTION SUBMITTALS

- A. Product Data: For each product specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: Show elevations of each door type, door construction details and methods of assembling sections, hardware locations and installation methods, dimensions, and shapes of materials, anchorage and fastening methods, weatherstripping, and finish requirements.
 - 1. Provide schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings and Schedules.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Product Test Reports: For verification of "Performance Requirements".
- B. Energy Performance Certificates: Energy Performance Certificates: Signed and dated certification for the installed doors listing the U-factor and air leakage rate.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum door type.

1.6 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Maintenance Data: For aluminum-framed systems to include in maintenance manuals. Include maintenance procedures for care and cleaning of entrance systems, as well as maintenance tools specific to door maintenance.
 - 2. Warranties: Special warranties specified in this Section.

1.7 MAINTENANCE

- A. Entrance Door Hardware:
 - 1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer and supervisor who has specialized in installing aluminum doors similar to those required for this Project and who is acceptable to manufacturer.
- B. Regulatory Requirements: Doors shall be provided to conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. Where openings, in the opinion of the supplier/manufacturer, do not conform, the A/E shall be notified.

1.9 FIELD CONDITIONS

- A. Field Measurements: Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the work.

1.10 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals, metal finishes unless special finish warranty is required, and other materials beyond normal weathering.
 - d. Water leakage through fixed glazing and framing areas.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - a. Capitol Aluminum & Glass (Capitol)
 - b. CMI Architectural (fka Cronstroms Manufacturing Inc.) (CMI)
 - c. Cross Aluminum Products (Cross)
 - d. EFCO Corporation (EFCO)
 - e. Kawneer Company, Inc. (Kawneer)
 - f. Manko Window Systems Inc. (Manko)
 - g. Special-Lite, Inc.
 - h. Tubelite Inc. (Tubelite)
 - i. U.S. Aluminum Division, CR Laurence Co. (CRL).
 - j. YKK AP America Inc. (YKK)
 - k. Commercial Door Systems (CDS), a Seneca Company
 - l. Oldcastle Building Envelope

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Refer to Division 08 Section "Aluminum-Framed Storefront" for additional "opening" requirements.
- B. General: Provide aluminum doors capable of withstanding loads and thermal and structural movement requirements without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg. F, material surfaces.
- C. Design Wind Loads
 - 1. Wind Loads: As indicated on Drawings.
 - 2. The design wind pressure for the project will be:
 - a. 20 psf positive and negative, unless otherwise noted
 - 1) Provide a minimum of 25 psf negative at corner zones.
 - b. Per local building codes.
- D. Structural: Test according to ASTM E330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding 1/175 of the glass edge length for each individual glazing tile.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Performance Requirements: Exterior entrance doors
 - 1. Air Infiltration Test: With door sash closed and locked, test units in accordance with ASTM E283 or NFRC 400 at a static air pressure difference of 1.57 psf.
 - a. Air infiltration shall not exceed .50 cfm/SF of unit, for single doors.
 - b. Air infiltration shall not exceed 1.0 cfm/SF of unit, for a pair of doors.
 - 2. Water Penetration under Static Pressure: Test according to ASTM E331 and as follows:
 - a. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq.ft.
- F. Energy Performance: Certify and label energy performance according to NRFC as follows:
 - 1. Thermal Transmittance (U-factor): Thermally-improved doors shall have U-factor at not more than 0.80 Btu/sq.ft. x h x deg F.
 - 2. Entrance Doors: CRF of not less than 63 as determined in accordance with AAMA 1503.
 - 3. Labeling of Doors: The U-factor and the air leakage rate for all manufactured doors installed between conditioned space, semi-heated space, unconditioned space, and exterior space shall be identified on a permanent nameplate installed on the product by the manufacturer.
 - a. When doors do not have such a nameplate, the installer or supplier of any doors shall provide a signed and dated certification for the installed doors listing the U-factor and air leakage rate.

2.3 STANDARD DOORS

- A. Stile and Rail Design: Wide stile, nominally 5-inch wide vertical stiles, 6-1/2-inch high top rail, intermediate rail, and nominally 10-inch high bottom rail.

1. Wide Style (modified top and bottom rail and intermediate rail): Capitol.
2. 452 (modified top and bottom rail and crossrail): CMI.
3. Series 550 (modified top and bottom rail and door muntin): U.S. Aluminum Division of CRL.
4. WS-500-HD (modified top and bottom rail and intermediate rail): Cross.
5. Series D500 (modified top and bottom rail) and mid-rail: EFCO.
6. 500 (modified top and bottom rail) and intermediate rail: Kawneer.
7. Series 150 (modified top and bottom rail and mid-rail): Manko.
8. Series SL-15 (modified top and bottom rail and intermediate rail): Special-Lite, Inc.
9. Wide Stile (modified top and bottom rail and intermediate rail): Tubelite.
10. 50D Wide Stile (modified top and bottom rail and intermediate rail): YKK.
11. R500 Wide Stile Heavy Duty: CDS.
12. WS-500 Wide Stile: Oldcastle Building Envelope.

2.4 DOOR MATERIALS AND CONSTRUCTION

- A. Sections shall be extruded from 6063-T5 aluminum alloy (ASTM B221 Alloy GS 10A T5).
- B. Major portions of the door stiles shall be 0.125 inch in thickness, and glazing molding shall be 0.050 inch thick.
 1. Mullions shall be as detailed on Drawings and as required for type of door being furnished.
 2. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
 3. Glazing Stops and Gaskets: Square, snap-on, extruded aluminum stops and preformed gaskets of neoprene bulb type.
 - a. Provide lock-in tamperproof type glazing stops on outside of door.
 - b. No exposed screws shall be required to secure stops.
- C. Screws, miscellaneous fastening devices, and internal components shall be of stainless steel, plated, or corrosion-resistant materials of sufficient strength to perform the functions for which they are used.
- D. Wide Stile: Corner construction shall consist of both sigma deep penetration and sigma fillet welds and mechanical fastening. Inside joints between the top rail and vertical stiles shall have a continuous bead of sealant. Interior glazing stops shall be square snap-in type with neoprene bulb type glazing. Square stops on exterior side shall be lock-in tamperproof type. No exposed screws shall be required to secure stops.
- E. Weathering: Manufacturer's replaceable components used as tested for air-infiltration, water penetration and thermal "Performance Requirements".
- F. Where ADA-compliant threshold is scheduled, provide door with door bottom sweeps and undercut door as required for weathertight seal. Verify type threshold with door hardware schedule.
- G. Doors shall have the lock stile portion of the top rail closed for mounting security door contacts.
- H. Where aluminum doors are scheduled to receive a concealed overhead stop, the jamb bracket shall be mortised into the frame and the channel mortised into the top of the door. The cut for the arm on the stop side of the door shall not be cut below the stop strip of the frame.

2.5 DOOR AND WINDOW FRAMING MATERIALS AND CONSTRUCTION

- A. Refer to Division 08 Section "Aluminum-Framed Storefront".

2.6 HARDWARE

- A. Basis-of-Design: Aluminum doors specified in this Section shall receive heavy-duty full-mortise continuous-gear hinges as manufactured by the Roton Division of the Hager Companies. Furnish 780-112HD (for flush-mounted doors) or 780-111HD/780-224HD (for doors inset from frame) as required by frame manufacturer.
 - 1. Subject to compliance with requirements, provide either the named products or comparable products by one of the following.
 - a. Architectural Builders Hardware Mfg., Inc.; A110HD or A111HD/A240HD.
 - b. Bommer Inds., Inc.; FM-SLFHD or FM-SLIHD/FM-HD.
 - c. McKinney Products Company, Assa Abloy; MCK-12HD or MCK-14HD/MCK-25HD.
 - d. Pemko Mfg. Co., Assa Abloy; FM-SLFHD or FM-SLIHD/FM-HD.
 - e. Select Products Limited; SL-11HD or SL-18HD/SL-24HD.
 - f. Stanley Hardware; 661HD or 662HD.
 - g. Zero International; 910DB or 914DB.
- B. Continuous gear hinge finish shall match door and frame finish.
 - 1. Where painted finish is required, the hinge cap shall be painted by the door manufacturer with the same high-performance organic coating as the door and frame.
- C. For balance of hardware furnished by others, refer to Division 08 Section "Door Hardware".

2.7 GLAZING

- A. Glazing: Comply with Division 08 Section "Glazing" and as required to meet "Performance Requirements".
- B. Glazing Gaskets: As recommended by manufacturer to meet "Performance Requirements" and general requirements of Division 08 Section "Glazing".

2.8 FABRICATION

- A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.
- B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
- C. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory-assemble door units and factory-install hardware to greatest extent possible. Reinforce door units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.
 - 1. Interior Doors: Provide ANSI/BHMA A156.16 silencers at stops to prevent metal-to-metal contact. Provide 3 silencers on strike jamb of single door frames and 2 silencers on head of double door frame.
 - 2. At pairs of exterior doors, provide sliding-type weatherstripping retained in adjustable strip and mortised into door edge to comply with "Performance Requirements".
 - 3. At exterior doors, provide weather sweeps applied to door bottoms to comply with "Performance Requirements".
- D. Entrance Door Hardware Installation: Factory install entrance door hardware specified in this Section by the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- E. After fabrication, clearly mark components to identify their location in Project according to Shop Drawings.

2.9 FINISH

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.
- C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. Clear Anodic Finish: AAMA 611-20, AA-M12C22A41 or AAM10C21A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.
 - 1. Verify location of preset anchors, perimeter fasteners, and block-outs are in accordance with shop drawings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
 - 1. Aluminum Surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.3 INSTALLATION

- A. Aluminum doors shall be securely installed according to the manufacturer's recommendations, and operating hardware shall be checked for proper function and adjustment. Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions.
 - 1. Adjust weatherstripping contact and hardware movement to produce proper operation.
- B. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers written instructions.
 - 1. Field-Installed Entrance Door Hardware: Install surface mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
- C. Install glazing to comply with requirements of Division 08 Section "Glazing", unless otherwise indicated.
- D. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weatherstripping.
- E. Do not cut aluminum frame stop strip when mounting exit devices and closers.

- F. Where aluminum doors are scheduled to receive a concealed overhead stop, the jamb bracket shall be mortised into the frame and the channel mortised into the top of the door. The cut for the arm on the stop side of the door shall not be cut below the stop strip of the frame.

3.4 ERECTION TOLERANCE

- A. Refer to Division 08 Section "Aluminum-Framed Storefronts".

3.5 ADJUSTING/CLEANING

- A. Adjust doors and hardware to provide tight fit at contact points and weatherstripping, smooth operation, and weathertight closure.
 - 1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70 degree open position to 3 inches from the latch measured to the leading door edge.
- B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.6 PROTECTION

- A. Protect the aluminum doors and their finish against damage from construction activities and harmful substances. Clean the aluminum surfaces as recommended for the type of finish applied.

END OF SECTION 08 13 16

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Five-ply flush wood veneer-faced doors for transparent finish.
 2. Factory-preparation of wood doors for hardware specified in Division 08 Section "Door Hardware".
 3. Doors shall be factory-finished, unless otherwise noted.
 4. Factory-fitting flush wood doors to frames.
 5. Factory glazing
- B. Related Sections:
1. Division 08 Section "Hollow Metal Frames".
 2. Division 08 Section "Door Hardware" for coordination and for testing and inspection.
 3. Division 08 Section "Glazing".

1.2 ACTION SUBMITTALS

- A. Product Data: Submit door manufacturer's product data, specifications, and installation instructions for each type of wood door, including door construction description and WDMA I.S.1-A and AWS classifications.
1. Include details of core and stile construction and similar components.
 2. Include factory-finishing specifications.
- B. Shop Drawings: Indicate locations, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
1. Door schedule indicating door location, type, size, and swing.
 2. Door elevations, dimensions, and locations of hardware, lite cutouts, and glazing thickness.
 3. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 4. Dimensions and locations of blocking for hardware attachment.
 5. Dimensions and locations of mortises and holes for hardware.
 6. Undercuts and clearances.
 7. Requirements for veneer matching.
 8. Doors to be factory finished and finish requirements.
- C. Samples for Verification: Factory finishes applied to actual door materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of 3 samples showing typical range of color and grain to be expected in the finished work.

1.3 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
1. Cleaning Instructions: Submit manufacturer's cleaning instructions for doors.
 2. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Comply with the applicable requirements of the following standards unless otherwise indicated:
1. ANSI/WDMA I.S. 1, "Industry Standard for Wood Flush Doors," published by Window and Door Manufacturers Association (WDMA), formerly the National Wood Window and Door Association (NWWDA).

- B. Openings shall be provided to conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. Where, in the opinion of the supplier/maker, openings do not conform, notify the A/E.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect wood doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced ANSI standard and recommendations of WDMA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors," as well as with manufacturer's instructions.
- B. Identify each door with individual opening numbers that correlate with designation system used on shop drawings for door, frames, and hardware, and STC or fire rating where applicable, using temporary, removable, or concealed markings.
- C. Polybag protect each door for shipment and handling.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, installer, and contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42 by 84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3 inch span.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 2. Warranty shall be in effect during the following period from date of Substantial Completion.
 - a. Interior Solid-Core Interior Doors: Full Life of Original 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. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - a. Masonite Architectural
 - b. Lambton Doors
 - c. Oregon Door
 - d. Oshkosh Door Company
 - e. VT Industries, Inc.
 - f. Five Lakes Manufacturing
 - g. Wilsonart LLC

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Obtain doors from a single manufacturer to ensure uniformity in quality of appearance and construction.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors".
 - 1. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- C. Particleboard-Core Doors:
 - 1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde resin.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors, General:
 - 1. ANSI/WDMA I.S. 1A Grade: Custom (Grade A faces).
 - 2. Species: Select white maple.
 - 3. Faces: Single-plywood veneer not less than 1/50 inch thick.
 - 4. Cut: Plain sliced (flat sliced).
 - 5. Match between Veneer Leaves: Slip match.
 - 6. Assembly of Veneer Leaves on Door Faces: Running match.
 - 7. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 - 8. Exposed Vertical Edges: Solid wood of same species as faces or a compatible species-edge Type A.
 - 9. Core:
 - a. Doors without Exit Devices, Light Openings, or Louvers: Provide particle board core (PC), unless otherwise noted.
 - 10. Construction: Five plies. Stiles and rails are bonded to core, then abrasive-plane entire unit before veneering. Faces are bonded to core using a hot press.
 - a. Seven plies will not be acceptable.
 - 11. Adhesives: Type 1 in accordance with WDMA T.M.6.
- B. Doors in Exit Enclosures: Doorway opening protectives for exit enclosures shall be labeled means of egress fire doors and shall have a maximum transmitted temperature end point of not more than 450 degrees F above ambient at the end of 30 minutes of standard fire test exposure.

2.4 GLAZING

- A. Factory Glazing:
 - 1. Nonrated doors shall be glazed with 1/4-inch-thick clear tempered safety glass, unless otherwise noted.
 - 2. Door supplier shall provide wood stops for nonrated and 20-minute doors. Stop shall be flush with face veneer; recessed stops will not be acceptable.

2.5 PREFITTING AND PREPARATION FOR HARDWARE

- A. Pre-fit and pre-machine wood doors at factory, including beveling both edges 1/8 inch in 2 inches. Where pairs of doors are scheduled, pre-fit and pre-machine as pairs. Where pairs of doors are scheduled with 3-point latching (lockset and flush bolts), the strike edge of the inactive leaf shall be square equal to WDMA meeting edge option E1.
- B. Doors shall comply with tolerance requirements of NFPA 80 for pre-fitting. Machine doors for hardware requiring cutting of doors. Comply with final hardware schedules and door frame shop drawings and with hardware templates and other essential information required to ensure proper fit of doors and hardware.
 - 1. Top and hinge edges: 1/8 inch maximum.
 - 2. Single door, lock edge: 1/8 inch maximum.
 - 3. Pair meeting edge: 1/16 inch per leaf maximum.
 - 4. Bottom (rated or nonrated):
 - a. 1/2 inch from decorative floor covering.
 - b. 3/4 inch maximum from top of noncombustible floor.
 - c. 3/8 inch maximum from top of noncombustible sill or threshold.
 - d. Doors with vertical rod exit devices, manual or automatic flush bolts shall be undercut for latching of bolts to a flush floor strike or threshold.
 - e. See Division 09 Section "Room Finish Schedule", for floor finish materials.
- C. Coordinate with the metal frame supplier the locations of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in factory.
- D. 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.

2.6 FABRICATION

- A. General:
 - 1. The utility or structural strength of the doors must not be impaired in fitting to the opening in applying hardware, in preparing for lights, louvers, plant-ons or other detailing.
 - 2. Pilot holes must be drilled for all screws that act as hardware attachments. Threaded-to-the-head screws are preferable for fastening hardware to nonrated doors and are required on fire-rated doors.
 - 3. In fitting for height, do not trim top or bottom edge by more than 3/4 inch, unless accommodated by additional blocking. Do not trim top edge of fire doors.
- B. 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 clearance requirements of referenced quality standard for fitting, unless otherwise indicated.
- C. Factory-machine doors for hardware that is not surface-applied.
 - 1. Locate hardware to comply with DHI-WDHS-3.
 - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W and hardware template standards, and hardware templates.
 - 3. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory-machining.
 - 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
- D. 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".

2.7 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory-finishing.
 - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 2. Finish faces, all four edges, edges of cutouts, and mortises.
 - 3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory, unless specifically noted otherwise.
- C. Transparent Finish:
 - 1. Grade: Custom.
 - 2. Finish: WDMA TR-6 catalyzed polyurethane or TR-8 UV cured acrylated.
 - 3. Staining: None required.
 - 4. Sheen: Semigloss.

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.
- C. Ensure frames are solidly anchored, allowing no deflection when doors are installed.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware".
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. 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 do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

3.4 CLEANING

- A. Clean doors promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.5 PROTECTION

- A. Protect installed doors from damage during construction.

END OF SECTION 08 14 16

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 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 09 Section "Gypsum Board Assemblies" for anchoring access door frames set in gypsum board construction.
 - 4. Division 09 Section "Acoustical Panel Ceilings" for suspended acoustical panel ceilings.
 - 5. Division 09 Section "Interior Painting" for field painting of access doors and frames.
 - 6. Division 23 Section "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.2 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.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical data for each type of access door and panel assembly, including setting drawings, templates, finish requirements, and details of anchorage devices.
 - 1. Include complete schedule, type, locations, construction details, finishes, latching or locking provisions, and other pertinent data.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.
- B. 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.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.
- B. Size Variations: Obtain A/E's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acudor Products, Inc.
 - 2. Babcock-Davis.

3. Cendrex Inc.
4. Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
5. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
6. Karp Associates, Inc.
7. Lane-Aire Manufacturing Corp.
8. Larsen's Manufacturing Company.
9. Maxam Metal Products Limited.
10. Metropolitan Door Industries Corp.
11. MIFAB, Inc.
12. Milcor Inc.
13. Nystrom, Inc.
14. Williams Bros. Corporation of America (The).

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Flush Access Doors with Exposed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Optional Features: Masonry anchors, where needed.
 3. Locations: Wall.
 4. Door Size: 24 inches by 24 inches, unless otherwise noted.
 5. Uncoated Steel Sheet for Door: Nominal 0.060 inch, (fka 16 gauge).
 - a. Finish: Factory prime.
 6. Frame Material: Same material, thickness, and finish as door.
 7. Hinges: Manufacturer's standard.
 8. Hardware: As indicated in "Fabrication" article.
- B. Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
 2. Locations: Wall and ceiling.
 3. Door Size: 24 inches by 24 inches, unless otherwise noted.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, (fka 16 gauge).
 - a. Finish: Factory prime.
 5. Frame Material: Same material and thickness as door.
 6. Hinges: Manufacturer's standard.
 7. Hardware: See "Fabrication".

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879, with cold-rolled steel sheet substrate complying with ASTM A 1008, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same type as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329.

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 doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. Provide one cylinder lock per door accessible to public, unless otherwise noted. For cylinder locks, furnish two keys per lock and key all locks alike.
 - a. A latching device may be provided where doors are not accessible to public and where indicated.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that rough openings for door and frame are correctly sized and located.
 - 2. Verify mechanical and electrical requirements for ceiling or wall access panels.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Advise installers of other work about specific requirements relating to access door installation, including size of openings to receive access door and frame, as well as locations of supports, insert, and anchoring devices. Furnish inserts and anchoring devices for access doors that must be built into other construction. Coordinate delivery with other work to avoid delay.
 - 1. Coordinate locking requirements with Owner.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
 - 1. Install frames plumb and level in opening. Secure rigidly in place.
 - 2. Position units to provide convenient access to concealed work requiring access.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.4 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13

SECTION 08 43 13 - ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Aluminum-framed storefront (framing) systems.
- B. Related Sections:
 - 1. Division 07 Section "Joint Sealants": For sealant between aluminum frames and adjacent materials.
 - 2. Division 08 Section "Aluminum Doors".
 - 3. Division 08 Section "Door Hardware".
 - 4. Division 08 Section "Glazing": For glazing requirements.

1.2 ACTION SUBMITTALS

- A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, and details of components, provisions for expansion and contraction, and attachments to other work. Drawings must show actual wall conditions.
 - 1. Indicate member sizes, reinforcement and support hardware necessary for a complete installation.
 - 2. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 3. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 4. Transition Details: Include details of the frame illustrating how the frame will interface with the transition strip associated with the air barrier in the masonry cavity. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 - 5. Include point-to-point wiring diagrams showing the following:
 - a. Power requirements for each electrically operated door hardware.
 - b. Location and types of switches, signal devices, conduit sizes, and number and size of wire.
- C. Performance Requirement Verification: Provide verification that installation of products will result in compliance with "Performance Requirements" indicated. This may include calculations, testing results, manufacturer installation and attachment requirements, fastener information for indicated substrate, or other means necessary to demonstrate compliance.

1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Energy Performance Certificates: For aluminum-framed storefront framings accessories and components, from manufacturer, provide a signed and dated certification for the installed fenestration listing the U-factor, SHGC, and the air leakage rate.
 - 1. Provide an NFRC Component Modeling Approach (CMA) generated label certificate shall be provided by the manufacturer. The label certificate shall be project specific and will contain the thermal performance ratings of the manufacturer's framing combined with specified glass and glass spacer used in the fabrication of the glass, at NFRC standard test size as defined in table 4-3 in NFRC 100-2010.

1.4 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
 - 2. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer and supervisor who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.
- B. Regulatory Requirements
 - 1. Accessible Entrances: Conform to the U.S. Architectural & Transportation Barriers Compliance Board's, "Americans with Disabilities Act Accessibility Guidelines" (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
 - a. Opening-Force Requirements:
 - 1) Egress Doors: Not more than 30 lbf required to set door in motion and not more than 15 lbf required to open door to minimum required width.
 - 2) Accessible Interior Doors: Not more than 5 lbf.
- C. Mockups: Building mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. First installation of aluminum-framed entrances and storefronts, including glazing may serve as mockup. Coordinate location with A/E.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

- A. Field Measurements: Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the work.

1.7 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals, metal finishes (unless special finish warranty is required), and other materials beyond normal weathering.
 - d. Water leakage through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Products: Subject to compliance with requirements, provide one of the products specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Obtain all components of aluminum-framed storefront system, including framing and accessories, from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacturer, fabrication, installation, or other defects in construction.
1. Aluminum-framed storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
 3. Transition of the AWB assemblies and fenestration needs to align as close as possible.
 4. Connection shall accommodate anchors, shims, adjustments, and building movement maintaining continuity of the building envelope AWB.
 5. Avoid thermal "short circuits" and align thermal breaks in fenestration with surrounding wall insulation to optimize energy performance.
- B. Glazing: Physically and thermally isolate glazing from framing members.
- C. Structural Loads
1. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," "6.5, Method 2 - Analytical Procedure," whichever are more stringent.
 - a. Basic Wind Speed: 120 mph.
 - b. Importance Factor: 1.15.
 - c. Exposure Category: As indicated.
 - d. Building Classification: III, unless otherwise noted.
 2. Per local building codes, but never less than 20 psf positive and negative or 25 psf negative in corner zones.
- D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing tile to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

- E. Structural: Test according to ASTM E330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

- F. Air Infiltration: Test according to ASTM E283 or NFRC 400 for infiltration as follows:
 - 1. Fixed Framing and Glass Area
 - a. Maximum air leakage of 0.06 cfm/sq.ft. at a static-air-pressure differential of 1.57 lbf/sq.ft.
 - 2. Entrance Doors
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq.ft. at a static-air-pressure differential of 1.57 lbf/sq.ft.
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq.ft. at a static-air-pressure differential of 1.57 lbf/sq.ft.

- G. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq.ft.

- H. Energy Performance: Certify and label energy performance according to NFRC as follows:
 - 1. Thermal Transmittance (U-factor):
 - a. Types I and II (Non-Thermally Broken Frames): Entrance door framing shall have U-factor of not more than 0.80 Btu/sq.ft. x h x deg F.
 - b. Type III: Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq.ft. x h x deg F as determined according to NFRC 100.
 - 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
 - 3. Condensation Resistance: Fixed glazing and framing areas shall have a NFRC-certified condensation resistance rating of no less than 56 as determined according to NFRC 500.
 - 4. Labeling of Fenestration Products: All manufactured fenestration products shall have a permanent nameplate, installed by manufacturer, listing the U-factor, SHGC, and air leakage rate.
 - a. When the fenestration product does not have such nameplate, the installer or supplier of such fenestration shall provide a signed and dated certification for the installed fenestration listing the U-factor, SHGC, and air leakage rate.

- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change: 120 deg F., ambient; 180 deg F., material surfaces.

- J. Dimensional Tolerances: Provide window and storefront systems that accommodate dimensional tolerances of building frame and other work.

2.3 STOREFRONT SYSTEMS

- A. Framing members, transition members, mullions, sills, adapters, and mountings (including sill anchors, frame receptors at jambs, and other frame trim and accessories shown on Drawings), and as required to meet Performance Requirements, shall be extruded aluminum with alloy and temper consistent with the method of manufacturer.
 - 1. Framing members shall be of thickness required and reinforced as required to support imposed loads.
 - 2. Construction: Where indicated, members shall incorporate a thermal-barrier by one of the following methods:
 - a. Framing members shall be composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.

- b. High-performance plastic connectors separate framing members exposed to the exterior from members exposed to the interior.
 - 3. Glazing System: Retained mechanically with gaskets on four sides.
 - 4. Glazing Plane: Center.
 - 5. Fabrication Method: Field-fabricated stick system.
 - 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 7. Steel Reinforcement: As required by manufacturer.

- B. Type I – 1-3/4 by 4-1/2 inch. Framing members shall provide for flush center glazing of 1/4-inch glass, by use of elastomeric gaskets on both sides of the glass, with no projecting stops. Vertical and horizontal framing members shall have a nominal face dimension of 1-3/4 inches with an overall depth of 4-1/2 inches. Entrance framing members shall be compatible with glass framing in appearance. Single acting entrance frames shall include weatherstripping.
 - 1. Manufacturers: Subject to compliance with requirements, provide one of the manufacturers specified:
 - a. 145 Non-Thermal Aluminum Frame System; Capitol Aluminum & Glass Corp.
 - b. 450 FG; CMI Architectural.
 - c. T/E 4500 Series; Cross Aluminum Products
 - d. System 400 (NT); EFCO Corporation
 - e. Trifab VG 450; Kawneer Co.
 - f. 450 Series; Manko Window Systems, Inc.
 - g. SL-450; Special-Lite, Inc.
 - h. 4500 Series; Tubelite
 - i. YES 45; YKK AP America
 - j. 450 Series; U.S. Aluminum Div. of CRL
 - k. FG-2000; Oldcastle Building Envelope (OBE)
 - 2. Application for framing type
 - a. Interior vestibule doors.
 - b. Exterior doors with no sidelight and/or transom.
 - c. Interior storefront system (no doors).

- C. Type II – 2 by 4-1/2 inch. Framing members shall provide for flush center glazing of one-inch insulating glass, by use of elastomeric gaskets on both sides of the glass, with no projecting stops. Vertical and horizontal framing members shall have a nominal face dimension of 2 inches with an overall depth of 4-1/2 inches. Entrance framing members shall be compatible with glass framing in appearance. Single acting entrance frames shall include weatherstripping.
 - 1. Manufacturers: Subject to compliance with requirements, provide one of the manufacturers specified:
 - a. 14000 (Non-Thermally Improved); Cross Aluminum Products
 - b. 450 TB (Non-Thermally Improved); CMI Architectural.
 - c. 245 (Non-Thermally Improved); Capitol Aluminum & Glass Corp.
 - d. Series 402; EFCO Corporation
 - e. Trifab VG 451; Kawneer Co.
 - f. 1450 Series; Manko Window Systems, Inc.
 - g. SL-450T (Non-Thermally Improved); Special-Lite, Inc.
 - h. 14000 (Non-Thermally Improved); Tubelite
 - i. YES 45FS; YKK AP America
 - j. 451 Series; U.S. Aluminum Div. of CRL
 - k. FG-3000; Oldcastle Building Envelope (OBE)
 - 2. Application for framing type
 - a. Exterior doors with single sidelight or transom.

- D. Type III – 2 by 4-1/2 inch with thermal barrier. Framing members shall provide for flush center glazing of one-inch insulating glass, by use of elastomeric gaskets on both sides of the glass, with no projecting stops. Framing members shall incorporate a thermal barrier. Vertical and horizontal framing members shall have a nominal face dimension of 2 inches with an overall depth of 4-1/2 inches. At door jambs and head Type II 2 by 4-1/2-inch entrance framing members shall be incorporated into the Type III framing system and shall be compatible with glass framing in appearance. Door entrance frames shall include weatherstripping.

1. Manufacturers: Subject to compliance with requirements, provide one of the manufacturers specified:
 - a. 450T-CG 2 x 4-1/2 inch Thermal; CMI Architectural.
 - b. 245T; Capitol Aluminum & Glass Corp.
 - c. System 403 Thermal; EFCO Corporation
 - d. Trifab VG 451T; Kawneer Co.
 - e. 2450 Series; Manko Window Systems, Inc.
 - f. T 14000; Tubelite
 - g. YES 45TU; YKK AP America
 - h. IT451 Series; U.S. Aluminum Div. of CRL
 - i. Series 300 Thermal MultiPlane; Oldcastle Building Envelope (OBE)
2. Application for framing type
 - a. Entries with multiple sidelights or transoms.
 - b. Exterior storefront system (punched openings).

- E. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

2.4 GLAZING

- A. Glazing as specified in Division 08 Section "Glazing".
- B. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
- C. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.
- D. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.
- E. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 07 Section "Joint Sealants".
- F. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other system components with which it comes in contact; and recommended by sealant and aluminum-framed system manufacturer for this use.

2.5 HARDWARE

- A. Refer to Division Section "Door Hardware", unless otherwise noted.
 1. Refer to Door Sections for continuous or pivot hinges.
 2. Hardware shall be sent to the door and frame manufacturer for application. The finish hardware supplier shall be responsible for furnishing physical hardware and templates of hardware to the entrance door and frame manufacturer prior to fabrication and for coordination hardware delivery requirements with the hardware manufacturer.
- B. Weather Stripping: Manufacturer's standard replaceable components.
 1. Compression Type: Mode of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
- C. Silencers: BHMA A156.16, Grade 1.

2.6 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below:
 - 1. Sheet and Plate: ASTM B209.
 - 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B429.
 - 4. Bars, Rods, and Wire: ASTM B211.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10.
 - 6. Structural Profiles: ASTM B308.
- B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC Standard.
 - 1. Structural Shapes, Plates, and Bars: ASTM A 36.
 - 2. Cold-Rolled Sheet and Strip: ASTM A 1008.
 - 3. Hot-Rolled Sheet and Strip: ASTM A 1011.
- C. Steel Reinforcement Primer: Manufacturers standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.7 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - 2. Reinforce members as required to receive fastener threads.
 - a. Provide a backup reinforcement, at door frame head, of steel or 1/4-inch aluminum for attachment of closer arm.
 - b. All members less than 0.125 inch thick to receive threaded fasteners shall receive backup reinforcement.
- B. Anchors: Three-way adjustable anchors with minimum adjacent of 1 inch that accommodate fabrication and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.
- C. Flashing: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.
- D. Vertical mullions between doors shall have steel reinforcement and be attached to the floor with concealed fasteners.
- E. Subsills: Thermally broken, extruded aluminum subsills.
 - 1. Provide at all storefront assemblies above first floor line (grade).
- F. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30 mil thickness per coat.
- G. Transition Membrane: To maintain the air and water barrier a pre-formed silicone sheet or manufacturer approved flexible flashing of stainless steel core with polymer fabric laminated to bottom stainless steel face with non-asphalt adhesive.
 - 1. Basis-of-Design: Multi-Flash SS; Yoke Manufacturing or a comparable product by one of the following:

- a. IPCO Stainless Steel Fabric Flashing; Illinois Products Inc.
- b. R-Guard SS ThruWall; Prosoco, Inc.
- c. Wall Guardian Stainless Steel TWF; STS Coatings, Inc.
- d. TK TWF; TK Products, Inc.

2.8 FABRICATION

- A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - a. Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual".
 - 6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or panels.
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - 8. Where aluminum will contact dissimilar metals, protect against galvanic action.
- B. Form or extrude aluminum shapes before finishing.
- C. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).
- E. Storefront Framing: Fabricate components for assembly using screw-spline system or head and sill receptor system with shear blocks at intermediate horizontal members.
 - 1. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.
 - 1. At exterior and interior doors, provide compression weather stripping at fixed stops.
 - 2. Provide subframes and reinforcing of types indicated or, if not indicated, as required for complete system.
 - 3. Where aluminum doors are scheduled to receive a concealed overhead stop, the jamb bracket shall be mortised into the frame and the channel mortised into the top of the door. The cut for the arm on the stop side of the door shall not be cut below the stop strip of the frame.
- G. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.
- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and top for factory-installed entrance door hardware before applying finishes.

2.9 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.
- C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. Clear Anodic Finish: AAMA 611-20, AA-M12C22A41 or AA-M10C21A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Openings for aluminum entrances shall be prepared to the proper size, plumb, square, level, and in the proper location and alignment as shown on the Drawings and the final shop drawings.
 - 1. Coordinate with masonry tolerances. Refer to Division 04 Section "Unit Masonry".

3.3 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
 - 1. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 2. Shim and brace aluminum system before anchoring to structure.
 - 3. Provide sill flashing at exterior storefront systems. Extend extruded flashing continuous with splice joints; set in continuous beads of sealant.
 - 4. Verify storefront system allows water entering system to be collected in gutters and wept to exterior.
 - 5. Locate expansion mullions where indicated on reviewed shop drawings.
 - 6. Seal perimeter and other joints watertight, unless otherwise indicated.
 - a. Do not seal weeps.
 - 7. Locate sealant to maintain the continuity of the air and water barrier. The sealant installed at the exterior face is a weather seal.
 - a. When it is not possible to install sealant in the recommended location a transition membrane can be used.
- B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
 - 1. Provide end dams at all sill terminations.

- D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 07 Section "Joint Sealants".
 - 1. To minimize the potential for water leakage attributed to the subsill, fastener penetrations through the horizontal leg of the subsill should be avoided. Instead, brackets that engage the subsill without penetrating the wet zone should be mechanically attached to the subsill extrusion and fully sealed to ensure a watertight interface.
 - 2. Exterior Flashing Receivers: Install in accordance with manufacturer's recommendations, approved submittals and in proper relationship with adjacent construction. Includes the following:
 - a. Secure receiver at perimeter of wall opening with adhesives or fasteners.
 - b. Place flashing into receiver channel.
 - c. Secure flashing with receiver clip.
 - E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
 - F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
 - 1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
 - G. Install glazing to comply with requirements of Division 08 Section "Glazing", unless otherwise indicated.
 - 1. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - H. Install perimeter sealant to comply with requirements of Division 07 Section "Joint Sealants", unless otherwise indicated.
 - I. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surface abut in line or are separated by a reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.
 - J. Do not cut aluminum frame stop strip when mounting exit devices and closers.
 - K. Coordinate with Division 08, Division 26, and security access contractor for location and installation of conduit/wiring required for electrified hardware items mounted to doors and frames, including, but not limited to, cutting/drilling any access holes required for pulling wires through frame head/jambs to the electrified hardware items.
- 3.4 PROTECTION
- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 43 13

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Cabinets (casework), including locks in cabinets
2. Signage
3. Toilet accessories

C. Related Sections:

1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
2. Division 06 Section "Miscellaneous Rough Carpentry"
3. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
4. Division 08 Sections:
 - a. "Hollow Metal Frames"
 - b. "Flush Wood Doors"
 - c. "Aluminum-Framed Storefronts"
5. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
6. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
 - a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
 - b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.

10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:

- a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
- b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
- c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
- d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
- e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
- f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
 - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. Fire door assemblies, in compliance with NFPA 80.
 - b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.

3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
 4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- B. Certifications:
1. Fire-Rated Door Openings:
 - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
 2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
 - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
 3. Electrified Door Hardware
 - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
 4. Accessibility Requirements:
 - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.
- C. Pre-Installation Meetings
1. Keying Conference
 - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Requirements for access control.
 - 5) Address for delivery of keys.
 2. Pre-installation Conference
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing-in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.
 - f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:
 - a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks
 - a) 3 years
 - 2) Exit Devices
 - a) 3 years
 - 3) Closers
 - a) 30 years
 - 4) Automatic Operators
 - a) 2 years

- b. Electrical Warranty
 - 1) Locks
 - a) 1 year
 - 2) Exit Devices
 - a) 1 year

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 - 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

- A. Fabrication
 - 1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
 - 2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series
2. Acceptable Manufacturers and Products:
 - a. Hager BB1191/1279 series
 - b. McKinney TB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Select
 - b. Roton

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.

4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin EPT-10
2. Acceptable Manufacturers and Products:
 - a. Securitron CEPT-10
 - b. Security Door Controls PTM

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 DOOR CORDS

A. Manufacturers:

1. Scheduled Manufacturer and Product:
 - a. Schlage 788/798 Series
2. Acceptable Manufacturers and Products:
 - a. Securitron TSB Series
 - b. Locknetics DC Series

B. Requirements:

1. Provide door cords with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.07 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage L9000 series
2. Acceptable Manufacturers and Products:
 - a. Corbin-Russwin ML2000 series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.

2. Indicators: Where specified, provide indicator window measuring a minimum 2-3/5-inch x 3/5 inch with 180-degree visibility. Provide messages color-coded using ANSI Z535 Safety Red with full text and/or symbols, as scheduled, for easy visibility. When applicable allows for lock status indication on both sides of the door.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
7. Provide motor based electrified locksets that comply with the following requirements:
 - a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
 - b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case.
 - c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
 - d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate “hot levers” in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
 - e. Connections – provide quick-connect Molex system standard.
8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Lever Design: 06A

2.08 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin 99/33A series
2. Acceptable Manufacturers and Products:
 - a. Corbin-Russwin ED5000 series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide grooved touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.

10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.09 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage/Von Duprin PS900 Series
2. Acceptable Manufacturers and Products:
 - a. Precision ELR series
 - b. Sargent 3500 series

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:
 - a. 12/24 VDC Output, field selectable.
 - b. Class 2 Rated power limited output.
 - c. Universal 120-240 VAC input.
 - d. Low voltage DC, regulated and filtered.
 - e. Polarized connector for distribution boards.
 - f. Fused primary input.
 - g. AC input and DC output monitoring circuit w/LED indicators.
 - h. Cover mounted AC Input indication.
 - i. Tested and certified to meet UL294.
 - j. NEMA 1 enclosure.
 - k. Hinged cover w/lock down screws.
 - l. High voltage protective cover.

2.10 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer and Product:
 - a. Corbin-Russwin (Match Owner's Existing System)
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.11 KEYING

A. Scheduled System:

1. Existing factory registered system:
 - a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Construction Keying:
 - a. Replaceable Construction Cores.
 - 1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - a) 3 construction control keys
 - b) 12 construction change (day) keys.
 - 2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.
2. Permanent Keying:
 - a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - 1) Master Keying system as directed by the Owner.
 - b. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - c. Provide keys with the following features:
 - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
 - d. Identification:
 - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
 - 2) Identification stamping provisions must be approved by the Architect and Owner.
 - 3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
 - 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
 - e. Quantity: Furnish in the following quantities.
 - 1) Permanent Control Keys: 3.
 - 2) Master Keys: 6.
 - 3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
 - 4) Key Blanks: Quantity as determined in the keying meeting.

2.12 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4040XP series

2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.13 ELECTRO-MECHANICAL AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN Senior Swing
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide low energy automatic operator units that are electro-mechanical design complying with ANSI/BHMA A156.19.
 - a. Opening: Powered by DC motor working through reduction gears.
 - b. Closing: Spring force.
 - c. Manual, hydraulic, or chain drive closers: Not permitted.
 - d. Operation: Motor is off when door is in closing mode. Door can be manually operated with power on or off without damage to operator. Provide variable adjustments, including opening and closing speed adjustment.
 - e. Cover: Aluminum.
2. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 1 to 32 seconds, and logic terminal to interface with accessories, mats, and sensors.
3. Provide drop plates, brackets, and adapters for arms as required to suit details.
4. Provide motion sensors and/or actuator switches, and receivers for operation as specified. Provide weather-resistant actuators at exterior applications.

5. Provide key switches, with LED's, recommended and approved by manufacturer of automatic operator as required for function as described in operation description of hardware sets. Cylinders: Refer to "KEYING" article, herein.
6. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.

2.14 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.15 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.16 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
 - a. Glynn-Johnson
2. Acceptable Manufacturers:
 - a. Rixson
 - b. Sargent

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.17 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button or thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.18 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Zero International
2. Acceptable Manufacturers:
 - a. Reese
 - b. Legacy

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.19 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.20 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Schlage
2. Acceptable Manufacturers:
 - a. GE-Interlogix
 - b. Sargent

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Custom Steel Doors and Frames: HMMA 831.
 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Lock Cylinders:
 - 1. Install construction cores to secure building and areas during construction period.
 - 2. Replace construction cores with permanent cores as indicated in keying section.
 - 3. Furnish permanent cores to Owner for installation.
- J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Connections to panel interface modules, controllers, and gateways.
 - 6. Testing and labeling wires with Architect's opening number.
- K. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.
- L. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- M. Overhead Stops/ HOLDERS: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.

2. **Electric Strikes:** Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 3. **Door Closers:** Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. **Occupancy Adjustment:** Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

106776 OPT0362085 Version 1

Hardware Group No. 01

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8305 10" 4" X 16" F	630	IVE
1	EA	SURFACE CLOSER	4040XP REG OR PAAS REQ	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 02

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070L 06A	626	SCH
1	EA	Mortise Cylinder	As Required	626	C-R
1	EA	LFIC CORE	AS REQUIRED (MATCH OWNERS EXISTING)	626	C-R
1	EA	SURFACE CLOSER	4040XP REG OR PAAS REQ	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 03

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080L 06A	626	SCH
1	EA	Mortise Cylinder	As Required	626	C-R
1	EA	LFIC CORE	AS REQUIRED (MATCH OWNERS EXISTING)	626	C-R
1	EA	SURFACE CLOSER	4040XP REG OR PAAS REQ	689	LCN
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 04

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	EU MORTISE LOCK	L9092LEU 06A RX CON 12/24 VDC	626	SCH
1	EA	Mortise Cylinder	As Required	626	C-R
1	EA	LFIC CORE	AS REQUIRED (MATCH OWNERS EXISTING)	626	C-R
1	EA	SURFACE CLOSER	4040XP REG OR PAAS REQ	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	MULTITECH READER	MTB11/MTB15 - BY ACCESS CONTROL PROVIDER	BLK	SCE
1	EA	DOOR CONTACT	679 SERIES	BLK	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	LGR	SCE

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER MOMENTARILY UNLOCKS OUTSIDE LEVER ALLOWING ENTRY. FREE EGRESS AT ALL TIMES.

Hardware Group No. 05

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	EU MORTISE LOCK	L9092LEU 06A RX CON 12/24 VDC	626	SCH
1	EA	Mortise Cylinder	As Required	626	C-R
1	EA	LFIC CORE	AS REQUIRED (MATCH OWNERS EXISTING)	626	C-R
1	EA	SURFACE CLOSER	4040XP REG OR PAAS REQ	689	LCN
1	EA	KICK PLATE	8400 8" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	MULTITECH READER	MTB11/MTB15 - BY ACCESS CONTROL PROVIDER	BLK	SCE
1	EA	DOOR CONTACT	679 SERIES	BLK	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	LGR	SCE

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER MOMENTARILY UNLOCKS OUTSIDE LEVER ALLOWING ENTRY. FREE EGRESS AT ALL TIMES.

Hardware Group No. 06

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	EU MORTISE LOCK	L9092LEU 06A RX CON 12/24 VDC	626	SCH
1	EA	Mortise Cylinder	As Required	626	C-R
1	EA	LFIC CORE	AS REQUIRED (MATCH OWNERS EXISTING)	626	C-R
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP REG ST-1630	689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ	689	LCN
1	EA	MULTITECH READER	MTB11/MTB15 - BY ACCESS CONTROL PROVIDER	BLK	SCE
1	EA	DOOR CONTACT	679 SERIES	BLK	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	LGR	SCE

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER MOMENTARILY UNLOCKS OUTSIDE LEVER ALLOWING ENTRY. FREE EGRESS AT ALL TIMES.

Hardware Group No. 07

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	LD-99-EO	626	VON
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	65A	A	ZER

DOORS REQUIRE SPECIAL 3/8 INCH UNDERCUT FOR ADA TYPE THRESHOLD.

PERIMETER WEATHER SEALS PROVIDED BY ALUMINUM SECTION.

Hardware Group No. 08

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	DOOR CORD	788-18 LESS WIRES	626	SCE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	SD-RX-QEL-99-L-DT-06 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	SD-RX-QEL-99-L-NL-06 24 VDC	626	VON
3	EA	Mortise Cylinder	As Required	626	C-R
1	EA	RIM CYLINDER	AS REQUIRED	626	C-R
4	EA	LFIC CORE	AS REQUIRED (MATCH OWNERS EXISTING)	626	C-R
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA ST-2731	689	LCN
1	EA	SURF. AUTO OPERATOR	9540	ANCLR	LCN

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	ACTUATOR, TOUCH	8310-853T	630	LCN
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE
1	EA	MULTITECH READER	MTB11/MTB15 - BY ACCESS CONTROL PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	679 SERIES	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4RL 120/240 VAC	LGR	SCE

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RETRACTS PANIC DEVICE LATCH AND ENABLES OUTSIDE ACTUATOR FOR USE. PANIC DEVICE LATCHES ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN (I.E. PUSH/PULL MODE) AS DESIGNATED BY ACCESS CONTROL SYSTEM SCHEDULE. INTERIOR ACTUATOR ENABLED AT ALL TIMES. PRESSING INTERIOR ACTUATOR MOMENTARILY RETRACTS PANIC DEVICE LATCH AND SIGNALS AUTOMATIC OPERATOR TO OPEN DOOR. FREE EGRESS AT ALL TIMES.

Hardware Group No. 09

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	SD-RX-QEL-99-EO 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	SD-RX-QEL-99-NL-OP-110MD 24 VDC	626	VON
3	EA	Mortise Cylinder	As Required	626	C-R
1	EA	RIM CYLINDER	AS REQUIRED	626	C-R
4	EA	LFIC CORE	AS REQUIRED (MATCH OWNERS EXISTING)	626	C-R
2	EA	90 DEG OFFSET PULL	8190EZHD 10"	630-316	IVE
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	SURF. AUTO OPERATOR	9540	ANCLR	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
2	EA	ACTUATOR, TOUCH	8310-853T	630	LCN
1	EA	MULTITECH READER	MTB11/MTB15 - BY ACCESS CONTROL PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	679 SERIES	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4RL 120/240 VAC	LGR	SCE

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RETRACTS PANIC DEVICE LATCH AND ENABLES OUTSIDE ACTUATOR FOR USE. PANIC DEVICE LATCHES ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN (I.E. PUSH/PULL MODE) AS DESIGNATED BY ACCESS CONTROL SYSTEM SCHEDULE. INTERIOR ACTUATOR ENABLED AT ALL TIMES. PRESSING INTERIOR ACTUATOR MOMENTARILY RETRACTS PANIC DEVICE LATCH AND SIGNALS AUTOMATIC OPERATOR TO OPEN DOOR. FREE EGRESS AT ALL TIMES.

Hardware Group No. 10

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	SD-RX-QEL-99-EO 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	SD-RX-QEL-99-NL-OP-110MD 24 VDC	626	VON
3	EA	Mortise Cylinder	As Required	626	C-R
1	EA	RIM CYLINDER	AS REQUIRED	626	C-R
4	EA	LFIC CORE	AS REQUIRED (MATCH OWNERS EXISTING)	626	C-R
2	EA	90 DEG OFFSET PULL	8190EZHD 10"	630-316	IVE
2	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	SURF. AUTO OPERATOR	9540	ANCLR	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA SRT	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 SRT	689	LCN
2	EA	ACTUATOR, TOUCH	8310-853T	630	LCN
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	65A	A	ZER
1	EA	MULTITECH READER	MTB11/MTB15 - BY ACCESS CONTROL PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	679 SERIES	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4RL 120/240 VAC	LGR	SCE

DOORS REQUIRE SPECIAL 3/8 INCH UNDERCUT FOR ADA TYPE THRESHOLD.

PERIMETER WEATHER SEALS PROVIDED BY ALUMINUM SECTION.

OPERATION: DOOR NORMALLY CLOSED AND LOCKED. PRESENTING VALID CREDENTIAL TO READER MOMENTARILY RETRACTS PANIC DEVICE LATCH AND ENABLES OUTSIDE ACTUATOR FOR USE. PANIC DEVICE LATCHES ALSO CAPABLE OF BEING ELECTRONICALLY DOGGED DOWN (I.E. PUSH/PULL MODE) AS DESIGNATED BY ACCESS CONTROL SYSTEM SCHEDULE. INTERIOR ACTUATOR ENABLED AT ALL TIMES. PRESSING INTERIOR ACTUATOR MOMENTARILY RETRACTS PANIC DEVICE LATCH AND SIGNALS AUTOMATIC OPERATOR TO OPEN DOOR. FREE EGRESS AT ALL TIMES.

END OF SECTION 08 71 00

SECTION 08 80 00 – GLAZING

PART 1 - GENERAL

1.1 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. Storefront framing.
 - 2. Glazed entrances.
 - 3. Doors
- B. Related Sections include the following:
 - 1. Division 08 Section “Aluminum Doors” for thermal performance requirements.
 - 2. Division 08 Section “Flush Wood Doors” for coordination.
 - 3. Division 08 Section “Aluminum-Framed Storefront” for thermal performance requirements.

1.2 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 (mm) according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Solar Heat Gain Coefficient (SHGC): The ratio of the solar heat gain through the glass relative to the incident solar radiation. Solar heat gain includes both direct and indirect gain. The direct gain is the solar energy directly transmitted through the glazing. The indirect gain is the solar energy absorbed by the glazing and subsequently convected and thermally radiated inward.
- E. Low-Emissivity (“Low-E”): Having the demonstrated ability to reduce heat gain or loss by reflecting long-wave infra-red (IR) energy (heat), thereby decreasing the U-value and improving energy efficiency.
 - 1. “Solar-Control” Low-E Glazing: Glazing that has a SHGC equal to or less than 0.40. Solar-control low-e coatings maximize the amount of daylight transmitted through the glass while minimizing both the amount of solar heat transmitted into the building and the amount of heat loss from the long-wave infrared portion of the heat spectrum.
- F. Sealed Insulating Glass Unit Surface Designations:
 - 1. Surface 1 – Exterior surface of the outer glass lite.
 - 2. Surface 2 – Interspace surface of the outer glass lite.
 - 3. Surface 3 – Interspace surface of the inner glass lite.
 - 4. Surface 4 – Interior surface of the inner glass lite.
- G. Outer Lite: The glazing pane facing the exterior of the building or away from the room or space.
- H. Inner Lite: The glazing pane facing the interior of the building or into the room or space.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances and adequate sealant thicknesses, with reasonable to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each glass type and glazing material required, including installation and maintenance instructions.
- B. Shop Drawings: Indicate required face and edge clearances and recommended edge sealants, if not identified in Product Data.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. 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.
 - 2. Glazing materials contain less than one-percent asbestos by weight (mass).
 - 3. Insulating glass meets CBA Standards or proof of certification.
- B. Qualification Data:
 - 1. For fabricators of insulating-glass units with sputtered low-e coatings.
 - 2. For installers.

1.6 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Warranties: Special warranties specified in this Section.

1.7 QUALITY ASSURANCE

- A. Qualifications
 - 1. Fabricator Qualifications for Insulating-Glass Units: Fabricator must be capable of producing certified sealed insulating-glass products equivalent to "CBA" level. Fabricators must be listed in the IGCC directory or submit evidence of quality-assurance program. The quality-assurance program, as a minimum, must have the following elements:
 - a. A quality manual.
 - b. Operating procedures documenting how insulating-glass units are fabricated.
 - c. A designated person responsible for quality assurance.
 - d. Routine product or component checks.
 - 2. Installer Qualifications: An experienced installer who has completed glazing similar in material design and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
 - a. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass and Metal (AG&M) contractors.
 - 3. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC's CAP 1 Certification Agency Program.
 - 4. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

- B. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of Insulating Glass Certification Council (IGCC).
- C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in Division 08 Section(s) "Aluminum-Framed Storefronts" to match glazing systems required for Project, including glazing methods.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturers and fabricator's written instructions. Prevent damage to glass and glazing materials from:
 - 1. Condensation.
 - 2. Temperature changes.
 - 3. Direct exposure to sun.
 - 4. Other causes.
 - a. Primary seal protection: Follow manufacturer/fabricator protocols to minimize the risk for damage to, or failure of, the primary IG unit seal caused by shearing stresses during handling and storage.
 - b. Avoid glass-to-glass contact: Guard against latent damage to large IG units caused by glass-to-glass contact when subject to changes in temperature and/or barometric pressure.
 - 5. Protect from contact with corrosive chemicals.
 - 6. Avoid placement of glass edge on concrete, metal, or other hard objects.
- B. For insulating-glass units that might be exposed to substantial altitude changes, comply with insulating-glass fabricator's written recommendations for venting and sealing units to avoid hermetic seal ruptures.
- C. Deliver glass to site in suitable containers that will protect glass from the weather and from breakage. Carefully store material, as directed, in a safe place where breakage can be reduced to a minimum. Deliver sufficient glass to allow for normal breakage. Glazing compounds shall arrive at the project site in labeled containers that have not been opened.
 - 1. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coating on glass.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. 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.

1.10 WARRANTY

- A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- B. Insulating Glass: Fabricator's standard form in which insulating-glass fabricator agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributable to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions.

1. Evidence of failure is the obstruction of vision by:
 - a. Dust.
 - b. Moisture.
 - c. Film on interior surfaces of glass.
2. Glass breakage due to thermal stress will be replaced by the Contractor at no additional cost to the Owner during the guarantee period.
3. Warranty Period: Manufacturer's/fabricators standard but not less than 10 years after date of Fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers Glass: Subject to compliance with requirements, provide products from the following.
 1. AGC Primary Division and AGC Coatings Division, AGC Flat Glass North America, Inc. (fka AFG), Asahi Glass America, Inc., Asahi Glass Co. Ltd.
 2. Cardinal IG Co., Cardinal Glass Industries.
 3. Guardian/Sunguard Industries Corp.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least ten days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following:
 1. Defective manufacture, fabrication, or installation.
 2. Failure of sealants or gaskets to remain watertight and airtight.
 3. Deterioration of glazing materials.
 4. Other defects in construction.
- B. Reference Standards: Perform work according to standards specified and as follows, unless modified by requirements in Contract Documents.
 1. Make available via internet access or maintain on site a copy of each standard affecting the work of this Section.
- C. Regulatory Requirements:
 1. Safety Glazing: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
 - a. Subject to compliance with requirements, permanently mark safety glazing with certification label of Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction.
 - 1) Identification on tempered glass shall include the words "Tempered Safety Glass".

- b. Where glazing units, including Kind-FT (fully tempered) glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 square feet in exposed surface area of one side, provide glazing products that comply with Category II materials. For lites 9 square feet or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials.
 - 1) Exception for hazardous locations: Where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified and required by Opening Manufacturer to meet requirements, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 2. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBNL's WINDOW 6.3 computer program, expressed as Btu/sq.ft. x h x deg F.
 - 3. Solar Height-Gain Coefficient and Visible Transmittance: Center of glazing values, according to NFRC 200 methodology and based on LBNL's Window 6.3 computer program.
 - a. Solar Heat Gain Coefficient: Shall not be greater than the following:
 - 1) 0.40

2.3 FABRICATORS

- A. Fabricators of Glass: Subject to compliance with requirements, provide products by one of the fabricators listed as certified with IGCC or meeting "Quality Assurance" requirements.

2.4 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass manufacturers, glass product fabricators, and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. Glass Association of North America (GANA):
 - a. Glazing Manual (2009).
 - b. Sealant Manual (2008).
 - 2. American Architectural Manufacturers Association (AAMA):
 - a. Glass Design for Sloped Glazing (AAMA GDSG-1-87).
 - b. Sloped Glazing Guidelines (AAMA TIR-A7-83).
 - 3. Insulating Glass Manufacturers Alliance (IGMA):
 - a. SIGMA TM-3000 "Glazing Guidelines for Sealed Insulating Glass Units".
 - b. IGMA Guidelines for Sloped Glazing (IGMA TB-3001-01).
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IgCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

2.5 PERFORMANCE VALUES FOR SPECIFIC INFORMATION

- A. Coated Float Glass:
 - 1. Low-E Coating without Reflective Coating:
 - a. Sputtered Low-E Coating (Performance Level Three):

- 1) On Surface No. 2: Provide clear 25-mm thick insulating glass with sputtered low-e coating on Surface No. 2 meeting the following performance values.

Tint Color	Visible Light Transmittance	Outdoor Visible Light Reflectance	U-Value Winter	Shading Coefficient	SHGC	Light to Solar Gain (LSG)
Clear	68-72%	9-13%	0.27-0.31	0.42-0.46	0.36-0.40	1.83-1.87

2.6 GLASS PRODUCTS

- A. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated. Performance requirements:
 - a. Distortion Tolerance: Roll wave peak-to-valley (PV) not to exceed 0.003 center/0.008 edges.
 - b. Millidiopter: 90 percent of surface not to exceed +/- 120 millidiopters.
 - c. Monitoring: Every lite measured with an on-line distortion measurement system.
 - d. Bow/Warp Tolerance: Maximum tolerance for bow/warp is 1/2 of ASTM C 1048.
 - e. All documentation recorded and may be available upon request.
- B. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum-deposition process after manufacture and heat-treatment (if any) and complying with other requirements specified.
1. Kind: Kind CV (coated vision glass).
 - a. Exception where the lower edge of the glass is more than 6 feet above the adjacent floor level or cannot be approached closer than 10 feet: Kind CO (coated overhead glass).

2.7 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
1. Provide Kind-FT (fully tempered) glass lites.
 2. 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.
- B. Spacer: Manufacturer's recommended spacer material and construction, required to meet thermal performance requirements of opening.
- C. Desiccant: Molecular sieve or silica gel, or blend of both.

2.8 GLASS USAGE

- A. General: Hereinafter are the minimum glazing requirements. Adjust sealed space, spacer, and coating as required to meet opening performance requirements. Glass shall be as required by opening manufacturer to meet thermal requirements as documented in manufacturer's published test data or verified with testing prescribed.
- B. Exterior:
1. Glass for Exterior Openings:
 - a. 25-mm thick fully tempered safety insulating glass consisting of 6.0-mm thick, minimum, clear outer panel, a 13-mm wide hermetically sealed air or gas as required to meet opening "Performance Requirements". space, and 6.0-mm thick, minimum, clear inner panel and shall be factory-installed.

- 1) Provide low-e coating on second or third surface as required to meet opening "Performance Requirements".

C. Interior:

1. Glass for Vestibule Doors, Sidelights, and Transoms: 6-mm thick clear tempered safety glass, unless otherwise noted.

2.9 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. EPDM, ASTM C 864.
2. Silicone, ASTM C 1115.
3. Thermoplastic polyolefin rubber, ASTM C 1115.

B. Soft Compression Gaskets:

1. 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:
 - a. EPDM.
 - b. Silicone.
 - c. Thermoplastic polyolefin rubber.
2. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.10 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 selected by A/E from manufacturer's full range.
4. Glazing materials brought on site shall contain less than one percent asbestos by content.

B. Elastomeric Glazing Sealant Standard (Weatherseal): Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

1. Low-Modulus Neutral-Curing Silicone Glazing Sealant (ASTM C 920, Type S, Grade NS, Class 100/50, Use NT):
 - a. 790 by Dow Corning Corp.
 - b. Bondaflex Sil 290 by May National Associates, Inc.; a subsidiary of Sika Corporation.
 - c. Silpruf LM SCS2700 by Momentive Performance Materials Inc., Apollo Management, LP (fka GE Sealants and Adhesives).
 - d. 890 by Pecora Corp.
 - e. PSI-641 by Polymeric Systems, Inc., Whitford Worldwide.
 - f. Spectrem 1 by Tremco Sealant/Weatherproofing Division, RPM International Inc.
2. Medium-Modulus Neutral-Curing Silicone Glazing Sealant (ASTM C 920, Type S, Grade NS, Class 50, Use NT):

- a. Omniseal 50 by MBCC Group.
 - b. 756-SMS, 791, 795, or 995 by Dow Corning Corp.
 - c. Bondaflex Sil 295 by May National Associates, Inc.
 - d. SilGlaze II SCS2800, Silpruf NB SCS9000, Silpruf SCS2000, or UltraPruf II SCS2900 by Momentive Performance Materials Inc., Apollo Management, LP (fka GE Sealants and Adhesives).
 - e. 864, 895, 895NST, or 898 by Pecora Corp.
 - f. PSI-641 by Polymeric Systems, Inc., Whitford Worldwide.
 - g. SikaSil-C995 by Sika Corp. (USA).
 - h. Spectrem 2 or Spectrem 3 by Tremco Sealant/Weatherproofing Division, RPM International Inc.
3. High-Modulus Neutral-Curing Silicone Glazing Sealant (ASTM C 920, Type S, Grade NS, Class 25, Use NT):
- a. 799 by Dow Corning Corp.
 - b. Bondaflex Sil 200 GPN and Bondaflex Sil 201 FC by May National Associates, Inc.
 - c. UltraGlaze SSG4000 or UltraGlaze SSG4000AC by Momentive Performance Materials Inc., Apollo Management, LP (fka GE Sealants and Adhesives).
 - d. PSI-631 by Polymeric Systems, Inc., Whitford Worldwide.
 - e. PolyGlaze Plus (SM5731) by Schnee-Moorehead (S-M) Division, Illinois Tool Works (ITW) Inc.
 - f. Proglaze SSG or Tremsil 600 by Tremco Sealant/Weatherproofing Division, RPM International Inc.
4. High-Modulus Acid-Curing Silicone Glazing Sealant (ASCTM C 920, Type S, Grade NS, Class 25, Use NT):
- a. OmniPlus by MBCC Group.
 - b. Chem-Calk 1200 by Bostik Construction Products Division, Bostik Findley Unit of TotalFinaElf.
 - c. 999-A by Dow Corning Corp.
 - d. Sil 100 GC, Sil 100 GP, or Sil 100 WF by May National Associates, Inc.
 - e. Contractors SCS1000 or SCS1200 by Momentive Performance Materials Inc., Apollo Management, LP (fka GE Sealants and Adhesives).
 - f. 860 by Pecora Corp.
 - g. PSI-601 by Polymeric Systems, Inc., Whitford Worldwide.
 - h. PolyGlaze (SM5732) by Schnee-Moorehead (S-M) Division, Illinois Tool Works (ITW) Inc.
 - i. Proglaze or Tremsil 200 by Tremco Sealant/Weatherproofing Division, RPM International Inc.

2.11 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, non-staining and non-migrating in contact with non-porous surfaces, with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with ASTM C 1281 and AAMA 800 for products indicated below:
- 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, polyvinyl-chloride (PVC) foam tapes, factory-coated with adhesive on both surfaces, and complying with AAMA 800 for the following types:
- 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.12 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 are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Silicone material with a Shore, Type A durometer hardness of 85, plus-or-minus 5.
 - 1. Type recommended by sealant or glass manufacturer.
- D. Spacers: Neoprene 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: Silicone material of hardness needed to limit glass lateral movement (side walking).
 - 1. Type recommended by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise optimum glazing sealant performance.

2.13 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.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.
- D. Tempered Glass: Cut float glass materials to indicated sizes and provide cut-outs and holes, if indicated, before heat strengthening.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine glass framing, channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION FOR GLAZING

- A. Clean the glazing channel or other framing members to receive glass, immediately before glazing. Remove coatings that are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.
 - 1. Seal porous glazing channels and recesses with primer or sealer compatible with substrate.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
 - 1. All glazing exposed to exterior shall be wet/wet or wet/dry in accordance with GANA Glazing Manual for window type.
- C. Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials, and other defects in the Work.
- D. Adjust glazing channel dimensions as required by project conditions during installation to provide:
 - 1. Necessary bite on glass.
 - 2. Minimum edge and face clearances.
 - 3. Adequate sealant thicknesses, with reasonable tolerances.
- E. The glazier is responsible for correct glass size for each opening within the tolerances and necessary dimensions established.
- F. Protect glass from edge damage at all times during handling, installation, and operation of the building. 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.
 - 1. Inspect each piece of glass immediately before installation and eliminate those that have observable edge damage or face imperfections.
- G. Apply primers or sealers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant substrate testing and as recommended by sealant manufacturer.
- H. 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.
- I. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- J. Provide spacers inside and out and of proper size and spacing for glass lites where length plus width is larger than 50 united inches, except where gaskets are used for glazing.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width.
 - a. Exception for Glazing Tape: Use thickness slightly less than final compressed thickness of tape.
- K. 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.
1. Coordinate glazing with wood door stops so stop is flush with outside of face veneer.
- L. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in the channel at the heel of jambs and head (do not leave voids in the sill channels) except as otherwise indicated, depending on light size, thickness, and type of glass, and complying with manufacturer's recommendations.
- M. Do not attempt to cut, seam, nip, or abrade glass that is tempered, heat-strengthened, or coated.
- N. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- O. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- P. Set glass lites with proper orientation so that coatings face fire side or protected of exterior or interior as specified.
- Q. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.
- R. Clean and trim excess glazing materials from the glass and stops or frames promptly after installation and eliminate stains and discoloration.
- S. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket does not "walk" out when subjected to dynamic movement.
- T. Square-cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away. Seal corner joints and butt joints with sealant recommended by gasket manufacturer.
- 3.4 TAPE GLAZING
- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
 - B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
 - C. Cover vertical framing joints by applying tape to heads and sills first and then to jambs. Cover horizontal framing joints by applying tape to jambs and then to heads and sills.
 - D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joint miter cut and bonded together at corners.
- C. Installation with Drive-In Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.8 CURING

- A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength, and surface durability.

3.9 PROTECTION, AND CLEANING

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect exterior glass from breakage and other damage immediately upon installation by attaching crossed streamers to framing held away from glass. Do not apply markers to surfaces of glass. Remove non-permanent labels and clean surfaces.
- C. Protect glass from contact with contaminating substances resulting from construction operations. If despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- D. Examine glass surfaces adjacent to or below exterior concrete and 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.
- E. Remove and replace glass that is broken, chipped, cracked, or abraded, or that is otherwise damaged due to natural causes, accidents, or vandalism, during the construction period.
- F. 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 according to:
 - 1. Written recommendations of glass manufacturer.
- G. Do not use scrapers or other metal tools to clean glass.

END OF SECTION 08 80 00

SECTION 08 87 33 - ARCHITECTURAL WINDOW FILM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Architectural Window Film of the Following Types:
 - 1. Decorative Pattern: Custom-Printed per project (by other than Manufacturer) (3M Decorative Polyester Glass Finish Film).

1.2 RELATED SECTIONS

- A. Division 08 Section "Glazing".

1.3 PERFORMANCE REQUIREMENTS

- A. Flammability: Surface burning characteristics when tested in accordance ASTM E 84, demonstrating film applied to glass rated Class A for Interior Use:
 - 1. Flame Spread Index: no greater than 25.
 - 2. Smoke Developed Index: no greater than 450.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's current technical literature on each product to be used, including:
 - 1. Manufacturer's Data Sheets.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- B. Verification Samples: For each film specified, two samples representing actual film color and pattern.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years' experience.
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
 - 1. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.
 - 2. Provide a commercial building reference list of 5 properties where the installer has applied window film. This list will include the following information:
 - a. Name of building.
 - b. The name and telephone number of a management contact.
 - c. Type of glass.
 - d. Type of film and/or film attachment system.
 - e. Amount of film and/or film attachment system installed.
 - f. Date of completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Follow Manufacturer's instructions for storage and handling.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

- A. At project closeout, provide to Owner or Owner's Representative an executed current copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.
- B. In order to validate warranty, installation must be performed by an Authorized 3M dealer and according to Manufacturer's installation instructions. Verification of Authorized 3M dealer can be confirmed by submission of active 3M dealer code number.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: 3M Commercial Solutions, which is located at: 3M Center Bldg. 223; St. Paul, MN 55144-1000; Toll Free Tel: 888-650-3497; Tel: 651-737-1081; Fax: 651-737-8241; Email:[request info \(apeters2@mmm.com\)](mailto:requestinfo(apeters2@mmm.com)); Web:http://www.3m.com/3M/en_US/architectural-design-us/?utm_medium=redirect&utm_source=vanity-url&utm_campaign=www.3M.com/AMD|http://www.3m.com/3M/en_US/building-window-solutions-us

2.2 ARCHITECTURAL FINISH FILMS

- A. Architectural Finish Films: 3M Decorative Polyester Glass Finish Film as manufactured by 3M Company - Commercial Solutions.
- B. Material Properties:
 - 1. General: Glass finish field applied application to glass material as visual opaque or decorative film.
 - 2. Film: Polyester
 - 3. Decorative Pattern: Custom-Printed per project (by other than Manufacturer)
 - 4. Adhesive: Acrylic, Pressure Sensitive, Permanent
 - 5. Liner: Silicone-coated Polyester
 - 6. Thickness (Film and Adhesive without Liner): 3 mils (76 microns)
 - 7. Fire Performance: Surface burning characteristics when tested in accordance with ASTM E84, Class A:
 - a. Flame Spread: 25 maximum.
 - b. Smoke Developed: 450 maximum.
- C. Optical Performance:
 - 1. Decorative Polyester Glass Finish Decorative Glazing Film applied to 3mm thick clear glass (ASTM E 903, ASTM E 308):
 - a. Ultraviolet Transmittance: 0.1 percent.
 - b. Visible Light Transmittance: 89 percent.
 - c. Visible Light Reflectance: 10 percent.
 - d. Solar Heat Transmittance: 81 percent.
 - e. Solar Heat Reflectance: 9 percent.
 - f. Shading Coefficient at 90 Degrees (Normal Incidence): 0.96.

PART 3 EXECUTION

3.1 EXAMINATION

A. Film Examination:

1. If preparation of glass surfaces is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
 - a. Glass surfaces receiving new film should first be examined to verify that they are free from defects and imperfections, which will affect the final appearance.
2. Do not proceed with installation until glass surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.
3. Commencement of installation constitutes acceptance of conditions.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Film Installation, General:

1. Install in accordance with manufacturer's instructions.
2. Cut film edges neatly and square at a uniform distance of 1/8 inch (3 mm) to 1/16 inch (1.5 mm) of window sealant. Use new blade tips after 3 to 4 cuts.
3. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
4. Apply film to glass and lightly spray film with slip solution.
5. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
6. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
7. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.
8. If completing an exterior application, check with the manufacturer as to whether edge sealing is required.

3.4 CLEANING AND PROTECTION

- A. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.
- B. Touch-up, repair or replace damaged products before Substantial Completion.
- C. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

END OF SECTION 08 87 33

SECTION 09 05 61.13 - MOISTURE VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fluid-applied, resin-based, membrane-forming systems that control moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for resinous floor covering installation.
1. Work Includes:
 - a. All labor, materials, tools and equipment as necessary to perform installation of surface applied moisture vapor tolerant epoxy floor system for interior concrete slabs on new concrete slabs, as shown on drawings and as specified in this section.
 - b. Testing of concrete floor slabs for moisture and alkalinity (pH).
 - c. Moisture Vapor Emission Control (for concrete with relative humidity and/or pH levels too high prior to installation of flooring).
 - d. Prior to installation of structural floor slab, advise General Conditions, in writing of all requirements of concrete substrate regarding finish, level tolerance, curing and below substrate vapor barrier.
 - e. Locate all flexible joints required.
- B. Related Sections:
1. Division 01 Section "Alternates" for description of alternates affecting work of this Section.
 2. Division 03 Section "Cast-In-Place Concrete".
 3. Division 09 Section "Decorative Resinous Flooring" for coordination and moisture requirements.

1.2 REFERENCE STANDARDS

- A. ASTM F-1869-04 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- B. ASTM F-2170-02 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes.

1.3 DEFINITIONS

- A. MVE: Moisture vapor emission.
- B. MVER: Moisture vapor emission rate.
- C. RH: Relative Humidity (measured in percentage).
- D. VOC: Volatile Organic Compound (measured in g/L).
- E. CSP: Concrete Surface Profile defined by ICRI.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Conduct a pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements for flooring. Discuss contract document requirements, moisture tests, manufacturer recommendations, installer's recommendations, scheduling, and protection of work from damage by other trades. A/E will schedule meeting.
1. Flooring subcontractor and manufacturer representative should attend along with concrete subcontractor.

2. Objective of meeting is:
 - a. Review methods and procedures.
 - b. Tour job site representative areas to inspect and discuss condition of substrate.
 - c. Review concrete finishing requirements.
 - d. Review and finalize construction schedule.
 - e. Review required inspections, testing, certifications, material usage procedures.
 - f. Review environmental restrictions and forecasts.
 - g. Record content of meeting including attendance and topics.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of project. Submit product data on products meeting requirements determined by preinstallation testing and manufacturer's installation requirements.
 1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- B. Shop Drawings: Details of construction and relationship with adjacent construction. Indicate location of building movement joints, termination details, details at floor material transitions and where adjoining equipment.
 1. Indicate location of cracks, both static and dynamic, on shop drawings.
 2. Locate and provide detailing for flexible joints required for flooring in area of installation.

1.6 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS:

- A. Product Test Reports: For each MVE-control system, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
 1. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test results.
- B. Qualification Data: For installers and manufacturer.
- C. Pre-Installation Testing Reports.
 1. Description of areas tested; include floor plans and photographs, if helpful.
 2. Summary of conditions encountered.
 3. Moisture and alkalinity (pH) test reports.
 4. Copies of specified test methods.
 5. Recommendations for remediation of unsatisfactory surfaces.
- D. Field quality-control reports, including Moisture Vapor Tests and Bond Strength Pull Tests on coatings and repair mortars.

1.7 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 1. Warranty: Warranty documents specified herein.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection and approving application method.
- B. Contractor Qualifications: An authorized representative who is trained and approved by manufacturer.
- C. Contractor's Responsibility Relating to Independent Agency Testing of Concrete:
 1. Provide access for a cooperate with testing agency.
 2. Confirm date of start of testing at least 10 days before actual start.

3. Allow at least 4 business days on-site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify A/E when specified ambient conditions have been achieved and when testing will start.

- D. Installer to verify locations of all flexible joints required by the provisions of this Section and by the recommendations of the related resinous flooring material manufacturers.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.
- B. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
- C. Disposal: Legally dispose of containers and materials.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.
 1. Store system components in a temperature-controlled environment and protected from weather and at ambient temperature of not less than 65 deg F and not more than 85 deg F at least 48 hours before use.
- B. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg F or more than 85 deg F and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
- C. Install MVE-control systems where concrete surface temperatures will remain a minimum of 5 deg F higher than dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Key Resin Company; Key Epocon SL.
- B. System Description: Moisture vapor tolerant and alkaline resistant, two-component epoxy resin surfacing system, grouted with two component bis-A epoxy key #502 and sealed with two component Urethane Key #445 with NSA additive.
- C. Alternate products by other listed resinous manufacturers maybe used and must be preapproved by resinous manufacturer and A/E before use.
- D. Components of MVE Control System shall be from a single source manufacturer or approved by MVE manufacturer in writing.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Provide substrates with moisture and alkalinity levels acceptable for floor covering materials. Final test results must show acceptable conditions within manufacturer's moisture and alkalinity limits before commencement of any flooring work.
 - 1. System shall be a 1/8 inch moisture vapor and alkaline tolerant epoxy surfacing.
- B. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits following conditions:
 - 1. MVER: Maximum 25 lb of water/1000 sq. ft. when tested according to ASTM F 1869.
 - 2. Relative Humidity: 75 percent or above when tested according to ASTM F 2170 using in situ probes.
- C. Water-Vapor Transmission: Through MVE-control system, maximum 0.1 perm when tested according to ASTM E 96.
- D. Tensile Bond Strength: For MVE-control system, greater than 200 psi with failure in concrete according to ASTM D 7234.

2.3 MATERIALS

- A. Prime Coat: Key Epocoat primer/scratch coat.
- B. Matrix: Key Epocoat bodycoat/aggregate composition.
- C. Grout: Key #502 Epoxy Primer.
- D. Sealer: Key #445 Matte Finish Urethane with NSA aggregate.

2.4 MIXING

- A. Mix according to manufacturer's instructions. Apply Moisture Vapor Tolerant Epoxy Floor System to specified physical properties.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of Work.
 - 1. Verify slab has not been contaminated.
 - 2. Perform water bead test and photographically record contact angle of water bead meniscus to floor to ensure concrete is hydrophilic.
 - 3. Record ambient air RH, dew point and temperature.
 - 4. Record slab temperature.
 - 5. Concrete substrates must be structurally sound, solid, and meet industry standards as defined in ACI Committee 201 Report "Guide to Durable Concrete".
 - 6. Verify that no hydrostatic pressure exist.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.

1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents or acids.
 - a. Do not use sweeping compounds.
 2. If required by manufacturer, provide concrete surface profile complying with ICRI 310.2R CSP 3 by shot blasting using apparatus that abrades concrete surface with shot, contains dispensed shot within apparatus, and recirculates shot by vacuum pickup.
 - a. Option, in lieu of shot blast contractor may achieve ICRI 310.2R Minimum CSP 2 by diamond grinding that abrades concrete surface. Remove all dust by vacuuming with high-efficiency particulate arrestance (HEPA) filter.
 3. After shot blasting, repair damaged and deteriorated concrete according to MVE-control system manufacturer's written instructions.
 - a. Reinforcing fibers that become visible after shot blasting must be removed and vacuumed leaving no fibers exposed above concrete surfaces.
 - b. Allow concrete to off-gas after bead blasting or grinding prior to application for a minimum of 24 hours but no more than 48 hours to avoid contamination by other trades. Failure to wait may result in epoxy coatings ability to perform as a MVE control due to pin-holing, blisters and fish-eyes.
 4. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
 5. Fill surface depressions and irregularities with patching and leveling material.
 6. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.
 - a. Consult with Project or manufacturers engineer for determine appropriate substrate repair procedures and joint treatment methods. Engineer should address contraction as well as potential expansion, movement and isolation joints.
 - b. Mechanically prepare non-moving control and construction joints with a diamond crack-chasing/concrete-cutting blade. Overcut joint width to obtain a sound, clean edge. Clean cracks or joints with oil-free compressed air and dustless high-efficiency particulate arrestance (HEPA) filter vacuum to completely remove contaminants (follow ACI RAP Bulletin 2, "Crack Repair by Gravity Feed with Resin").
 - c. Pre-filling static thin random drying shrinkage cracks (less than 0.01 inch width and not vertically displaced is not required).
 7. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
 8. Before installing MVE-control systems, broom sweep and vacuum prepared concrete.
- B. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

3.3 INSTALLATION

- A. Install all floor materials in strict conformance with manufacturer's instructions.
- B. Route out all cracks (larger than 1/16 inch width) and fill with Key Epocoat. Reinforce crack with 18 inch width fiberglass cloth using Key Epocoat. For random cracking over entire slab, or where severe moment is expected, consult with Key Resin on the optional use of flexible crack isolation membrane.
- C. Prime entire surface with Key Epocoat as a scratch coat. Allow to cure.
- D. Apply Key Epocoat sand-filled slurry at 15-20 square feet per gallon to achieve a total minimum thickness of 90-100 mils. Allow to cure a minimum of 16 hours at 75 degrees F.
- E. Apply Key #502 epoxy primer at coverage rate of 100-160 square feet per gallon. Allow to cure. Allow Key #445 Urethane Sealer at coverage rate of 225 sq.ft. per gallon. Allow to cure.
- F. Apply temporary protection until Moisture Vapor Tolerant Epoxy Floor System is fully cured.

3.4 CLEANING

- A. Immediately clean MVE-control system from glass and metal with soap and water, and dry.

3.5 PROTECTION

- A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.
- B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise MVE-control system membrane.

END OF SECTION 09 05 61.13

SECTION 09 21 16.00 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Gypsum board, metal support systems, metal accessories, fasteners, and related items necessary as indicated and as follows:
1. Interior gypsum board products types, sizes, and thickness indicated.
 - a. Gypsum boards shall have fire-resistance ratings and be moisture and mold resistant.
 - 1) Joint treatment shall be moisture and mold resistant.
 2. Non-Structural Steel Framing, including firestop top track seals.
 - a. Interior framing systems (e.g., framed soffits, etc.).
 - b. Interior suspension systems (e.g., suspended soffits, etc.).
 3. Reinforcement, both metal and wood, within framing systems to support wall and ceiling-mounted furnishings or equipment provided by other trades.
- B. Related Sections include the following:
1. Division 05 Section "Cold-Formed Metal Framing": Exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists.
 2. Division 06 Section "Miscellaneous Rough Carpentry": For wood blocking.
 3. Division 07 Section "Miscellaneous Thermal Insulation": For thermal insulation and vapor barriers.
 4. Division 07 Section "Penetration Firestopping": For firestopping systems.
 5. Division 09 Section "Acoustical Joint Sealants" for acoustical sealants.
 6. Division 09 Section "Interior Painting": For primers applied to gypsum board surfaces and for coordination of repair work.

1.2 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C11 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
1. Coordinate blocking and furring work with installers of related work including, but not limited to casework, acoustical ceilings, thermal insulation, gypsum board, light fixtures, mechanical system, electrical systems, and sprinklers.
 2. All work above ceiling line should be completed, prior to installing the gypsum board. There should be no materials resting against or wrapped around the suspension system, hanger wires or ties.

1.4 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's product data and installation instructions for each type of product indicated, including other data as might be required to show compliance with these Specifications.

1.5 QUALITY ASSURANCE

- A. Materials or operations specified by reference to the published specifications of a manufacturer or other published standards shall comply with the requirements of the standards listed.
1. Standards include ASTM C840 and GA216, except more stringent requirements of manufacturer shall govern.
 2. Materials brought on-site shall contain less than 1 percent asbestos by polarized light microscopy (PLM) analysis.

3. Applicable requirements of ASTM C754 for installation of steel framing.
 4. Apply acoustical sealant in accordance with applicable requirements of ASTM C919.
- B. Refer to "Recommended Specification on Levels of Gypsum Board Finish" as published by the Gypsum Association (and AWCI/CISCA/PDCA) for finish levels required herein.
- C. Mold-Resistant: Gypsum board assemblies designed to provide extra protection against mold and mildew compared to standard paper-faced wallboard products. When tested by an independent lab per ASTM D3273 ("Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber") gypsum board shall achieve an average board score of 8 or greater out of a possible high score of 10.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected from weather, condensation, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum boards flat to prevent sagging.
1. Protect joint compounds from freezing.
- C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.
- D. Protect metal framing from corrosion, deformation and other damage during delivery, storage, and handling per requirements of AISI's S202, "Code of Standard Practice" for Cold-Formed Steel Structural Framing".

1.7 FIELD CONDITIONS

- A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C840 and with gypsum board manufacturer's recommendations. Do not install gypsum board when ambient temperature is below 40 deg. F.
1. Do not install paper-faced gypsum boards until installation areas are enclosed and conditioned.
 - a. Only interior extended exposure gypsum boards maybe installed.
 2. Maintain dry bulb temperatures between 55 and 80 degrees F. and relative humidity at less than 50 percent during taping and curing of joint compound.
- B. Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40 degrees F. For adhesive attachment and finishing of gypsum board, maintain not less than 55 degrees F. for 48 hours prior to application and continuously after until dry. Do not exceed 80 degrees F. when using temporary heat sources.
- C. Ventilation: Ventilate building spaces, as required, for dry joint-treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.
- D. Do not install boards that are wet, those that are moisture-damaged, and those that are mold-damaged.
1. Indications that boards are wet or moisture-damaged include, but are not limited to discoloration, sagging, or irregular shape.
 2. Indications that boards are mold-damaged include, but are not limited to fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Moisture and Mold Resistant Gypsum Boards (WGWB)
 - a. EcoSmart Mold Tough (Firecode); United States Gypsum Company
 - b. XP Fireshield Wallboard; National Gypsum Co.
 - c. M2Tech Gypsum Wallboard or Air Renew (Type X); CertainTeed Gypsum, Inc.
 - d. M-Bloc (Type X); American Gypsum
 - e. Mold-Guard Gypsum Board or Dens Armour Plus (Interior) (Type X); Georgia Pacific
 - f. Mold Defense (Type X); Continental Building Products, LLC (fka Lafarge)
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other board products or from a manufacturer acceptable to the gypsum board manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. System Requirements: Fabricate and install systems as indicated, but not less than that required to comply with ASTM C754 under the following conditions:
1. Gypsum board partitions:
 - a. Standard systems: Maximum deflection of L/240 of partition height.

2.3 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with AISI S220 and ASTM C645, Section 10 for conditions indicated.
1. Steel Sheet Components: Comply with AISI S220 and ASTM C645, Section 10 requirements for metal, unless otherwise indicated.
 2. Protective Coating: ASTM C645 and ASTM A653, G40, or equivalent corrosion resistance, unless otherwise indicated.
 - a. Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

2.4 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A641, Class 1 zinc coating, soft temper or of a material and size having superior corrosion-resistance and equivalent strength to the galvanized steel wire specified.
1. Tie wire shall be 0.0625-inch or double strand of 0.0475 inch diameter wire.
- B. Hangers: As follows:
1. Wire Hangers: ASTM A641, Class 1 zinc coating, soft temper, 0.162 inch diameter.
 - a. In high-humidity areas, provide one of the following:
 - 1) Stainless-Steel Wire: ASTM A580, Type 304, nonmagnetic.
 - 2) Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 2. Rod Hangers: ASTM A510, mild carbon steel.
 - a. Diameter: 1/4 inch, unless otherwise indicated or required by load.
 - b. Protective Coating: ASTM A 153, hot-dip galvanized or rust-inhibitive paint.

3. Flat Hangers: Commercial-steel sheet, ASTM A653, G40, hot-dip galvanized, unless otherwise noted.
 - a. At high-humidity areas, provide ASTM A 653, G60, hot-dip galvanized material.
 - b. Size: 1 by 3/16 inch by length indicated, unless otherwise noted or required by loads.
 4. Angle Hangers: ASTM A 653, G60, hot-dip galvanized commercial-steel sheet.
 - a. Minimum Base Steel Thickness: 0.0312, unless otherwise noted.
 - b. Size: 1-5/8 by 1-5/8 inches.
- C. Carrying Channels: Base steel thickness of 0.0538 inch (fka 16 gauge), a minimum 1/2-inch wide flange, with ASTM A653, G40, or equivalent corrosive resistance.
1. Depth: 1-1/2 inches, unless otherwise noted.
- D. Furring Channels: ASTM A653, G40, or equivalent corrosive resistance.
1. Cold-Rolled Channels: 0.0538 inch bare-steel thickness (fka 16 gauge), with minimum 1/2 inch wide flanges, 3/4 inch deep.

2.5 STEEL FRAMING FOR SOFFITS

- A. Steel Studs and Runners: AISI S220 and ASTM C 645, Section 10, with flange edges of studs bent back 90 degrees and doubled over to form 3/16 inch wide minimum lip (return), and complying with the following requirements:
1. Thickness and spacing of studs shall be as indicated, but not less than that required complying with AISI S220 with maximum deflection L/240 at 5 lbf. per sq.ft., unless otherwise noted.
 2. Unless indicated otherwise, metal stud framing shall be formed from 0.0296-inch minimum sheet base metal (fka 20 gauge-non-structural) or equivalent thickness 0.0181 inch (fka 20EQ gauge non-structural).
 3. Depth: As indicated.
- B. Slip-Type Head Joints: Provide one of the following:
1. Single Long-Leg Runner System: ASTM C645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs of provide lateral bracing.
 2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) The Steel Network, Inc.; VertiClip SLD Series or VertiTrack VTD Series.
 - 2) ClarkDietrich; MaxTrak or Slotted Deflection Track.
 - 3) Metal-Lite, Inc.; Slotted Track.
- C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing.
1. Flat Strap: Minimum Base Steel Thickness: 0.0296 inch (fka 20 gauge).
 2. Backing Plate: Steel galvanized, 6 inches wide by 0.0538 inch (fka 16 gauge) thick minimum by lengths to suit size of items to be attached; fastened to studs for attachment of surface mounted fittings and accessories.
 - a. Provide either backing plates or wood blocking. Direct attachment of accessories or equipment to studs is strongly discouraged, unless loads have been analyzed.
- D. Cold-Rolled Channel Bridging: 0.0538-inch base steel thickness (fka 16 gauge), with minimum 1/2 inch wide flange.
1. Depth: 1-1/2 inches, unless otherwise noted.
 2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.053 inch thick (fka 16 gauge), galvanized steel.
 3. Proprietary bridging may also be provided as contractor's option.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645 or AISI S220.
1. Minimum Base Steel Thickness 0.0179 inch (fka 25 gauge).

2. Depth: 7/8 inch, unless otherwise noted.
- F. Soffit Framing System (Option): Prefabricated soffit framing system that clicks into shape and installs quickly.
1. Aligns with construction industry dynamics:
 - a. Enhanced safety.
 - b. Reduced need for skilled labor.
 - c. Transition from stick-build to pre-fab/off-site construction.
 2. Minimum G40 hot-dipped, galvanized coating (per ASETM C645); provides superior corrosion resistance.
 3. Basis-of-Design: SIMPLESOFFIT; Armstrong Ceiling and Wall Solutions.

2.6 GYPSUM BOARD PRODUCTS

- A. General Requirements: Comply with ASTM C 1396. Provide in maximum lengths and widths available that will minimize joints in each area, that will minimize joints in each area, and that correspond with support system indicated.
1. Unless otherwise noted all gypsum board shall be fire-resistance-rated. Refer to Code Plan in Construction Drawings for specific locations and requirements of fire-resistance-rated assemblies indicated.
 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
 3. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
 4. Where building is not enclosed and environmental conditions cannot be maintained only interior extended exposure gypsum boards maybe used. Only setting type joint compounds may be used as well.
 5. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- B. Moisture-and Mold-Resistant Gypsum Boards (WGWB): ASTM C 1396 with moisture and mold resistant core and surfaces.
1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.7 MISCELLANEOUS MATERIALS

- A. General: Comply with ASTM C475 and C1396. Provide auxiliary materials that comply with referenced installation standards.
- B. Thermal Insulation: As specified in Division 07 Section "Miscellaneous Thermal Insulation".
- C. Joint Tape: Tape shall be mold resistant and achieve a 10 rating when tested per ASTM D 3273.
1. Interior Gypsum Board (Temperature/Humidity controlled): Paper.
- D. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats. Pre-mixed compounds shall be free of antifreeze, vinyl adhesives, preservatives, biocides, and other slow releasing compound. All-purpose type compound will not be acceptable for prefilling, embedding, first coat, or fill coat.
1. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats. Pre-mixed compounds shall be free of antifreeze, biocides, and other slow releasing compound. All-purpose type compound will not be acceptable for prefilling, embedding and first coat.
 2. Prefilling: At open joints and damaged surface areas, use setting-type compound.
 - a. ProForm Brand Quick Set Lite Setting Joint Compound, by National Gypsum Company.
 - b. Sheetrock Brand Easy Sand Setting Type Joint Compound, by USG.

- c. Comparable product approved by one of the gypsum board manufacturers listed.
 - 3. Level 2: Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type compound.
 - a. ProForm Brand Quick Set Lite Setting Joint Compound or ProForm Brand Lite Blue Ready Mix Joint Compound, by National Gypsum Company.
 - b. Sheetrock Brand Easy Sand Setting Type Joint Compound or Sheetrock Brand Plus 3 Lightweight or Ultra Lightweight All Purpose Joint Compound, by USG
 - c. Comparable product approved by one of the gypsum board manufacturers listed.
 - 4. Level 3: Fill coat, Second and Third Coat: For third coat, use all –purpose, midweight, topping, or lightweight compounds.
 - a. ProForm Brand Lite Blue Ready Mix [**or ProForm All Purpose with Dust-Tech**] Joint Compound, by National Gypsum Company.
 - b. Sheetrock Brand Plus 3 Lightweight or Ultra Lightweight All Purpose Joint Compound, by USG
 - c. Comparable product approved by one of the gypsum board manufacturers listed.
 - 5. Level 4: Finish Coat: For fourth coat, use all-purpose, midweight, topping, or lightweight compounds.
 - a. ProForm Brand Lite Blue Ready Mix [**or ProForm All Purpose with Dust-Tech**] Joint Compound, by National Gypsum Company.
 - d. Sheetrock Brand Plus 3 Lightweight or Ultra Lightweight All Purpose Joint Compound, by USG
 - e. Comparable product approved by one of the gypsum board manufacturers listed.
 - 6. Level 5: Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound, or a high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
 - a. Primer and its application to surfaces are specified in Division 09 Section "Interior Painting."
- E. Steel Screws for Gypsum Board: ASTM C1002, unless otherwise noted.
 - 1. Use screws complying with ASTM C954 for fastening boards to steel members from 0.033 to 0.112 inch thick.
- F. Fasteners for Metal Framing: Of type, material, size, corrosion-resistance, holding power, and other properties required to fasten steel members to substrates.
- G. Accessories for Interior Installation: Corner bead, edge trim, and control joints complying with ASTM C1047 and requirements indicated below:
 - 1. Material: Formed metal with metal complying with the following requirements:
 - a. Steel sheet zinc-coated by hot-dip or electrolytic process, or steel sheet coated with aluminum or rolled zinc, unless otherwise noted.
 - 1) Do not use plastic accessories, unless otherwise noted or approved by A/E in writing.
 - 2) Provide paper-faced galvanized steel sheet at abuse-resistant gypsum boards, where recommended by manufacturer.
 - 2. Shapes indicated below by reference to Figure 1 designations in ASTM C1047:
 - a. Corner Bead: Use at outside corners, unless otherwise indicated.
 - b. L-bead with face flange only; face flange formed to receive joint compound. Use for edge trim (perimeter relief).
 - c. LC-bead (J-shaped): Exposed long flange receives joint compound; use at exposed board edges.
 - d. One-piece control joint formed with V-shaped slot and removable strip covering slot opening.
 - 3. Base-of-Wall Galvanized Moisture Barrier Trim (option): Galvanized-steel sheet, 2 inches high.
 - a. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1) VersaDry, LLC
 - 4. Base-of-Wall PVC Moisture Barrier Trim (option): Extruded PVC 1/2 inch high.

- a. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1) Waterguard, www.keeps/Drywall/Dry.com.
- H. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gaskets: Closed-cell vinyl foam adhesive-backed strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit metal stud size indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section.
- B. Examine boards before installation. Reject boards that are wet, moisture damaged, and mold damaged.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the work and that hangers will develop their full strength.

3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation, except comply with framing sizes and spacing indicated.
 - 1. Do not bridge building expansion and control joints with steel framing members. Independently frame both sides.
 - 2. Install bracing at terminations in assemblies.
 - 3. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, (shelving) or similar construction.
 - a. Install backer plates or wood blocking accurately positioned and firmly secured to metal studs to support transferred loads.
- B. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Intertek Laboratories.

3.4 INSTALLING SUSPENSION SYSTEMS, CEILINGS/SOFFITS

- A. Install suspension system components in sizes and spacing indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling, plenum that are not part of supporting structural or 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 spacing 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 fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
 4. Secure rod, flat, or angle hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Locate and suspend carrying channel runners 48 inches o.c. with hangers to structure above.
 - a. Follow manufacturer's recommendation for hanger spacing. If structure above forces the hanger to exceed 48 inches, substitute steel studs for the carrying channel runners.
 - b. Extend runners to within 6 inches of walls.
 - c. Do not permit furring or runners to contact masonry or concrete walls.
 6. Install furring channels 24 inches o.c., perpendicular to channel runners above. Assemble components in accordance with manufacturer's instructions.
 - a. Stagger butt connect furring tees for gypsum board end support.
 - b. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports; do not clip.
 - c. Provide 1 inch clearance between furring or runners and abutting walls and partitions.
 7. Do not support ceilings/soffits directly from permanent metal forms.
 8. Do not attach hangers/metal stud framing to steel deck tabs.
 9. Do not attach hangers/metal stud framing to steel roof deck. Attach hangers to structural members.
 10. Do not connect or suspend steel framing from ducts, pipes or conduit.
 11. 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.
 - a. Flat Ceilings: Main tees shall be spaced a maximum of 48 inches on center and supported by hanger wires spaced a maximum 48 inches on center and as specified by UL Fire Resistance Directory attaching hanger wires directly to structure above. Do not attach to metal deck.
 - 1) Cross tees shall be spaced per manufacturers' recommendations and as specified by UL Fire Resistance Directory.
 - b. Transitions (changes in elevation in soffit and fascia ceiling applications): When constructing stepped soffits, bracing of the gypsum board suspension system and/or additional hanger wires might be necessary to ensure stability and structural performance during and after gypsum board attachment.
 - 1) The maximum vertical soffit height shall be 48 inches. (Maximum unsupported gypsum area shall not exceed 48 inches by 24 inches).
 - 2) Intermediate cross tees are not necessary when bulkhead dimensions do not exceed 24 inches.
 - 3) Cross tee spacing in horizontal soffit plane shall not exceed 24 inches.
 - 4) Intermediate cross tees might be necessary to maintain visually acceptable drywall planes and drywall corners.

- D. Installation Tolerances: Install suspension systems that are level to within 1/8-inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

- A. Framing systems shall be set to the dimensions indicated on the Drawings.
 - 1. Where framing is installed directly against exterior walls, install felt strips or foam gaskets between studs and wall.

3.6 APPLYING AND FINISHING BOARDS, GENERAL

- A. Gypsum Board Application and Finishing Standards: Install and finish gypsum boards to comply with ASTM C840.
- B. Work shall be provided in accordance with the manufacturer's printed instructions and as specified herein. Where fire-rating requirements for systems are indicated on the Drawings or in the schedules, install components in accordance with manufacturer's instructions to comply with indicated fire rating requirements.
 - 1. Tolerances
 - a. Do not exceed 1/8 inch in 8 feet 0 inches variation from plumb or level in exposed lines of surface, except at joints between gypsum board units.
 - b. Do not exceed 1/16 inch variation between planes of abutting edges or ends.
 - c. Shim as required to comply with specified tolerances.
- C. Wallboard joints shall be butted tightly together.
 - 1. Install ceiling boards in direction, either parallel or perpendicular to framing members, which results in the least number of joints. Install in maximum practical lengths to span with minimum number of end (butt) joints. Stagger end joints of adjoining boards not less than one framing member.
 - 2. Form control and expansion joints with space between edges of adjoining gypsum boards.
 - 3. Attachment to Steel Framing: Attach boards so leading edge or end of each board is attached to open (unsupported) edges of stud flanges first.
 - 4. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide a minimum of 1/4-inch perimeter relief where board abuts different materials, including floors. Trim edges with U-bead edge trim, where edges of gypsum boards are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
 - a. In lieu of 1/4 perimeter relief of gypsum wallboard at floors and acoustical sealant, contractor may install Waterguard in accordance with manufacturer's instructions.
 - 1) No additional screws, glue, or sealant are required unless otherwise specified except on 2 hour fire-rated walls once the wall assembly is constructed, place a bead of fire/acoustical sealant at floor level against the outer most layer of Waterguard.
 - 5. Install gypsum boards with face-side out. Butt boards together for a light contact at edges and ends with not more than 1/16 inch of open space between boards. Do not force into place.
 - 6. 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.
 - 7. Cover both faces of steel-stud partition framing with gypsum boards in concealed spaces (above ceilings, etc.) except in chases braced internally or where gypsum board is specifically noted as being installed on only one side of steel-stud partition framing.
 - a. 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.
 - b. Fit gypsum boards around ducts, pipes, and conduits.

- c. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum boards to fit profile formed by joists, and other structural members; allow 1/4 to 3/8 inch wide joints to install sealant.

3.7 APPLYING INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
 1. On ceilings, apply gypsum boards before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 2. On partitions/walls, apply gypsum boards 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 boards.
 - b. Use maximum length boards to minimize end joints.
 3. Fastening Methods: Apply gypsum boards to supports with steel drill screws.
- B. Openings cut in gypsum board to fit electrical outlets, plumbing, and piping shall fit snugly and shall be small enough to be covered by plates and escutcheons. Both face and back paper shall be cut for cutouts that are not made by use of a saw.
 1. Make necessary cut-outs and seal cut or exposed board edges as recommended by gypsum board manufacturer.
- C. Fasteners: Install fasteners no closer than 3/8 inch to end or edge. Space fasteners approximately 7 inches o.c., opposite each other on adjacent ends or edges. Begin fastening from center of wallboard and proceed toward outer end or edges.
- D. Apply pressure on gypsum board, adjacent to fasteners being driven, to ensure that gypsum board will be secured tightly to framing member. Check for looseness at fasteners. Drive fastener with shank reasonably perpendicular to face of board.
- E. Drive screws with power screwdriver as recommended by gypsum board manufacturer. Surface of head shall be below surface of paper without cutting paper.

3.8 INSTALLING TRIM ACCESSORIES

- A. General: For trim with backflanges intended for fasteners, attach to framing with same fasteners used for boards. Otherwise, attach trim according to manufacturer's written instructions.
- B. Joint and corner treatment shall be in accordance with the manufacturer's printed instructions to provide a finished surface, ready for painting. Surface shall be free of dimples, excess finishing compound, ridges, or untrue corners.
 1. Install edge trim where edge of gypsum boards would otherwise be exposed or semi-exposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.
- C. Provide control joints in gypsum board partitions, bulkheads, ceilings, and soffits according to ASTM C840 and as follows:
 1. Partition abuts a structural element (except floor) or dissimilar wall or ceiling.
 2. Ceiling or soffit abuts a structural element, dissimilar wall or partition or other vertical penetration.
 3. Construction changes within plane of partition or ceiling.
 4. Partition run exceeds 30 feet, unless noted otherwise.
 5. Ceiling dimensions exceed 40 feet in either direction.
 6. Wings of "L", "U", and "T"-shaped ceiling areas are joined.
 7. Expansion or control joints occur in the exterior wall.
 8. Less-than-ceiling-height frames should have control joints extending to the ceiling from both corners. Ceiling height door frames may be used as control joints. Treat window openings in same manner as doors.

9. Control Joint: Apply over face of gypsum board where specified. Cut to length with a fine-toothed hacksaw (32 teeth per inch). Cut end joints square, butt together, and align to provide neat fit. Attach control joint to gypsum board with fasteners spaced 6 inches o.c. maximum along each flange. Remove plastic tape after finishing with joint compound or veneer finish.
 - a. Leave a 1/2-inch continuous opening between gypsum boards for insertion of surface-mounted joint.
 - b. Do not attach gypsum board to steel studs on one side of control joint.
 - c. Provide separate supports for each control joint flange.
 - d. Provide an adequate seal behind control joint where sound or fire ratings are prime considerations.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
 1. Prefill open joints and damaged surface areas.
 2. Apply joint tape over gypsum-board joints, except those with trim having flanges not intended for tape.
 3. Joint tape and setting compounds shall not reduce moisture and mold resistance of gypsum wallboard assembly.
 4. Coats of non-setting type components shall be thoroughly dry before sanding of the application of additional coats.
- B. Levels of Finish: The following levels of finish are established as a guide for specific final finishes in accordance with GA-214 and ASTM C840, for locations as indicated.
 1. Level 0: No taping, finishing, or accessories required.
 - a. This level of finish shall be used in temporary construction only.
 2. Level 1: Joints and interior angles shall have tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
 - a. This finish level shall be used in plenum areas above ceilings, in attics, and in areas where the assembly is concealed.
 3. Level 2: Not used.
 4. Level 3: Not used.
 5. Level 4: All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener head and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges.
 - a. This level is to be used at areas to receive flat paints are to be applied.
 6. Level 5: All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.
 - a. This level is to be used at areas to receive eggshell and semi-gloss and gloss paint and areas subject to severe lighting, where indicated.

3.10 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

- B. Protect installed products from damage from weather, condensation, direct sunlight, construction and other causes during remainder of the construction period.
- C. Remove and replace boards that are wet, moisture-damaged, and mold-damaged.
 - 1. Indications that boards are wet or moisture-damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that boards are mold-damaged include, but are not limited to fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 21 16.00

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes following:
 - 1. Ceramic wall tile (CWT).
- B. Related Sections include following:
 - 1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.2 DEFINITIONS

- A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic wall tile in color blend patterns, provide full sheets of each color blend.

1.4 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: Include cleaning methods, cleaning solutions recommended, stain removal methods, and polishes and waxes recommended.

1.5 QUALITY ASSURANCE

- A. Installers Qualifications: Work done under this Section of Specifications shall be performed by mechanics skilled and experienced in class of work involved. Workmanship shall be in accordance with best trade practices, and surface shall be true to line and free from waves and other imperfections. Joints between tiles shall be maintained uniform and even and properly grouted.
 - 1. Installers shall be experienced in ANSI A108 standards and Tile Council of North America (TCNA) recommendations. A copy of these standards shall be present at jobsite.
 - 2. Install shall meet one or more of following qualifications:

- a. Installer is a five-star member of National Tile Contractors Association or a Travel of Excellence member of Tile Contractors' Association of America.
- b. Installer's supervisor for Project holds International Masonry Institute's Foreman Certification.
- c. Installer employs Ceramic Tile Education Foundation Certified Installers.
- d. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of large format tile.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
- D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at levels indicated in referenced standards and manufacturer's written instructions.
- B. Protection: Protect adjacent work surfaces during tile work. Close rooms or spaces to traffic, of all types, until mortar and grout have set.
- C. Safety: Observe manufacturer's safety instructions including those pertaining to ventilation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, following requirements apply for product selection:
 - 1. Products: Subject to compliance with requirements, provide one of products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for Architect/Engineer's approval must be accompanied by "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
 - 1. Where products are indicated on List of Finishes with color selected, provide sample or color chart to verify color match with substitution request.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1/.2, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.

2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
 - C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with following requirements:
 1. Refer to "List of Finishes".
 - D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.3 TILE PRODUCTS

- A. Ceramic Wall Tile (CWT): Flat tile as follows:
 1. Module Size: As indicated.
 2. Face Size Variation: Rectified.
 3. Thickness: 5/16 inch.
 4. Face: Plain with cushion edges, unless otherwise noted.
 5. Finish: Bright, opaque glaze, unless otherwise noted.
 6. Mounting: Factory back-mounted.
 7. Basis-of-Design Product: Refer to "List of Finishes"
- B. Ceramic Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
 1. Wainscot Cap for Thin-Set Mortar Installations, where indicated: Surface bullnose, module size as indicated.
 2. External Corners for Thin-Set Mortar Installations: Surface bullnose.
 3. Internal Corners: Field-buttet square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.

2.4 SETTING AND GROUTING MATERIALS

- A. Products: Subject to compliance with requirements, provide one of following:
 1. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15
 - a. HB Fuller; TEC Super Flex or TotalFlex 110 Silica Free Universal Mortar
 - b. Custom Building Products; Flexbond-LFT Premium Crack Prevention Large Format Tile Mortar
 - c. LATICRETE SUPERCAP, LLC; 4-XLT
 - d. MAPEI Corporation; Keraflex Plus
 2. Polymer-Modified, Unsanded Tile Grout: ANSI A118.7
 - a. ARDEX Engineered Cements; FG-C Microtec Unsanded Floor and Wall Grout/Grout Booster
 - b. Bostik; Hydroment (Unsanded)/425
 - c. C-Cure; Supreme 925/MP 923/CureCylic 938/Color Cure 945
 - d. DAP; Durabond C150/Durabond DBL26
 - e. Laticrete; 600 Series/LATICRETE 1776
 - f. MAPEI; Keracolor U/Ultra Care Grout Maximizer
 - g. Southern Grouts & Mortars; Dry-Set Grout Unsanded Polymer Modified Tile Grout/Southcrete 20 Acrylic Admix
 - h. Summitville Tiles; SB687/SB775
 - i. HB Fuller; TEC Unsanded AccuColor/TA Acrylic Grout Additive

- j. Custom Building Products: Polyblend Non-Sanded Tile Grout/Stain Blocker Additive
- B. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.
 - 1. Provide prepackaged, dry-mortar mix containing dry, re-dispersible, vinyl acetate or acrylic additive to which only water must be added to Project site.
 - 2. For wall applications, provide mortar that complies with requirements for non-sagging mortar in addition to other requirements in ANSI A118.15.
- C. Organic Adhesive: Not acceptable.
- D. Polymer-Modified, High-Performance, Tile Grout: ANSI A118.7, color as indicated.
 - 1. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
 - a. Un-sanded grout mixture for joints 1/8 inch and narrower.

2.5 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 07 Section "Joint Sealants."
- B. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
 - 1. Products:
 - a. Dow Corning Corporation; Dow Corning 786.
 - b. GE Silicones; Sanitary 1700.
 - c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - d. Tremco, Inc.; Tremsil 600 White.
 - e. Laticrete International, Inc., Latasil Tile and Stone Sealant.
 - f. MAPEI, Mapesil
 - g. ARDEX Engineered Cements; SX 100% Silicone Sealant.
 - h. Custom Building Products: Commercial 100% Silicone Sealant.
 - i. HB Fuller; TEC AccuColor 100% Silicone Sealant.

2.6 MISCELLANEOUS MATERIALS

- A. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.7 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

2.8 SOURCE QUALITY CONTROL

- A. **Manufacturer Services:** Manufacturer assures product submitted is appropriate for application and environment in which it is to be installed and that product is merchantable for service, free of visible and latent defects and will perform for purpose for which it is intended without compromise.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials, using mechanical methods recommended by manufacturer. Do not use solvents.
- B. **Wall Preparation:** Comply with ANSI A108.01, Section 2.5.

3.3 INSTALLATION, GENERAL

- A. **ANSI Tile Installation Standards:** Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules and apply to types of setting and grouting materials used.
- B. **TCNA Installation Guidelines:** TCNA's "Handbook for Ceramic Tile Installation." Comply with TCNA installation methods indicated in ceramic tile installation schedules.
 - 1. Lay out tilework so as to minimize cuts less than one-half tile in size. Do not interrupt pattern through openings, unless otherwise noted. No staggered joints will be permitted.
 - 2. Locate cuts in both walls and floors so as to be least conspicuous.
 - 3. Align floor joints to give straight uniform grout lines parallel with walls. Align joints between floor and base tile. Align joints in both directions. Create transitions to other material or colors under door, unless otherwise noted.
- C. Provide manufacturer's standard trim shapes where necessary to eliminate tile edges, unless otherwise noted.
- D. Grout tile to comply with requirements of following tile installation standards:
 - 1. For ceramic tile grouts (polymer-modified tile grouts), comply with ANSI A108.10.

3.4 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in Wall Tile Installation Schedule, including those referencing TCNA installation methods and ANSI setting-bed standards.
- B. **Joint Widths:** Install tile on walls with following joint widths:
 - 1. Ceramic Wall Tile: 1/8 inch.

3.5 ADJUSTING/CLEANING AND PROTECTING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
- C. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.6 INTERIOR, WALL TILE INSTALLATION SCHEDULE

- A. Interior Wall Installations, Masonry or Concrete
 - 1. Tile Installation: Interior wall installation over sound, dimensionally stable masonry or concrete; thin-set mortar; TCNA W202I and ANSI A108.5.
 - a. Tile Type: Ceramic wall tile.
 - b. Thin-Set Mortar: Improved modified dry-set mortar as recommended by manufacturer for application indicated.
 - c. Grout: Polymer-modified, high-performance, un-sanded grout.

END OF SECTION 09 30 00

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 DEFINITIONS

- A. AC: Articulation Class.
- B. CAC: Ceiling Attenuation Class.
- C. LR: Light Reflectance coefficient.
- D. NRC: Noise Reduction Coefficient.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Sequencing
 1. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generated activities and wet work have terminated, and overhead work is completed, tested, and approved.
 2. Install acoustic units after interior wet work is dry.
 3. Ensure that products of this Section are supplied to affected trades in time to prevent interruption of construction progress.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including:
 1. Preparation instructions and recommendations.
 2. Dimensions, load carrying capacity, and performance standards compliance.
 3. Storage and handling requirements and recommendations.
 4. Installation and maintenance instructions.
- B. Samples: Do not submit.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 1. Ceiling suspension system components, including method of suspension where interference exists.
 2. Structural members to which suspension systems will be attached.
 3. Method of attaching hangers to building structure, including structural members to which suspension system will be attached.
 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 5. Items penetrating finish ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures
 - b. Diffusers
 - c. Grilles
 - d. Speakers

- e. Sprinklers
- f. Perimeter moldings
- 6. Minimum Drawing Scale: 1/8 inch = 1 foot.

- B. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry Underwriter's Laboratory certification of NRC and CAC.
 - 1. Provide a letter from the manufacturer certifying materials contain less than 1-percent asbestos by polarized light microscopy (PLM) analysis.

1.6 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For finishes to include in maintenance manuals.
 - 2. Receipt of extra materials.

1.7 EXTRA (MAINTENANCE) 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. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
 - 2. Hold-Down Clips: Equal to 2 percent of quantity installed.
- B. Replacement Stock: In addition to the maintenance stock specified above, provide extra replacement stock of acoustical materials, consisting of a minimum of one percent of area of each size, type, and thickness installed on the job. This extra stock is for replacement of damaged materials during the 60-day period following Substantial Completion, when the Owner's agent cannot ascertain the party responsible for the damage. Replacement stock that is not used shall be furnished to the Owner as extra materials.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified in Schedule at end or section.

- B. No substitutions.
- C. Source Limitations: Obtain acoustical panel ceiling and suspension system from one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Panels shall meet the following minimum performance criteria:
 - 1. ASTM E1264, Class A materials.
 - 2. Moisture Resistant: No visible sag at of 90-percent relative humidity and 104 degrees F.
- B. Storage, locker, and toilet excluding classrooms and halls require aluminum, aluminum faced galvanized steel or stainless-steel grid and lay-in panels with smooth, unperforated vinyl, polyester film (Mylar), or similar surface.
- C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
 - 1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
 - a. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance's, unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by A/E from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C. Panel Characteristics: Comply with "Acoustical Ceiling Product Schedule" at the end of this section.
- D. Humidity Resistance: Where indicated in "Acoustical Panel Ceiling Product Schedule," panels shall be dimensionally stable at up to 100 percent relative humidity at temperatures ranging from 32 to 104 deg F. without having to acclimatize tiles.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
 - 1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

1. Power-Actuated Fasteners in Concrete: Not allowed.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper, unless otherwise noted.
 - a. Where high-humidity finishes are specified, provide one of the following:
 - 1) Stainless-Steel Wire: ASTM A 580, Type 304, nonmagnetic.
 - 2) Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire but provide not less than 0.135-inch diameter wire (fka 9 gauge).
- E. Hanger Rods or Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch thick, galvanized steel sheet complying with ASTM A 653, G90 coating designation; with bolted connections and 5/16-inch diameter bolts.
- G. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.
1. Provide at the following locations and where indicated:
 - a. ACT located in vestibules, toilet rooms, and locker rooms.

2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653, G60 coating designation, with prefinished, cold-rolled, 15/16-inch wide, aluminum caps on flanges.
1. Structural Classification: Intermediate duty system.
 2. Face Design: Flat, flush.
 3. Cap Material: Aluminum.
 4. Face Finish: Painted white, unless otherwise noted.
 5. Provide this suspension system with ACT, unless otherwise noted.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 4. Provide radiused corner edge molding trim at bullnose block.

2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Products: Subject to compliance with requirements, provide one of the following:

- a. BOSS 826 Acoustical Sound Sealant; Accumetric LLC.
- b. RCS 20 Acoustical; GE Construction Sealants.
- c. Acoustical Sealant GSC; Grabber Construction Products.
- d. OSI Pro-Series SC-175 Acoustical Sound Sealant; Henkel Corp.
- e. AC-20 FTR or AIS-919; Pecora Corp.
- f. Smoke-N-Sound Acoustical Sealant; Specified Technologies, Inc.
- g. Quiet Seal Pro; Serious Energy, Inc.
- h. SHEETROCK Acoustical Sealant; USG Corp.
- i. CP 506 Smoke and Acoustical Sealant; Hilti.
- j. Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: Franklin International.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the Project Conditions.
- B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders and comply with layout shown on reflected ceiling plans.
- C. Refer to Room Finish Schedule, Legend and Reflected Ceiling Plan for spaces to receive acoustical ceiling tile. Grid shall be laid out and coordinated for lighting fixtures and mechanical system items. Furnish layouts for anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
- D. The installation of the ceiling shall be done prior to the installation of shelving, built-in counters, and finished floors; but after the other work in the room has been completed, including painting, unless otherwise approved by the A/E.
- E. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install suspension wires 4 foot on center, maximum in both directions.
 - 2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.

4. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
 5. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 6. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structures.
 - a. In installations where hanger wire is wrapped through or around main runners, the wire loops shall be tightly wrapped and sharp bent to prevent any vertical movement or rotation of the member within the loops. The wire must be wrapped around itself a minimum of three full turns (360 degree each) within a 3-inch length. For safety purposes, the bottom of the hanger wires shall either be cut close to the vertical portion of the wire or shall be bent upward parallel to the vertical portion of the hanger wire.
 7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, that extend through forms into concrete.
 - a. Powder-actuated fasteners are not allowed.
 8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 9. Do not attach hangers to steel deck tabs.
 10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications and so deflection does not exceed 1/360 of the span.
- C. Secure bracing wires, if required by authorities, with jurisdiction, to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer if edges are not concealed by suspension system flanges.
5. Install hold-down clips in areas indicated, space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.5 ACOUSTICAL PANEL CEILING PRODUCT SCHEDULE

- A. Acoustical Panel Ceilings
 1. ACT Type A: Wet formed, high density mineral fiber, ASTM E 1264, Type III, Form 2, Pattern CE, 24 by 24 by 5/8 inch, beveled, tegular lay-in, 15/16 inch grid, with NRC of 0.50, Class A, humidity sag resistant, light reflectance of 0.86 minimum and \geq .45 pound/sq.ft. Factory applied vinyl latex paint with scuff resistant spatter coat, color - white, unless otherwise noted.
 - a. Products: Subject to compliance with requirements, provide one of the following products specified:
 - 1) Item No. 1004, USG Alpine.

END OF SECTION 09 51 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include fire-resistance testing.
- B. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 1-1/2 inches long, of each resilient product color, texture, and pattern required.

1.3 MAINTENANCE MATERIALS

- A. Leave, at Project where directed, any remaining full-size pieces of each type, color, pattern, and size for Owner's maintenance.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. Maintain the ambient relative humidity between 40 percent and 60 percent during installation.
- C. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 85 deg F.
- D. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
 - 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.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by a qualified testing agency by testing identical products.
 - 1. Critical Radiant Flux Classification (ASTM E 648 or NFPA 253): Class I (not less than 0.45 watts per cm²).
 - 2. Smoke Generation (ASTM E 662 or NFPA 258): Maximum specific optical density of 450 or less.
- B. Accessibility: Transitions and adaptors shall comply with accessibility requirements of the U.S. Architectural and Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 as required by local authorities with jurisdiction.

2.3 RESILIENT BASE (RB)

- A. Resilient Base:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the as indicated on the "List of Finishes."
- B. Resilient Base Standard: ASTM F 1861.
 - 1. Material Requirement: Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic).
 - 2. Manufacturing Method: Group I (solid, homogeneous) or Group II (layered).
 - 3. Style and Location: Style B, Cove: Provide unless otherwise noted or required by governing authority.
- C. Minimum Thickness: 0.125 inch.
- D. Height: 4 inches, unless otherwise noted.
- E. Lengths: Cut lengths, 48 inches long.
- F. Outside Corners: Factory preformed or factory precut or job formed. Corners must be a minimum of 4 inches in length each way.
- G. Inside Corners: Factory preformed or job formed.
- H. Finish: Satin.
- I. Colors and Patterns: Refer to "List of Finishes".

2.4 RESILIENT MOLDING ACCESSORY (RMA)

- A. Material: Vinyl or rubber, unless otherwise noted.
 - 1. Where indicated, provide extruded aluminum with mill finish of width shown, of height required to protect exposed edges of floor coverings, and in maximum available lengths to minimize running joints.
- B. Profile and Dimensions: As indicated.
 - 1. General, provide where meeting unfinished floor or flooring of different material transitions.

- a. Comply with accessibility requirements for change in level and slope requirement for ramps.

C. Colors and Patterns: Refer to "List of Finishes".

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Metal Edge Strips, where indicated: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
 - 1. Exception: Resilient base shall not wrap 1-inch thick worksurface supports between workstations.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 4 inches in length.
 - a. Butt one piece to corner then cope/scribe next piece to fit.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 67 23 – DECORATIVE RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes decorative resinous flooring systems with epoxy body coat(s). (DRF), including:
 - 1. Fluid applied seamless flooring with integral cove base.
 - 2. Joint, edge, and termination strips.
 - 3. Locate all flexible joints required.
 - 4. Accessories necessary, including decal for complete installation.

- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for moisture barrier and slab requirements, including coordination with potential admixtures or toppings that may affect performance of installed floors.
 - a. Concrete subfloor to be level (maximum variation not to exceed 1/4 inch in 10 feet) and to have a steel troweled finish. No curing agents or other additives which could prevent bonding should be used unless the mechanical surface preparation method completely remove the curing agent residue or sealer.
 - 2. Division 07 Section "Joint Sealants" for sealants installed at joints in resinous flooring systems.
 - 3. Division 09 Section "Moisture Vapor Emission Control" for coordination with alternate.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Prior to installation of structural floor slab, advise General Contractor, in writing, of all requirements of concrete substrate regarding finish, level tolerance, and curing.

- B. Preinstallation Meeting: Conduct meeting at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." A/E will schedule and conduct meeting.
 - 1. Review mockup.
 - 2. Review manufacturer's written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
 - 3. Review details of integral cove bases.
 - 4. Review manufacturer's written instructions for installing resinous flooring systems.
 - 5. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.
 - 6. Flooring product manufacturer will have a technical installation representative available at the jobsite at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer's technical representative will document and confirm that the substrate, material and installation are in compliance with manufacturer's guidelines and accepted industry standards and practices.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
 - a. Include preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - 2. Provide details for flexible joints required for flooring in area of installation.
 - 3. Provide details of cove base, if indicated, and termination details at floor material transitions and where adjoining equipment.

- B. Samples for Initial Selection: For each type of exposed finish required.
- C. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

- A. Certified Test: Submit two copies of suppliers/manufacturers written certification that flooring system meets or exceeds required properties.
- B. Manufacturers Application Instructions: Submit descriptive data and specific recommendations for mixing, application, curing including any precautions of special handling instructions.

1.5 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
 - 1. Maintenance Data: For resinous flooring to include in maintenance manuals.
 - a. Submit current copies of the flooring manufacturer's printed recommendations on maintenance methods and products.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
 - 1. Engage an installer who employs only persons trained and approved by resinous flooring manufacturer for applying resinous flooring systems indicated.
 - 2. Installer to verify locations of all flexible joints required by the provisions of this Section and by the recommendations of the related material manufacturers.
 - 3. Installer to keep daily log of the date of installation, room number, type color, and method of application of product being installed.
- B. Manufacturer Field Technical Service Representative: Resinous flooring manufacturer shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on this project.
 - 1. Field Technical Services Representatives shall be employed by the system manufacturer to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.
 - 2. Flooring product manufacturer will have a technical service representative available at the jobsite at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer's technical representative will document and conform that the substrate, material, and installation are in compliance with manufacturer's guidelines and accepted industry standards and practices.
 - 3. Any noticed defect with the product or installation system will require the response of the manufacturer's technical field service personnel on site to determine cause, correction or replacement.
- C. Portable Mockups: Prior to starting application of flooring:
 - 1. Purposes:
 - a. To verify color selections made under Sample submittals.
 - b. To determine texture (cleanability versus slip-resistance).
 - c. To demonstrate aesthetic affects, chemical-resistance, thickness, and other features of the resinous flooring.
 - d. To set quality standards for materials and execution.

2. Provide full scale portable mock-up of not less than 4 square feet.
 - a. Include 48 inch length of integral cove base with inside corner, if applicable.
3. Simulate finished lighting conditions for A/E's review of Mock-Ups.
4. If judged unacceptable, make adjustments to comply with requirements and apply another similar sample until acceptable.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
- B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects. Maintain temperatures within the required range. Do not use materials which exceed the manufacturer's maximum recommended shelf life.
- C. All materials used shall be factory pre-weighed and pre-packaged in single easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
 1. Site requirements
 - a. Application may commence when building has been fully enclosed and the HVAC controls are running for a minimum of two weeks.
 - b. Application and proceed while air, material and substrate temperatures are between 60 degrees F and 85 degrees F providing the substrate temperature is above the dew point. Outside of this range, the manufacturer shall be consulted.
 - c. The relative humidity in the specific location of the application shall be less than 85 percent and the surface temperature shall be at least 5 degrees F above the dew point.
 2. Conditions of new concrete or concrete topping
 - a. Concrete shall be moisture cured for a minimum of 7 days and have fully cured for 14 days in accordance with ACI-308 prior to the application for the coating system pending moisture tests. Outside of these parameters manufacturer shall be consulted.
 - b. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary or desirable).
 - c. Sealers and curing agents should not be used.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
 1. Non-related personnel in the work area shall be kept to a minimum.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated in the "List of Finishes".
 1. Vinyl Flakes

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
 - 1. Where products are indicated on List of Finishes with colors selected, provide sample to verify color match with substitution request.
- C. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- D. Flammability: Self-extinguishing according to ASTM D 635.

2.2 DECORATIVE RESINOUS FLOORING (DRF)

- A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, decorative-aggregate-filled, (chips) epoxy-resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base.
- B. System Characteristics:
 - 1. Color and Pattern: Refer to "List of Finishes."
 - 2. Wearing Surface: Manufacturer's standard wearing surface.
 - 3. Integral Cove Base: 6 inches high, unless otherwise noted or required by governing authority.
 - 4. Thickness: 1/8 inch minimum, thickness does not include waterproofing or reinforcing membrane.
- C. System Components: Manufacturer's standard components that are compatible with each other and as follows:
 - 1. Body Coat(s):
 - a. Resin: Epoxy.
 - b. Formulation Description: 100 percent solids.
 - c. Type: Pigmented, unless otherwise noted in "List of Finishes".
 - d. Application Method: Self-leveling slurry with broadcast aggregates (chips).
 - 1) Thickness: 30 mils minimum nominal (flake) thickness does not include waterproofing or reinforcing membrane.
 - 2) Number of Coats: One or two are recommended by manufacturer for application indicated.
 - e. Aggregates: Vinyl Flake.
 - 2. Primer, if required: Type recommended by manufacturer for substrate and body coat(s) indicated.
 - 3. Reinforcing Membrane: Flexible resin formulation that is recommended by manufacturer for substrate and primer and body coat(s) indicated and that prevents substrate cracks from reflecting through resinous flooring.
 - a. Formulation Description: 100 percent solids.
 - 1) Provide fiberglass scrim embedded in reinforcing membrane as recommended by manufacturer.
 - 4. Topcoat: UV-resistant sealing or finish coat(s).
 - a. Resin: Epoxy or urethane as recommended by manufacture for application indicated.
 - b. Formulation Description: 100 percent solids.
 - c. Type: Clear.
 - d. Finish: Gloss.

- D. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
1. Compressive Strength: 6,000 psi per ASTM C 579.
 2. Tensile Strength: 1,500 psi per ASTM C 307.
 3. Water Absorption: 1.0 percent maximum per ASTM C 413.
 4. Abrasion Resistance: 0.023 gram maximum weight loss per ASTM D 4060.
 5. Flammability: Self-extinguishing per ASTM D 635.
 6. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation per MIL-D-3134.
 7. Resistance to Elevated Temperature: No slip or flow of more than 1/16-inch per MIL-D-3134.
 8. Critical Radiant Flux: 0.45 W/sq. cm or greater in accordance with NFPA 253.

2.3 ACCESSORY MATERIALS

- A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated. Material must be compatible and coordinated with concrete slab mix.
- B. Joint Sealants: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

2.4 SOURCE QUALITY CONTROL

- A. Manufacturer Services: Manufacturer assures the product submitted is appropriate for the application and environment in which it is to be installed and that the product is merchantable for service, free of visible and latent defects and will perform for the purpose for which it is intended without compromise.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate and areas, with the Installer present, for compliance with the requirements for installation tolerances and other unsatisfactory conditions affecting performance of the Work.
1. Verify substrate mix design for additives, i.e. hardeners, moisture vapor reduction admixture and other ingredients that might affect performance of installed flooring.
- B. Proceed with the installation only after unsatisfactory conditions, including levelness tolerances have been corrected and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
1. Roughen concrete substrates as follows:
 - a. Comply with NACE No. 6/SSPC-SP13, with a Concrete Surface Profile (CSP) of 3 or greater in accordance with the International Concrete Repair Institute (ICRI) Technical Guideline No. 310.2 R, unless manufacturer's written instructions are more stringent.
 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.

3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - a. Perform relative humidity test using in situ Verify that concrete substrates are dry and moisture-type emissions are within acceptable levels according to manufacturer's written instructions.
 - 1) Perform anhydrous calcium chloride test, ASTM F 1869. probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - 2) Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.
 - 3) Moisture testing shall be performed at least 60 days in advance of flooring installation to allow sufficient drying time if levels are found to be excessive.
 - a) If moisture levels in concrete slabs are too high, temporary climate control may be used to remove excess moisture to levels acceptable to floor manufacturer. Refer to Division 01 Section "Temporary Facilities and Control."
 - b. Relative Humidity Test: Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
 - c. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
 4. If concrete additives, i.e., hardeners, moisture vapor reduction admixtures or other ingredients have been included in the mix or suspected to be in the mix that might affect the performance of the flooring installation, test the bond.
 - a. Perform bond and any additional tests as recommended by the flooring manufacturer. If tests do not produce satisfactory results, coordinate with both concrete additive manufacturer and flooring manufacturer for potential solutions. Retest until a satisfactory result can be obtained.
- C. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.3 INSTALLATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
 - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Reinforcing Membrane: Apply reinforcing membrane to substrate cracks.
- D. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
1. Integral Cove Base: 6-inches high, unless otherwise noted.

2. Coordinate profile of top of integral cove base to receive ceramic wall tile.
- E. Self-Leveling Body Coats: Apply self-leveling slurry body coat(s) in thickness indicated for flooring system.
1. Broadcast aggregates and, after resin is cured, remove excess aggregates to provide surface texture indicated.
 2. A decal shall be placed after the floor has received its clear coat of epoxy over the flakes. This minimizes distortion in the decal while maximizing adhesion. After decal installation, the floor (not decal) is lightly sanded to ensure intercoat adhesion. A flood coat of epoxy is then applied to lock in the decal. These coats of resin will create a smooth floor.
- F. Topcoats: Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.4 TERMINATIONS

- A. Chase edges to "lock" the flooring system into the concrete substrate along lines of termination.
- B. Penetration Treatment: Lap and seal the flooring system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.
- C. Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.
- D. Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.5 JOINTS AND CRACKS

- A. Treat control joints to bridge potential cracks and to maintain monolithic protection.
- B. Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.
- C. Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.6 FIELD QUALITY CONTROL

- A. Material Sampling: Owner may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.
 1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
 2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
 3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.7 CURING, PROTECTING, AND CLEANING

- A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Chose area of application for a minimum of 24 hours.

- B. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
- C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION 09 67 23

SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes modular carpet tile.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-In-Place Concrete" for moisture barrier and slab requirements, including coordination with potential admixtures or toppings that may affect performance of installed floors.
 - 2. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 REFERENCES

- A. Carpet and Rug Institute:
 - 1. The Carpet Primer
 - 2. Carpet Installation Standard
- B. ASTM Standards:
 - 1. ASTM F-1869 – Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Calcium Chloride.
 - 2. ASTM F-710 – Standard Practice for Preparing Concrete to Receive Resilient Flooring.
 - 3. ASTM F-2170 – In-situ Relative Humidity Testing.
 - 4. ASTM F3191-16 – Standard Practice for Field Determination of Substrate Water Absorption (Porosity).

1.3 DEFINITIONS

- A. Carpet Terminology: Refer to Carpet and Rug Institute (CRI) – "Carpet Installation Standard, Appendix."

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct meeting at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.
 - 2. Flooring product manufacturer will have a technical installation representative available at the jobsite at the inception of the installation to insure there are no conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer's technical representative will document and confirm that the substrate, material and installation are in compliance with manufacturer's guidelines and accepted industry standards and practices.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade-resistance.
- B. Samples for Verification: 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 Tile: Full-size Sample.
2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch long Samples.

1.6 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Manufacturer's written installation recommendations for each type of substrate.
 1. If the carpet and/or adhesive manufacturer have products with specific installation instructions, then the carpet and/or adhesive manufacturer shall make those installation instructions available.
- B. Manufacturers Certification: Manufacturer shall provide a letter on company letterhead stating substrate, material, and installation are in compliance with manufacturer's guidelines and accepted industry standards and practice. Certification letter shall include a summary written as to observations, conversations, instructions, condition concerns, corrections and other pertinent information.

1.7 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 1. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - a. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - b. Precautions for cleaning materials and methods that could be detrimental to carpet tile.
 2. Warranty: Special warranty specified in this Section.
 3. Receipt for extra materials.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- 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 Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.9 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Carpet tile product manufacturer will have a technical installation representative available at the job site at the inception of the installation to insure there are not conditions which will compromise the installation of the material and that the material is being installed according to industry standards, practices and manufacturers guidelines. The manufacturer's technical representative will document and confirm that the substrate, material, and installation are in compliance with manufacturer's guidelines and accepted industry standards and practices.
 1. Any noticed defect with the product or installation system will require the response of the manufacturer's technical field service personnel on-site to determine cause, correction or replacement.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104, Section 5, "Storage and Handling."

1.11 FIELD CONDITIONS

- A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

1.12 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excess static discharge, and delamination.
 - 3. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
 - 1. Refer to "List of Finishes."
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
 - 1. Where products are indicated on List of Finishes with colors selected, provide sample to verify color match with substitution request.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated, as determined by testing identical products per ASTM E 648 and NFPA 253 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux Classification: Not less than 0.45 W/sq.cm.
 - 2. Flooring Radiant Panel Test: Meets NFPA Class 1 when tested under ASTM E-648 glue down.
 - 3. Smoke Density: NBS Smoke Chamber NFPA-258, less than 450 flaming mode.
- B. Chemical Emission/Indoor Air Quality: Carpet shall comply with the Carpet and Rug Institute (CRI) Green Label Plus Program. The program label and registration number serve as evidence of compliance.
- C. Accessibility: Flooring shall be provided to comply with accessibility requirements of the U.S. Architectural and Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 as required by local authorities with jurisdiction.

2.3 CARPET TILE (CART)

- A. General: Refer to "List of Finishes".

2.4 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer. Material must be compatible and coordinated with concrete slab mix.

- B. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and high-moisture subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 - 1. Adhesives shall be approved by manufacturer for use over concrete substrates with maximum RH of less than 95 percent (ASTM F2170) and maximum pH of 10 and adhesive shall be compatible with flooring material backing and suitable for substrate conditions.
 - 2. Where results of relative moisture testing of concrete per ASTM F 2170 exceed 95percent relative humidity moisture level work to remedy will be by change order. Contractor shall propose a solution as recommended by flooring manufacture.
- C. Metal Edge/Transition Strips: Extended aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

2.5 SOURCE QUALITY CONTROL

- A. Manufacturer Services: Manufacturer assures product submitted is appropriate for application and environment in which it is to be installed and that product is merchantable for service, free of visible and latent defects and will perform for purpose for which it is intended without compromise.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 - a. Moisture testing shall be performed at least 60 days in advance of flooring installation to allow sufficient drying time if levels are found to be excessive.
 - 1) If moisture levels in concrete slabs are too high, temporary climate control may be used to remove excess moisture to levels acceptable to floor manufacturer. Refer to Division 01 Section "Temporary Facilities and Controls."
 - 2. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a less than 95 percent relative humidity level measurement.
 - 3. Substrate shall exhibit a pH in range of 5 to 10 when wetted with potable water and tested by applying test paper. Basis-of-Design: pHydron by Micro Essential Laboratory Inc., Brooklyn, NY.
 - 4. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
 - 5. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 6. Substrate Density: Assess substrate density for absorptivity/porosity per ASTM F3191-16.
- D. Verify substrate mix design for additives, i.e., hardeners, moisture vapor reduction admixture and other ingredients that might affect performance of installed flooring.

1. If concrete additives, i.e., hardeners, moisture vapor reduction admixtures or other ingredients have been included in mix or suspected to be in mix that might affect performance of flooring installation, test bond.
 - a. Perform bond and any additional tests as recommended by flooring manufacturer. If tests do not produce satisfactory results, coordinate with both concrete additive manufacturer and flooring manufacturer for potential solutions. Retest until a satisfactory result can be obtained.
- E. Proceed with installation only after unsatisfactory conditions have been corrected and manufacturer has approved substrate for material to be installed without compromise.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
 1. During installation, maintain air circulation by operating HVAC system at full capacity.
 2. Continue operating ventilation system at normal room temperature for up to 72 hours after installation.
- B. Installation Method: As recommended in writing by carpet tile manufacturer for application indicated.
 1. Product as installed to be securely attached to floor in compliance with Americans with Disabilities Act (ADA), Section 4.5.3.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
 1. Joints: Modules in complete installation should be tight, but not compressed. To insure proper spacing when installing modular carpet, measure distance covered by 11 modules (10 joints) installed on floor with no visible gaps, peaks or overlaps. Continually check that modules are being installed in compliance with manufacturer specifications for that particular product. Take care not to trap yarn between modules.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. 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, non-staining marking device.

- G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform following operations immediately after installing carpet tile:
 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 2. Remove yarns that protrude from carpet tile surface.
 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel and iron.
 - 2. Galvanized metal.
- B. Work under this contract shall also include, but not necessarily be limited to the following:
 - 1. Surface preparation of substrates as required for acceptance of painting, including cleaning, small crack repair, patching, and caulking.
 - 2. Priming (except where pre-primed with an approved primer under other sections of work) and painting of structural steel and primed steel equipment.
 - 3. Painting of all semi-concealed areas (e.g. inside of light troughs and valances, behind grilles, and projecting edges above and below sight lines).
 - 4. Painting of roof vent flashings.
 - 5. Painting of exposed to view fire suppression, plumbing, HVAC, electrical, communication, and electronic safety and security work unless prefinished.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
- D. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.2 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 - 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 - 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 - 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including primers and the following:
 - 1. Product characteristics.
 - 2. Surface preparation instructions and recommendations.
 - 3. Primer requirements and finish specification.
 - 4. Storage and handling requirements and recommendations.
 - 5. Application methods.
 - 6. VOC content.
- B. Samples for Initial Selection: For each type of topcoat product, where color is not preselected.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. 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.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. 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. Include color designations.

1.5 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
 8. VOC content.
- B. Store Materials
1. Store only the approved materials at the Project site and store only in a suitable and designated area restricted to the storage of paint materials and related equipment.
 - a. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - b. Protect from freezing. Keep storage area neat and orderly.
 - c. Remove oily rags and waste daily.
 2. Use means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.
 3. Use means necessary to protect paint materials before, during, and after application and to protect the installed work and materials of other trades.
 4. Where toxic and/or volatile/explosive/flammable materials are being used, provide adequate fireproof storage lockers and take all necessary precautions and post adequate warnings (e.g. no smoking) as required.
 5. Take all necessary precautionary and safety measures to prevent fire hazards and spontaneous combustion and to protect the environment from hazard spills. Materials that constitute a fire hazard (paints, solvents, drop clothes, etc.) shall be stored in suitable closed and rated containers and removed from site on a daily basis.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
1. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 degrees F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

- C. Perform no exterior painting work unless environmental conditions satisfy written requirements of paint manufacturer or until adequate weather protection is provided. Where required, suitable weatherproof covering and sufficient heating facilities shall be in place to maintain minimum ambient air and substrate temperatures for 24 hours before, during and after paint application.
- D. Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.

1.8 SCHEDULING

- A. Schedule painting operations to prevent disruption of and by other trades.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers as listed hereinafter.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PAINT, GENERAL

- A. Material Compatibility: Paint materials selected for coating systems for each type of surface shall be the product of a single manufacturer.
 - 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. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the material to be thinned.
- C. All materials used shall be lead-, mercury-, and cadmium free and shall have a VOC content not exceeding the following, unless a lower VOC content is required by authorities having jurisdiction.
- D. Colors: As selected by A/E manufacturer's full range.
- E. Submission of a proposal indicates that the Contractor has reviewed the bidding documents with the painting subcontractor and accepts the Specifications as sufficient to produce approved painting results. If the painting subcontractor contends that the materials or number of coats specified will not produce satisfactory results, he shall so notify the A/E directly or indirectly through a Bidding Contractor 10 days prior to receipt of bids for proper action.

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. 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 applicable to substrates and paint systems indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. Remove and securely store (e.g. electrical plates, door hardware), removable rating/hazard/instruction labels, light fixture trim, etc. from wall and ceiling surfaces, doors and frames, prior to painting, and replace upon completion. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. Carefully clean and replace all such items upon completion of painting work in each area. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (e.g. lacquer finishes).
 - 2. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - 3. Hollow metal doors shall be removed before repainting to paint bottom and top edges and then re-hung.
 - 4. 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 or provide barrier coats as required to produce paint systems indicated. Notify A/E in writing about anticipated problems using the specified finish coat materials with substrates primed by others.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 - 1. SSPC-SP 2, "Hand Tool Cleaning," unless otherwise recommended by paint manufacturer for substrate indicated.
- E. 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.
 - 1. Surface preparation should start with SSPC SP-1 Solvent Cleaning to remove oil/grease contamination. If the galvanized surface is shinney, the surface must be de-glossed and roughened in one of two ways:
 - 2. Galvanized metals are very smooth and have virtually no profile for the coating to adhere to. It is important to abrade the surface of the galvanized metal through Brush of Blast (SSPC SP7), or an etching primer before coatings application, as recommended by paint manufacturer.

3. Galvanized surfaces must use a primer before applying a topcoat. Topcoats will not adhere to the zinc layer of the galvanized surface and requires a primer to form a bond between the two. Manufacturer's water-based bonding primers as an alternative to the previously used cementitious primers. An epoxy primer may also be used, however, it should be noted that epoxy primers typically require an abrasive blast-cleaned surface.

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.
 3. Do not paint over labels of independent testing agencies of equipment name, identification, performance rating, or nomenclature plates.
 4. Primers specified in paint schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Scheduling Painting: Apply first coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
 2. Slightly vary the color of succeeding coats.
- C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate.
 1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
 2. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn through or other defects due to insufficient sealing.
- D. 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.
- E. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- F. 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.
- G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 1. Paint the following where exposed to view:
 - a. Equipment, including panel boards.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.

3.4 FIELD QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of paint materials with product requirements, including dry film thicknesses.
 - a. Contractor shall touch up and restore painted surfaces damaged by testing.
 - b. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 3. Allow empty cans to dry before disposal.
 4. Collect waste paint cans to dry before disposal.
- 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 A/E, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE (P-Code)

- A. Steel and Iron (Ferrous) Substrates:
 1. W.B. Light Industrial Coating System: (Code #5.1)
 - a. Prime Coat: Primer, Rust-Inhibitive, Water-Based.
 - 1) Sherwin Williams; Pro-Industrial Pro-Cryl Universal Primer
 - 2) PPG; 4020 Pitt-Tech Plus DTM Industrial Primer
 - 3) Benjamin Moore: Super Spec HP Metal Primer, P04.
 - b. Intermediate Coat: Light industrial coating, exterior matching topcoat.
 - c. Topcoat: Light industrial coating, exterior (semigloss).
 - 1) Sherwin Williams; B66-600 Pro Industrial Acrylic
 - 2) PPG; 4216HP Pitt-Tech Plus DTM
 - 3) Benjamin Moore Ultra Spec HP DTM Acrylic Semi-Gloss HP29
 - 4) Applications: Include, but are not limited to:
 - a) Structural steel and metal fabrications.
- B. Steel-High Heat Substrates:
 1. Heat Resistant Enamel System: (Code #5.2)
 - a. Prime Coat:
 - 1) Sherwin Williams: Flame Control, TemperKote 1000

- 2) PPG: Hi-Temp 1027
 - 3) Dampney: Thurmalox 210C
 - b. Topcoat: Heat resistant enamel finish (semi-gloss)
 - 1) Sherwin Williams: Flame Control, TemperKote 600
 - 2) PPG: Hi-Temp 500 VS
 - 3) Dampney: Thurmalox 200C
 - 4) Application: Include, but are not limited to:
 - a) Heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range of up to 400 deg. F.
- C. Galvanized-Metal (Non-Ferrous) Substrates:
- 1. Water-Based Light Industrial Coating System: (Code #5.3).
 - a. Prime Coat: Primer, galvanized, water based, or topcoat manufacturer's recommended primer for indicated application.
 - 1) Sherwin Williams; Pro-Industrial Pro-Cryl Universal Primer
 - 2) PPG; 4020 Pitt-Tech Plus DTM Industrial Primer
 - 3) Benjamin Moore; Ultra Spec HP Acrylic Metal Primer HP04
 - 4) Note: Prime coat may be omitted when not required by paint manufacturer.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based (semigloss).
 - 1) Sherwin Williams: B66-600 Pro Industrial Acrylic
 - 2) PPG: 4216HP Pitt-Tech Plus DTM
 - 3) Benjamin Moore Ultra Spec HP DTM Acrylic Semi-Gloss HP29
 - 4) Applications: Include, but are not limited to:
 - a) Exterior lintels.
 - b) Miscellaneous exposed metal items, e.g. metal bollards.

END OF SECTION 09 91 13

SECTION 09 91 23.00 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and application of paint systems on the following interior substrates:
1. Concrete masonry units (CMU).
 2. Steel and iron.
 3. Galvanized metal.
 4. Gypsum board.
- B. Work under this contract shall also include, but not necessarily be limited to following:
1. Surface preparation of substrates as required for acceptance of painting, including cleaning, small crack repair, patching, and caulking.
 - a. Provide for safe and adequate ventilation as required over and above temporary ventilation supplied by others, where toxic and/or volatile/flammable materials are being used.
 2. Priming (except where pre-primed with an approved primer under other sections of work) and painting of structural steel, miscellaneous metal, and primed steel equipment.
 3. Painting of all semi-concealed areas (e.g. inside of light troughs and valances, behind grilles, and projecting edges above and below sight lines).
 4. Painting of exposed-to-view fire suppression, plumbing, HVAC, electrical, communication, and electronic safety and security.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Concealed surfaces including walls or ceilings in following generally inaccessible spaces:
 - a. Foundation spaces
 - b. Furred areas
 - c. Ceiling plenums
 - d. Utility tunnels
 - e. Pipe spaces
 - f. Duct shafts, unless otherwise noted
 2. Finished metal surfaces include following:
 - a. Anodized aluminum
 - b. Stainless steel
 - c. Chromium plate
 - d. Copper and copper alloys
 - e. Bronze and brass
 3. Operating parts include moving parts of operating equipment.
 - a. Valve and damper operators (including valve stems).
 - b. Linkages
 - c. Sensing devices
 - d. Motor and fan shafts
 4. Labels: Do not paint over UL, FMG, or other code required labels or equipment name, identification, performance rating, or nomenclature plates.
 5. Communication Cable: Do not paint cable and protect communications cabling from overspray. Paint voids warranty of cable and if painted shall be replaced at painting contractor's expense.
 - a. Communications plenum cable.
 - b. Communications riser cable.
 - c. Communications general purpose cable.
 - d. Communications cable, limited use.
 - e. Under carpet communications wire and cable.
- D. Related Sections include following:

1. Division 05 Sections for shop priming of metal substrates.
2. Division 09 Section "Exterior Painting" for surface preparation and application of paint systems on exterior substrates.

1.2 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for application and use.
- B. Samples for Initial Selection: For each type of topcoat product, where color has not been preselected.
- 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 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.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Product List: For each product indicated, include following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
- B. Submit invoice list of all paint materials ordered for Project work indicating manufacturer, types and qualities for verification and compliance with specification.

1.5 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
1. Receipt of extra materials. Properly package materials and obtain a signed receipt.
 2. At Project completion provide an itemized list complete with manufacturer, paint type and color coding of all paints used for Owner's later use in maintenance.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements
1. Conform to work place safety regulations for storage, mixing, application and disposal of all paint related materials to requirements of those authorities having jurisdiction.
 2. To reduce amount of contaminants entering waterways, sanitary/storm drain systems or into ground following procedures shall be strictly adhered to:
 - a. Retain cleaning water for water-based materials to allow sediments.
 - b. Retain cleaners, thinners, solvents, and excess paint and place in designated containers and ensure proper disposal.

- c. Return solvent and oil-soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
- d. Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
- e. Empty paint cans are to be dry prior to disposal or recycling.
- f. Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well-ventilated fire-safe area at moderate temperature.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to job site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.
- B. Store Materials
 - 1. Store only approved materials at jobsite and store only in a suitable and designated area restricted to storage of paint materials and related equipment.
 - a. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - b. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.
 - c. Remove rags and waste from storage areas daily.
 - 2. Use means necessary to ensure safe storage and use of paint materials and prompt and safe disposal of waste.
 - 3. Use means necessary to protect paint materials before, during, and after application and to protect installed work and materials of other trades.
 - 4. Where toxic and/or volatile/explosive/flammable materials are being used, provide adequate fireproof storage lockers and take all necessary precautions and post adequate warnings as required.
 - 5. Take all necessary precautionary and safety measures to prevent fire hazards and spontaneous combustion and to protect environment from hazard spills. Materials that constitute a fire hazard (paints, solvents, drop clothes, etc.) shall be stored in suitable closed and rated containers and removed from site on a daily basis.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
 - 1. Apply solvent thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F. and 95 degrees F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above dew point; or to damp or wet surfaces.
- C. Perform no interior painting or decorating work unless adequate continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above minimum requirements for 24 hours before, during, and after paint application. Provide supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

- D. Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect quality of finished surfaces.
- E. Perform no painting or decorating work unless a minimum lighting level of 30-foot candles is provided on surfaces to be painted.

1.9 SCHEDULING

- A. Schedule painting operations to prevent disruption of and by other trades.

1.10 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied in unopened cans and that are packaged for storage and identified with labels describing contents for Owner's later use in maintenance. Store where directed.
 - 1. Quantity: Furnish 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers as indicated hereinafter.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PAINT, GENERAL

- A. Material Compatibility: Paint materials selected for coating systems for each type of surface shall be product of a single manufacturer.
 - 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. Paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with surface to be coated; tools and equipment shall be compatible with coating to be applied.
 - 1. Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, furnish information on characteristic of finish materials to ensure use of compatible primers.
- C. Thinners, when used, shall be only those thinners recommended for that purpose by manufacturer of material to be thinned.
- D. All materials used shall be lead-, mercury-, and cadmium free and VOC-compliant with local authorities with jurisdiction.
- E. Colors: As indicated in "List of Finishes."

- F. By submitting a proposal, Contractor has reviewed bidding documents with painting subcontractor and accepts Specifications as sufficient to produce approved painting results. If painting subcontractor contends that materials or number of coats specified will not produce satisfactory results, he shall so notify A/E directly or indirectly through a Bidding Contractor 10 days prior to receipt of bids for proper action.

2.3 MIXING AND TINTING

- A. Unless otherwise specified or pre-approved, all paints shall be ready mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity.
- B. Paste, powder, or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- C. Where thinner is used, addition shall not exceed paint manufacturer's recommendations.
- D. If required, thin paint for spraying in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to A/E.

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. Test suspect surfaces (concrete, masonry, plaster and wood surfaces) for moisture and alkalinity as required by paint manufacturer. Conduct all moisture tests using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a "cover patch test, unless otherwise required by paint manufacturer. Maximum moisture shall not exceed:
 - 1. Masonry (CMU): 12 percent
 - 2. Gypsum Board: 12 percent
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- 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. Warning. Removal of old paint by sanding, scraping, or other means may generate dust or fumes that contain lead. Exposure to lead dust or fumes may cause brain damage or other adverse health effects, especially in children or pregnant women. Controlling exposure to lead or other hazardous substances requires use of proper protective equipment, such as a properly fitted respirator (NIOSH approved) and proper containment and cleanup. For more information, call National Lead Information Center at 1-800-424-LEAD (in US) or contact your local health authority. Removal must be done in accordance with EPA Renovation, Repair and Painting Rule and all related state and local regulations. Care should be taken to follow all state and local regulations which may be stricter than those set under federal RRP Rule.
- B. Comply with manufacturer's written instructions and recommendations applicable to substrates indicated.

1. Proper product selection, surface preparation and application affect coating performance. Coating integrity and service life will be reduced because of improperly prepared surfaces. Selection and implementation of proper surface preparation ensures coating adhesion to substrate and prolongs service life of coating system.
- C. Remove and securely store all miscellaneous hardware and surface fittings/fastenings (e.g. electrical plates, mechanical louvers, door and window hardware) (e.g. hinges, knobs, locks, trim frame stops), removable rating/hazard/instruction labels, washroom accessories, light fixture trim, etc. from wall and ceiling surfaces, door and frames, prior to repainting and replace upon completion. Carefully clean and replace all such items upon completion of repainting work in each area. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (e.g. lacquer finishes). Doors shall be removed before repainting to paint bottom and top edges and then re-hung. 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 trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- D. Protect all adjacent interior surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, etc., from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.
 1. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, nomenclature plates, or communicating cabling.
- E. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 1. Schedule cleaning and painting application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.
- F. Concrete Masonry Substrates: Remove 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.
- G. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than following:
 1. SSPC-SP 2, "Hand Tool Cleaning," unless otherwise noted or recommended by paint manufacturer for application indicated.
- H. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- I. 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.
 1. Surface preparation should start with SSPC SP-1 Solvent Cleaning to remove oil/grease contamination. If galvanized surface is shinney, surface must be de-glossed and roughened in one of two ways:
 - a. In mild building environments, wash with a chemical etching solution.
 2. Galvanized metals are very smooth and have virtually no profile for coating to adhere to. It is important to abrade surface of galvanized metal through Brush of Blast (SSPC SP7), or an etching primer before coatings application, as recommended by paint manufacturer.
 3. Galvanized surfaces must use a primer before applying a topcoat. Topcoats will not adhere to zinc layer of galvanized surface and requires a primer to form a bond between two. Manufacturer's water-based bonding primers as an alternative to previously used cementitious primers. An epoxy primer may also be used, however, it should be noted that epoxy primers typically require an abrasive blast-cleaned surface.

- J. Gypsum Wallboard: Must be clean and dry. Fill nail heads must be set and spackled. Joints must be taped and covered with joint compound. Spackled nail heads and taped joints must be sanded smooth and all dust removed prior to painting.
1. Vacuum wall with brush attachment.
 - a. As wall is vacuumed, wipe if down with microfiber cloth. Piles of dust may accumulate near base. Be sure to vacuum this dust before you begin to paint; otherwise, it could become airborne and ruin your smoothly painted wall.
 2. Wipe down wall with microfiber cloth.
 3. Gently wash walls.
 - a. Apply water sparingly. Let wall dry thoroughly before painting.
 4. Repeat steps until all traces of dust are removed.

3.3 APPLICATION

- A. General: Do not commence painting unless substrates are acceptable and until all environmental conditions (heating, ventilation, lighting and completion of other substrate work, if applicable) are acceptable for applications of products.
- B. 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.
 4. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
 5. Omit first coat (primer) on metal surfaces that have been shop primed and touch-up painted, unless otherwise indicated.
 6. Where a level 5 drywall finish is specified or required in critical lighting conditions or when using non-flat finish, comply with following to optimize results:
 - a. Even if initial finish was sprayed, back roll surface: Stipple pattern of roller can help hide underlying texture variations. A 1/2 inch/15 mm nap roller may offer best and most efficient results.
 - b. When finish occurs in phases (stops one batch and finishes with another) painter shall "blend back" finish of each new section by shading new topcoat back over previous section with a spray gun; with a flat finish, this can effectively prevent a noticeable difference between sections finished at different dates with material from different batches.
- C. Scheduling Painting: Apply first coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of undercoat, unless manufacturer's directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.
 2. Slightly vary color of succeeding coats.
- D. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate.
1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
 2. Sand and dust between each coat to provide an anchor for next coat and to remove defects in previous coat (runs, sags, etc.) visible from a distance up to 39 inches.
 3. Deep and accent clear base colors may require 1 or 2 more coats to achieve proper hide.

- E. 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.
- F. 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.
 - 1. To avoid air entrapment in applied coats, apply material in strict accordance with manufacturer's spread rates and application requirements.
- G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication and Electronic Safety and Security Work:
 - 1. Paint following work where exposed in occupied spaces:
 - a. Mechanical, electrical, and other equipment:
 - 1) Exceptions:
 - a) Do not paint electrical switchgear, transformers or substation equipment.
 - b) Do not paint new electrical panelboards.
 - c) Do not paint communication cabling.
 - d) Do not paint sprinkler heads.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 2. Paint portions of internal surfaces of metal ducts, without liner behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves right to invoke following procedure at any time and as often as Owner deems necessary during period when paints are being applied:
 - 1. Owner will engage services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance with product requirements, including dry film thicknesses.
 - a. Contractor shall touch up and restore painted surfaces damaged by testing.
 - b. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, two paints are incompatible.
- B. Standard of Acceptance
 - 1. All surfaces, preparation and paint applications shall be inspected by A/E.
 - 2. Painted interior surfaces shall be considered to lack uniformity and soundness if any of following defects are apparent to A/E:
 - a. Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
 - b. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.

- c. Damage due to touching before paint is sufficiently dry or any other contributory cause.
 - d. Damage due to application on moist surfaces or caused by inadequate protection from weather.
 - e. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
3. Painted surfaces shall be considered unacceptable if any of following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
- a. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 - b. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 - c. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
 - d. When final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
4. Painted surfaces rejected by A/E shall be made good at expense of Contractor. Small, affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.
 - 2. Clean equipment and dispose of wash water/solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with safety requirements of authorities having jurisdiction.
- 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 A/E, and leave in an undamaged condition.
 - 1. Erect barriers or screens and post signs to warn, limit or direct traffic away or around work area as required.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE (P-CODE)

- A. CMU Substrates:
 - 1. Institutional Low-Odor/VOC Latex System: (Code #4.14)
 - a. Prime Coat: Interior/exterior latex block filler.
 - 1) Sherwin Williams; PreRite Block Filler.
 - 2) PPG; 6-15XI Speedhide Hi-Fill Latex Block Filler
 - 3) Benjamin Moore: Ultra Spec HP Masonry Int/Ext High Build Block Filler 571
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC
 - 2) PPG: Speedhide Zero, 0 VOC
 - 3) Benjamin Moore: Ultra Spec 500 Zero VOC – T537 (Low Sheen Eggshell) T546 (Semi-Gloss)

4) Application includes, but is not limited to:

B. Steel (Ferrous) Substrates:

1. Water-Based Dry-Fall System (over shop-applied primer): (Code #5.11).
 - a. Prime Coat: Not applicable.
 - b. Topcoat: Waterborne dry fall, flat or eggshell.
 - 1) Sherwin Williams; Pro Industrial Waterborne Acrylic DryFall
 - 2) PPG; 6-725XI Speedhide Super Tech Interior Dry Fog.
 - 3) Benjamin Moore: Latex Dry Fall Flat 395
 - 4) Application includes, but is not limited to:
 - a) Beams and joists.
2. Institutional Low-Odor/VOC Latex System: (Code #5.12)
 - a. Prime Coat: Rust-inhibitive primer (water based).
 - 1) Sherwin Williams; Pro Industrial Pro-Cryl Universal Primer
 - 2) PPG: 4020 Pitt-Tech Plus DTM Primer
 - 3) Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
 - 4) Verify compatibility with primer, if shop-applied primer is used.
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
 - 1) Sherwin Williams; B66-600 Pro Industrial Acrylic or Pro Industrial Waterbased Alykd Urethane, B53-1150
 - 2) PPG: 4216HP Pitt-Tech Plus DTM.
 - 3) Benjamin Moore: Ultra Spec HP DTM Acrylic Enamel – HP25 (Low Luster) HP29 (Semi-Gloss)
 - 4) Application includes, but is not limited to:
 - a) Hollow metal doors, including vision lite kits, frames, door mullions and astragals.
 - b) Miscellaneous ferrous metal surfaces.
 - c) Access doors.
 - d) Exposed to view, in public areas, fire suppression, plumbing, HVAC, electrical communication, and electronic safety and security unfinished items.

C. Galvanized-Metal Substrates:

1. Water-Based Dry-Fall System: (Code #5.31)
 - a. Prime Coat: Waterborne dry fall.
 - b. Topcoat: Waterborne dry fall, flat or eggshell.
 - 1) Sherwin Williams; Pro Industrial Waterborne Acrylic DryFall
 - 2) PPG; 6-725XI Speedhide Super Tech Interior Dry Fog.
 - 3) Benjamin Moore: Latex Dry Fall Flat 395
 - 4) Application includes, but is not limited to:
 - a) Overhead decking, pipes, ducts, etc.
 - b) Exposed metal deck.
2. Institutional Low-Odor/VOC Latex System: (Code #5.32).
 - a. Prime Coat: Waterborne galvanized-metal bonding primer. MPI #134.
 - 1) Sherwin Williams: Pro Industrial Pro-Cryl Universal Primer
 - 2) PPG: 4020 Pitt-Tech Plus DTM Primer
 - 3) Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
 - 4) Note: Primer may be omitted, if not required by paint manufacturer.
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).
 - 1) Sherwin Williams: B66-600 Pro Industrial Acrylic or Pro Industrial Waterbased Alkyd Urethane B53-1150
 - 2) PPG; 4216HP Pitt-Tech Plus DTM
 - 3) Benjamin Moore: Ultra Spec HP DTM Acrylic Enamel – HP29 (Semi-Gloss) HP-28 (Gloss)
 - 4) Application includes, but is not limited to:
 - a) Hollow metal doors, including vision lite kits, frames, door mullions, and astragals.

b) Rails and other non-ferrous surfaces.

D. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System: (Code #9.21)
 - a. Prime Coat: Interior latex primer/sealer. .
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
 - 2) PPG; 6-2 Speedhide Quick Drying Latex Sealer
 - 3) Benjamin Moore: Ultra Spec 500 Zero VOC Interior Latex Primer N534
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex flat.
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC
 - 2) PPG; Speedhide Zero, 0 VOC
 - 3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC - Flat T535
 - 4) Application includes, but is not limited to:
 - a) Horizontal gypsum surfaces.
2. Institutional Low-Odor/VOC Latex System: (Code #9.22)
 - a. Prime Coat: Interior latex primer/sealer.
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
 - 2) PPG; 6-2 Speedhide Quick Drying Latex Sealer
 - 3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC Latex Primer N534
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex eggshell.
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC
 - 2) PPG; Speedhide Zero, 0 VOC
 - 3) Benjamin Moore: Ultra Spec 500 Interior Low Sheen Eggshell T537
 - 4) Application includes, but is not limited to:
 - a) Vertical gypsum surfaces where cleaning is not frequently to occur.
3. Institutional Low-Odor/VOC Latex System: (Code #9.23)
 - a. Prime Coat: Interior latex primer/sealer.
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC Latex Primer
 - 2) PPG; 6-2 Speedhide Quick Drying Latex Sealer
 - 3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC Latex Primer N534
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex semigloss.
 - 1) Sherwin Williams; Pro Mar 200 Zero VOC
 - 2) PPG; Speedhide Zero, 0 VOC
 - 3) Benjamin Moore: Ultra Spec 500 Interior Zero VOC Semi-Gloss T546
 - 4) Application includes, but is not limited to:
 - a) Vertical gypsum surfaces where cleaning is likely to occur.

END OF SECTION 09 91 23.00

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and application of high-performance coating systems (HPC) on the following substrates:
 - 1. Interior Substrates:
 - a. Concrete masonry units (CMU).
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates.
 - 2. Division 09 painting Sections for special-use coatings and general field painting.

1.2 DEFINITIONS

- A. Standard coating terms defined in ASTM D 16 apply to this Section.
- B. Gloss ranges used in this Section include the following:
 - 1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
 - 2. High gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of coating system and in each color and gloss of finish coat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Product List: For each product indicated. Cross-reference products to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply benchmark samples of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. A/E will select one surface to represent surfaces and conditions for application of each type of coating and substrate.
 - a. Wall Surfaces: Unless otherwise noted, first-in-place 100 sq.ft. of each product and surface may serve as mockup.
 - b. Other Items: A/E will designate items or areas required.
 - 2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
 - 3. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by A/E at no added cost to Owner.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.

5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:
 1. Name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
 8. Handling instructions and precautions.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers on Schedule at end of Section.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL (HPC)

- A. Material Compatibility:
 1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
 3. Provide products of same manufacturer for each coat in a coating system.
- B. All materials used shall be lead, mercury, and cadmium-free and VOC compliant with local authorities with jurisdiction.
- C. Colors: Refer to "List of Finishes".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
 - 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Masonry (CMU): 12 percent.
- B. Verify compatibility with and suitability of substrates, including compatibility with primers.
- C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Coating application indicates acceptance of surfaces and conditions.
- D. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.
 - 1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
 - a. Confirmation of primer's suitability for expected service conditions.
 - b. Confirmation of primer's ability to be top coated with materials specified.
 - 2. Notify A/E about anticipated problems before using the coatings specified over substrates primed by others.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - 1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
- C. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.
 - 2. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.
- D. CMU Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by A/E, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.5 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. CMU Substrates:
 - 1. Water-Based Epoxy Coating System: (Code #4.223).
 - a. Prime Coat: Interior/exterior latex block filler.
 - 1) Sherwin Williams; Pro Industrial Heavy Duty Block Filler
 - 2) PPG; 6-15XI Speedhide Hi-Fill Block Filler
 - 3) Tnemec; Series 54 Masonry Filler
 - 4) Benjamin Moore; Ultra Spec Masonry Int/Ext High Build Block Filler 571
 - b. Intermediate Coat: Water-based epoxy (interior).
 - c. Topcoat: Water-based epoxy (interior), semi-gloss.
 - 1) Sherwin Williams; Pro Industrial Pre-Catalyzed Epoxy
 - 2) PPG; 16-510 Pitt-Glaze WB1 Pre-Catalyzed Epoxy
 - 3) Tnemec; Series 114 HB Tneme-Tufcoat
 - 4) Benjamin Moore; Corotech Pre-Catalyzed Waterborne Epoxy – Semi-Gloss V341
 - d. Application includes, but is not limited to:
 - 1) Dry environments where additional abrasion resistance is required, e.g. toilet rooms.

END OF SECTION 09 96 00

SECTION 09 96 63 - INTERIOR FINISH SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Surface preparation and interior finish system (IFS) as indicated.
- B. Work of This Section; But Specified Elsewhere
 - 1. Division 07 Section "Joint Sealants".
- C. Related Sections:
 - 1. Division 09 Section "Gypsum Board Assemblies": For metal framing.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical information for each component of systems specified.
 - 1. Include technical information, basic materials analysis and instructions for handling, storage, and application.
 - 2. List each coating material and cross reference the specific coating application. Identify each material by manufacturer's catalog number and general classification.
- B. Samples for Verification: Submit freshly prepared 2 foot square sample of each color in required surface texture.

1.3 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Qualification Data: For installers.

1.4 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: Methods for maintaining coating and precautions for using cleaning materials and methods that could be detrimental to the finish and performance.
 - 2. Warranty: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Interior Finish System Applicator Qualifications: Applicator shall be approved or certified by the material manufacturer.
 - 1. Installation workmen shall be thoroughly trained and experienced in skills required and shall be completely familiar with manufacturer's current methods of installation as well as requirements of this Work.
- B. Mock-Up: Apply 25 square feet of interior finish system on specified substrate at location on Project as directed by the A/E. Upon approval by A/E, mock-up will demonstrate minimum standard for the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in original unopened packaging with legible manufacturer's identification.
 - 1. Upon arrival, materials shall be inspected for physical damage, freezing or overheating. Questionable materials shall not be used.
- B. Store products in a cool dry place out of direct sunlight, protected from the elements and from damage.
 - 1. Store at a temperature of not less than 50 degrees F.

1.7 FIELD CONDITIONS

- A. Environmental Requirements
 - 1. Application of the system shall be in ambient temperatures above 50 degrees F. Substrate system shall also be above 50 degrees F.
 - a. For installation in temperatures less than 50 degrees F, supplementary heat shall be provided.
 - 2. A minimum ambient temperature of 50 degrees F shall be maintained for at least 24 hours after the system installation.
 - 3. Adequate fresh air and ventilation during application shall be provided.
- B. Protection
 - 1. Protect surrounding areas and surfaces to preclude damage during application of the system.
 - 2. Protect finished Work when stopping for the day or when completing an area in order that water will not penetrate behind the system.
- C. Coordination
 - 1. The Work of this Section requires close coordination between related sections.
 - 2. Joints to be caulked shall be done immediately after the installation of the system as recommended by manufacturer.
- D. Scheduling: Sufficient manpower and equipment shall be employed to ensure a continuous operation, free of cold joints, scaffold lines, texture variations, etc.

1.8 WARRANTY

- A. Interior Finish System: The complete installation of the system shall be jointly warranted by the installer and the manufacturer against defects in material and workmanship for a period of 5 years following installation and acceptance by the Owner. The warranty shall be submitted in writing through the A/E to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Model F477; STO Industries, Inc. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
 - 1. Firestone, Simplex Products Div.
 - 2. Parex
 - 3. Senergy, Inc.
 - 4. Dryvit Systems, Inc.
 - 5. Omega Products International, Inc.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Option interior finish system from single source from single IFS manufacturer and from sources approved by IFS manufacturer as compatible with IFS components.

2.2 SHEATHING

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

- B. Sheathing: Provide one of the following, per manufacturers recommendations and system requirements:
 - 1. Glass Mat Gypsum Backing Board: ASTM C 1178.
 - a. Core: 5/8 inch, Type X.
 - 2. Exterior Cement Board: Not less than 7/16 inch, fiber cement board complying with ASTM C1186, Type A, for exterior applications.
 - a. Fasteners: Wafer head or hard-roc steel drill screws complying with ASTM C954, with an organic polymer coating or other corrosion protective coating having a salt-spray resistance of more than 500 hours per ASTM B117.
 - 1) Size and Length: As recommended by sheathing manufacturer for type and thickness of sheathing board to be attached.
 - 3. Tile Backer: ASTM C1179, Type X.
 - a. Core: 5/8 inch, ASTM C36, Type X.

2.3 INTERIOR FINISH SYSTEM - MATERIALS

- A. Job Mix Ingredients
 - 1. Water: Shall be clear, clean and potable, without any foreign matter in solution which might affect the color or setting qualities of the cement, adhesive, or finish coat; mixed in at factory.
 - 2. Portland Cement: ASTM C150, Type I.
- B. Reinforcing Mesh: Nominal 4.2 oz./sq. yd., symmetrical, interlaced open weave glass fiber fabric made with minimum 25 percent by weight alkaline resistant coating for compatibility with IFS system manufacturers.
- C. Base Coat: Acrylic based, fiber reinforced, flexible waterproofer.
- D. Primer: A synthetic resin, pigmented, copolymer based primer. Tint to same shade as finish.
- E. Finish Coat Materials: IFS manufacturer's siliconized acrylic based coating complying with the following requirements for material composition and method of combined materials:
 - 1. Factory mixed formulation of polymer emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 - 2. Texture: Medium sand finish.
 - 3. Color: As selected by A/E from manufacturer's standards unless otherwise noted in "List of Finishes".

2.4 ACCESSORIES

- A. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with IFS manufacturer's written requirements; manufactured from UV stabilized PVC; and complying with ASTM D1784, manufacturer's standard Cell Class for use intended, and ASTM C1063.
 - 1. Casing Bead: Prefabricated one piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
 - 2. Expansion/Control Joint: Prefabricated one piece V profile; designed to relieve stress of movement.
- B. Elastomeric Sealant Products: Provide IFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in EIMA's "EIMA Guide for Use of Sealants with Exterior Insulation and Finish Systems, Class PB" and with requirements in Division 07 Section "Joint Sealants" for products corresponding to description indicated below:
 - 1. Low modulus, nonacid curing silicone sealant.

2.5 INTERIOR FINISH SYSTEM – MIXING

- A. Materials shall be mixed in clean plastic containers, free of foreign substance. Do not use container which has been used for or cleaned with a petroleum product.
- B. Finish
 - 1. Thoroughly mix the factory prepared finish material with the high speed mixer, until a uniform workable consistency is attained.
 - a. A small amount of clean potable water may be added to adjust workability.
- C. Mix components in strict accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.1 SUBSTRATE INSTALLATION METHODS

- A. Gypsum Board Application and Finish Standards: ASTM C 840.
- B. Apply sheathing 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.

3.2 INTERIOR FINISH SYSTEM - INSTALLATION

- A. Installation, General: Materials shall be mixed and applied in accordance with manufacturer's published product data sheets for the individual products specified.
 - 1. Under no circumstances shall products be altered by adding any additives, except for small amounts of clean water as directed on the label. Antifreeze, accelerators, rapid binders, etc., are forbidden.
- B. The surface to receive the interior finish system shall be clean and dry. Substrate joints shall be taped and sanded smooth.
- C. Base Coat: Apply to exposed surfaces of insulation in minimum thickness recommended in writing by IFS manufacturer, but not less than 1/16 inch dry coat thickness.
- D. Trim Accessories: Mechanically fasten accessories to framing members, masonry, or concrete at perimeter and control joints.
- E. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written requirements. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base coat material if necessary, so reinforcing mesh color and pattern are not visible.
 - 1. Standard impact reinforcing mesh.
- F. Primer: Apply over dry base coat according to IFS manufacturer's written instructions.
- G. Finish Coat: Apply over dry primer, maintaining a wet edge at all times for uniform appearance in thickness required by IFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
- H. Provide expansion/control joints at locations specifically recommended by manufacturer and in general conformance with the following:
 - 1. Control joints shall be installed for a maximum of 900 square foot area, or every 30 LF.
 - 2. At expansion or control joints in the substrate.

3. Where IFS system is applied to dissimilar substrates.

3.3 INSTALLATION OF JOINT SEALANTS

- A. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Division 07 Section "Joint Sealants" and in EIMA's "EIMA Guide for Use of Sealants with Exterior Insulation and Finish System, Class PB."
 1. Clean surfaces to receive sealants to comply with indicated requirements and IFS manufacturer's written instructions.
 2. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
 3. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
 4. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.

3.4 CLEAN-UP AND PROTECTION

- A. Clean-Up: During progress of Work remove from site discarded coatings materials, rubbish, cans, and rags at end of each work day.
- B. Protection: Protect work of other trades, whether to be coated or not, against damage by coating and finishing work. Correct any damage by cleaning, repairing, or replacing and repainting, as acceptable to A/E.
- C. Provide: "WET PAINT" signs as required to protect newly coated surfaces. Remove temporary protective wrappings and completion of coating operations.
- D. After completion of Work of other trades, touch-up and restore damaged or defaced coated surfaces.

END OF SECTION 09 96 63

SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Visual display board assemblies
 - a. Markerboards (MB)
 - b. Tackable wall surface (TWS)

1.2 DEFINITIONS

- A. Tackboard: Framed or unframed, tackable, visual display board assembly.
- B. Visual Display Board Assembly: Visual display surface that is factory-fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.
- C. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.
- B. Shop Drawings: For visual display units.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Show location of joints, between units. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
 - 3. Show location of special-purpose graphics for visual display surfaces.
 - 4. Include sections of typical trim members.
- C. Samples for Initial Selection: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:
 - 1. Actual sections of porcelain-enamel face sheet, tack assembly, or visual display fabric.
 - 2. Fabric swatches of fabric-faced tack assemblies.
 - 3. Samples of accessories involving color selection.
- D. Samples for Verification: For each type of visual display surface indicated and as follows:
 - 1. Visual Display Surface and Tackboard fabric: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one sample for each type, color, and texture required.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Manufacturer's Instructions: Provide manufacturer's installation instructions.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for surface-burning characteristics of vinyl and polyester fabrics.
- C. Buy American Act Certification: Submit documentation certifying that product comply with provisions of the Buy American Act 41 U.S.C 10a – 10d.

1.5 CLOSEOUT SUBMITTALS:

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For visual display surfaces to include in maintenance manuals.
 - 2. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Units shall be factory-assembled, unless otherwise noted.
- B. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated (Class A per applicable building code), as determined by testing identical products per ASTM E 84 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. Flame Spread: 25 or less.
 - 2. Smoke Developed: 50 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display boards, including factory-applied trim, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured board size, provide two or more pieces of equal length as acceptable to A/E. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.
- B. Store visual display units vertically with packing materials between each unit.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify dimensions 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 visual display surfaces without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.9 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces become slick or shiny.
 - c. Surfaces exhibit crazing, cracking, or flaking.
 - 2. Warranty Period: Life of the building.

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. Product: Subject to compliance with requirements, provide product specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.

2.3 MATERIALS, GENERAL

- A. Porcelain-Enamel Face Sheet: PEI-1002, with manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; 1.7 to 2.5 mil thick ground coat, and color cover coat; and concealed face coated with primer and 1.7 to 2.5 mil thick ground coat.
 - 1. Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.
- B. Particleboard: ANSI A208.1, Grade M-1.
- C. Fiberboard:
 - 1. Cellulosic or Wood Fiberboard: ASTM C208 and ASTM C209.
 - 2. Mineral Fiberboard: ASTM C612.
 - 3. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
- D. Hardboard: ANSI/AHA A135.4, Class 1, tempered.
- E. Plastic-Impregnated Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto burlap backing; with washable vinyl finish and integral color throughout, with surface-burning characteristics indicated.
- F. Vinyl Fabric: FS CCC-W-408, Type II, burlap weave; weighing not less than 13 oz./sq. yd.; with flame-spread index of 25 or less when tested according to ASTM E 84, with surface-burning characteristics indicated.
 - 1. Refer to "List of Finishes."
- G. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.4 MARKERBOARD ASSEMBLIES (MB)

- A. Porcelain-Enamel Markerboard Assembly (MB): Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and minimum 0.0209-inch- thick (fka 25 gauge), porcelain-enamel face sheet with [high] [low]-gloss finish.
1. Manufacturers:
 - a. AARCO Products, Inc.
 - b. ADP/Lemco, Inc.
 - c. Best-Rite Manufacturing by Moore Co, Inc.
 - d. Claridge Products & Equipment, Inc.
 - e. Ghent Manufacturing Inc.
 - f. Marsh Industries, Inc.
 - g. Platinum Visual Systems; a division of ABC School Equipment, Inc.
 - h. Cig Jan Products Ltd.
 - i. K-Pro Specialty Products.
 - j. Nelson Adams Naco
 - k. ASI Visual Display Products, an ASI Group Company
 2. Core: Particleboard (3/8 inch thick, minimum); with 0.005-inch- thick, aluminum foil backing, minimum.
 - a. Manufacturer's Option: Medium-density fiberboard (3/8-inch thick, minimum) may be substituted for particleboard.
 3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.
 4. Edges: Mitered extruded aluminum J-shaped channels. No exposed fasteners permitted.
 5. Color: As selected by A/E from full range of industry colors.
- B. Melamine and high-pressure laminate markerboard assemblies are not acceptable.

2.5 MARKERBOARD AND TACKBOARD ACCESSORIES

- A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; of size and shape indicated.
1. Factory-Applied Trim: Manufacturer's standard, unless otherwise noted.
 - a. Where boards exceed maximum manufactured lengths, provide snap-on trims with no visible screws or exposed joints for field-application.
 - b. Limit projection of frame from board surface to 3/8 inch or less.
- B. Chalktray: Manufacturer's standard, continuous.
1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
 2. Solid Type: Not acceptable.
- C. Display/Map Rail: Manufacturer's standard, extruded-aluminum display rail designed to hold the following accessories:
1. Display Rail: Continuous and integral with rail; fabricated from plastic-impregnated cork approximately 1 to 2 inches high, unless otherwise noted.
 - a. Color: As selected by Architect from full range of industry colors.
 2. End Stops: Located at each end of map rail.
 3. Paper Holder: Extruded aluminum; designed to hold paper by clamping action, provide two per map rail.
- D. Special-Purpose Graphics: Fuse or paint the following graphics into surface of porcelain-enamel visual display unit:
1. Basketball court.

2.6 TACK WALL PANELS (TACKABLE WALL SURFACE) (TWS)

- A. Manufacturers:
1. Claridge Products and Equipment Co.

2. ADP/Lemco, Inc.
 3. Best-Rite Manufacturing by MooreCo, Inc.
 4. Marsh Industries, Inc.
 5. Ghent Manufacturing Inc.
 6. Cig Jan Products Ltd.
 7. Platinum Visual Systems, A Division of ABC School Equipment, Inc.
 8. AARCO Products, Inc.
 9. Conwed
 10. Kinetics Noise Control
 11. ESSI Acoustical Products Co.
 12. Decoustic
 13. MPC, Inc.
 14. Golterman & Sabo, Inc.
 15. Sound Seal
 16. Woodard Contract LLC
 17. K-Pro Specialty Products
- B. Vinyl Fabric-Faced Tack Wall Panels: 7/16- or 1/2 inch thick cellulosic or wood fiberboard or 1/2 inch thick mineral fiberboard or 3/8-inch thick cellulosic or wood fiberboard with 1/4-inch thick hardboard backing 0.015-inch- thick, aluminum sheet at exterior wall.
1. Provide tack wall panels where indicated.
 2. Board shall be vinyl-covered with wrapped edges.
 3. Color: As indicated by in "List of Finishes".
- C. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific tack wall panels and substrate application, as recommended in writing by visual display surface manufacturer.

2.7 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
1. Height of visual display assemblies shall be four feet, unless otherwise noted.
 2. Provide individual and combination markerboard and tackboard units as indicated.
- B. Visual Display Boards: Factory-assemble visual display boards, unless otherwise indicated.
1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.
- C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
 2. Provide manufacturer's standard vertical-joint hidden spline system between abutting sections of markerboards.
 - a. H-trim is not acceptable.
 3. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.
 4. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by A/E from manufacturer's standard structural support accessories to suit conditions indicated.

2.8 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between and surfaces.
 - 1. Prime wall surfaces indicated to receive visual display fabric as recommended in writing by primer/sealer manufacturer.
 - 2. Prepare substrates indicated to receive visual display wall covering as required by manufacturer's written instructions to achieve a smooth, dry, clean, structurally sound surface that is uniform in color.
 - a. Moisture Content: Maximum of 4 precast when tested with an electronic moisture meter.
 - b. Painted Surfaces: Treat areas susceptible to pigment bleeding.

3.3 INSTALLATION, GENERAL

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Field-Assembled Visual Display Units: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.
 - 1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
 - 2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.
 - a. H-trim will not be acceptable.
 - 3. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY UNITS

- A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches o.c.
 - a. Attach chalktrays to boards with fasteners at not more than 12 inches o.c.

3.5 INSTALLATION OF TACK WALL PANELS

- A. Tack Wall Panels (TWS): Attach panels to wall surface with egg-size adhesive gobs at 16 inches o.c. horizontally and vertically.
 1. Install wrapped-edge wall panels with butt joints between adjacent wall panels.

3.6 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 10 11 00

SECTION 10 14 23.16 – INTERIOR PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Panel signs, including room-identification signs that are directly attached to building.
 - a. Acrylic
 - 2. Field-applied, vinyl-character signs
 - 3. Vinyl wall graphics
- B. Related Sections include the following:
 - 1. Division 01 Section "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
 - 2. Division 22 Section "Identification of Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
 - 3. Division 23 Section "Identification of HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
 - 4. Division 26 Sections for electrical service and connections for illuminated signs.
 - 5. Division 26 Section "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
 - 6. Division 26 Section "Interior Lighting" for illuminated Exit signs.

1.2 DEFINITIONS

- A. Accessibility Standard: U.S. Department of Justice's "2010 ADA Standards for Accessible Design."

1.3 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
 - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
 - 1. Acrylic sheet.
- D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
 - 1. Panel Signs: Full size sample. If shipped with return envelope, sign will be returned for use.

1.5 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For signs to include in maintenance manuals.
 - 2. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Signage shall be provided to conform to the USDOJ's "2010 ADA Standards for Accessible Design", ICC/ANSI A117.1, and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
 - 1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
 - a. Illuminated Exit Signs: Refer to Division 26.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image, colors, and sign lamination.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers: Subject to compliance with requirements, provide signage by one of the manufacturers specified.
 - 1. Panel Signs
 - a. Acrylic
 - 1) ASI Sign Systems, Inc.
 - 2) Advance Corporation
 - 3) Diskey Architectural Signage
 - 4) 2/90 Sign Systems
 - 5) ACS Sign Systems
 - 6) Forty-Nine Degrees
 - 7) Interior Graphic Systems
 - 8) ACE Sign Systems
 - 9) ASE, Inc.
 - 10) Best Sign Systems
 - 11) Contemporary Plastics Inc.
 - 12) Essential Architectural Signs, Inc.
 - 13) Jarob
 - 14) Roban Signs
 - 15) Sign Solutions
 - 16) Appenx Architectural Signage
 - 17) Ellet Sign Company
 - 18) Sign PDQ
 - 19) REM Graphics and Signs LLC; Raster Braille Signage
 - 20) Identity Group Interior Sign Solution
 - 21) ISF Signs (Indianapolis)
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" Sample sign, and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design," ICC A117.1, and requirements of authorities with jurisdiction for signs.

2.3 MATERIALS

- A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVF (UV filtering).
- B. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.
- C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 PANEL SIGNS (INTERIOR SIGNAGE)

- A. Signage, General:
 - 1. Graphic Process: Comply with ADA Accessibility Guidelines and ICC/ANSI A117.1. All letters, numbers, and/or symbols shall contrast with background either light characters on a dark background or dark characters on a light background. Characters and background shall have matte finish.
 - a. Graphic Content and Style: Provide sign copy that complies with requirements indicated for size, style, spacing, content, mounting height and location, material, finishes, and color of signage.
 - 2. Characters: Letters and numbers shall have width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32-inch, uppercase, sans serif or simple sans serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be 5/8-inch high minimum and 2 inches high maximum. Equivalent written description must be placed directly below pictogram. Pictogram can be any size within a minimum field of 6 inches in height. Produce precisely formed characters with square cut edges free from burrs and cut marks.
- B. Material:
 - 1. Acrylic Panel, fabricated in accordance with one of the following methods:
 - a. Inlaid acrylic signs
 - 1) Acrylic sheet shall be CNC cut to specifications with square or radius corners, and/or custom shapes, 0.080 inch minimum.
 - 2) 1/32 inch modified acrylic plate shall be adhered to the acrylic plate with a high bond chemical adhesive and the text and/or symbols shall be CNC cut to specifications.
 - a) Option: One layer of 1/4 inch acrylic with .062 inch backer when needed.
 - 3) Corresponding text and/or symbols shall be CNC cut from 1/16 inch modified acrylic embedded 1/32 inch and bond with chemical adhesive to the acrylic plate.
 - 4) Domed grade 2 Braille shall be embedded in the surface.
 - 5) Comply with requirements indicated for material, color, finish, design, shape, size, and details of construction.
 - b. Double panel (window) sign with changeable insert(s).
 - 1) Tactile appliqué: Opaque, single ply, modified acrylic sheet not less than 0.032 inch in thickness.
 - 2) Braille: Braille dots shall consist of 0.0625 optically clear UV stable acrylic spheres.

- 3) Face laminate: Clear, non-glare, cast acrylic sheet not less than 0.080 inch in thickness.
 - 4) Backing sheet: Expanded PVC sign board or acrylic sheet not less than 0.125 inch in thickness.
 - 5) Changeable insert: Provide one of the following:
 - a) Polystyrene not more than 0.032 inch in thickness with pressure sensitive vinyl copy or digitally printed graphics.
 - b) 0.020 inch thick clear lexan with vinyl letters.
 - c) Color printed card stock.
- C. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:
1. Edge Condition: Eased, unless otherwise noted.
 2. Corner Condition: Rounded to a 3/8 inch radius, unless otherwise noted.
 3. Backer Sheet: Include a solid backer, 1/8 inch thick of acrylic sheet for all signs occurring on glass sidelights. Color shall match sign background color.
- D. Interior Panel Sign Types: Refer to Signage Schedule
1. Toilet Room Handicapped Signs: Provide one sign depicting International Men/Women Symbol along with the words "Men" or "Women" indicated on the sign at each toilet room, equipped with facilities for the handicapped.
 2. Interior Room Name and Number Signs
 - a. Layout of room name and number shall be as directed by the A/E.
 - b. Number of signs required:
 - 1) Doors off halls, corridors, and passages.
 - 2) All spaces listed in Finish Schedule. If more than one door to a space, a sign will be required for each door.
 - c. Provide signs with clear acrylic nameplate as indicated on Signage Types.

2.5 FIELD-APPLIED, VINYL-CHARACTER SIGNS

- A. Field-Applied, Vinyl-Character Sign: Prespaced characters die cut from 3 to 3.5 mil thick, weather-resistant vinyl film with release liner on the back and carrier film on the front for on-site alignment and application.
1. Manufacturers: Subject to compliance with requirements provide one of the following:
 - a. Allen Markings
 - b. APCO Graphics, Inc.
 - c. Mohawk Sign Systems
 - d. Seton Identification Products
 2. Size: As indicated on Drawings.
 3. Substrate: As indicated on Drawings.
 4. Text and Font: As indicated on Drawings.

2.6 VINYL WALL GRAPHICS

- A. Applied Vinyl Wall Graphics: Vinyl film of nominal thickness of between 3 and 3.5 mil, adhesive; aggressive and removable, unprinted outdoor durability; 5 years, indoor durability; 5 years and ASTM E 84, Class A surface burning resistance.
1. Manufacturers: Subject to compliance with requirements provide one of the following:
 - a. Avery Dennison
 - b. Orafol
 - c. MACtac
 2. Size: As indicated on Drawings.
 3. Substrate: As indicated on Drawings.
 4. Graphics: As indicated on Drawings.

2.7 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, complying with the following:
 - 1. Exposed Metal-Fastener Components, General:
 - a. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant allen-head, spanner-head, or one-way-head slots unless otherwise indicated.

2.8 ACRYLIC SHEET FINISHES

- A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that anchor inserts are correctly sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs and accessories, using mounting methods of types described and complying with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 4. Install signs so they do not protrude or obstruct according to the accessibility standard.
- B. Accessibility Signs: Installation height and location shall comply with applicable provisions in the U.S. Architectural and Transportations Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.
 - 1. Height above finish floor or ground: Tactile characters on signs shall be located 48 inches minimum above the "finish" floor or ground surface, measured from the base line of the lowest tactile character and 60 inches maximum above the finish floor or ground surface, measured from the baseline of the height tactile character.
 - a. Exception: Tactile characters for elevator car controls shall not be required to comply.
 - 2. Location: Where a tactile sign is provided at a door, the sign shall be located alongside the door latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leaves, the sign shall be located to the right of the right hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall. Signs containing tactile characters shall be located so that a clear floor space of 18 inches minimum by 18 inches minimum, centered on tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.

- a. Exception: Signs with tactile characters shall be permitted on the push side of doors with closures and without hold-open devices.
 - C. Wall-Mounted Panel Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
 - 1. Mechanical (through) Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
 - D. Field-Applied, Vinyl-Character Signs: Clean and dry substrate. Align sign characters in final position before removing release liner. Remove release liner in stages, and apply and firmly press characters into final position. Press from the middle outward to obtain good bond without blisters or fish mouths. Remove carrier film without disturbing applied vinyl film.
- 3.3 ADJUSTING AND CLEANING
- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
 - B. Remove temporary protective coverings and strippable films as signs are installed.
 - C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 14 33 – ILLUMINATED EXTERIOR PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Illuminated panel signage (logo).
- B. Related Sections include the following:
 - 1. Division 01 Section "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
 - 2. Division 10 Section "Interior Panel Signage".
 - 3. Division 10 Section "Post and Panel/Pylon Signage" for freestanding signs.
 - 4. Division 22 Section "Identification of Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
 - 5. Division 23 Section "Identification of HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
 - 6. Division 26 Sections for electrical service and connections for illuminated signs.
 - 7. Division 26 Section "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
 - 8. Division 26 Section "Interior Lighting" for illuminated Exit signs.

1.2 DEFINITIONS

- A. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

1.3 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.
- B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show locations of electrically powered.
 - 4. Include diagrams for power signal and control wiring.
- C. Closeout Submittals:
 - 1. Maintenance Data: For signs to include in maintenance manuals.
 - 2. Warranty: Special warranty specified in this Section.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image, colors, and sign lamination.
 - 2. Warranty Period: Five years from date of Contract Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers: Subject to compliance with requirements, provide signage by one of the manufacturers specified.
 - 1. Panel Signs
 - a. A1 Signs
 - b. Archetype
 - c. Architectural Design & Signs
 - d. MS Signs, Inc.
 - e. Poblocki Sign Co.
 - f. Stewart Signs
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" Sample sign, and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
 - 1. Uniform Wind Load: As indicated on Drawings.

2.3 MATERIALS

- A. Polycarbonate Sheet: ASTM C 1349, Appendix XI, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coatings on both sides.
- B. Acrylic Sheet: ASTM D4802, category as standard with manufacturers for each sign, Type UVF (UV filtering).

2.4 PANEL SIGNS (EXTERIOR)

- A. Illuminated Panel Signs: Facelighted construction with LED lighting (5000k) including transformers, insulation, and other accessories for operability, with provision for serving and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from sign surfaces as needed to illuminate evenly.
 - 1. Power: 120V, 60Hz, 1 phase, 15A.
 - 2. Weeps: Provide weep holes to drain water at lowest part of exterior signs. Equip weeps with permanent baffles to block light leakage without inhibiting drainage.
 - 3. Sheet Sign: Provide one of the following as recommended by manufacturer for application indicated.
 - a. Laminate Polycarbonate-Sheet Sign: Polycarbonate face sheet laminate to a base sheet.
 - 1) Surface-Applied, Flat Graphics: Applied photo image.
 - a. Solid-Sheet Sign: Acrylic.
 - 4. Frame: Entire perimeter.
 - a. Material: Aluminum.
 - 5. Mounting: Manufacturer's standard method for substrates indicated.
 - 6. Surface Finish and Applied Graphics:
 - a. Integral Aluminum Finish: Clear anodized.
 - b. Photo-Image Graphics: Manufacturer's recommended to match image indicated.

2.5 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, complying with the following:
 1. Use concealed fasteners and anchors, unless indicated to be exposed.

2.6 FABRICATION

- A. General: Provide manufacturer's standard signs of configurations indicated.
 1. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
 2. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
 3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
 4. Internally brace signs for stability and for securing fasteners.
 5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear faced-sheet material to produce precisely formed image. Image shall be free of rough edges.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish, complying with AAMA 611.

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 work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces, unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
 3. Install signs so they do not protrude or obstruct according to the accessibility standard.
 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods
 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

- a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until adhesive fully sets.
- C. Wall-Mounted Panel Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 21 13.13 – METAL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes baked-enamel units as follows:
 - 1. Toilet Enclosures: Overhead braced.
 - 2. Urinal Screens: Wall hung.
- B. Related Sections include the following:
 - 1. Division 10 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of reinforcements for compartment-mounted grab bars.
 - 4. Show locations of centerlines of toilet fixtures.
 - 5. Show locations of floor drains.
- C. Samples for Verification: Of each type of color and finish required for units, prepared on 6-inch-square Samples of same thickness and material indicated for Work.

1.3 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.4 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 METAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Accurate Partitions Corporation.
 - 2. All American Metal Corp.
 - 3. American Sanitary Partition Corporation.
 - 4. Ampco.
 - 5. Bradley Corporation; Mills Partitions.
 - 6. Flush Metal Partition Corp.
 - 7. General Partitions Mfg. Corp.
 - 8. Global Steel Products Corp.

9. Hadrian Inc.
10. Knickerbocker Partitions Corp.
11. Marlite.
12. Metpar Corp.
13. Sanymetal; a Crane Plumbing Company.
14. Weis-Robart Partitions, Inc.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Toilet compartments shall be provided to conform with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.

2.3 COMPONENTS AND SCREENS

- A. Toilet-Enclosure Style: Overhead braced.
- B. Urinal-Screen Style: Wall hung, flat panel.
- C. Baked-Enamel Units: Facing sheets and closures fabricated from ASTM A 591, ASTM A 653 (hot-dip galvanized or galvanized), commercial steel sheet for exposed applications, that is mill phosphatized, and selected for smoothness.
1. Facing Sheet Thicknesses: Minimum base-metal (uncoated) thicknesses as follows:
 - a. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.0329 inch.
 - b. Panels: Manufacturer's standard thickness, but not less than 0.0269 inch.
 - c. Doors: Manufacturer's standard thickness, but not less than 0.0269 inch.
 - d. Integral-Flange, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.0269 inch.
 - e. Wedge-Shaped, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.0329 inch.
 2. Steel Sheet Finish: Manufacturer's standard pigmented, organic coating, including thermosetting, electrostatically applied, and powder coatings. Provide coating system that complies with coating manufacturer's written instructions for pretreatment, application, baking, and minimum dry film thickness.
 - a. Color: One color in each room. Refer to "List of Finishes".
- D. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets are pressure laminated to core material. Units have continuous, interlocking molding strip or lapped and formed edge closures. Exposed surfaces are free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections. Provide with no-sightline system. Corners are sealed by welding or clips. Exposed welds are ground smooth.
1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch for doors and panels and 1-1/4 inches for pilasters.
 2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units of size and material adequate for panel to withstand applied toward load on grab-bar of at least 250 lbf, when tested according to ASTM F446, without deformation of panel.
 3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
- E. Urinal-Screen Construction: Matching panels.

- F. Pilaster Shoes and Sleeves (Caps): Stainless steel, ASTM A 666, Type 302 or 304, not less than 0.0312 inch specified thickness and 3 inches high, finished to match hardware.
- G. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type, unless otherwise noted: Manufacturer's standard design; stainless steel or aluminum.
 - 2. Provide stirrup type, ear or U-brackets, clear anodized aluminum or stainless steel at ambulatory accessible toilet compartments as required to accommodate a clear width opening of 32 inches minimum with the door open 90 degrees.

2.4 COMPONENTS

- A. Doors and Dividing Panels: Privacy stile, no sightlines.
 - 1. 55 to 58 inches high, mounted 14 inches above finished floor.
 - 2. Doors: 60 degree angle on two opposite edges for enhanced privacy.
 - 3. Dividing Panels: Slotted on one edge to accept wall bracket.
- B. Sightlines: Provide brackets and components to provide no minimum sightlines.

2.5 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
 - 1. Material: Clear anodized aluminum or stainless steel.
 - 2. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
 - 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.
 - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
 - 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 - 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.6 MATERIALS

- A. Aluminum Castings: ASTM B26.
- B. Aluminum Extrusions: ASTM B221.
- C. Steel Sheet: Commercial steel sheet for exposed application; mill phosphatized and selected for smoothness.
 - 1. Hot-Dip Galvanized: ASTM A653, either hot-dip galvanized or galvanized.
- D. Stainless Steel Castings: ASTM A743.

2.7 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories, and solid blocking within panel where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Doors: Unless otherwise indicated, provide 24-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide out-swinging doors with a minimum 32-inch- wide clear opening for compartments indicated to be accessible to people with disabilities.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Coordinate layout and installation of supports, inserts, and anchors built into other units of work for toilet compartment anchorage.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Where required to provide a 32-inch clear opening, install panel-to-pilaster with no fewer than three brackets attached at midpoint and near top and bottom of panel.
 - 3. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 - 4. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set plaster with anchors penetrating not less than 1-3/4 inches into structural floor, unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with not less than two fasteners. Hang doors to align tops of doors with tops of panels and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Wall-Hung Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13.13

SECTION 10 21 13.19 – SOLID POLYMER TOILET COMPARTMENTS

(ALTERNATE)

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes solid-polymer units as follows:
 - 1. Toilet Enclosures: Overhead braced.
 - 2. Urinal Screens: Wall hung.
- B. Related Sections include the following:
 - 1. Division 01 Section "Alternates" for description of alternates affecting the work of this section.
 - 2. Division 10 Section "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.2 COORDINATION

- A. Coordinate requirements for overhead supports, blocking, reinforcing, and other supports concealed within wall to ensure that toilet compartments can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of cutouts for compartment-mounted toilet accessories.
 - 2. Show locations of floor drains.
 - 3. Details including anchoring components (bolt layouts) and methods for project conditions; indicate components required for installation, but not supplied by toilet compartment manufacturer.
 - 4. Show locations of centerlines of toilet fixtures.
- C. Samples for Verification: Of each type of color/pattern, texture, and finish required for units, prepared on 6-inch- square Samples of same thickness and material indicated for Work.

1.4 CLOSEOUT SUBMITTALS:

- A. General: Closeout Submittals are to be submitted with O and M Manuals only.
 - 1. Warranty: Special warranties specified in this Section.
 - 2. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments 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 toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.6 WARRANTY

- A. Toilet compartment manufacturer shall warrant plastic panels for 5 years against warping and defect.
 1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOLID-POLYMER UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 1. Solid High Density Polyethylene (HDPE)
 - a. American Sanitary Partition Corp.
 - b. ASI Global Partitions
 - c. General Partitions Mfg. Corp.
 - d. Global Steel Products Corp., ASI Group.
 - e. Scranton Products (Hiny Hiders fka Santana/Comtec/Capitol).
 - f. Partition System International of South Carolina (PSISC); Columbia Systems International of South Carolina LLC
 - g. Weis/Robart Partitions, Inc.
 - h. Metpar Corp.
 - i. Hadrian Inc.; Zurn Industries, LLC
 - j. Knickerbocker Partitions Corp.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural and Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities," ICC/ANSI A117.1 and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
- B. Flammability Characteristics: High-density polyethylene or polypropylene shall be tested in accordance with the NFPA 286 Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth" and meet the "Pass-Fail" criteria contained in the local codes and required by authorities with jurisdiction.
- C. Structural Performance: Accessories and fasteners to comply with the following requirements:
 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.3 COMPARTMENTS AND SCREENS

- A. Toilet-Enclosure Style: Overhead braced, privacy type.

- B. Urinal-Screen Style: Wall hung.
- C. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material. Provide with no-sightlines system consisting of door and pilaster lapped edges on strike side of door and door and pilaster lapped edges on hinge side of door (unless continuous hinge is used).
 - 1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
 - 2. Heat-Sink Strip: Manufacturer's standard continuous, stainless steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
 - 3. Color and Pattern and Texture: One color and pattern in each room. Refer to "List of Finishes".
- D. Urinal-Screen Construction: Matching panel construction.
- E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer or stainless steel.
 - 1. Polymer Color and Pattern: Matching pilaster.
- F. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type, unless otherwise noted: Manufacturer's standard design; polymer or extruded aluminum or stainless steel.
 - a. Polymer Color and Pattern: Matching pilaster.
 - 2. Provide stirrup type, ear or U-brackets, clear-anodized aluminum or stainless steel at ambulatory accessible toilet compartments as required to accommodate a clear width opening of 32 inches minimum with the door open 90 degrees.

2.4 COMPONENTS

- A. Sightlines: Provide brackets and components to provide no minimum sightlines.

2.5 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories as required to comply with "Performance Requirements". Mount with through bolts.
 - 1. Material: Clear anodized aluminum or stainless steel.
 - 2. Hinges: Manufacturer's standard, allowing emergency access by lifting door and recommended by manufacturer for application indicated.
 - 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit, designed for emergency access, and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.
 - 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at outswinging doors.
 - 6. Door Pull: Manufacturer's standard unit at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or nickel-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.6 MATERIALS

- A. Aluminum Castings: ASTM B26.
- B. Aluminum Extrusions: ASTM B221.
- C. Stainless Steel Sheet: ASTM A240 or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless Steel Castings: ASTM A743.
- E. Zamac: ASTM B86, commercial zinc-alloy die castings.

2.7 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Doors: Unless otherwise indicated, provide 24-inch wide in-swinging doors for standard toilet compartments and 36-inch wide out-swinging doors with a minimum 32-inch wide clear opening for compartments indicated to be accessible to people with disabilities.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Stirrup Brackets: Secure panels or screens to wall and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel or screen.
 - a. Locate wall brackets, so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 - 3. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets, unless otherwise noted.
 - a. Where required to provide a 32-inch clear opening, install panel-to-pilaster with no fewer than three brackets attached at midpoint and near top and bottom of panel.
 - 1) Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.

2) Align brackets at pilasters with brackets at walls.

- B. Wall-Hung Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13.19

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes following:
 - 1. Public-use washroom accessories.
 - 2. Public-use shower room accessories.
 - 3. Custodial accessories.
- B. Owner-Furnished Material
 - 1. Toilet-tissued (roll) dispenser
 - 2. Paper towel dispenser
 - 3. Liquid soap dispenser

1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying Work.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include following:
 - 1. Construction detail, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work, substrate preparation, and installation methods.
 - 3. Storage and handling requirements and recommendations.
 - 4. Features that will be included for Project.
- B. Sample for Initial Selection: Color chart for manufacturers standard color of shower curtains.
- C. Performance Requirement Verification: Provide verification that installation of products will result in compliance with "Performance Requirements" indicated. This may include: calculations, testing results, manufacturer installation and attachment requirements, fastener information for indicated substrate, or other means necessary to demonstrate compliance.
 - 1. Include manufacturer's installation instructions to meet required loads.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS:

- A. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated on Drawings.
 - 2. Identify products using designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For toilet and bath accessories to include in maintenance manuals; including replacement parts information.
 - 2. Warranty: Special warranties specified in this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Protect

1.7 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: Comply with requirements applicable in jurisdiction of project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.
 - 1. Where bottoms of units are between 27 and 80 inches above finished floor, accessories mounted on or in wall cannot protrude more than 4 inches into a clear access aisle.
- B. Structural Performance: Accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
 - 2. Shower Seats: Installed units are able to resist 360 lbf applied in any direction and at any point.

2.2 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
 - 2. Products: Subject to compliance with requirements, provide one of specified products.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for A/E's approval and complete technical data for evaluation must be received at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.3 MATERIALS

- A. Stainless Steel: ASTM A 240 or ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Brass: ASTM B 19 flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008, Designation CS (cold-rolled, commercial steel), 0.0359-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

- G. Chrome Plating: Not acceptable.
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0-mm thick.
 - 1. Provide mirror furnished with a uniform plastic film 8 mils nominal thickness with acrylic adhesive which is moisture resistant and non-corrosive, meeting 16 CFR 1201-11 and ANSI 297.1 requirements category II tape back.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.4 PUBLIC-USE WASHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
 - 1. AJW Architectural Products
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.
 - 5. GAMCO Commercial Restroom Accessories Division, Bobrick Washroom Equipment, Inc.
- B. Toilet-Tissue (Roll) Dispenser: Owner-Furnished
- C. Paper-Towel Dispenser: Owner-Furnished
- D. Liquid-Soap Dispenser: Owner-Furnished
- E. Bar Soap Dish Tray:
 - 1. Surface-Mounted Soap Dish Tray (ST-1): Surface-mounted soap dish shall be constructed of stainless steel with satin finish. Support arm and flange shall be 0.03125-inch thick (fka 22-gauge) and be equipped with concealed 0.0625-inch thick (fka 16-gauge) mounting bracket which locks to concealed stainless steel and wall plate with stainless-steel lock screw. One-piece seamless soap dish shall be welded to support arm and shall have 2 drain holes and 2 soap support ridges.
 - a. Products:
 - 1) Bobrick: B-680
 - 2) Bradley: 9015 (polished)/9014 (satin)
 - 3) AJW Architectural Products: UX122-SF
 - 4) American Specialties: 7320B
 - 5) Gamco: 7680
- F. Grab Bar:
 - 1. Stainless Steel Type: Provide grab bars with wall thickness not less than 0.05 inch and as follows:
 - a. Mounting: Concealed, manufacturer's standard flanges and anchorages.
 - b. Clearance: 1-1/2-inch clearance between wall surface and inside face of bar.
 - c. Gripping Surfaces
 - 1) Smooth, satin finish, unless noted otherwise.
 - 2) Manufacturer's standard nonslip texture in wet areas.
 - d. Heavy-Duty Size: Outside diameter of 1-1/4 inches minimum.
 - 2. Grab bar shall be constructed of Type 304 stainless steel with satin finish. Concealed mounting flanges shall be 1/8-inch-thick stainless-steel plate, 3-1/8 inch diameter, and each shall have 2 screw holes for attachment to wall. Flange covers shall be 0.03125-inch thick (fka 22-gauge), 3-1/4-inch diameter by 1/2-inch deep and shall snap over mounting flange to conceal mounting screws. Ends of grab bars shall pass through concealed mounting flanges and be heliarc-welded to form one structural unit. Grab bars shall comply with ADA Accessibility Guidelines for structural strength. Provide concealed anchor device or backing as specified or required in accordance with local building codes before wall is finished.

- a. Products:
 - 1) Bobrick: B-5806 Series
 - a) Horizontal two wall for 36 by 36 shower stall (GB2): B-6861 (15-7/8 by 30-7/8)
 - b) (GB3): B-5806 by 18 (V)
 - c) (GB6): B-5806 by 36
 - d) (GB7): B-5806 by 42
 - 2) Bradley: 832-001 Series
 - a) (GB2): 832-0591830
 - b) (GB3): 832 by 18 (V)
 - c) (GB6): 832 by 36
 - d) (GB7): 832 by 42
 - 3) AJW Architectural Products: UG2 Series
 - a) (GB2): UG2-G-1630
 - b) (GB3): UG2-A by 18 (V)
 - c) (GB6): UG2-A by 36
 - d) (GB7): UG2-A by 42
 - 4) American Specialties: 3700 Series
 - a) (GB2): 3700, Type 74 (modified)
 - b) (GB3): 3700 by 18 (V)
 - c) (GB6): 3700 by 36
 - d) (GB7): 3700 by 42
 - 5) Gamco: 125S-Series
 - a) Horizontal two wall for 36 by 36 shower stall (GB2): 125-S (15-7/8 by 30-7/8)
 - b) (GB3): 1255 by 18 (V)
 - c) (GB6): 125S by 36
 - d) (GB7): 125S by 42

G. Sanitary-Napkin/Tampon Accessories:

- 1. Surface-Mounted Partition Mounted Sanitary-Napkin/Tampon Disposal (ND-1): Surface-mounted sanitary-napkin disposal shall be Type 304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Self-closing door shall be secured to cabinet with a spring-loaded, full-length, stainless-steel piano hinge and equipped with international graphic symbol identified sanitary-napkin disposal. Unit shall be furnished with a removable stainless-steel receptacle that is equipped with a tumbler lock. Receptacle shall have a capacity of 1.2 gallons.
 - a. Products:
 - 1) Bobrick: B-254
 - 2) Bradley: 4722-150000
 - 3) AJW Architectural Products: U582/IGS
 - 4) American Specialties: 0473-1A
 - 5) Gamco: ND-5

H. Mirror Unit, Glass:

- 1. Stainless-Steel Framed Mirror (M-1, M-2): Mirror shall have a one-piece, Type 304 stainless-steel angle frame, 3/4 inch by 3/4 inch with continuous integral stiffener on all sides and beveled front to hold frame tightly against mirror; corners shall be heliarc-welded, ground, and polished smooth; all exposed surfaces shall have satin finish with vertical grain. Float/plate glass mirror shall be guaranteed for 15 years against silver spoilage. All edges shall be protected by plastic filler strips and back shall be protected by full-size, shock-absorbing, water-resistant, nonabrasive, 1/8-inch-thick polyethylene padding. Corrugated cardboard is not an acceptable filler material. Galvanized-steel back shall have integral hanging brackets for mounting on concealed rectangular wall hanger(s). Mirror shall be secured to hanger(s) with concealed Phillips-head locking screws located in bottom of frame.
 - a. Products:
 - 1) Bobrick: B-290

- 2) Bradley: MIR780
- 3) AJW Architectural Products: U700
- 4) American Specialties: 0600
- 5) Gamco: A-Series

2.5 PUBLIC-USE SHOWER ROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of following:
1. AJW Architectural Products.
 2. American Specialties, Inc.
 3. Bobrick Washroom Equipment, Inc.
 4. Bradley Corporation.
 5. GAMCO Commercial Restroom Accessories Division, Bobrick Washroom Equipment, Inc.
- B. Shower Curtain Rod:
1. Shower Rods (SR): Shower curtain rod shall be 1-1/4-inch outside diameter and constructed of 0.0500-inch thick (fka 18-gauge), Type 304, stainless steel with satin finish. Flanges shall be 0.0375-inch thick (fka 20-gauge), Type 304, stainless steel with satin finish. Flanges shall be 0.0375-inch thick (fka 20-gauge), one-piece, die-formed, Type 304 stainless steel with satin finish.
 - a. Products:
 - 1) Bobrick: B-6047 by length as indicated.
 - 2) Bradley: 9531
 - 3) AJW Architectural Products: UX2-B
 - 4) American Specialties: 1204
 - 5) Gamco: 125SR by length as indicated.
- C. Shower Curtain:
1. Shower curtains, shall be opaque, matte vinyl 0.006-inch thickness with hemmed edges and corrosion-resistant grommets. Color shall be as selected by A/E. Curtains shall be fabricated as follows:
 - a. Curtains to be at least 10-percent wider than rod from which they hang and shall extend to within 2 to 3 inches of floor.
 - b. Shower Curtain Hooks: Stainless-steel, spring-wire curtain hooks with snap fasteners sized to accommodate specified curtain rod. Provide one hook per curtain grommet.
 - c. Products:
 - 1) Bobrick: 204-2/204-1.
 - 2) Bradley: 9533/9536.
 - 3) AJW Architectural Products: UX250P/UX169.
 - 4) American Specialties: 1200V/1200-SHU (hook).
 - 5) Gamco: 125SQ by length as indicated
- D. Folding Shower Seat:
1. Folding Shower Seat (SS): Folding shower seat shall have a frame constructed of Type 304, satin-finish stainless steel that consists of 0.0625-inch thick (fka 16-gauge) 1-1/4-inch square tubing and 0.0500-inch thick (fka 18-gauge), 1-inch diameter seamless tubing. Seat shall consist of 6 slats constructed of 5/16-inch thick, solidly fused plastic laminate with matte finish melamine surfaces, ivory-colored face sheets, and black phenolic resin core; secured to frame with stainless-steel carriage bolts and acorn nuts. Shower seat shall be equipped with two 3-inch diameter mounting flanges constructed of Type 304, 3/16-inch thick satin-finish stainless steel; a guide bracket constructed of Type 304, 0.0625-inch thick (fka 16-gauge), satin-finish stainless steel; and a spring constructed of Type 304, 0.0250-inch thick (fka 24-gauge) stainless steel that is spot-welded to base plate of Type 304, heavy-gauge stainless steel. Seat shall be able to lock in upright position when not in use. Shower seat shall comply with ADA Accessibility Guidelines for structural strength.

- a. Products:
 - 1) Bobrick: B-5181
 - 2) Bradley: 9569
 - 3) AJW Architectural Products: U929
 - 4) American Specialties: 8206-R/8206-L
 - 5) Gamco: 5181

E. Towel Hooks (TH):

- 1. Surface-mounted stainless-steel towel pin shall be constructed entirely of Type 304 stainless steel with bright polished finish. Flange shall be equipped with 0.0625-inch thick (fka 16-gauge) mounting bracket which locks to concealed 0.0625-inch thick (fka 16-gauge) wall plate with stainless-steel lock screw. Cap shall be 0.1406-inch thick (fka 10-gauge) stainless steel, welded to post.
 - a. Products:
 - 1) Bobrick: B-7671
 - 2) Bradley: 9115
 - 3) AJW Architectural Products: UX110BF
 - 4) American Specialties: 7340-B
 - 5) Gamco: 7671

F. Surface-Mounted Soap Dish Tray at Individual Showers (ST-1):

- 1. Surface-mounted stainless-steel soap dish shall be constructed of steel with satin finish. Support arm and flange shall be 0.03125-inch thick (fka 22-gauge) and be equipped with concealed 0.0625-inch thick (fka 16-gauge) mounting bracket which locks to concealed stainless steel and wall plate with stainless-steel lock screw. One-piece seamless soap dish shall be welded to support arm and shall have two drain holes and two soap support ridges.
 - a. Products:
 - 1) Bobrick: B-680
 - 2) Bradley: 9015
 - 3) AJW Architectural Products: UX122SF
 - 4) American Specialties: 7320B
 - 5) Gamco: 7680

2.6 CUSTODIAL ACCESSORIES

A. Manufacturers:

- 1. AJW Architectural Products.
- 2. American Specialties, Inc.
- 3. Bobrick Washroom Equipment, Inc.
- 4. Bradley Corporation.
- 5. GAMCO Commercial Restroom Division, Bobrick Washroom Equipment, Inc.

B. Mop and Broom Holder:

- 1. Mop and Broom Holders (MH): Surface-mounted mop and broom holder shall be Type 304 stainless steel with satin finish. Unit shall be 24-inches long with 4 spring-loaded, rubber cam holders.
 - a. Products:
 - 1) Bobrick: B-223-XX
 - 2) Bradley: 995X
 - 3) AJW Architectural Products: UJ13B
 - 4) American Specialties: 8215
 - 5) Gamco: MS

2.7 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:
 - 1. Provide galvanized-steel backing sheet, not less than 0.0336-inch thick (fka 22-gauge) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
- C. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate requirements for blocking and construction of wall openings for recessed units.
- B. Provide templates and rough-in measurements as required.

3.2 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Verify blocking, if required, has been installed properly.
 - 2. Verify location does not interfere with door swings or use of fixtures.
 - 3. Comply with manufacturer's recommendations for backing and proper support.
 - 4. Use vandal-resistant fasteners and anchors suitable for substrate and project conditions.
 - 5. Conceal evidence of drilling, cutting, and fitting to room finish.
 - 6. Test for proper operation.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- C. Grab Bars: Install to comply with specified structural-performance requirements.
- D. Shower Seats: Install to comply with specified structural-performance requirements.

3.3 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Sections:
 - 1. Division 10 Section "Fire Extinguishers."

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
 - 1. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
 - a. Field Measurement: Verify dimensions of existing recessed wall openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 2. Coordinate sizes and locations of fire protection cabinets with wall depths.
 - 3. Where shallow profile fire extinguishers are required or indicated to fit within wall cavity, fully recessed, flat trim, cabinets suitable for housing shallow profile fire extinguishers shall be installed into the designated wall assembly.
- B. Sequencing
 - 1. Apply decals or vinyl lettering on field-painted fire-protection cabinets after painting is complete.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
 - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.4 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semi-recessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on drawings.

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.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

- A. U.S. Architectural and Transportation Barriers Compliance Board, Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG), Adopted in 1991; Continual revisions as published in Federal Register.
 - 1. These regulations shall supersede Technical Specifications of this Section.

2.3 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B.
- B. Stainless-Steel Sheet: ASTM A 240 or ASTM A 666, Type 304.
- C. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).
 - 1. Note: Wire glass and acrylic sheets are not acceptable.

2.4 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. J. L. Industries, Inc., a division of Activar Construction Products Group.
 - b. Larsen's Manufacturing Company.
 - c. Modern Metal Products, Division of Technico Inc.
 - d. Guardian Fire Equipment, Inc.
 - e. Potter Roemer LLC; Alta Series.
 - f. Moon American.
 - g. Nystrom, Inc.
 - h. Babcock-Davis.
 - i. Oval Fire Products
 - j. Croker; a Division of Morris Group International
- B. Cabinet Material: Steel sheet.
- C. Semi-recessed Cabinet (SR-): Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation.
 - 1. Rolled-Edge Trim: 4-inch backbend depth.
- D. Cabinet Trim Material: Same material and finish as door.
- E. Door Material: Stainless-steel sheet.
- F. Door Style:
 - 1. Vertical duo panel with frame, unless otherwise noted.
- G. Door Glazing: Tempered float glass (clear).

- H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide recessed door pull and friction latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

- I. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire protection cabinet with the words "**FIRE EXTINGUISHER.**"
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Silk-screened, engraved, etched, or die cut.
 - a) Pressure-sensitive vinyl letters or decals are not acceptable.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

- J. Finishes:
 - 1. Manufacturer's standard baked-enamel paint for the following:
 - a. Interior of cabinet.
 - 2. Stainless Steel: No. 4.

2.5 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Provide factory-drilled mounting holes.
 - 3. Miter corners and grind smooth.

- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick, unless otherwise noted.
 - 2. Miter and weld perimeter door frames.

- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

- C. Finish fire protection cabinets after assembly.

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

2.7 STEEL FINISHES

- A. Surface Preparation: 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". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- B. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, comply in with AAMA 2603.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
 - 2. Color and Gloss: White.

2.8 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide semi-recessed fire protection cabinets.
 - 2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
- C. Identification: Apply decals or vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturers written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Sections:
 - 1. Division 10 Section "Fire Extinguisher Cabinets."

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
 - 1. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.3 ACTION 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.

1.4 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Warranty: Sample of special warranty.
 - 2. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 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.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, following:
 - a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within warranty period.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
1. Portable Fire Extinguishers
 - a. Amerex Corp.
 - b. Ansul Inc.
 - c. Bobcock-Davis
 - d. Badger Fire Protection
 - e. Buckeye Fire Equipment Company
 - f. Fire End and Croker Corp.
 - g. Guardian Fire Equipment, Inc.
 - h. J.L. Industries; a division of Activar Construction Products Group
 - i. Kidde, Residential and Commercial Div., UTC Fire and Security Co., United Technologies Corp.
 - j. Larsen's Manufacturing Company
 - k. Moon America
 - l. Nystron Building Products
 - m. Potter-Roemer
 - n. Pem All Fire Extinguisher Company, A Division of PEM System
 - o. Pyro-Chem, Tyco Safety Products
 - p. Strike First Corp. of America
 - q. Oval Fire Products
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Obtain fire extinguisher, fire-protection cabinets, and accessories, from a single source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers".
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.3 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
1. Valves: Manufacturer's standard, unless otherwise noted.
 2. Handles and Levers: Manufacturer's standard, unless otherwise noted.
 - a. Gauge face cover and horn cone parts shall be metal. No plastic or nylon valves, trigger/handle, casing, or gauge will be acceptable.
 3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
 4. Low Profile Portable, Hand-Carried Fire Extinguishers: Where indicated or required by wall cavity depth, and subject to compliance with requirements, provide a low-profile (oval) fire extinguisher in lieu of a round model.

- B. Multipurpose Dry-Chemical Type in Steel or Aluminum Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled container.
 - 1. Provide this type throughout facility, unless otherwise noted.

2.4 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
- 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 words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical or horizontal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 48 inches above finished floor to handle of fire extinguisher, unless required by authorities with jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 10 51 13 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. All-welded, open-front athletic metal lockers.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for base under athletic lockers.
 - 2. Division 06 Section "Miscellaneous Rough Carpentry" concealed wood support base, furring, blocking, and shims required for installing metal lockers and concealed within other construction before metal locker installation.

1.2 DEFINITIONS

- A. Uncoated Steel Sheet Thicknesses: Indicated as the minimum thicknesses.
- B. ADA Compliant Locks: Locks designed to meet the ADA requirements cited in the current edition of the Department of Justice ADA Standards for Accessible Design or ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
 - 1. Coordinate size and location of concrete or concrete masonry bases under athletic lockers.
 - 2. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.4 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.
 - 1. Preparation instructions and recommendations, including locks.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods, including locks.
- B. Shop Drawings: For metal lockers
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Show base, sloping tops, filler panels, recess trim and other accessories as applicable.
 - 3. Include locker identification system and numbering sequence.
- C. Samples for Verification: For the following products, in manufacturer's standard size:
 - 1. Lockers and equipment.
- D. Product Schedule: For lockers. Use same designations as indicated on Drawings.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS:

- A. Qualification Data: For Installer.
- B. Buy American Act Certification: Submit documentation certifying that product comply with provisions of the Buy American Act 41 U.S.C 10a – 10d.

1.6 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For adjusting, repairing, and replacing locker doors, latching mechanisms and locks including ADA locks to include in maintenance manuals.
 - 2. Warranty: Special warranty specified in this Section.
 - 3. Locks: 3 student keys with removable ADA compliant key heads for each ADA compliant lock.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:
 - 1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
 - 2. Recessed openings.
 - 3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware, but not including locks.
 - 2. Damage from deliberate destruction and vandalism is excluded.
 - 3. Warranty Period for All-Welded Metal Lockers: 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. Manufacturers: Subject to compliance with requirements, provide products from one of the manufacturers specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
 - 1. Five percent of lockers provided shall be lockers for the physically challenged complying with Americans with Disabilities Act Accessibility Guidelines.
 - a. Where locker rooms are provided at least 5 percent, but not less than one, of each type of use in each cluster provided shall be accessible.

2.3 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS) Type B, suitable for exposed applications.
 - 1. Provide additional corrosion-resistance where indicated as follows:
 - a. Galvanized Steel Sheet: ASTM A653, Structural Steel (SS), Grade 40 zinc coating.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, Structural Steel (SS), Grade 33 minimum, AZ50 aluminum-zinc alloy coating.
- B. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.
- C. Anchors: Select material, type, size, and finish required for secure anchorage to each substrate.
 - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts for corrosion resistance.
 - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.4 ALL-WELDED, OPEN-FRONT ATHLETIC METAL LOCKERS

- A. Manufacturers/Products: Refer to "List of Finishes" on the Drawings.
 - 1. All-Welded, Open-Front Athletic Metal Lockers:
 - a. DeBourgh Mfg. Co.; Open Front with Security Compartment Lockers.
 - b. List Industries Inc.; All-Star Lockers.
 - c. Penco Products, Inc., Open Front Athletic Lockers.
 - d. Republic Storage Systems Company; MVP Welded.
 - e. Art Metal Products: Pro Sport Open Front Locker.
 - f. General Storage Systems: Varsity Locker.
 - g. Lockers MFG: Open Front Series.
- B. Locker Arrangement: Open front configuration as indicated on Drawings.
- C. Body: Assembled by welding body components together. Fabricate from unperforated, cold-rolled steel sheet galvanized steel with thicknesses as follows:
 - 1. Tops and Bottoms: 0.0528 inch thick, with single bend at edges.
 - 2. Backs: 0.0428 inch thick.
 - 3. Shelves: 0.0528 inch thick, with double bend at front and right-angle single bend at sides and back.

- D. Sides: Provide one of the following:
1. Unperforated Sides: Fabricated from 0.0528-inch- thick, cold-rolled steel sheet.
- E. Frames: Channel formed; fabricated from 0.0528-inch- thick, cold-rolled steel sheet or 0.0966-inch- thick steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames.
- F. Locker Base: Structural channels, formed from 0.060-inch- thick, cold-rolled steel sheet; welded to front and rear of side-panel frames.
- G. Seats/Shelves: Full width of metal locker; channel formed; fabricated from 0.0677-inch- thick, cold-rolled steel sheet; with stiffeners for reinforcement.
- H. Seats/Footlockers: Enclosure full width of bottom of metal locker; fabricated from cold-rolled steel sheet.
1. Seat/Lid: 0.0677 inch thick; channel formed, and reinforced with stiffeners; with manufacturer's standard, steel continuous hinge that is completely concealed and tamper resistant when seat/lid is closed; with padlock hasp.
 2. Front Panel: 0.0677 inch thick; channel formed at top edge; with minilouvers for ventilation; and recessed for padlock loop.
 3. Sides: Integral part of unperforated sides.
- I. Security Boxes: Consisting of partition extending from upper shelf to top of metal locker, fabricated from 0.0528-inch- thick, cold-rolled steel sheet; with channel-formed, 0.0528-inch-thick, cold-rolled steel sheet door frame, and door fabricated from 0.0677-inch- thick, cold-rolled steel sheet with right-angle single bend at edges; with manufacturer's standard, steel continuous hinge that is completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
1. Single-Point Latching: Stainless-steel strike plate with integral pull; with steel, nonmoving latch hook designed to engage bolt of built-in combination or cylinder lock or with steel padlock loop that projects through door and is finished to match metal locker body as required to meet locking requirements.
- J. Security Compartments: Full width of metal locker; with door fabricated from 0.0677-inch- thick, cold-rolled steel sheet.
- K. Standard Combination Padlocks: Provided by Owner.
- L. ADA Lockers for the Physically Challenged: Zinc, die-cast chrome plated lever handle shall be easy to grip and depress with rotation of 30 degrees or less. Handle shall return to **latched** position when released. Depressing handle will also cause locker door to pop open, ajar. Recommended handle location: 34 inches from floor.
1. ADA Compliant Locks; provide one of the following:
 - a. Digital Touch Button Locks (ADA Lockers): ADA compliant lock designed for lockers. Touching the user button key to lock will unlock the 1/2 inch deadbolt for 10 seconds providing the user ample time before automatically relocking the vertical locking bar. Lock operates on 4-AAA batteries. Provide one of the following accessories per lock.
 - 1) User Button Key: Each user button key carries a unique digital identification that eliminates key duplication and unauthorized access. Only one User Button Key can be programmed per lock while multiple locks can be programmed with one key.
 - 2) Management Button Key: Allows access to all locks in the system. Up to 25 Management Button keys can be programmed per lock.
 - 3) Programming Button Key: Use for registering user and management button keys to a lock. Keys are registered by touching the programming button key to the lock followed by the user or management button key(s).
 - 4) Time-Set Button Key: Time can be changed with the use of a time-set button key.

- 5) Power Jumper: When the battery level is low, lock shall emit a low battery chip when used. If the batteries fail, the power jumper provides external power to the lock for replacing the batteries located in the rear unit. A valid button key is also required to gain access to the lock.
 - 6) Basis-of-Design: Digilock T-30; Digilock, Petaluma, California or comparable locks by Zephyr.
2. ADA Combination Locks for lift handle lockers.
- a. Type: Built-in, ADA, lock with steel body for mounting on gravity lift handle lockers.
 - b. Mounting: Concealed in recessed pocket or flush mount to locker door.
 - c. Operation: Vertical travel locking bolt engages lift handle locker mechanism. Locks automatically on door closure.
 - d. Combination: 3 digit dial type. Provide 5 preset combinations to be selected by pressing button. Locks shall have random combination change pattern with no sequentially adjacent locks having same pattern.
 - e. Provide 5 pin tumbler cylinder for supervisory access. Master key enabled. Includes 2 student keys with 1 ADA keyhead.
 - f. Basis-of-Design: Model 1636MKADA Series: Master Lock.

M. Accessories:

- 1. Filler Panels: Fabricated from 0.0428-inch- thick, cold-rolled steel sheet.
- 2. Boxed End Panels: Fabricated from 0.0528-inch- thick, cold-rolled steel sheet.
- 3. Closer Angle: Minimum 1-inch legs by 0.0528-inch thick, steel sheet finished to match lockers and located at the exposed end of a group of lockers where the rear edge abuts the wall.

N. Finish: Baked enamel or powder coat.

- 1. Color(s): Refer to "List of Finishes".
 - a. Interior shall be same color as exterior.

2.5 FABRICATION

- A. General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.
- 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
 - 2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.
- B. Unit Principle: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
- C. Welded Construction: Factory-preassemble metal lockers by welding all joints, seams, and connections, with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory-weld main locker groups into one-piece structures. Grind exposed welds flush.
- D. Accessible Lockers: Fabricate to comply with applicable requirements of the U.S. Architectural and Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities and ICC/ANSI A117.1.
- 1. Locate bottom shelf no lower than 15 inches above floor for front approach.
 - 2. Where hooks, coat rods or additional shelves are provided, locate no higher than 48 inches above the floor.
- E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
- F. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates; with numbers and letters at least 3/8 inch high.

- G. Continuous Base: Fabricated from manufacturer's standard thickness, but not less than 0.060-inch nominal-thickness steel sheets. Formed into channel or Z profile for stiffness, and fabricated in lengths as long as practicable to enclose base and base ends of metal lockers; finished to match lockers.
- H. Filler Panels: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch nominal steel sheet. Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip joint filler angle formed to receive filler panel.
- I. Boxed End Panels: Fabricated from 0.060-inch nominal-thickness steel sheet, Fabricated with 1-inch- wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
 - 1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.6 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
 - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
 - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.7 STEEL SHEET FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Factory-finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.
- C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.
- D. Finish: Provide one of the following as standard with manufacturer for color indicated.
 - 1. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.
 - 2. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

2.8 GALVANIZED STEEL SHEET FINISHES

- A. Surface Preparation: 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 A780.
 - 1. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- B. Baked Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked enamel finish consisting of a thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness.
 - 1. Color and Gloss: Refer to "List of Finishes".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.
 - 2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
- B. Welded Metal Lockers: Connect groups of all-welded metal lockers together with standard fasteners, with no exposed fasteners on face frames.
- C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 - 1. Attach hooks with at least two fasteners.
 - 2. Attach door locks on doors using security-type fasteners.
 - a. ADA compliant locks shall be installed on lockers that meet the Department of Justice ADA Standards for Accessible Design and ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities for space allowance and reach ranges for physically impaired.
 - b. After installation operate each lock to ensure proper operation. Correct deficiencies and adjust for smooth operation. Verify combination and locker numbers are as scheduled and recorded. Verify functional operation.
 - 3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
 - a. Attach plates to upper shelf of each open-front metal locker, centered, with at least two aluminum rivets.
 - 4. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight hairline joints, with concealed fasteners and splice plates.
 - a. Attach filler panels with concealed fasteners. Locate filler panels at the gap between the end of a group of lockers and the adjacent wall and at gaps between groups of lockers created by intervening columns, piping, and other obstructions.
 - b. Attach boxed end panels with concealed fasteners to conceal exposed ends of non-recessed metal lockers.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.
- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.
- C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION 10 51 13

SECTION 11 05 13 - COMMON MOTOR REQUIREMENTS FOR EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, alternating-current, small and medium, squirrel-cage induction motors, installed at equipment manufacturer's factory, and motors shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features to be compatible with the following:
 1. Motor controllers.
 2. Torque, speed, and horsepower requirements of the load.
 3. Ratings and characteristics of supply circuit and required control sequence.
 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Multispeed Motors: Variable torque.
 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- D. Rotor: Random-wound, squirrel cage.
- E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating.
- G. Insulation: Class B.

- H. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 11 05 13

SECTION 11 23 00 – COMMERCIAL LAUNDRY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Commercial laundry appliances, including washer extractors and drying tumblers.
- B. See Residential Equipment Schedule on the Drawings for acceptable models.
- C. Related Sections include the following:
 - 1. Division 01 Section "Allowances" for allowance affecting work of this Section.
 - 2. Division 11 Section "Common Motor Requirements for Equipment" for NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements.
 - 3. Division 22 Section "Domestic Water Piping" for water distribution piping connections to residential appliances.
 - 4. Division 22 Section "Sanitary Waste Piping" for water distribution piping connections to residential appliances.
 - 5. Division 22 Section "Plumbing Fixtures" for kitchen sinks.
 - 6. Division 23 Section "Metal Ducts" for exhaust vent for clothes dryer.
 - 7. Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" for services and connections to appliances.

1.2 ALLOWANCES

- A. See Section "Allowances" for description of allowances affecting items specified in this Section.
- B. Work of this Section will be performed as part of an allowance.

1.3 REFERENCES

- A. UL Certification: Provide electric equipment and components that are evaluated by UL for fire, and electric shock according to applicable safety standards and that are UL certified for compliance and labeled for intended use.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.
 - 2. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
 - 3. Preparation instructions and recommendations.
 - 4. Storage and handling requirements and recommendations.
- B. Shop Drawings: Include plans, elevations, sections, rough-in dimensions, fabrication details, utility service requirements, and attachments to other work.
- C. Coordination Drawings: Indicate locations of laundry equipment and connections to utilities and clearance requirements for equipment access and maintenance.

1.5 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Warranties: Manufacturer's special warranties.

2. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals, including the following:
 - a. Designation indicated on Drawings.
 - b. Manufacturer's name and model number.
 - c. List of factory-authorized service agencies including their addresses and telephone number.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store equipment on site protected from weather, direct sunlight and temperature extremes. Do not remove packaging prior to storage.
- B. Consult a manufacturer if machines are to be stored for an extended period.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside the manufacturer's absolute limits.

1.8 WARRANTY

- A. Washer Extractor Parts Only: Manufacturer's standard form in which manufacturer agrees to repair or replace any part of the equipment assembly that fails within specified warranty:
 1. Warranty Period: Three years from date of Substantial Completion.
- B. Washer Extractor Parts Only, Mainframe, Cylinder Shaft Assembly, and Bearings Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace main frame, bearing, cylinder or cylinder shaft assembly that fails within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.
- C. Dryer Tumbler Parts Only: Manufacturer's standard form in which manufacturer agrees to repair or replace any part of the equipment assembly that fails within specified warranty period:
 1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 RESIDENTIAL APPLIANCES

- A. Refer to the residential appliance schedule on drawings.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect/Engineer's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
- C. Source Limitations: Obtain each type of residential appliance from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Gas-Fueled Appliances: Certified by a qualified testing agency for each type of gas-fueled appliance according to ANSI Z21 Series standards.

2.3 MATERIALS

- A. Washer Extractors - Stainless Steel: ASTM A666, Type 304 with No. 4 finish (directional satin finish) on exposed surfaces.
- B. Dryer Tumblers – Galvanized Steel: ASTM A653, G90 coating designation; commercial-quality, cold-rolled steel that is zinc coated by the hot-dip process and chemically treated.

2.4 WASHER EXTRACTOR MODELS AND COMPONENTS

- A. Model No. UYN020
 - 1. Design: Freestanding automatic laundry washer-extractor for processing water-washed linen items.
 - a. Construction: 304 or equal stainless-steel cylinder, tub, front and top panels.
 - b. Input voltage: Z: 208-240/50-60/1; 2 wire.
 - c. Dry weight capacity: 20 lb.
 - d. Wash cylinder volume: 2.64 cu ft minimum.
 - e. Overall width: 27.95 inches nominal.
 - f. Overall height: 43.89 inches nominal.
 - g. Overall depth: 31.10 inches nominal.
 - h. Number and size of water supply inlet valves: 3 with 3/4 inch BSP male connections (2 standard).
 - i. Number and size of drain outlets: 1 at 3 inches.
 - j. Overflow: Internally plumbed.
 - k. Control system: Programmable microprocessor.
 - l. Cylinder drive: Single motor, 1 hp, capable of 1165 RPM maximum, using a rotation sensor to monitor performance.
 - m. Bearing lubrication: Shall require lubrication once a month or every 200 working hours, whichever comes first.
 - 2. Performance:
 - a. G-force at highest extract speed: 400 G's.
 - b. Chemical Supply System:
 - 1) Manually filled 5 compartment dry chemical dispensing system.
 - 2) Automatic flushing and connections for 11 external supply lines and control signals for 8 external supplies.
 - c. 21 Programmable water levels.
 - d. Control System:
 - 1) Programmable microprocessor.
 - 2) 99 cycle capacity.
 - 3) RS-485 pc link for programming.
 - 4) USB drive.
 - 5) Capable of precise temperature controlled fills.
 - 6) Thermal cooldown.
 - 7) Overnight soak.
 - e. Drain valve automatically opens in event of power failure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 11 31 00.00

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.

B. Related Requirements:

1. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
2. Division 07 Section "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.
3. Division 09 Section "Gypsum Board Assemblies" for coordination with gypsum ceilings, soffits, and bulkheads.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
2. Preparation instructions and recommendations.
3. Installation and maintenance instructions.
4. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operation instructions.
5. Storage and handling requirements and recommendations.
6. Mounting details and installation methods.

B. Shop Drawings: Include window opening dimensions, methods of attachment and structural support. Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 inches long.

E. Product Schedule: For roller shades. Use same designations indicated on Drawings. Field verify window quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

1.4 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
 - a. Methods for maintaining roller shades and finishes.
 - b. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
 - c. Operating hardware.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.
- B. Label containers and shades according to Window Shade Schedule.
- C. Store products in manufacturer's unopened packaging until ready for installation.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements products that may be incorporated into the work include, but are not limited to, products listed in other Part 2 a articles.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests of A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

- C. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide roller shade band 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:
 - 1. Flame-Resistance Ratings: Passes NFPA 701.
- B. Product Standard: Provide roller shades complying with WCMA A 100.1.

2.3 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Manual Shades
 - a. MechoShade Systems, Inc. (GreenGuard, HPD, Declare)
 - b. Draper Inc.
 - c. Lutron Electronics Co. Inc.
 - d. DFB Sales, Sol-R-Shades
 - e. Hunter Douglas Contract, Nysan Roller Shades
- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Manufacturer's standard.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Clip, jamb mount.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
 - 2. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Shadebands:
 - 1. Shadeband Material: Light-filtering fabric.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Color and Finish: As selected by Architect from manufacturer's full range.
- F. Installation Accessories:
 - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches.
 - 2. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fad resistant.

1. Shade Band Material: PVC coated fiberglass or polyester duplex basketweave with light side and dark side. GREENGUARD Children and Schools certified as a low emitting fabric. Fire rating: NFPA 701.
 - a. Openness Factor: 5 percent.
2. Color: As selected from manufacturer's full range.

2.5 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
 2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
 2. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.
- B. Coordinate requirements for power supply conduct, and wiring required for window shade motors and controls.

3.3 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
- B. Roller Shade Locations: As indicated on Drawings.

3.4 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

- B. Test window shades to verify that operating mechanism, fabric retainer, and other operating components are functional. Correct deficiencies.

3.5 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 12 32 16 - MANUFACTURED PLASTIC-LAMINATE-FACED (EDUCATIONAL) CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic laminate faced cabinets of stock design, where indicated.
 - a. This Work includes special and modified stock design preassembled units for installation as movable, fixed, or built-in, as indicated.
 - b. The use of dimensions and specific requirements set forth in Drawings and Specifications are not intended to preclude the use of other acceptable manufacturer's products or procedures which may be equivalent, but are given for purpose of establishing standard of design and quality for materials, construction, and workmanship.
 - c. Cabinets indicated to receive sinks shall be constructed to allow for installation of sinks of sizes indicated. Coordinate with Division 22 for sink sizes.
2. Casework hardware and accessories.
3. Plastic-laminate countertops.

B. Related Sections:

1. Division 01 Section "Alternates" for description of alternate(s) affecting this Section.
2. Division 06 Section(s) "Plastic-Laminate-Faced Architectural Cabinets" for coordination with custom casework.
 - a. At a minimum, casework scheduled in the same rooms, spaces, or areas shall have coordinated:
 - 1) Plastic-laminate selections.
 - 2) Working surface heights.
 - 3) Edge treatments.
 - 4) Backsplash/endsplash conditions.
 - 5) Hardware finishes.
3. Division 07 Section "Joint Sealants."
4. Division 09 Section "Resilient Base and Accessories" for resilient base applied to manufactured wood casework.
5. Division 22 Section "Plumbing Fixtures" for sinks.

- ##### C. Contractor Option:
- Unless otherwise noted, Contractor has option of providing either Division 06 Section "Plastic-Laminate-Faced Architectural Cabinets" or Division 12 "Manufactured Plastic-Laminate-Faced (Educational) Casework". While a mixture complying with referenced standards is permitted, do not mix fabrication methods in individual room or spaces, unless specifically approved by A/E.

1.2 DEFINITIONS

- A. General: Definitions in Architectural Woodwork Institutes (AWI) "Architectural Woodwork Quality Standards" apply to the work of this Section, unless otherwise noted herein.
- B. MDF: Medium-density fiberboard.
- C. Exposed Portions of Cabinets: Surfaces visible when doors and drawers are closed, including sides, and bottoms of cabinets more than 48 inches above floor, and tops less than 78 inches above floor. Surfaces that are visible in open cases, or through glass doors or grille doors, shall also be considered to be exposed portions.
- D. Semi-exposed Portions of Cabinets: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interior faces of doors. Tops of cases 78 inches or more above floor are defined as semi-exposed.

- E. Concealed Portions of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, and ends and backs that are placed directly against walls or other cabinets.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
 - 1. Coordinate casework installation with size, location and installation of service utilities. Sequence installation to accommodate required utility connections.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show fabrication details, including types and locations of hardware.
 - 3. Show installation details, including field joints and filler panels.
 - 4. Show locations and sizes for blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 5. Show locations and sizes of cutouts and holes for items installed in cabinets.
 - a. Indicate locations of plumbing and electrical service field connection by others.
- C. Samples for Verification: 8-by-10-inch Samples for each type of finish, including top material.

1.5 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS:

- A. Coordination Submittals
 - 1. Copy same submittals to other trades and other Contractors who have connecting or adjacent works for coordination review and for locating their work connected to or adjacent to the equipment specified herein.
 - 2. Distribute review "Field Use" copies to all affected trades when casework manufacturer and affected Contractors have completed coordination necessary for complete installation.

1.6 CLOSEOUT SUBMITTALS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Warranty: Sample of special warranty.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative of educational casework manufacturer for installation and maintenance of units required for this project. The installer must have completed 3 projects of similar size and scope to this project in the last 5 years or a certified participant in AWI's Quality Certification Program. References of these projects shall be supplied upon request.
- B. Quality Standard: Unless otherwise indicated, comply with requirements for modular cabinets in AWI's "Architectural Woodwork Quality Standards." Minimum quality standards shall be custom grade in accordance with AWI and additional requirements as specified herein.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver manufactured wood casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.
- B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install manufactured wood casework until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with manufactured wood casework by field measurements before fabrication.
 - 1. Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating educational casework without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.
- C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of manufactured wood casework that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of components or other failures of glue bond.
 - b. Warping of components.
 - c. Failure of operating hardware.
 - d. Deterioration of finishes.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - 1. Plastic-Laminate-Faced Manufactured Casework:
 - a. Case Systems Inc.
 - b. Stevens Industries, Inc.
 - c. TMI Systems Design Corporation.
 - d. Advanced Cabinet Systems.
 - e. Southern Cabinetry.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum. Manufacturers shall submit the following items to be considered for approval:
1. Architectural binder, cut sheets and specifications fully describing proposed products.
 2. List of at least ten projects of similar size, material, design, and extent to that indicated for this Project; whose work has resulted in casework installations with a record of successful in-service performance, including names and phone numbers of Architect and Owner.
 3. Sample of shop drawings produced for similar project.
 4. Sample of casework (base cabinet) complying with specification requirements.

2.2 SYSTEM DESCRIPTION

- A. Quality Standard: Unless otherwise indicated, comply with the AWI's "Architectural Woodwork Standards" for grades of casework indicated for construction finishes, installation, and other requirements.
1. Grade: Custom.
- B. Accessibility Requirements: Casework shall be provided to conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
- C. Performance Requirements
1. Casework shall meet or exceed load tests as outlined in ANSI A161.1, unless otherwise noted.
 - a. Countertops shall not deflect more than 1/4 inch when a load at 100 pounds per linear foot is applied, unless otherwise noted.

2.3 MATERIALS, GENERAL

- A. Softwood Plywood: DOC PS 1.
- B. Particleboard: ANSI A208.1, Grade M-2 made with binder containing no urea formaldehyde.
- C. MDF: ANSI A208.2, Grade 130 Grade 130, made with binder containing no urea formaldehyde.
- D. Hardboard: AHA A135.4, Class 1 Tempered.
- E. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
- F. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper complying with requirements of NEMA LD3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
- G. Edgebanding for Plastic Laminate:
1. Plastic laminate matching adjacent surfaces only where indicated. PVC edge-banding, through color with satin finish, 3 mm thick at doors and drawer fronts, 1 mm thick elsewhere.
 2. Barbed T-edging will not be acceptable.
- H. Edgebanding for Thermally Fused Laminate (TFL) Panels: PVC or polyester edge banding complying with LMA EDG-1 and matching color and pattern of thermoset decorative panels.

2.4 CABINET DESIGN

- A. Design: Provide reveal overlay with wire pulls, unless otherwise noted.
- B. Exposed Cabinet Materials:
 - 1. Plastic Laminate:
 - a. Countertops: 0.048-inch thick minimum with textured finish and conforming to NEMA HGS standards, unless otherwise noted.
 - b. Exposed horizontal surfaces except countertops: Nominal 0.028-inch thick minimum with low-lustre textured finish and conforming to NEMA HGS standards.
 - c. Exposed interior and exterior vertical surfaces: 0.028-inch thick minimum with low-lustre textured finish and conforming to NEMA VGS standards.
 - 2. Unless otherwise indicated, provide specified edge treatment on all exposed edges.
- C. Semi-Exposed Cabinet Materials:
 - 1. Plastic Laminate: Grade VGS or CLS.
 - a. Provide plastic laminate for semi-exposed surfaces unless otherwise indicated.
 - b. Shelves: .028 inch thick minimum with low luster textured finish and conforming to NEMA HGS standards.
 - 2. Thermally Fused Laminate (TFL) Panels: Thermoset decorative panels may be used for semi-exposed surfaces in lieu of plastic laminate, Grade CLS, as fabricator's option, unless otherwise indicated.
 - 3. Unless otherwise indicated, provide 1mm PVC on all semi-exposed edges.
- D. Concealed Cabinet Materials:
 - 1. Solid Wood: Any hardwood or softwood species, with no defects affecting strength or utility.
 - 2. Plywood: Hardwood plywood. Provide backs of same species as faces.
 - 3. Plastic Laminate: Grade BKL, 0.020-inch minimum thickness.

2.5 COLOR AND FINISH

- A. Thermally Fused Laminate (TFL) Panel Colors, Patterns, and Finishes: As selected by A/E from casework manufacturer's full range.
- B. Plastic-Laminate Colors, Patterns, and Finishes: Refer to "List of Finishes".
- C. PVC Edgebanding Color: As selected from casework manufacturer's full range.
 - 1. Colors of PVC leading edges:
 - a. Open Units: Match exterior plastic laminate color.
 - b. Horizontal and Vertical Front Cabinet Members: Match exposed plastic laminate color or as selected by A/E.
 - c. Semi-Exposed Locations: Match interior plastic laminate color.
 - d. Drawer and Door Fronts: As selected from colors to match plastic laminate, or as selected by A/E.

2.6 CABINET FABRICATION

- A. Complete fabrication, including assembly 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.
- B. Plastic-Laminate-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semi-exposed surfaces, unless otherwise noted or as required to meet "Performance Requirements".
2. Shelves:
 - a. Exposed Locations: 1 inch thick, vertical grade plastic laminate both sides. Color to match cabinet exterior plastic laminate or as selected by A/E.
 - b. Semi-exposed locations: 3/4 inch thick, thermally fused laminate (TFL) panels both sides.
 - c. Front and back leading edges shall be edged with flat 1mm thick impact-resistant PVC edging to match shelf color.
 - d. Number of adjustable shelves provided, unless indicated otherwise on the Drawings or on the Schedule
 - 1) Tall cabinets

3 up to 60 inches	5 up to 84 inches
4 up to 72 inches	6 up to 96 inches
 - 2) Base cabinets

1 up to 36 inches	
-------------------	--
 - 3) Wall hung cabinets

1 up to 24 inches	3 up to 42 inches
2 up to 36 inches	
3. Backs of Cabinets: 1/2-inch particleboard, plastic-laminate faced on exposed surfaces, thermally fused laminate (TFL) panels on semi-exposed surfaces.
4. Drawer Fronts: 3/4-inch particleboard, plastic-laminate faced to match doors.
5. Drawer Sides, Backs, and Bottoms:
 - a. Constructed of minimum 1/2-inch particleboard, plywood, hardwood lumber, or high-density fiber board; glued and doweled or dovetail jointed; surfaced with vertical grade laminate or melamine of balanced construction. Bottoms constructed of minimum 1/4-inch tempered hardboard, surfaced to match drawer sides, inset and glued to four sides. Reinforce bottoms on wide drawers with front to back inset stiffeners, 1 at 24 inch wide drawers, 2 at 36 inch and 4 at 48 inch; glue, fasten, and seal perimeter with hot melt adhesive.
 - 1) Drawers:
 - a) Sides, back and sub front shall be particleboard, 1/2-inch thick, laminated with vertical grade laminate or melamine of balanced construction. The back and sub front shall be doweled and glued into the sides. Dowels shall be fluted, with chamfered ends and a minimum diameter of 8mm.
 - b) Drawer bottom shall be particleboard, 1/2-inch thick, laminated with vertical grade laminate or melamine of balanced construction, screwed directly to the bottom edges of the drawer box. Drawer bottom less than 1/2-inch thick will not be permitted.
 - c) Paper storage drawers shall be constructed similar except retaining hood shall be included at the rear of each drawer.
6. File Drawers: Construct as specified above. File drawers shall have front-to-back and side-to-side hanger file capability with hanger channel for letter size files integral with file drawer sides. 3/16 inch by 1/2-inch removable steel channel to span side-to-side for legal size hanging files.
7. Doors: 3/4-inch particleboard or MDF, plastic-laminate faced may be provided as fabricator's option to wood drawers.

C. Shop cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

D. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.

2.7 SPECIALTY ITEMS

- A. Support Members: Furniture grade, epoxy powder coated steel, of size and configuration as detailed, indicated or required by "performance standards". Exposed welds shall be ground smooth.
1. Cantilevered Work Top Support Bracket: 1-1/2-inch by 1-1/2-inch by 0.1046-inch (fka 12 gauge) steel vertical, welded and ground smooth to 1-1/2-inch wide by 2-1/2-inch deep by 0.1046-inch (fka 12 gauge) horizontal, of the overall size as indicated on contract documents, or as designated by product number. Provide molded cap inserts at wall and countertop fastener holes.
 2. Angular Work Top Support Bracket: Factory-welded 1-1/2-inch by 1/4-inch flat steel of vertical, horizontal, and angular design according to size indicated on contract documents, or designated by product number.

2.8 CASEWORK HARDWARE AND ACCESSORIES

- A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware.
1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.
 2. Hardware shall conform to requirements of ADAAG.
- B. Butt Hinges: Stainless Steel, semi-concealed, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips with non-removable pins fastened with four screws in each leaf. No edge fastening. Provide 2 hinges for doors less than 48-inches high and 3 hinges for doors more than 48-inches high.
- C. Pulls: Stainless steel aluminum bent wire style pulls, fastened from back with two screws. For sliding doors, provide recessed powder-coated steel flush pulls. Provide 2 pulls for drawers more than 24-inches wide.
- D. Door Catches: Zinc-plated or powder-coated, nylon-roller spring catch, or dual, self-aligning, permanent magnet catch.
1. Catches shall comply with ADA requirements for pounds of pull required to open doors.
 2. Provide 2 catches on doors more than 48 inches high.
- E. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.
1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
 2. Drawers: Provide one bumper on back side of drawer front at each corner.
- F. Drawer Slides: BHMA A156.9, Type B05091.
1. Regular drawers, knee space and pencil: Epoxy coated steel, bottom corner mounted with smooth quiet nylon rollers.
 - a. Positive stop both directions with self-closing feature.
 - b. Loading: 100-pound load capacity.
 2. Paper Storage: 150-pound load rated epoxy coated steel slides.
 3. File Drawers: Full extension, epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers.
 - a. Positive stop both directions with self-closing feature.
 - b. Loading: 150-pound load capacity.
- G. Drawer and Hinged Door Locks:
1. Cylindrical (cam) or mortise type, 5-pin tumbler, brass with nickel-plated finish, and complying with BHMA A156.11, Grade 1.
 2. Cabinets to be keyed alike per room, each room keyed differently and master keyed, unless noted otherwise on drawings.
 - a. Provide four keys per room and 6 master keys.
 3. Provide locks on all doors and drawers.

- H. Adjustable Shelf Supports: Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 1-inch centers. Each shelf support has 2 integral support pins, to interface pre-drilled holes, and to prevent accidental rotation of support. Support also provides non-tip feature for shelving. Structural load to 1200 lbs. (300 lbs./support) without failure.
- I. Grommets for Cable Passage through Countertops: 3-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

2.9 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.10 COUNTERTOPS

- A. Countertops, General: Provide smooth, clean exposed tops and edges in uniform plane free of defects. Provide front and end overhang of 1 inch over base cabinets.
 - 1. Complete fabrication, including assembly, 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.
 - 2. Shop cut openings to maximum extent possible to receive fixtures and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.
 - a. For plastic-laminate clad countertops: Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish.
- B. Plastic-Laminate Tops: Plastic-laminate sheet, shop bonded to both sides of 1-1/8-inch plywood or particleboard. Sand surfaces to which plastic laminate is to be bonded.
 - 1. Plastic Laminate for Flat Tops: Grade HGS, unless otherwise noted.
 - 2. Plastic Laminate for Backing: Grade BKL.
 - 3. Provide 3-mm PVC edging on front edge of top, on top edges of backsplashes and end splashes, and on ends of tops and splashes.
 - 4. Backsplashes 4-inch high scribeable, square set; color matching, and mechanically attached, with endsplashes.
 - a. Provide at locations where countertops abut walls and where otherwise indicated.
 - b. Backsplashes shall have a moisture-resistant core.
 - 5. Use exterior plywood or exterior glue particleboard for countertops containing sinks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of manufactured wood casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.3 CASEWORK INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Install level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using shims as required, using concealed shims. Where manufactured wood casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
 - 1. Provide removable or false backs for access or concealment of heating or plumbing items.
- C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Fasten cabinets to masonry or framing, wood blocking, or reinforcements in walls and partitions with fasteners spaced 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
 - 1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24 inches o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.
- D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in walls or partitions. Align similar adjoining doors to a tolerance of 1/16 inch.
 - 1. Fasten through back, near top and bottom, at ends, and not more than 16 inches o.c.
 - 2. Use toggle bolts at hollow masonry.
 - 3. Use expansion anchors at solid masonry.
 - 4. Use No. 10 wafer-head screws sized for 1-inch penetration at wood hanging strips.
- E. Fasten cabinets to adjacent cabinets and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI's "Architectural Woodwork Quality Standards".
- F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- G. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.4 INSTALLATION OF TOPS

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in shop.
- C. Field Jointing: Where possible make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings. Scribe tops and backsplashes to walls and other adjoining vertical surfaces.
 - 1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

- D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
 - E. Scribe and cut plastic-laminate-clad countertops to fit adjoining work, refinish out surfaces, and repair damaged finish at cuts.
 - F. Secure tops to cabinets with Z- or L-type fasteners or equivalent, using two or more fasteners at each front, end, and back.
 - G. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.
 - 1. Install countertops with no more than 1/8 inch in 96 inch sag, bow, or other variation from a straight line.
 - H. Secure backsplashes and end splashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
 - I. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.
- 3.5 CLEANING
- A. Repair or remove and replace defective work as directed on completion of installation.
 - B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by A/E.

END OF SECTION 12 32 16

SECTION 12 93 00 - SITE FURNISHINGS AND AMENITIES

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. Pipe Bollards
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for installation of pipe sleeves cast or anchor bolts cast in concrete footings.

1.3 SUBMITTALS

- A. Samples for Initial Selection: For units with factory-applied color finishes.
- B. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Size: Not less than 6-inch- long linear components and 4-inch- square sheet components.
- C. Quality Assurance/Control Submittals
 - 1. Product Data: For each type of product indicated.
- D. Closeout Submittals
 - 1. Maintenance Data: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:
 - 1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B 211.
 - 2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B 221.
 - 3. Structural Pipe and Tube: ASTM B 429.
 - 4. Sheet and Plate: ASTM B 209.
 - 5. Castings: ASTM B 26.
- B. Steel and Iron: Free of surface blemishes and complying with the following:
 - 1. Plates, Shapes, and Bars: ASTM A 36.
 - 2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53, or electric-resistance-welded pipe complying with ASTM A 135.
 - 3. Tubing: Cold-formed steel tubing complying with ASTM A 500.
 - 4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513, or steel tubing fabricated from steel complying with ASTM A 1011 and complying with dimensional tolerances in ASTM A 500; zinc coated internally and externally.
 - 5. Sheet: Commercial steel sheet complying with ASTM A 1011.
 - 6. Perforated Metal: From steel sheet not less than 0.0897-inch nominal thickness; manufacturer's standard perforation pattern.

7. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F 1267.
 8. Malleable-Iron Castings: ASTM A 47, grade as recommended by fabricator for type of use intended.
 9. Gray-Iron Castings: ASTM A 48, Class 200.
- C. Stainless Steel: Free of surface blemishes and complying with the following:
1. Sheet, Strip, Plate, and Flat Bars: ASTM A 666.
 2. Pipe: Schedule 40 steel pipe complying with ASTM A 312.
 3. Tubing: ASTM A 554.
- D. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality, tamperproof, vandal and theft resistant, or concealed, recessed, and capped or plugged. Provide one of the following:
1. Angle Anchors: For inconspicuously bolting legs of site furnishings to on-grade substrate; one per leg, unless otherwise noted.
 2. Antitheft Hold-Down Brackets: For securing site furnishings to substrate; two per unit.
- E. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.
- F. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil thick.
 2. Hot-Dip Galvanizing: According to ASTM A 123, ASTM A 153, or ASTM A 924.

2.2 BOLLARDS

- A. Bollard Construction:
1. Pipe OD: Not less than 6 inches
 - a. Steel: Schedule 40 pipe.
 - b. Steel Finish: Color coated.
 - 1) Exterior primer and two coats exterior enamel to achieve full coverage.
 - 2) Color: As selected by Architect from manufacturer's full range.
 - c. Quantity:
 - 1) Utility protection areas: (2) Bollards

2.3 FABRICATION

- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
- B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.
- C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

- D. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces.
- E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
- F. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.4 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: 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.

2.5 STEEL AND GALVANIZED STEEL FINISHES

- A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
- B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.
- D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

- E. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.
- F. Pipe Sleeves: 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 anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.
- G. Installing Bollards (Exterior Barrier Posts)
 - 1. Anchor exterior barrier posts with one of the following methods or as indicated:
 - a. Anchor exterior barrier posts in concrete in formed or core-drilled holes not less than 8 inches deep and 3/4 inch greater than OD of bollard. After bollards have been inserted into holes, fill annular space surrounding bollard solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufactured written instructions. Slope grout up approximately 1/8 inch toward bollard.
 - 2. Fill exterior barrier post solidly with concrete, mounding top surface.

3.3 CLEANING

- A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 12 93 00

SECTION 23 05 00 - COMMON WORK RESULTS

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 written expectations of general installation requirements.

1.3 DEFINITIONS

- A. General Terminology:
 1. Project A/E: Project Architect and/or Engineer of Record.
 2. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
 3. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
 4. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
 5. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
 6. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
 7. Project Documents: All documentation issued for bid and construction of described project. Documentation includes such items as Project Contracts, Project Schedules, Project Drawings, Project Specification, Requests for Information (RFI), Product Submittals, Test Reports, Start-Up Reports, Construction Change Directives (CCD), Proposal/Change Requests (PR, CR, CO, etc.), Close-Out Documentation, Operational and Maintenance Manuals, Warranty Documentation, etc.

1.4 QUALITY ASSURANCE

- A. General Requirements:
 1. All deviations, such as cost, electrical power, physical space, operating conditions, between identified basis of design product and selected product shall be contractor's responsibility to evaluate and therefore the contractor's burden if added cost results.
 2. Material and installation shall be compliant of governing and controlling regulations.
 3. All materials used shall be new, of first-class quality and condition at installation.
 4. Work done by Contractor shall include service of an experienced superintendent.
 5. Steel Support Welding: Compliant of AWS D1.1, "Structural Welding Code--Steel."
 - a. Each welder shall be certified by AWS qualification tests.
 6. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics shall be considered, provided the proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost to the base contract.

1.5 CLOSEOUT

- A. General Requirements; Refer to Division 01 for fully detailed listing of requirements.
 1. Remove all rubbish, unused tools, equipment and materials.

2. Repair / repaint factory finishes with prime and finish coats where damaged exists.
3. Clean equipment, permanent filters and exposed materials; replace disposable filters.
4. Attic Stock: Deliver extra materials, such as filters, belts, thermometers, control components etc., to Owner and obtain signed receipt(s) of delivery.
5. Owner shall accept all conditions in writing prior to issuance of Substantial Completion.

B. FINAL COMPLETION

1. All work shall be cleaned prior to issuance of Substantial Completion.
2. Retouch or repaint factory painted prime and finish coats where damaged.
3. Deliver filters, belts, and equipment, as required by this Specification, to Owner and obtained signed receipts of delivery.
4. Clean equipment, repair damaged materials, and leave site in acceptable condition.
5. Remove all installation tools, equipment, surplus materials, and rubbish from site.
6. Contractor shall submit written certificates warranting each item of equipment.

C. RECORD DRAWINGS

1. Project Record Drawings shall be submitted to Project A/E for review.
 - a. Provide finished copy of record drawings to Test & Balance Contractor prior to commencement of test and balance of the building systems.
 - b. Final Project Record Drawings: Provide to A/E with Project Closeout Documents.

D. MAINTENANCE & OPERATING MANUALS

1. Maintenance and Operating Manuals shall comply with other Sections of this Specification. Submit in triplicate for inclusion in Maintenance and Operating Manuals.
 - a. Provide bound hardcopies of operating instructions, reviewed shop drawings, equipment catalog data, warranties and manufacturer's instructions.

E. WARRANTY

1. Contractor shall warrant installation, including materials, devices, equipment and labor, for a continuous 1-year period after the documented Date of Substantial Completion.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Transport & Storage Requirements:

1. Deliver pipe and tube with factory-applied end caps. Maintain covers during shipment, storage, and handling to prevent damage and dirt, debris and moisture infiltration.
2. Protect plastic pipes from direct sunlight. Support to prevent warping or bending.
3. All pipe, tube and equipment shall be elevated above grade during storage.
4. Store air-side equipment, duct, and sheet metal accessories indoors, above floor. Materials stored outdoors may be rejected, as determined by determined by A/E.
5. Store insulation and insulation accessories indoors, above floor. Materials stored outdoors may be rejected, as determined by determined by A/E.
6. Air handlers shall ship fully crated or wrapped by factory for protection from weather.
7. All air-side materials and equipment, such as insulation, air handlers, coils, fans, heaters, duct and duct accessories shall be shipped, received and stored to prevent moisture damage, whether directly or to not prevent biological growth. Equipment and material that is found wet or having visible indication of having been wet may be rejected, as determined by determined by A/E.
8. Do not operate cold-air systems prior to completion of insulation to avoid the accumulation on condensation, and subsequent damage to other building materials.

B. General Installation Requirements:

1. Clarification of Scope of Work: Seek instruction from Project A/E when necessary, as a result of document or present deviation(s).
2. Project Schedule: Contractor shall include costs of coordination with other trades and performance of their work in conformance to Project Schedule.
3. Contractor is responsible for work described within Project Documents, which includes bid documentation and all documentation issued thereafter to fully describe the requirements for completion of this project.
4. Protection of Finishes: Contractor shall protect new, existing, and temporary components, finishes and services during completion of work. Contractor shall identify existing damage; that will otherwise be their responsibility to repair or replace before work begins at location damage is discovered. Existing damage shall be documented to Project A/E. Damage incurred by Contractor shall be corrected at Contractor's expense.
5. Installation Conditions: Location on these sheets are diagrammatic to define Scope of Work with an approximate indication of location/position of equipment, duct, pipe and other components, devices, and materials relative to other new or existing components. Contractor is responsible for a complete installation in compliance with the Project Documents and is responsible to include the cost of minor installation offsets where necessary for a complete and coordinated installation. Although elevations may be identified on the project drawings, these indications are intended to provide general expectations from 2-dimensional plans. Contractor is responsible to identify final coordinated installation elevations relevant to noted elevations, and as identified in the Project Documents. Except where specifically indicated otherwise, the precise installation conditions, including work of other trades, are the contractor's responsibility to coordinate in a time efficient progression to complete work in compliance of Project Documents.
6. Coordination of Contractor Selected Product: Contractor is responsible to understand extent of work, including work of other trades, and selected material and equipment installation requirements, limitations and service clearances required by product manufacturer, project documents and code requirements. Equipment, components requiring access and devices shall be installed with acceptable access, as determined by Project A/E. Contractor is responsible to install access to meet A/E expectations.
7. Installation Arrangement: Duct routing, equipment connection orientation and configuration, etc., are relatively specific in consideration to the system's friction loss calculated by the Project A/E. Contractor is expected to install equipment and materials in relative compliance to the indicated positions, routes, fitting quantity and fitting type. Expected deviation to position, routes and fittings shall be brought to the attention of the Project A/E for review with the Coordinated Drawing Set; all expected deviations shall be specifically clouded for identification. Document field installation deviations with a Request for Information to attain review and directive from Project A/E.
8. Basis of Design Equipment: Layout is manufacturer specific when a Basis of Design Manufacturer is identified in the Project Documents; a general equipment layout should be expected otherwise. Contractor is responsible to understand, coordinate and install to the requirements of the equipment being procured.
9. Equipment Information: In addition to Project Specifications, tagged equipment may also be identified with equipment schedules or drawings notes on Project Drawings. Information conveyed at all locations are expected for compliance; although redundant information is expected, not all information may be provided at a location, therefore, contractor is responsible to coordinate all information from all locations.
10. Wall Escutcheon: Penetrations through exposed walls shall be covered with a contractor fabricated 2-piece sheet metal escutcheon constructed of not less than 20-gauge galvanized sheet metal; finish matching adjacent wall area.
11. Wall Penetration: Install metal sleeves through wall penetrations consisting of non-uniform materials and fire-caulking material(s) where necessary; refer to Architectural Sheets and Project Specifications for rated-wall requirements.
12. Installation Identification: Installation shall be marked in compliance of Section 23 05 53.

C. Equipment with Connecting Duct System Requirements:

1. Duct Take-Off Connectors:

- 1) Low-pressure Supply-, Return-, and Exhaust-Air Duct:
 - a) Round Tap: 45-degree entry style 90-degree tap; lo-loss tap or strait 45-degree tap.
 - b) Rectangular Tap: 45-degree entry style 90-degree tap; shoe tap or strait 45-degee tap.
 2. Duct Size: Supply duct and fittings shall be sized to nearest indicated upstream mainline size, with transitions taking place downstream of nearest upstream branch; conversely, exhaust and return duct and fittings shall be sized to nearest indicated downstream mainline size, with transitions taking place upstream of nearest downstream branch.
 3. Fire Dampers: Type-B, unless otherwise indicated. Install fire damper with duct mounted access panel to allow visual of damper position and component access. Refer to Section 23 33 00 for damper and access requirements.
 4. Visible Duct: Bare and insulated duct installed through exposed areas shall be assumed painted, unless otherwise indicated. Clean and prepare duct or insulation for finishing, coordinate work with other trades.
- D. Equipment with Connecting Electronic System Requirements
1. Devices: Install electronic comfort control devices and sensors, such as but not limited to local multifunction controllers, temperature, humidity, carbon dioxide (CO2) and pressure sensors, as indicated on the Project Documents. If a necessary control device location is not found on the Project Drawings that is identified, seek clarification for device location; device is required. Wall mounted sensors shall be installed with flush-mounted wall boxes, with wires installed within wall. Combination shall be utilized where indicated. Refer to respective equipment installation manuals for device specific requirements.
 2. Control Device Power Wiring: Wiring and/or cabling required to power control devices is the responsibility of the contractor to include in the base contract.

3.2 PAINTING

- A. General Requirements:
1. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
 2. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

END OF SECTION 23 05 00

SECTION 23 05 53 – IDENTIFICATION

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. Equipment labels.
 2. Duct labels.
 3. Warning signs and labels.

1.3 SUBMITTALS

1. Product Data: For each type of product indicated.
2. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 QUALITY ASSURANCE

1. Compliance with ASME A13.1.

1.5 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
 1. Coordinate installation of identifying devices with locations of access panels and doors.
 2. Install identifying devices before installing acoustical ceilings and similar concealment.

1.6 INSTALLATION

- A. All identification shall be completed prior to issuance of Substantial Completion.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 2. Letter Color: White.
 3. Background Color: Black.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 5. Minimum Label Size: Length and width vary, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances.
 7. Fasteners: Stainless-steel self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
 9. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 DUCT LABELS

- A. Material: Printed plastic with contact-type, permanent-adhesive backing.
 1. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 2. Minimum Label Size: Length and width vary, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances.
4. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
5. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - a. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - b. Lettering Size: At least 1-1/2 inches high.

2.3 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 1. Letter Color: Black.
 2. Background Color: Yellow.
 3. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 4. Minimum Label Size: Length and width vary, but not less than 2-1/2 by 3/4 inch.
 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 6. Fasteners: Stainless-steel self-tapping screws.
 7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
 8. Label Content: Include warning information and emergency notification instructions.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease and incompatible substances.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.4 WARNING-TAG INSTALLATION

- A. Attach warning tags to equipment and other items where required.

END OF SECTION 23 05 53

SECTION 23 05 93 – TESTING & BALANCING

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 TAB to produce design objectives for the following:
 - 1. Air Systems:
 - a. Constant-volume air systems.
 - b. Exhaust systems.
 - 2. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

- A. General Terminology:
 - 1. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
 - 2. Balance: To proportion flows within the distribution system, including sub-mains, branches, and terminals, according to indicated quantities.
 - 3. NC: Noise criteria.
 - 4. RC: Room criteria.
 - 5. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
 - 6. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 7. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
 - 8. TAB: Testing, adjusting, and balancing.
 - 9. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
 - 10. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

- A. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

1.5 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.
- B. Balancing shall be performed to meet the requirements of ASHRAE Standard 90.1.
- C. Certification of TAB Reports: Certify TAB field data reports. This certification includes:
 - 1. Review field data reports to validate data accuracy and to prepare certified TAB reports.
 - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

- D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems," NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing."
- E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's " Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, " Section II, " Required Instrumentation for NEBB Certification."
- F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
 - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

1.7 WARRANTY

- A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
 - 1. Certification of tested and balanced systems according to the Contract Documents.
 - 2. Balanced systems to optimum functional performance of design and installation limits.
- B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
 - 1. Certification of tested and balanced systems according to the Contract Documents.
 - 2. Balanced systems to optimum functional performance of design and installation limits.

1.8 REPORTING

- A. General Report Conditions
 - 1. Final Report: Certification sheet, with content and format according to AABC or NEBB standard forms.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 - 1. Contract Documents are defined in General and Supplementary Conditions of Contract.
 - 2. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are installed as required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

- B. Before proceeding with the measurement, balancing, adjusting of system operation, contractor shall examine project design and construction documents to fully understand the operation of the various HVAC system installations.
1. Approved submittal data of HVAC equipment and their start-up test reports.
 2. Project Record Documents described in Division 01.
 3. Design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and assumptions about HVAC system and equipment controls.
 4. Equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
 5. HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
 6. HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
 7. Terminal units, such as variable-air-volume terminals, to verify that they are accessible and their controls are connected and functioning.
 8. Strainers for clean screens and proper perforations.
 9. Three-way valves for proper installation and function of diverting or mixing fluid flows.
 10. Heat-transfer coils for correct piping connections and for clean and straight fins.
 11. Pumps to ensure absence of entrained air in the suction piping.
 12. Equipment for installation and for properly operating safety interlocks and controls.
- C. Examine automatic temperature system components to verify the following:
1. Dampers, valves, and other controlled devices are operated by the intended controller.
 2. Dampers and valves are in the position indicated by the controller.
 3. Integrity of valves and dampers for full operation and for tightness at fully closed and fully open positions.
 4. Automatic modulation of control valves, with proper connections and orientations.
 5. Temperature control system sensors are located to avoid adverse effects of sunlight, drafts, and cold walls.
 6. Sensors are located to sense only the intended conditions.
 7. Sequence of operation for control modes is according to the Contract Documents.
 8. Controller set points are set at indicated values.
 9. Interlocked systems are operating.
 10. Changeover from heating to cooling mode occurs according to indicated values.
- D. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
1. Permanent electrical power wiring is complete.
 2. Automatic temperature-control systems are operational.
 3. Equipment and duct access doors are securely closed.
 4. Balance and fire dampers are open.
 5. Isolating and balancing valves are open and control valves are operational.

6. Windows and doors can be closed so indicated conditions for system operations are met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and this Section.
- B. Cut insulation, ducts, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
 1. Check condensate drains for proper connections and functioning.
 2. Check to be sure system is completely completed and all access locations are closed.
 3. Open all manual control dampers for full/maximum flow condition from system fans.
 4. Check fan motor load. Adjust motor electronic controller (VFC) to prevent overloading.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to provide total system airflow within the maximum allowable fan speed.
 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Simulate dirty filter operation and record point filters change-out is recommended.
 3. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
 6. Maximum design airflow shall be accommodated by reducing fan speed through VFC(s).
 7. Record air handling unit airflow during normal unit occupied and unoccupied operation and during economizer operation.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
- C. Measure terminal outlets and inlets without making adjustments.
 - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

3.6 PROCEDURES FOR EXHAUST AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed.
 - 1. Measure fan static pressures to determine actual static pressure.
 - 2. Compare design data with installed conditions to determine variations in design static pressure versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 - 3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust manual volume dampers for main, submain and branch ducts to indicated airflows.
 - 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

3.7 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Air System Components:
 - a. Fans and Equipment with Fans: +/-10% of design condition.

3.8 FINAL REPORT

- A. General: Electronic, typewritten, tabulated and divided into sections by tested systems.
- B. Include certification within binder signed and sealed by certified testing and balancing engineer.
- C. General Report Data: Include the following data in the final report, as applicable:
 - 1. Name and address of TAB firm.
 - 2. Project name and location.
 - 3. Architect's and Engineer's name(s) and address(es).
 - 4. Contractor's name and address.
 - 5. Signature of TAB firm certifying report.
 - 6. Table of Contents to identify pages for each section of report.
 - 7. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence, if different than Contract Documents.
 - 8. Notes to explain why certain final data in the body of reports varies from indicated values.
 - 9. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Fan drive settings including settings and percentage of maximum pitch diameter.

- e. Settings for supply-air, static-pressure controller.
- f. Other system operating conditions that affect performance.

D. Air Handling Unit Test Reports:

- 1. Unit Data: Include the following:
 - a. System and identification, service and location.
 - b. Manufacture, model, type and size.
 - c. Number of filters, type, and size.
- 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Electrical Service; in terms of Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
- 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in CFM.
 - b. Total system static pressure in Inches WG.
 - c. Suction and discharge static pressures in Inches WG.
 - d. Filter static-pressure differential in Inches WG.
 - e. Main coil static-pressure differential in Inches WG.

E. Fan Test Reports:

- 1. Fan Data:
 - a. System and identification, service and location.
 - b. Manufacture, model, type and size.
- 2. Motor Data:
 - a. Horsepower and rpm.
 - b. Volts, phase, and hertz.
 - c. Full-load amperage and service factor.
- 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in CFM.
 - b. Total system static pressure in Inches WG.

F. Instrument Calibration Reports:

- 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Dates of calibration.

3.9 INSPECTIONS

A. Final Inspection:

- 1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete, request that a final inspection be made by A/E.
- 2. TAB firm shall recheck all measurements and make adjustments. Revise final report and balancing device settings to include all changes and resubmit the final report.

END OF SECTION 23 05 93

SECTION 23 07 00 - INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Insulation Materials:
 - a. Fiber blanket and preformed pipe insulations.
 - 2. Factory-applied jackets.
 - 3. Tapes.
- B. Related Sections:
 - 1. Division 23 Section "Metal Ducts" for duct liner.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors:
 - a. Flame-Spread Index: 25 or less
 - b. Smoke-Developed Index: 50 or less.
- B. Materials and installations shall meet NFPA 255 and UL 723 compliance.
- C. Insulation thicknesses shall be as indicated herein and compliant with ASHRAE 90.1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and thermal inserts specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for insulating materials.
- B. General Conditions:
 - 1. Products shall not contain asbestos, lead, mercury, or mercury compounds.
 - 2. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
 - 3. Insulation materials for use on stainless steel shall be qualified as acceptable according to ASTM C 795.
 - 4. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- C. Mineral-Fiber Blanket Insulation: Mineral fiber bonded with a thermosetting resin. Comply with ASTM C 553, Type II, Class F-1 and ASTM C 1290; Type II with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; All-Service Duct Wrap.

2.2 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.3 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
 - 1. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
 - 2. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
 - 1. Install insulation with longitudinal seams at top and bottom of horizontal runs.
 - 2. Install multiple layers of insulation with longitudinal and end seams staggered.
 - 3. Keep insulation materials dry during application and finishing.
 - 4. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
 - 5. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
 - 6. Install insulation with least number of joints practical.
- B. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- C. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- D. Installation of insulation at thermal inserts shall allow for continuous vapor barrier across the insert material and continuous thermal barrier through the supporting mechanism.
 - 1. Pipe hanger thermal inserts: Inserts shall retain vapor barrier, pipe insulation shall firmly abut together on each side of the insert, with no gaps, materials shall be adjoined with finishing tape compliant with the insulation jacket being utilized.
 - 2. Duct hanger thermal inserts: Inserts shall only be utilized where trapeze style hangers, or similar mechanisms that primarily support duct from the bottom face, are utilized. Rigid thermal material shall be installed between the duct and supporting mechanism, but shall only account for half (1/2) the thickness of the blanket style insulation, the blanket insulation shall fully encapsulate the duct and rigid thermal material, with the entire assembly rested atop the supporting mechanism. Combination of the rigid thermal

material and compressed blanket insulation are expected to retain a continuous thermal barrier at the supporting mechanism without interruption of the blanket insulation vapor barrier.

- E. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage for wet and dry film thicknesses.
- F. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- G. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- H. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 - 1. Comply Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.

3.5 MINERAL-FIBER INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Firmly abut end of insulation to provide a continuous thermal barrier on heating and cooling components and vapor barrier on cooling components.
- B. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for full coverage of duct, fitting and plenum surfaces.
 - 2. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. Duct/plenum sides and bottom surfaces with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches on center.

- b. Duct/plenum sides and bottom surfaces with dimensions larger than 18 inches, space pins 16 inches on center each way, and 3 inches maximum from insulation joints. Install pins to hold insulation tightly at cross bracing.
 - c. Impale insulation over pins and attach speed washers.
 - d. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface and cover pins and washers with tape.
3. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair damage to vapor-barrier with tape to match factory jacket.
 4. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where field-applied jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of insulated material. Seal with manufacturer's recommended adhesive.

3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Supply-Air Duct: All rigid supply-air duct, except factory insulated flexible duct.
 1. Mineral Fiber Blanket; 1.5-inches thick, 1.0-lb/cu. ft.
- B. Exhaust-Air Duct: To 4' from building exterior penetration.
 1. Mineral Fiber Blanket; 1.5-inches thick, 1.0-lb/cu. ft.

END OF SECTION 23 07 00

SECTION 23 09 00 – CONTROL INSTRUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Provisions of the General Conditions, Supplementary Conditions, Sections included under Division 01, General Requirements, and Section 230500 of this Division are included as a part of this Section as though bound herein.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.
- C. Refer to the details and schedules on the Drawings for additional requirements.

1.2 SUMMARY

- A. Existing Conditions
 - 1. Existing Building Temperature Control System components and devices are expected to remain in place as is, unless replacement is necessary for the integration of the existing and new Temperature Control System, or if existing equipment sequence revisions also require a hardware upgrade, no matter the reason(s). Contractors shall include the cost of integration to existing Temperature Control System components and devices as part of the Base Bid.
- B. New Building Addition and Integration to Existing Temperature Control System
 - 1. Temperature Control System Contractor shall provide hardware and system software for a fully programmable system, customize installation as described herein and design for current open, and integration into existing building temperature control system. Temperature Control System shall provide product compliant of existing building system installation with interoperable operability via existing building system.
 - 2. Temperature Control System Contractor or otherwise indicated as Contractor herein shall furnish and install a fully integrated Temperature Control System comprised of a network of interoperable stand-alone digital controllers communicating on an open protocol communication network accessible computer via secure internet connection.
 - 3. All materials and equipment used shall be standard components, regularly manufactured for the specified system. All systems and components shall have been thoroughly tested and proven in actual use of at least 5 years.
 - 4. Contractor shall be responsible to:
 - a. Provide a complete electronic direct digital control system consisting of application specific controllers able to provide automated heating, ventilation and air conditioning systems sequencing and control for building comfort.
 - b. Provide control of heating, ventilating, and air-conditioning (HVAC) equipment including, but not limited to air-handlers, fans, terminal units, heaters, pumps, valves, etc. as are denoted on drawings.
 - c. Provide Application Specific Controllers (ASCs) and Programmable Control Units (PCUs) as specified herein. Provide I/O and ancillary devices as specified herein, and as necessary to perform the sequences of operation. Provide products that communicate on MS/TP channels to meet the functional specifications including, but not limited to actuators for dampers and valves, relay/starter switches, measurement devices, limit switches, etc. and other control point related devices described herein to meet the system sequence requirements as described in section.
 - d. Provide power and communication wiring to control devices.
 - e. Provide wiring and interlock wiring for control devices as required for operation.
 - f. Provide control device mounting hardware as required for control device installations in the pipe and duct installations such as, but not limited to, thread-o-lets, thermo-wells, and etc.
 - g. Provide supervision of related work performed by others to insure proper installation and operation of the completed product.
 - h. Installation verification and functionality testing of completed installation.

- i. Install code compliant control panel(s) with electrical power and/or data connection(s). Coordinate work with the Division 26 Contractor.
 - 1) Provide low voltage step-down transformers, power supplies and power/communication/input/output cabling necessary for the control system.
 - 2) Install conduit, junction boxes, fittings, panels, enclosures, and hardware as specified herein and on the drawings.
- 5. Contractor shall read all other Drawings and Specifications, become familiar with requirements and Project Scope, and include such coordination work as may be required.
- 6. Related Sections include the following:
 - a. List below only products, construction, and equipment that the reader might expect to find in this Section but are specified elsewhere.
 - b. Division 23 09 93; "Operational Sequences" as it relates to this Section.
 - c. Division 23 09 93p; "Points Lists" as it relates to this Section.
- 7.

1.3 DEFINITIONS

- A. General Terminology:
 - 1. DDC: Direct digital control.
 - 2. IP: Internet Protocol.
 - 3. I/O: Input/output.
 - 4. MS/TP: Master-slave/token-passing.
 - 5. PC: Personal computer.
 - 6. PID: Proportional plus integral plus derivative.
 - 7. RTD: Resistance temperature detector.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 - 1. Retain three subparagraphs below for DDC systems.
 - 2. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
 - 3. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
 - 4. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.
- C. Software and Firmware Operational Documentation: Include the following:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On DVD disc, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.
 - 5. Software license required by and installed for DDC workstations and control systems.
- D. Coordinate paragraph below with qualification requirements in Division 01 Sections.
- E. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.

2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

1.5 QUALITY ASSURANCE

A. General Conditions:

1. Electrical components shall be UL listed.
2. Energy management components shall comply with NEMA EMC1.
3. Electrical requirements shall meet NFPA 70.
4. Installation as a part of the HVAC system shall comply with NFPA 90A.
5. System installation shall allow for application of the "BACnet" protocol to meet requirements of ASHRAE 135.
6. Control systems shall meet the requirements of ASHRAE Standard 90.1.

1.6 CONTRACTOR RESPONSIBILITIES

A. Temperature Control Contractor shall be responsible to:

1. Provide submission of drawings, component lists, specification sheets and sequences of operation to the Engineer for approval before start of installation.
2. Provide final design drawings, installation of all control wiring and control devices in accordance with National Electric Code. The temperature control contractor shall also be responsible for startup and complete checkout of the systems.
3. Provide electronic sets of drawings, parts lists, product specification, operation and maintenance manuals to the mechanical contractor for delivery to the Owner.
4. Provide DDC logic diagrams for "as-builts" and included in the Operation and Maintenance Manuals for the Owner.
5. Use all room numbers developed and approved by the school district in the development of the Temperature Control System for this building.

1.7 PROJECT CONDITIONS

A. Contractor shall be responsible for:

1. Accurately locating installation components and coordination with other trades for the appropriate installation of their materials.
2. Concealment of wire installation within wall conduit and above ceilings in wire management systems, conduit in chases and in equipment rooms, insofar as is practical; so that such work will not interfere with the proper coordinated installation work of other trades.
3. Installed of wiring and conduit in parallel (or at right angles) to the building walls, and at such heights as not to obstruct any portion of windows, doorways, stairways, pipe space, tunnels, or passageways, and properly concealed to not interfere with the proper coordinated installation of other trades or Contractors. Where interferences develop in the field, the Work shall be offset or routed as required to clear such interferences. Coordinate with other Contractors before installing work.

PART 2 - PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – WAIBLE ENERGY SYSTEMS

- A. Manufacturers: Provide products by Vykon by Tridium as installed by Waibel Energy Systems.

2.2 ELECTRONIC RELAYS & SWITCHES

- A. Current Sensing Status Switches

1. Shall be capable of detecting changes in flow of current to motors in determining accurate and reliable equipment operational status. All fans and pumps shall be equipped with a device to indicate the operation of the attached device.
2. Ampere rating for 0 - 135 amps continuous.
3. Sensor supply voltage shall be included from monitor conductor.
4. Minimum current required is 1 amp.
5. Trip set point shall be adjustable to +/- 1 percent of range.
6. Manufacturer/Model: Veris Industries, Inc. Model No. 705 (Hawkeye).

B. Electric Relays – Automatic Electronic Engagement/Disengagement Switches

1. Where required, provide relays for energizing or re-energizing equipment operation, in response to Temperature Control System digital output. Relays shall be UL labeled and sized for not less than 140 percent of the connected amperage load. Relays shall be rated for the system voltage and have proper throw and poles.

2.3 ELECTRONIC SENSING DEVICES

- A. All field mounted sensors shall be field labeled/tagged with common identification terminology as to their system identification and function.

B. Thermostat Guards

1. Clear Lexan wall-mounted guard with tamperproof screws.

2.4 CONTROL CABINETS/ENCLOSURES

- A. Control cabinet/enclosure shall be extruded aluminum, galvanized steel or factory-hardened plastic with key locks and hinged doors. Electric panels shall be of code steel construction with UL label.

1. Control cabinet/enclosure shall be required to house devices not enclosed as a part of Temperature Control System panels. Pre-wire with internal wiring terminated at labeled terminal strips. Thermometers and switches shall be mounted on the cover of the panel. Relays, transformers, and components shall be mounted inside the panel. Devices, whether interior or exterior, shall be provided with legend plates of engraved Formica or equivalent.
2. Local type panels need not contain graphic representations or symbols, unless specified below, but must contain approved nameplates, legends, etc., for each device.
3. Where panels contain any wiring, panels shall be UL approved.

2.5 TEMPERATURE CONTROL SYSTEM

- A. General: Configure Temperature Control System with a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, network devices and other devices as specified herein. System shall provide password authority protected secure access to all features, functions and data contained in overall Temperature Control System.

B. Open, Interoperable, Integrated Architectures

1. Specification intent is to provide peer-to-peer networked, stand-alone, distributed control system with the capability to integrate the ANSI/ASHRAE Standard 135-1995 BACnet MS/TP and/or IP technology communication protocols in one open, interoperable system.
2. Software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-1995, BACnet to assure interoperability between all system components is required. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet.

3. System must incorporate the ability to access all data using Java enabled browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.
 4. Hierarchical topology is required for reasonable system response times and to manage flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
 - a. Maximum acceptable response time from any alarm occurrence (at the point of origin) to point of annunciation shall not exceed 10 seconds to user interfaces.
- C. Java Application Control Engine (JACE)
1. JACE shall provide the interface between the Web Supervisor and field control devices. It shall be capable of executing application control programs to provide:
 - a. Calendar functions
 - b. Scheduling
 - c. Trending
 - d. Alarm monitoring and routing
 - e. Time synchronization
 - f. Integration of BACnet controller data
 - g. System operating analytics
 - h. Security
 2. JACE must provide the following hardware features as a minimum:
 - a. TI AM3352: 1000MHz ARM@ Cortex™-A8
 - b. 1GB DDR3 SDRAM
 - c. Removable micro-SD card with 4GB flash total storage/2GB user storage
 - d. Wi-Fi (Client or WAP)
 - 1) IEEE802.11a/b/g/n
 - 2) IEEE802.11n HT20 @ 2.4GHz
 - 3) IEEE802.11n HT20/HT40 @ 5GHz
 - 4) Configurable radio (Off, WAP, or Client)
 - 5) WPAPSK/WPA2PSK supported
 - e. USB type A connector for back-up and restore support.
 - f. Two isolated RS-485 with selectable bias and termination.
 - g. Two 10/100MB Ethernet ports.
 - h. Runs Niagara 4, integrated analytics, and security.
 - i. Real-time clock.
 - j. Secure Reboot.
 3. JACE Operating Conditions:
 - a. Temperature range of 0 to 55°C.
 - b. Humidity range of 5 to 95% RH, non-condensing.
 4. Event Alarm Notification and actions
 - a. JACE shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 - b. JACE shall be able to route any alarm condition to any defined user location whether connected to a local network or wide-area network.
 - c. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to Alarm, Return to Normal, and Fault.
 - d. Allow for an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
 - e. Provide timed (schedule) routing of alarms by class, object, group, or node.
 - f. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. User shall be able to reset runtime or event count values with appropriate password control.
 5. Control equipment and network failures shall be treated as alarms and annunciated.
 6. Alarms shall be annunciated in all of the following manners as defined by the user:
 - a. Locally, by screen message text
 - b. Locally, by graphics with flashing alarm object(s)
 - c. Remotely, by e-mail, text, and/or phone:

- 1) Day of week
 - 2) Time of day
 - 3) Alarm Type
 - 4) Recipient
7. JACE shall record each alarm with the following information, at a minimum:
 - a. Time and date
 - b. Location (building, floor, zone, office number, etc.)
 - c. Equipment (tag, location, etc.)
 - d. Acknowledge time, date, and user who issued acknowledgement.
 - e. Number of occurrences since last acknowledgement.
 8. Alarm log shall be maintained by the JACE.
 9. Provide a "query" feature to allow review of specific alarms by user defined parameters.
- D. Interoperable BACnet Controller (IBC) or Approved Equivalent
1. Controls shall be microprocessor based Interoperable BACnet Controllers (IBC) in accordance with the ANSI/ASHRAE Standard 135-1995 or approved equivalent. IBCs shall be provided for Unit Ventilators, Fan Coils, Variable Air Volume and Temperature (VT) Terminals Units and other applications as shown on the drawings. The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals. System supplier must provide PICS document showing installed systems compliance level to the ANSI/ASHRAE Standard 135-1995. Minimum compliance is Level 3.
 2. IBCs shall communicate with the Web Supervisor via Ethernet connection at a baud rate of not less than 10 Mbps.
 3. IBC Sensor shall connect directly to the IBC and shall not utilize any of the I/O points of the controller. IBC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The IBC Sensor shall provide a communications jack for connection to the BACnet communication trunk to which the IBC controller is connected. The IBC Sensor, the connected controller, and all other devices on the BACnet bus shall be accessible by the POT.
 4. All IBCs shall be fully application programmable and shall at all times maintain their BACnet Level 3 compliance. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IBC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
 5. System software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in standalone control modules. Any system that does not use a drag and drop method of graphical icon programming as described herein is NOT acceptable. GPL is a method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors, etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.
 6. Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.
 - a. Graphic Sequence: Clarity of the graphic sequence must be such that the operator can verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming must be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.

- b. Simulation: Full simulation capability shall be provided with the graphic programming. Operator shall be able to fully simulate the constructed control sequence prior to downloading into field control modules. Simulation capabilities shall include step-by-step, accelerated time, and operator defined simulation criteria like outside weather, demand, and communication status. Multiple graphic programs shall be simulated and displayed in split screens at the same time.
- c. GPL Capabilities: Following is a minimum definition of capabilities of the Graphic Programming software:
 - 1) Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.
 - 2) Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.
 - 3) BACnet Points: Shall be points that comply with the BACnet structure as defined in the BIBB's Addendum B1/B2, and the BACnet standard.
 - 4) Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a specified sequence. A library of microblocks shall be submitted with the control contractors bid.
 - 5) Wires: Shall be Graphical elements used to form logical connections between microblocks and between logical I/O. Different wires types shall be used depending on whether the signal they conduct is analog or digital.
 - 6) Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead of a visual connection, i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.
 - 7) Parameter: A parameter shall be a value that may be tied to microblock input.
 - 8) Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain various editable and non-editable fields and shall contain 'push buttons' for the purpose of selecting default parameter settings.
 - 9) Icon: An icon shall be graphic representation of a software program. Each microblock has an icon associated with it that graphically describes function.
 - 10) Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.
 - 11) Live Graphical Programs: The Graphic Programming software must support a 'live' mode, where all input/output data, calculated data, and setpoints shall be displayed in a 'live' real-time mode.
- 7. For each piece of HVAC equipment, the entire graphic program shall be displayed through the Web Browser GUI. Operator must have the ability to scroll through the entire 'live' graphic program as necessary. Piecemeal graphic programs that only show one part of HVAC equipment program at any one time are NOT acceptable. For example, when viewing an AHU live graphic program, the operator shall see the entire AHU graphic program, not just the Heating Coil control.

E. Trended/Logged Information

- 1. Information logged by the Temperature Control System shall be automatically archived to the Web Supervisor each calendar month and able to be recalled through the Temperature Control System and shall not be automatically overwritten without the consent of operator.
 - a. Information shall be archived in a dedicated directory indicating its contents, with the archive files saved with a dated designation, such as "TCS Trend (YEAR)(MONTH)(DATE).*", where the "(YEAR)" designates the numerical 4 digit year, the "(MONTH)" indicates the numerical 2 digit month and "(DATE)" indicated the numerical 2 digit day of the month.
 - b. At option of operator, individual archived files must be able extracted from the computer as needed to view remotely, using the system interface on any connected computer. Extraction from the local computer shall be done via portable memory device, such as a flash drive.

2.6 TEMPERATURE CONTROL CABLING

- A. Cabling in air plenums shall be open wired UL listed plenum cable or shall be installed in conduit.
- B. Conduit shall be 1/2-inch minimum size and shall be furnished and installed by the temperature control contractor. Run all control wiring exposed in mechanical rooms and similar spaces in conduit, in a neat, workmanlike manner. Provide bushings on any open end of conduit. Conduit construction and sizing shall be in accordance with Project Manual Section 260533, Raceway and Boxes for Electrical Systems.
- C. Concealed wiring and wiring in non-plenum ceiling cavities, which is operating under 100 volts, may be open wired if in compliance with Article 725, NFPA-70 (NEC). Open wiring shall be supported as denoted below.
- D. Terminations shall be performed by the Temperature Control Contractor.
- E. Wire and conduit not indicated on the Drawings or in the Specifications, but required by the controls supplier, shall be paid for by the Temperature Control Contractor at no additional cost to the Owner.
- F. Cable Supports
 - 1. Provide cable supports that meet UL, NEC and TIA/EIA requirements for structured cabling systems.
 - 2. Cable support system shall provide support for various types of low voltage cables, fiber optic cables, innerduct, and temperature control cabling.
 - 3. Support system shall attach to the building structural elements or be wall mounted.
 - 4. Support shall be made of fire retardant and low smoke emission products, which meet UL 2034 requirements for air plenum spaces.
 - 5. Support products shall have a minimum of a 1 inch wide platform for the cable to rest. Bridle rings or bridle rings with 1" inserts are not acceptable.
 - 6. Individual supports shall be installed at intervals not greater than 60 inches.
 - 7. Cable supports shall be installed a minimum of 6 inches above lay-in ceiling system. Cable sags shall not allow the cable to touch ceiling grid or tiles.
 - 8. Minimum clearances from sources of EMI and RFI must be as specified in TIA/EIA-568C, TIA/EIA-569 and the latest version of the BICSI TDMM.
 - 9. Approved Manufacturers:
 - a. Caddy by Erico
 - b. Siemens
 - c. CPI
 - d. Panduit
 - e. Garvin Industries
 - f. B-line
- G. Cable Ties
 - 1. Provide plenum rated cable ties for cables in/or above ceiling.
 - 2. Cable ties shall be of appropriate length to loosely bundle and secure the low-voltage cables. Cable ties are not to be pulled so tight that they damage or distort the cables in the bundles. Trim cable tie loose ends.
 - 3. Cable ties shall meet UL 94V-O.
 - 4. Approved Manufacturers:
 - a. Panduit
 - b. Hubbell
 - c. Leviton
- H. Cable Hook and Loop Fasteners
 - 1. Provide cable hook and loop fasteners to secure cable bundle at equipment cabinets, panels, and controllers.
 - 2. Hook and loop fasteners may be used above ceiling if they are plenum rated.
 - 3. UL listed.
 - 4. Approved Manufacturers:
 - a. Panduit

- b. Hubbell
 - c. Leviton
- I. Innerduct (Indoor)
 - 1. Provide 1.0 inch I.D. plenum rated corrugated innerduct above ceiling for all non-armored fiber optic cable.
 - 2. Innerduct shall be UL listed and plenum rated.
 - 3. Approved Manufacturers:
 - a. Endot-Endocor
 - b. Carlon
 - c. Pyramid Industries
 - d. Eastern
- J. Innerduct (Outdoor)
 - 1. Provide 1.0 inch I.D. non-plenum polyethylene-type, ribbed inside tube, innerduct in the conduit as shown on the Drawings.
 - 2. Innerduct shall be UL listed.
 - 3. Provide a nylon pull string in all empty innerduct runs.
 - 4. Approved Manufacturers:
 - a. Enduct Ribbed (for outside applications)
 - b. Carlon
 - c. Pyramid Industries
 - d. Eastern
- K. Temperature Control Contractor shall refer to all Divisions 23 and 26 Project Manual sections for unique requirements for each piece of equipment.

PART 3 - PART 3 EXECUTION

3.1 INSTALLATION

- A. Automatic control and/or monitoring of all HVAC equipment and system described within Project Documents shall be performed with this direct digital control (DDC) system, unless otherwise noted.
- B. Refer to Project Drawings, Section 230900, 230993 and 230993p for listing of expected control points. Contractor is responsible to review Project Documents to realize/confirm all necessary points for compliance with Project Documents.
- C. Temperature Control System control panels for network control and system interface shall be installed as necessary by the temperature control contractor. Power wiring for control panels and devices shall be the responsibility of the Temperature Control Contractor, who is responsible to coordinated with the Division 26 Contractor to provide the necessary services to power the Temperature Control System control panels and devices. Power shall be obtained from the various Division 26 panels installed throughout the building, spares circuiting in these panels is expected to be utilized for the Temperature Control System installation.

3.2 SEQUENCE OF OPERATION

- A. Refer to Specification Sections 230993 and 230993p for equipment operation sequences and listing of control points.

3.3 OCCUPIED/UNOCCUPIED SYSTEMS & ZONES

- A. Each group of central plant air-handlers, connected by a common duct installation shall be considered a single system, and each temperature sensing and/or time dependent device considered a single zone. Each system shall be comprised of multiple zones. Equipment serving more than one system and/or zone, such as building entry heaters and restroom exhaust fans and heaters, shall be automatically engaged when either associated system is engaged to operate for occupied conditions. Equipment associations shall be configurable through the Temperature Control System. System engagement shall be controlled through the Temperature Control System.

Zone engagement shall be controlled through the Temperature Control System or the local room thermostat or sensor.

- B. Central air-handler systems shall be scheduled to provide system ventilation during occupied periods only, strictly through the building automation through secure system authority. Individual zone override control to reset zone set point temperatures shall be available through the Temperature Control System or from zone thermostats and sensors shall not allow for system outside air ventilation or sequence the central air-handler into occupied mode.

3.4 NETWORK MANAGEMENT FUNCTIONAL REQUIREMENTS

- A. Contractor shall thoroughly and completely configure Temperature Control System devices, software, supplemental software, application programming, network communications, control system server, operator workstations, remote operator workstations, portable operator's terminal, and network communications to permit the functional requirements of the IAS herein specified. Setup shall include as a minimum of the following network management procedure:
 1. Automatic backup of the DDC System database to appropriate media.
 2. Program, load and debug all software installations, including integration of third party applications (e.g. analytics and energy management).
 3. Network user auditing routine.

3.5 GUARANTEE

- A. Contractor shall include two (2) year control system service and system warranty as part of base bid cost. Guaranteed of workmanship material and devices for two (2) years, from the date of final, fully completed Substantial Completion, as acceptance by the Owner. Any material proving defective shall be repaired or replaced during that period. This shall not, apply to material that has been damaged due to willful vandalism or negligence.

3.6 COMPLETION

- A. Prior to final inspection, this Contractor shall perform the following service work, including, but not limited to, the following items:
 1. Check mechanical mechanisms; lubricate, adjust and tighten as necessary.
 2. Calibrate control instruments and devices.
 3. Observe and confirm functionality of systems; fine-tune operation, set-point conditions and scheduling as necessary.
- B. When the work is completed, and at a time directed by the Owner, Commissioning Agent (CxA) and the Architect/Engineer, the Contractor shall carefully adjust all parts of the equipment and systems. This includes adjustment of automatic controls and safety devices, proper setting of adjustable devices, dampers and valves, and other necessary operations so the systems are fully operable and automatic in operation. Upon completion of the Work, notify the Owner/CxA, and Architect/Engineer that system is ready for final tests and inspection.
- C. At the time of final inspection, this Contractor shall be represented by a person with the proper authority, who shall demonstrate, as directed by the Owner/CxA and Architect/Engineer, that his Work fully complies with the purpose and intent of the Specifications and Drawings. Labor, services, instruments, and tools necessary for demonstrations and tests shall be provided by the Contractor.
- D. Contractor shall test and adjust each instrument specialty and equipment furnished by him, prior to final acceptance. Contractor shall demonstrate, for approval by the Project Engineer, that subsystems operate as a coordinated and properly functioning, integrated system.
- E. Contractor shall furnish labor, provide adjustments and incidentals necessary to obtain the desired and intended results.

END OF SECTION 23 09 00

SECTION 23 09 93 – OPERATIONAL SEQUENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Special Conditions, Sections included under Division 1, General Requirements, and Section 230500 of this Division are included as a part of this Section as though Bound herein.
- B. Refer to the details and schedules on the Drawings for additional requirements.

1.2 SUMMARY

- A. This Section includes the Sequences of Operation for the HVAC Equipment and Systems. These sequences in narrative format are intended to be utilized as required guidelines for the installed systems operation; the Temperature Controls Contractor is responsible for a completely functional and highly efficient system operation in line with these stated guidelines.
 - 1. Correspondence with the design engineer may be necessary and is expected to be coordinated by the contractor if additional information is necessary in conversion of the below described narratives into electronic system programmed operating code.
 - 2. All controlled actions are to be calculated by a proportional integral derivative (PID) function with the response times of each action appropriate for the purpose, to prevent unnecessary overworking the operating devices.
- B. Temperature Control Contractor shall read all other Drawings and Specifications, become familiar with requirements and Project direct digital control (DDC) scope.
- C. Refer to other Division 23 Specifications Sections, Drawing Layouts, Schedules and Details for additional information and requirements of the controlled devices, equipment, and systems.

1.3 SUBMITTALS

- A. Submittals are required and shall include detailed descriptions of the proposed sequence of operations for all HVAC systems specific to the project.
- B. Control Diagrams:
 - 1. Prior to installation and as required in Section 01330, submit to Architect/Engineer a complete system diagram, showing control connections and devices and their connection to other equipment, together with a clearly written description of the system and an outline of its function under conditions of operation.
 - 2. DDC logic and control diagrams included for all equipment and sequences of control.
- C. Closeout Submittals:
 - 1. Prior to installation and as required in Section 01330, submit to the Architect/Engineer a complete system diagram, showing control connections and devices and their connection to other equipment, together with a clearly written description of the system and an outline of its function under conditions of operation.
 - a. Submittals shall be prepared on, or folded to, 8-1/2 inch by 11 inch size and bound in brochure form.
 - 2. DDC logic and control diagrams included for all equipment and sequences of control.
 - 3. Screen captures shall be included to demonstrate the various different graphical interfaces for operator input and monitoring of the various types of installed equipment.
 - 4. Upon completion of the Work, provide the complete, accurate, and approved diagrammatic blueprinted layouts on the automatic control system specified herein and as installed.

- a. Layouts shall show all control equipment including job installation changes, and the function of each system shall be indicated. Layouts and descriptions shall be included in the project record set and in the operating and maintenance manuals. Labels shall be identified on the submittals, field tags and on the "As-Built" document in common language such that devices are easily identified by non-technical reviewers.

PART 2 - SEQUENCES OF OPERATION

2.1 SYSTEMS INTERFACE

- A. Building temperature control system shall be configured as described in Section 230900.
- B. As monitored through Temperature Control System, all set point conditions and operating point conditions shall be indicated in close proximity on the graphical interface such that the systems operator is able distinguish whether or not the systems are operating correctly.
- C. Equipment shall be identified by the room number it serves, and where a unit specific tag is indicated the tag shall also be identified. Room numbers shall be the permanent number as decided by the building owner, which may be different than that indicated on the project drawings. Contractor is responsible for coordinating correct information into the final software user interface.

2.2 PACKAGED SINGLE-ZONE AIR HANDLERS (RTU-1)

- A. Packaged single-zone air handle operation shall provide available services for existing or replacement configuration. Air handler designations per building location are as follows:
 1. RTU-1: DX Cooling, Hot-Gas Reheat, & Nat. Gas Heating.
- B. Packaged air handler(s) shall be controlled locally by the integral equipment controller with a local wall mounted temperature, humidity, and carbon dioxide sensor. Equipment controller shall communicate to the Building Temperature Control System to allow for monitoring, scheduling, and over-ride control of a limited number of operating points. Refer to Packaged Air Handlers Section for additional requirements.

2.3 CABINET HEATERS (CUH)

- A. Space Comfort Operating Set Points: Install wall mounted flat plate temperature sensing device. Engage heating valve in response to deviation from dry-bulb temperature set point.
 1. Operating Deadbands: Incorporate set point deadbands for all operation conditions:
 - a. Temperature: -2 degrees (adj) from set point.
 2. Occupied Set Point Condition:
 - a. Heating: 70°F dry-bulb (adj).
 3. Unoccupied Set Point Condition:
 - a. Heating: 60°F dry-bulb (adj).
 4. Occupied Periods: Designated by outside ambient temperature.
 - a. When outside ambient is equal to and greater than 40°F (adj), cycle unit fan on and heating control valve to 80% (adj) to maintain space temperature set point.
 - b. When outside ambient is less than 40°F (adj), operate fan continuously and modulate heating control valve to maintain space temperature set point
 5. Unoccupied Periods: Unit fan shall cycle, open heating control valve to maintain space temperature set point.
 6. Proving Switches: All electrical motors shall be installed with a current sensor or other approved motor proving device. The proving device shall all the temperature control system to verify operation of the associated motor and indicate the device status through the graphical user interface, sending an alarm through the central Temperature Control System if failure occurs. Proving devices shall be installed on all pump motors sequenced by the building Temperature Control System.
- B. Alarms:

1. Low Space Temperature: Measured space temperature less than 45°F (adj).
2. High Space Temperature: Measured space temperature less than 90°F (adj).
3. Fan Motor: Fan motor current sensor does not acknowledge motor engagement.

2.4 FANS (F-1,2,3)

A. Fans and Functionality

1. Subtype E – Automatically Engaged with Field Installed Equipment: Engage/disengage fan with the identified equipment via electronic digital signal.
 - a. F-3: Engaged/disengaged with RTU-1 operation.
2. Subtype O – Scheduled Automatic Occupied Mode: Fans shall provide general air circulation or removal through building area(s) during predefined/scheduled occupancy periods through Temperature Control System. Fans shall also engage and operate when associated HVAC system (RTU-1) is manually engaged into operation for non-scheduled occupied comfort set points conditions - such as for an unscheduled event engaged locally with the occupied override device function. Operation is not required during unoccupied periods, except for cycling to maintain set back temperature conditions.
3. Fan Listing and Functionality Requirements: Confirm all quantities with Project Drawings, if a fan is shown, but not listed below, contractor shall seek clarification of intended control mode(s) for completion.

<u>Location (Room)</u>	<u>Fan Type</u>	<u>Fan Tag</u>	<u>Function(s)</u> (as noted above)
a. 105	F-1	F-105	O
b. 101	F-2	F-101	O
c. 113	F-3	F-113	E; RTU-1

- B. Refer to Fan Schedule on Project Drawings and Input/Output Summary Table in 230993-PL.

PART 3 - EXECUTION

3.1 POINTS LIST

- A. Temperature control devices are required for the complete installation of the above-described sequences and as indicated on construction drawings. The attached points listing is a summation of all the expected points by the design team, listed to aid the Temperature Control Contractor more quickly come a confident understanding how the described systems are expected to operate. The listing provided by the design team is to be considered as a minimum requirement because some points may have been unknowingly overlooked; it is the Contractors responsibility to understand and comply with the Project Documents, seeking clarification from the design team as necessary.

END OF SECTION 23 09 93

INPUT/OUTPUT SUMMARY TABLE

PROJECT: Edison State CC Convocation Center Expansion Piqua, Ohio - Packaged Air Handler - Cabinet & Unit Heaters - Fans	HARDWARE I/O												SOFTWARE											
	INPUT (T, D, V, C)						OUTPUT (O)						GRAPHICAL CONFIGURATION											
	DIGITAL			ANALOG			DIGITAL			ANALOG														
	STATUS	ALARM(S)	TEMPERATURE	HUMIDITY	CARBON DIOXIDE	PRESSURE	FLOW	PERFORMANCE	POWER	INDICATION	COMMUNICATION	START / STOP	ENABLE/DISABLE	STAGE CONTROL	OPEN / CLOSE	MODULATION	COMMUNICATION	COLOR GRAPHICS	OPERATION	CONTROL	ALARM(S)	MAINT. REPORT	RUNTIME REPORT	TRENDING
RTU-1 - Refer to Sections 230993 & 237413 for Additional Information																								
RTU-1 Controller (1; RTU-1 BACnet Interface)										X	X				X		X	X	X	X	X	X	X	X
RTU-1 Supply-Air Fan, VFC (1)										X							X	X	X	X	X	X	X	X
RTU-1 Outside-Air Damper (1)									X								X	X						X
RTU-1 Return-Air Damper (1)									X								X	X						X
RTU-1 Supply-Air Temperature Set Point (1)															X		X							X
RTU-1 Return-Air Temperature Sensor (1)			X														X							X
RTU-1 Mixed-Air Temperature Sensor (1)			X														X							X
RTU-1 Return-Air Duct Humidity Sensor (1)				X													X							X
RTU-1 Return-Air Duct Carbon Dioxide Sensor (1)									X								X		X					X
RTU-1 Outside-Air Humidity Sensor (1)				X													X							X
RTU-1 Supply-Air High Pressure Switch (1)	X																X		X					X
Hot-Gas By-Pass Valve Operation (1)									X								X							X
RTU-1 Filter Pressure Switch (1)					X												X		X	X				X
Condensate Overflow Switch (1)	X																X		X					X
Cabinet Heaters																								
Zone Temperature Sensor (1/unit)			X														X		X					X
Unit Fan (1/unit)											X						X	X	X					X
Fan Current Sensor (1/unit)	X																X	X	X				X	X
Electric Heating Element (1/unit)											X						X	X						X
Fans (F-1, 2, 3) - Refer to Section 230993 for Automatic Control Subtype; Fans may be Multi-Functional.																								
Control Subtype E; Equipment Interlock Engagement Mode				X							X						X	X	X				X	X
Control Subtype O; Occupancy Mode											X						X	X	X				X	X
Fan Current Sensor (1/unit)	X																X	X	X				X	X

SECTION 23 31 13 - RIGID DUCT

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 ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 2-inch w.g. Metal ducts include the following:
 - 1. Rectangular ducts and fittings.
 - 2. Single-wall, round spiral-seam ducts and formed fittings.
- B. Related Sections include the following:
 - 1. Division 07 Section "Penetration Firestopping."
 - 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Project Architect/Engineer.

1.4 QUALITY ASSURANCE

- A. Compliance Standards:
 - 1. UL 181.
 - 2. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 3. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
 - 4. NAIMA AH124-94: Fibrous Glass Duct Liner Standard.
 - 5. ASHRAE Handbook, HVAC Systems and Equipment.
 - 6. *Ductwork shall be sealed as required by ASHRAE Standard 90.1.*

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 Manufacturers: Subject to compliance with requirements.

2.2 RECTANGULAR DUCT LINER (1" ACRYLIC-POLYMER COATED)

- A. Semi-Flexible Roll: Acrylic-polymer coated fibrous materials. Microban® antimicrobial inhibitor. Comply with ASTM 1071 for fibrous materials. ASTM E84 at 25/50 for 1-inch thickness.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville Linacoustic RC-HP; Design Basis (DB).
 - 2. Materials: Comply with ASTM C534.
 - a. Thickness: 1-inch for Basis of Design product; increase thickness as necessary to meet or exceed all below indicated thermal and sound absorption values.
 - b. Thermal Conductivity (K-Value): 0.26 at 75 deg F. mean temperature.
 - c. Maximum Velocity: 6,000 FPM in accordance with UL 181..

- d. Minimum/Maximum Use Temperatures: -290°F / 180°F.
- e. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.
- f. Sound Absorption Sound Absorption Coefficients at Frequency:

<u>125 Hz</u>	<u>250 Hz</u>	<u>500 Hz</u>	<u>1K Hz</u>	<u>2K Hz</u>	<u>4K Hz</u>	<u>NCR†</u>
0.05	0.21	0.71	1.01	1.07	1.07	0.75

2.3 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M with G90 coating designation; ducts shall have mill-phosphatized exposed surface finishes.
- C. Stainless Steel: ASTM A480, Type 304 and having a mill/2B finish.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: "Sealant" is not limited to materials of adhesive or mastic but includes tapes and combinations of open-weave fabric strips and mastics.
 - 1. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Sealant shall comply with the testing and product requirements of the California Department of Health Services' Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.
- B. Tape Sealing: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically to form durable, airtight seal.
- C. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- D. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- E. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

- A. Hanger Materials: Galvanized sheet steel or threaded steel rod.
 - 1. Hangers Installed in Corrosive Atmospheres: Electro-galvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 - 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
 - 3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- B. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

- C. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
- D. Contractor may use load rated cable suspension system. Suspension system shall have a specified manufacturers safe working load and supplemental safety factor of at least five times the safe working load.
 - 1. Suspension system shall be verified by SMACNA Testing and Research Institute for compliance with SMACNA Duct Construction Standards Guidelines (1995 CH.4).

2.6 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
 - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 - 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Turning Vanes: Duct fittings with a mitered inside and/or outside corner or radius less than 1.5 times the duct diameter shall be equipped with turning vanes. For any transition, the contractor has the option to installed radius or mitered fittings, radius fittings of 1.5 times the duct diameter or larger are preferred, but contingent of the amount of space within the installation. Turning vanes shall be constructed of the same material as the duct.
- C. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
- D. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
 - 1. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
 - 2. Longitudinal Seams: Pittsburgh lock sealed with non-curing polymer sealant.
- E. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of non-braced panel area unless ducts are lined.

2.7 ROUND DUCT AND FITTING FABRICATION

- A. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- C. Fabricate elbows using die-formed, gored or pleated construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
 - 1. Round <15-Inches diameter: Fabricate die-formed or pleated elbows.
 - 2. Round >14-Inches diameter: Fabricate gored elbows.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

- A. Unless otherwise noted, duct shall be galvanized steel.
 - 1. Dedicated Shower Room Duct: Aluminum or stainless steel.

3.2 DUCT PRESSURE CLASS CONSTRUCTION

- A. Static-Pressure Classes: Unless otherwise noted, construct duct to the following:
 - 1. Supply-Air Ducts:: 2-inch w.g.
 - 2. Return/Relief-Air Duct (Negative Pressure): 2-inch w.g.
 - 3. Exhaust-Air Duct (Negative Pressure): 2-inch w.g.

3.3 DUCT BRANCH TAKE-OFF FITTINGS

- A. Supply-, Return- and Exhaust-Air Duct:
 - 1. Spiral duct take-off fittings shall be standard strait 90 degree take-off style fittings; refer to Project Drawings for specific fitting indications.
 - 2. Rectangular duct take-off fittings shall be with shoe-tap, or otherwise commonly "boot"-tap, style fittings, providing an intermediate integral 45-degree transition at the upstream side of the mainline connection.

3.4 TURNING VANES

- A. Unless otherwise noted, duct fittings with a mitered inside and/or outside corner or radius less than 1.5 times the duct diameter shall be equipped with turning vanes. For any transition, the contractor has the option to installed radius or mitered fittings, radius fittings of 1.5 times duct diameter or larger are preferred, but contingent of the amount of space within the installation. Turning vanes shall be constructed of the same material as duct.

3.5 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," unless otherwise indicated.
 - 1. Install round ducts in lengths not less than 12 feet unless interrupted by fittings.
 - 2. Install ducts with fewest possible joints.
 - 3. Install fabricated fittings for directional and size transitions.
 - 4. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
 - 5. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
 - 6. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
 - 7. Install ducts with no less than 1-3/4-inch clearance.
 - 8. Conceal ducts from view in finished spaces.
 - 9. Do not encase horizontal runs in solid partitions unless specifically indicated.
 - 10. Coordinate layout with ceiling, fire- and smoke-control dampers, lighting layouts.
 - 11. Seal all joints and seams.
- B. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- C. Non-Fire-Rated Partition Penetrations: Where ducts pass through partitions and walls are exposed to view, cover opening(s) with sheet metal escutcheon plate(s).

- D. Fire-Rated Partition Penetrations: Where ducts pass through rated partitions and walls, install rated damper(s), sleeves, and firestopping sealant. Fire and smoke dampers are described in Division 23 Section "Air Duct Accessories." Firestopping materials and installation methods are described in Division 07 Section "Penetration Firestopping."
- E. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

3.6 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
 - 1. For pressure classes lower than 2-inch w.g, seal transverse joints.

3.7 HANGING AND SUPPORTING

- A. General Conditions:
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Chapter 5, "Hangers and Supports," unless otherwise noted.
 - 2. Support horizontal within 24 inches of each elbow and terminations, and within 48 inches of each intersection.

3.8 CONNECTIONS

- A. Make connections to equipment containing fans or other vibration generating components with flexible connectors compliant with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.9 FIELD QUALITY CONTROL

- A. Cleanliness Verification:
 - 1. Visually inspect metal ducts for contaminants.
 - 2. Where contaminants are discovered, clean and reinspect ducts.

END OF SECTION 23 31 13

SECTION 23 33 00 - AIR SYSTEMS ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Bi-polar Ion generators
 - 2. Equipment air-inlet cottonwood filters.
 - 3. Manual volume dampers.
 - 4. Flange connectors.
 - 5. Turning vanes.
 - 6. Flexible connectors.
 - 7. Flexible ducts.
- B. Related Sections:
 - 1. Division 28 Section "Fire Detection and Alarm" for duct fire and smoke detectors.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BIPOLAR ION GENERATORS

- A. Manufacturers: Air purification systems shall be of the size, type, arrangement and capacity indicated below and corresponding to the air flow of the unit mounted within.
1. Basis-of-Design Product: Subject to requirement compliance, provide Global Plasma Solutions (GPS) GPS-DM48, dependent of zone airflow, or an equivalent product by one of the following:
 - a. Phenomenal Aire.
 - b. Plasma Air.
- B. Bipolar Ionization Design & Performance Criteria
1. Bipolar Ionization system shall provide:
 - a. Effective microorganism extermination downstream of bipolar ionization equipment (mold, bacteria, virus, etc.).
 - b. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
 - c. Reducing space static charges.
 - d. Reducing space particle counts.
 - e. When mounted to the air entering side of a cooling coil, keep the cooling coil free from pathogen and mold growth.
 - f. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:
 - 1) MRSA: 99.5% in 60 minutes or less
 - 2) E. Coli: 93.5% in 30 minutes or less
 - 3) H1N1: 86.6% in 60 minutes or less
 - 4) Aspergillus: 74.8% in 60 minutes or less
 - g. Manufacturers not providing the equivalent space kill rates shall not be acceptable. All manufactures requesting prior approval shall provide to the engineer independent test data from a NELEC accredited independent lab confirming kill rates and times meeting the minimum requirements stated above.
 2. Bipolar ionization system shall operate in such a manner that equal amounts of positive and negative ions are produced; single pole devices shall not be acceptable.
 - a. GPS-DM48 Ion Output: >400M ions/cc
 - b. Airflow rates may vary through full operating range of VAV system. Quantity of air exchange shall not be increased due to air purification system requirements.
 - 1) Airflow Range: 0 TO 4,800 CFM
 - c. Velocity Profile: Device shall not have a maximum velocity profile.
 - d. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions to the air purification system.
 3. Ionization Equipment Requirements: Provide multiple ion generating units to where few units do not meet or exceeds manufacturers recommended airflow limitations.
 - a. Electrode Specifications (Bipolar Ionization):
 - 1) Each plasma generator with bipolar ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity.
 - 2) Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
 - 3) Unit shall be equipped with output contacts for remote verification of operation, such as Temperature Control System graphical user interface.
 - 4) Ionization output when tested in the occupied space shall be between 500 and 800 ions/cm³.
 - 5) Manufacturer shall demonstrate that no voltage potential exists due to exposed electrical components in the duct system or plenum. Exposed needles protruding into the air stream will not be accepted.
 4. Unit Configuration
 - a. Ion generators shall be needlepoint, or needlepoint brush type ionizer(s). Product(s) shall be furnished to fit installation.

- 1) Modular Unit: Ionization unit shall be modularized to allow for small independent mounting locations at the identified locations. Unit shall be duct mounted within supply-air duct system, with connection(s) to the remote mounted power panel of low voltage wiring.
- 2) Self-Cleaning: Unit shall possess a self-cleaning mechanically actuated mechanism to routinely clean the needlepoint brush(es).
- b. Remote mount power supply panel shall be capable of directly accepting voltage of 12V DC or 24V AC. Panel shall have an manual on/off switch, ionizer indicator LED, and a set of dry contacts which will indicate ionizer functionality. Dry contacts that indicate power available only shall not be acceptable.
- c. For systems that don't utilize a feedback functionality indicating ion production, provide a duct mounted ion sensor powered from 12V DC or 24V AC. Ion sensor to be user adjustable from 500 to 20,000 ions per cm³ and contain a dry contact BMS interface. To be clear, for systems that only indicate power available to the ionizer, vendor must provide duct mounted ion sensor described herein.
- d. Needles on air-handler mounted units shall be recessed for safety and to avoid fouling of any exposed needles.
5. Certifications
 - a. Bipolar ionization units shall be tested and listed by either UL or ETL according to UL Standard 867 – Electrostatic Air Cleaners. UL listings for standards other than 867 will not be acceptable.
 - b. The operation of the electrodes or bipolar ionization units shall conform to UL 867 with respect to ozone generation.
6. Electrical Requirements:
 - a. Ion generators shall contain a built-in power supply and operate on 12V DC or 24V AC. Ion generator shall be powered by Temperature Control System only when unit is confirmed operational.
 - 1) Ion generators requiring 24V–240V power supply shall be coordinated and wired by Division 26 Contractor; cost for this work shall be the responsibility of Division 23 Contractor. Power relay device shall be required to automatically control line voltage units.
 - 2) Wiring, conduit and junction boxes shall be furnished and installed by the electrical contractor within housing plenums and shall be UL and NEC NFPA 70 approved.
7. Control Requirements:
 - a. All plasma ion generators shall include internal short circuit protection, overload protection, and automatic fault reset; manual fuse replacement shall not be accepted.
 - b. Ion generators shall include an external BMS interface to indicate ion generator status and alarm(s).

2.3 EQUIPMENT AIR-INLET COTTONWOOD FILTERS

- A. Manufacturers: Subject to compliance, provide products by one of the following:
 1. Air Solution Company.
 2. Nebraska Air Filter.
 3. Permatron.
- B. Heavy-Duty Commercial Grade Cottonwood Filters: Filters shall externally and completely cover all air inlets of outdoor equipment; filters shall be completely field-measured and field-installed. Filter shall have minimal affect to air static pressure loss and negligible to unit operation.
 1. Filter shall consist of engineered UV-resistant industrial grade nylon singly-ply mesh with outer heavy-duty 1.125-inch fiber reinforced vinyl border with integral hem and fastening eyelets.
 2. Commercial grade stainless steel or impact-resistant, UV-resistant nylon grommets with quick release twist lock (1/4-turn) fasteners shall be directly fastened to the equipment housing with stainless steel or hot-dipped galvanized steel hardware.
 3. Filters shall be easily removable without the use of tools, and shall be able to be vacuumed or power washed clean.

2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance, provide products by one of the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Duro Dyne Corporation.
 - d. Flexmaster U.S.A., Inc.
 - e. Greenheck Corporation.
 - f. McGill AirFlow LLC.
 - g. METALAIRE, Inc.
 - h. Nailor Industries Inc.
 - i. Pottorff; a division of PCI Industries, Inc.
 - j. Ruskin Company.
 - k. Vent Products Company, Inc.
 - l. Young Regulator Company.
 2. Standard leakage rating, with linkage outside airstream.
 3. Suitable for horizontal or vertical applications.
 4. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
 6. Blade Axles: Galvanized steel.
 7. Bearings:
 - a. Oil-impregnated bronze or molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch w.g. or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 8. Tie Bars and Brackets: Galvanized steel.
- B. Jackshaft:
1. Size: 1-inch diameter.
 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 3. Length and Number of Mountings: As needed for connection of all linkages.
- C. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch zinc-plated steel, and a 3/4-inch hexagon locking nut.
 2. Include center hole to suit damper operating-rod size.
 3. Include elevated platform for insulated duct mounting.
- D. Remote Damper Operator:
1. Damper mount casing clamp with wire stop.
 2. Flexible casing and wire.
 3. Locking rack and pinion operator with mounting bracket; operator shall be operable with standard-sized ASME socket wrench.

2.5 FLANGE CONNECTORS

- A. Manufacturers: Subject to requirement compliance, provide product by following:
1. Ductmate Industries, Inc.
 2. Nexus PDQ; Division of Shilco Holdings Inc.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
 - 1. Material: Galvanized steel.
 - 2. Gauge and Shape: Match connecting ductwork.

2.6 TURNING VANES

- A. Manufacturers: Subject to requirement compliance, provide product by following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIRE, Inc.
 - 4. SEMCO Incorporated.
 - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
 - 2. Vane Construction: Double wall.

2.7 FLEXIBLE CONNECTORS

- A. General Requirements:
 - 1. Materials: Flame-retardant or noncombustible fabrics.
 - 2. Coatings and Adhesives: Comply with UL 181, Class 1.
 - 3. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch wide, 0.028-inch, galvanized sheet steel or 0.032-inch aluminum sheets. Provide metal compatible with connected ducts.
 - 4. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - a. Minimum Weight: 26 oz./sq. yd.
 - b. Tensile Strength: 480 lb-f/inch in the warp and 360 lb-f/inch in the filling.
 - c. Service Temperature: Minus 40 to plus 200 deg F.

2.8 FLEXIBLE DUCTS

- A. Basis-of-Design Product: Flexmaster Type 6M. Equivalent products listed below are subject to compliance with herein listed requirements.
 - 1. JP Lamborn AMR-25.
 - 2. Quietflex QAS.
- B. All flexible duct material shall be UL 181 Listed, Class 1 with less than a 25/50 flame/smoke rating and designed for an operating temperature range from 20°F to 200°F in accordance with NFPA 90A and 90B.
- C. Factory Insulated Low Pressure Supply, Return and Exhaust Air Fabric Flexible Duct
 - 1. Insulated (R-6), low-pressure ducts shall be used to connect supply duct, terminal units with the air distribution devices. Duct shall be constructed having an inner core of acoustically transparent spunbond nylon liner with mechanical lock helix. The covering shall be one inch thick fiberglass of 3/4 pound density, with an airtight foil fire retardant outer jacket serving as a vapor barrier. The outer jacket to be constructed with a reinforced aluminum pigmented vapor barrier jacket having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E 96, procedure A. The flexible duct shall be suitable for 6" positive and 5" negative working pressures for the sizes indicated, equal to Flexmaster Type 6M.
 - 2. Insertion Loss for 6-feet of duct with 90 degree change in direction at 1,000 FPM:

Size	dBA	125 Hz	250 Hz	500 Hz	1K Hz	2K Hz	4K Hz	8K Hz
8"	33	20	28	31	34	35	33	29
10"	31	20	27	28	33	33	29	23

- D. Connectors for Flexible Duct:
 - 1. Nylon Strap: Nylon strap in sizes 6 through 18 inches, to suit duct size.
 - a. Nylon strap shall connect inner core to rigid duct and air device, and vapor barrier jacket to air device and rigid duct separately, total of 4 straps are necessary for each installation, as described by SMACNA standard.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
- B. Bi-Polar Ion Generators: Install a bi-polar ion generator per comfort zone:
 - 1. Each bi-polar ion generator shall be powered by an enabled 24V circuit that is enabled with the operation of the associated air handler, such that when the air handler is disengaged, the bi-polar ion generator is also automatically disengaged.
- C. Cottonwood Filters: Install filters for all outdoor equipment that draws outdoor air for ventilation or condenser heat rejection. Air intake openings shall be field-measured and equipped with screening sized for 100% of the equipment opening dimensions. Equipment openings shall consist of, but may not be limited to the following:
 - 1. RTU-1: Outside-Air Intake Opening at Each Unit
 - 2. RTU-1: Condenser-Air Intake Opening(s) at Each Unit
- D. Set manually operated dampers to fully open position before testing, adjusting, and balancing.
- E. Connect rigid supply, return and exhaust ducts to air devices with acoustically rated flexible duct between rigid duct installation and air device. Flexible duct shall extend a minimum of 4-feet and maximum 8-feet. Do not utilize flexible duct at exposed duct installations, locker room and kitchen return and exhaust air devices, and as indicated on the project drawings.
 - 1. Nylon strap shall connected inner core to rigid duct and air device, and vapor barrier jacket to air device and rigid duct separately, total of 4 straps are necessary for each installation, as described by SMACNA standard.

END OF SECTION 23 33 00

SECTION 23 34 23 - POWERED VENTILATORS

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. Direct-driven constant speed downblast fans.
 - 2. Direct-driven constant speed inline cabinet fans.
 - 3. Direct-driven constant pressure inline cabinet fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: Include certified operating capacities, specialties and accessories.
- B. Operation & Maintenance Data: Include data in operation & maintenance manuals.

1.5 QUALITY ASSURANCE

- A. General Requirements:
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
 - 2. AMCA Compliance: Licensed with AMCA-Certified Ratings Seal.
 - 3. NEMA Compliance: Motors and electrical accessories to comply with NEMA standards.
 - 4. UL Standard: Power ventilators shall comply with UL 705.

PART 2 - PRODUCTS

2.1 DIRECT-DRIVEN CONSTANT SPEED CENTRIFUGAL DOWNBLAST FANS (F-1)

- A. Design Basis: Subject to compliance, provide Greenheck G or a comparable by:
 - 1. Loren Cook Company.
 - 2. Twin City Fan and Blower.
- B. Description: Direct-driven centrifugal fans consisting of housing, wheel, fan shaft, permanently-lubricated bearings, split-capacitor motor, prewired disconnect switch, drive assembly, curb base, and accessories.
 - 1. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.
 - 2. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone. Finish shall be bare aluminum.
- C. NEMA Standard Efficient Motor: Single speed, standard split-capacitor (PSC) style with permanently lubricated ball bearings; motor shall be rigidly mounted to casing. Motor shall be non-overloading throughout the entire fan curved.
 - 1. Units shall incorporate a single point electrical and control connection for the entire unit. All electrical components shall be enclosed in a single control box with an access panel mounted on the side of the assembly. All controls shall be sealed. Units shall be ETL listed, ARI and CSA certified.

- D. Accessories:
1. Disconnect Switch: Pre-wired, toggle style, NEMA 1, non-fusible type, mounted inside of fan housing. Fan housing shall provide through curb conduit for power wiring.
 2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
 3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
- E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base. Finish shall be bare galvanized steel.
1. Configuration: Self-flashing without a cant strip, with mounting flange.
 2. Overall Height: 12 inches.
 3. Pitch Mounting: Manufacture curb for roof slope.

2.2 DIRECT-DRIVEN CONSTANT SPEED INLINE CABINET FANS (F-2)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Greenheck CSP or a comparable product by one of the following:
1. Loren Cook Company.
 2. Twin City Fan and Blower.
- B. Description: Direct-driven fans consisting of housing, wheel, fan shaft, permanently-lubricated bearings, split-capacitor motor, prewired disconnect switch, drive-assembly, and accessories.
1. Fan Wheel: Aluminum with backward-inclined blades.
 2. Housing: Steel, lined with acoustical insulation.
- C. NEMA Standard Efficient Motor: Single speed, standard split-capacitor (PSC) style with permanently lubricated ball bearings; motor shall be rigidly mounted to casing. Motor shall be non-overloading throughout the entire fan curved.
1. Units shall incorporate a single point electrical and control connection for the entire unit. All electrical components shall be enclosed in a single control box with an access panel mounted on the side of the assembly. All controls shall be sealed. Units shall be ETL listed, ARI and CSA certified.
- D. Accessories:
1. Disconnect Switch: Pre-wired, toggle style, NEMA 1, non-fusible type, mounted inside of fan housing. Fan housing shall provide through curb conduit for power wiring.

2.3 DIRECT-DRIVEN CONSTANT PRESSURE INLINE CABINET FANS (F-3)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Greenheck CSP-VG or a comparable product by one of the following:
1. Loren Cook Company.
 2. Twin City Fan and Blower.
- B. Description: Direct-driven fans consisting of housing, wheel, fan shaft, permanently-lubricated bearings, electronically commutated motor, prewired disconnect switch, drive-assembly, and accessories.
1. Fan Wheel: Aluminum with backward-inclined blades.
 2. Housing: Steel, lined with acoustical insulation.
- C. Motor Assembly: Motor shall be continuous duty brushless – Direct current (DC) electronically commutated (EC) type with integrated motor protection.
1. Motor Class B Insulation, Class 2 – IP44 enclosure, complete with and operated by a single-phase integrated controller/inverter that operates wound stator and sensor motor position to electronically commutate stator.
 2. Motor shall be designed for synchronous rotation. Motor rotor shall be permanent magnet type with near zero rotor losses. Motor shall be permanently lubricated with ball bearings. Motor shall maintain a minimum of 70% efficiency over its entire operating range. Motors shall be direct coupled to the pump.

3. Units shall incorporate a single point electrical and control connection for the entire unit. All electrical components shall be enclosed in a single control box with an access panel mounted on the side of the assembly. All controls shall be sealed. Units shall be ETL listed, ARI and CSA certified.

D. Accessories:

1. Fan Motor Controller: Equip motor controller with an analog 0-10VDC input for remote fan speed modulate by manufacturer provided constant pressure controller described herein.
2. Constant Pressure-Controller with Integral Transducer: Remote duct-mounted controller with field installed outdoor tip. Power controller from fan motor 24V output, controller shall return an analog 0-10VDC PID algorithm to fan motor speed control input; also refer to manufacturer's installation details for additional information. Design Basis: Greenheck 385604 controller.
3. Disconnect Switch: Pre-wired, NEMA 1, non-fusible type, mounted inside of fan housing. Fan housing shall provide through curb conduit for power wiring.

2.4 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: At flow rate, pressure, power, motor speed and efficiency by factory test and rating according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Requirements:
 1. Allow clearances for service and maintenance. Secure fan to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories."
 2. Label units according to requirements specified in Division 23 Section "Identification."
- B. Duct installation with flexible connection is required. Flexible connectors are specified in Division 23 Section "Air Duct Accessories" and shall be full size of fan connection.
- C. Ground equipment and install wiring according to Division 26 Sections "Grounding and Bonding for Electrical Systems," and "Low-Voltage Electrical Power Conductors and Cables."

3.2 CONTROL AND ADJUSTMENT

- A. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for procedures.
- B. Compared to outside (low-port) pressure, maintain 0.00" w.c. building (high-port) pressure.

END OF SECTION 23 34 23

SECTION 23 37 13 – DIFFUSERS, REGISTERS, & GRILLES

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 exhaust-, return-, and supply-air devices identified as follows:
 1. "S" – Square, ceiling mounted plaque face air diffuser.
 2. "T" – Square, ceiling mounted plaque face self-actuating air diffuser.
 3. "H" – Rectangular/square, wall mounted heavy-duty bar grilles.
 4. "R" – Rectangular/square, ceiling and wall mounted perforated face grilles.
 5. "E" – Rectangular/square, ceiling and wall mounted perforated face grilles.
- B. Related Sections include the following:
 1. Division 23 Section "Air Duct Accessories" for dampers not integral to described devices.

1.3 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
 1. Air Device Schedule: Indicate device designation, room location, quantity, and selection.
 2. Data Sheet: Indicate manufacturer construction, performance, and acoustical data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance, provide Price Industries or a comparable product by a below listed manufacturer:
 1. Krueger.
 2. Nailor Industries of Texas Inc.
 3. Titus.

2.3 TYPE "S" PLAQUE-FACE DIFFUSERS

- A. Description: Plaque face supply air ceiling diffuser:
 1. Steel 18-gauge diffuser; 24-inch by 24-inch module size, 18-inch by 18-inch face panel.
 2. Solid face panel with curved back-pan. Face panel shall be easily removed without tools.
 3. Back pan shall be one-piece die-formed steel with identified connection sizes.
 4. Baked white enamel finished unless otherwise denoted on Drawings.
 5. Accessories: Provide as needed for the described installation condition.
 - a. Include plaster frame assembly for air devices being mounted in hard ceilings.
 6. Equivalent to Price SPD Series.

2.4 TYPE "T" PLAQUE-FACE SELF-ACTUATING DIFFUSERS

- A. Description: Plaque face supply air ceiling diffuser:
 1. Steel 18-gauge diffuser; 24-inch by 24-inch module size, 18-inch by 18-inch face panel.
 2. Solid face panel with curved back-pan. Face panel shall be easily removed without tools.
 - a. Temperature and airflow adjustments must be accessible from the room side of the chassis and hidden behind the plaque face.
 3. Back pan shall be one-piece die-formed steel with identified connection sizes.
 4. Baked white enamel finished unless otherwise denoted on Drawings.

5. Accessories: Provide as needed for the described installation condition.
 - a. Include plaster frame assembly for air devices being mounted in hard ceilings.
6. Controls:
 - a. Room temperature setpoint adjustment shall be completed by rotating a thumbwheel in correspondence to the provided scale, independent adjustment shall be provided for heating and cooling modes. The adjustment must be made on the chassis system and accessible from behind the hinged plaque.
 - 1) Diffuser damper shall open when the unit is in cooling mode and the room air temperature rises above setpoint, and when the unit is in heating mode and the room air temperature lowers below setpoint.
 - 2) Diffuser damper shall close when the unit is in cooling mode and the room air temperature lowers below setpoint, and when the unit is in heating mode and the room air temperature lowers below setpoint.
 - 3) Cooling Setpoint: 72°F; Heating Setpoint: 70°F
 - a) Each set-point shall be adjustable without tools from room side of chassis and hidden behind plaque face. Adjustment range shall be 70°F to 78°F.
 - b. Minimum airflow setpoint shall be 50% of maximum flow (adjustable).
 - 1) Minimum air flow adjustment must be accessible from the room side of the chassis and hidden behind the plaque face. Airflow minimum shall be adjustable without tools and must have a readable gauge with a range from 20% to 100% of maximum flow.
 - 2) Balancing mode must be accessible from the room side of the chassis without opening the hinged plaque. Release of the balancing lever without tools, dial will place the unit into balancing mode.
 - c. Inlet pressure at diffuser shall be at least 0.05" w.c. and maximum of 0.25" w.c.
7. Equivalent to Price VPD Series.

2.5 TYPE "H"– HEAVY-DUTY BAR GRILLES

- A. Description: Typically utilized for wall mounted exhaust or return air inlet locations.
 1. Grille shall be all aluminum construction, minimum of 0.032-inch thick border, 1/2-inch horizontal blade spacing with 0-degree deflection. Reinforced blades at 6-inch centers.
 2. Surface mounted with screw holes in the integral device mounting flange.
 3. Baked white enamel finished unless otherwise denoted on Drawings.
 4. Refer to Project Drawings for grille size(s) and required connections.
 5. Equivalent to Price 97 series.

2.6 TYPE "R" and "E" – PERFORATED GRILLES

- A. Description: Grilles for ceiling-mounted exhaust-, return- or transfer-air.
 1. Grille shall have extruded aluminum borders with a perforated steel face of 3/16-inch diameter holes, staggered on 1/4-inch offset centers with no less than 51% free area.
 2. Back-Pan: One-piece die-formed steel with identified connection sizes, where necessary.
 3. Finish: Baked white enamel, unless otherwise denoted on Project Drawings.
 4. Refer to Project Drawings for grille size(s) and required connections.
 5. Accessories: Provide as needed for the described installation condition.
 - a. Include plaster frame assembly for air devices being mounted in hard ceilings.
 - b. Devices open to ceiling plenum shall be equipped with canopy style attenuator.
 - c. Contractor may provide opposed blade damper (OBD) where necessary to allow damper installation in where a duct mounted damper is necessary but not possible; provide remote damper operator where damper location is not accessible or as noted on the Project Drawings.
 6. Equivalent to Price PDDR for ceilings with manufacturer or contractor fabricated back-pans for devices requiring duct connections identified on Project Drawings, without back-pans for plenum return applications, or Price 10 series for wall installations.

2.7 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall comply with NFPA 90A.
- B. Connect rigid supply, return, and exhaust ducts to air devices with acoustically rated flexible duct between rigid duct installation and air device. Flexible duct shall extend a minimum of 6-feet and maximum 8-feet. Do not utilize flexible duct at exposed duct installations.
- C. Contractor to shop fabricate sheet metal transition for installation from air device outlet to duct size shown on Project Drawings if air device provided has no manufacturer fabricated back-pan to otherwise provide this means of transition.
- D. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

END OF SECTION 23 37 13

SECTION 23 74 13 – PACKAGED AIR HANDLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1. Package air-handlers.
2. Roof-mounted sound dampening plenum curbs.

1.3 SUBMITTALS

- A. Product Data: Include manufacturer's technical data, including functionality, rated capacities, dimensions, clearances, characteristics, furnished specialties, and accessories.
- B. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. ARI Compliance:
 1. Comply with ARI 210/240 and ARI 340/360; unit testing and rating efficiencies.
 2. Comply with ARI 270; unit testing and rating sound performance.
- B. ASHRAE Compliance:
 1. Comply with ASHRAE 15 for refrigeration system safety.
 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
 3. Comply with ASHRAE/IESNA 90.1 for minimum efficiency of heating and cooling.
- C. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
- D. UL Compliance: Comply with UL 1995.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and intended use.

1.5 WARRANTY

- A. Manufacturer shall replace components that fail within below specified warranty period.
 1. One-year parts and labor unit warranty from date of Substantial Completion
 2. Five-year compressor parts and labor warranty from date of Substantial Completion.

1.6 EXTRA MATERIALS

1. Filters: One set of filters.

PART 2 - PRODUCTS

2.1 PACKAGED AIR-HANDLERS

- A. Basis-of-Design Product: Subject to compliance, provide Trane Precedent (YSJ) Standard Efficiency Packaged Air Handler or comparable by:
 1. Carrier.
 2. Daikin.
 3. Johnson Controls.
- B. Casing

1. Casing shall be constructed of zinc coated, heavy gauge galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 672 hours in a salt spray test in compliance with ASTM B117.
2. Cabinet construction shall allow for all maintenance on one side of the unit. In order to ensure weather and air tight seal, service panels shall have hinged panels for service and access points, and removable panels with lifting handles for other points.
3. All exposed vertical panels and top covers in the indoor air section shall be insulated with a 1/2-inch, 1-pound density foil-faced, fire-resistant, permanent, and odorless glass fiber material. Unit base shall be insulated with 1/2-inch 1-pound density foil-faced, closed-cell material
4. Roof shall be one piece, or where seams exist, double hemmed and gasket sealed to prevent water infiltration.
5. Unit base pan shall have no penetrations within curb perimeter, other than for down-flow applications which require a raised 11/8-inch high supply/return openings to provide water damming.

C. Fan, Drive and Motor Section

1. Equip with direct -driven centrifugal fans.
 - a. Equip supply fan motor with a shaft grounding ring.
 - b. Motors shall be thermally protected.
 - c. All indoor fan motors meet the U.S. Energy Policy Act of 1992 (EPACT).
2. Variable Frequency Motor Controller: Equip with supply fan variable frequency motor controller for variably controlled motor speed operation.
 - a. Variable frequency drive shall be factory installed and tested for supply fan motor speed modulation.

D. Economizer

1. Allow for 100% outdoor-air (OA) operation with 0-100% modulating OA damper with comparative-enthalpy control.
 - a. Economizer shall meet low leak requirements for ASHRAE 90.1, IECC, and CA Title 24 standards.

E. Refrigerant Circuit Components

1. Equip with direct-drive, hermetic, scroll compressors with centrifugal type oil pumps. Compressor motor shall be inverter-duty for variable-speed compressor operation, equipped with suction gas-cooled, and with a voltage utilization range of +/-10% of nameplate voltage.
 - a. Compressor motors shall be able to modulate from 25% to 100% speed.
 - b. Internal overloads shall be provided with the scroll compressors.
 - c. Provide crankcase heaters, phase monitor, low- and high-pressure control.
 - d. Each refrigerant circuit shall have independent factory installed thermostatic expansion device, service pressure ports, and refrigerant line filter driers.
 - 1) Provide access for replacement suction line driers.

F. Coils

1. Evaporator – Cooling Coil
 - a. Direct-expansion cooling coil shall be sized to provide cooling and moisture removal capacity indicated on the equipment schedule.
 - b. Coil shall be of internally finned, 5/16" copper tubes are mechanically bonded to a configured aluminum plate fin with a 16-gauge galvanized or stainless-steel casing.
 - c. Coil face velocity shall not exceed 450 feet per minute.
 - d. Coils shall be secured to their respective supports with stainless steel hardware.
 - e. Coils shall be leak tested at the factory to ensure pressure integrity; rated at 450 PSIG in accordance with ARI standards.
2. Condenser – Heat Rejection Coil

- a. Internally finned, 5/16" copper tubes are mechanically bonded to a configured aluminum plate fin.
 - b. Microchannel type condenser coil with flat streamlined tubes and small ports with metallurgical tube-to-fin bond.
 - c. Coils shall be leak tested at the factory to ensure pressure integrity; rated at 600 PSIG in accordance with ARI standards.
3. Hot-Gas Reheat Refrigerant Coil:
- a. Coil shall be internally finned 5/8-inch O.D. copper tubes mechanically bonded to configured 0.0075-inch aluminum plate fins with a 16 gauge stainless steel with performance certified by ARI standards. All coils shall be fully tested for leaks. Coil and all required refrigerant specialties including heat reclaim solenoid valve, heat reclaim modulating control valve, pump out solenoid valve, suction line accumulator, and liquid line receiver to be integrally piped into the lead refrigeration circuit. Coil to be sized for the schedule temperature rise. Provide coil with a 3-way modulating control valve for modulating hot gas reheat control.
- G. Natural Gas Furnace
- 1. Equip with drum and tube style stainless steel natural gas heat exchanger. Combustion-air blower shall supply premixed fuel to a single burner ignited by a pilotless hot surface ignition system. Equip heat exchanger with 2-stage gas valve.
 - a. Negative pressure modulating gas valve shall be used with a pressure switch at furnace with modulating heat that requires blower operation to initiate gas flow. Combustion blower shall purge heat exchanger 45 seconds before ignition.
- H. Condensate Drain Pans:
- 1. Fabricate stainless steel drain pan with slopes in 2 planes or more for collection of cooling coil condensate (including coil piping connections, coil headers, return bends, and a minimum of 6 inches downstream of cooling-coil face).
 - 2. A minimum of 2 inches deep, and complying with requirements in ASHRAE 62.1.
 - 3. Drain Connections: Drain connection located as denoted on Drawings.
- I. Air Filtration
- 1. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - a. Pre- Filter: 2" Pleated; Minimum 90 percent arrestance, and MERV 8.
 - 2. Air handler unit shall be provided with unitary Interoperable BACnet MS/TP Controller, IBC, as a single zone variable air volume (VAV) operation.
 - 3. Interoperable BACnet Controller (IBC)
 - a. Controls shall be microprocessor based Interoperable BACnet Controllers (IBC) in accordance with the ANSI/ASHRAE Standard 135-1995. IBCs shall be provided for all applications as shown on the project drawings and described in the project specifications herein. The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals.
 - 1) Non-Occupied Operating Mode: Cycle air-handler to recirculate air to provide dehumidification and supplemental heating/cooling control.
 - a) Temperature Set Points: 68-/76-degrees heating/cooling.
 - b) Relative Humidity (RH); 55% RH.
 - c) Expected Air-Handler Operating Conditions:
 - o Supply-Air Temperature Set Point: 56°F (adjustable). Reset for operational efficiency while maintaining comfort for heating, cooling, and dehumidification services.
 - o Supply-Air Fan (SA-Fan): Single-zone VAV operation to provide dehumidification, heating, and cooling services; operating expected at minimum speed during most periods.
 - o Outside Airflow (OA-CFM): 0% air flow.
 - o Building Relief (BLD_RA): Cycle.

- 2) Occupied Operating Mode: Operate air-handler continuously to provide heating, cooling, dehumidification, and 0-100% outside-air modulation for occupant demand-controlled ventilation, comparative enthalpy economizer operation.
 - a) Temperature Set Points: 68-/76-degrees heating/cooling.
 - b) Relative Humidity (RH); 55% RH.
 - c) Expected Air-Handler Operating Conditions:
 - o Supply-Air Temperature Set Point: 72°F (adjustable). Reset for operational efficiency while maintaining comfort for heating, cooling, and dehumidification services.
 - o Supply-Air Fan (SA-Fan): VAV operation to provide occupant ventilation, cooling, heating, and dehumidification services.
 - o Outside Airflow (OA-CFM): 0% to 100% airflow.
- 3) Building Management Control Inputs to Air Handler; Temperature Control System may provide reset functionality of the following points beyond what the unitary controller provides:
 - a) Unit engagement/disengagement (DI).
 - b) Outside/Return-Air Damper Control (AI).
 - c) Supply-Air Fan Speed Control (AI).
- 4) Air-Handler Monitoring Outputs to Building Management System:
 - a) Hot-gas reheat valve operation (AO).
 - b) Filter status (Clogged Filter Switch) (DO).
 - c) Outside air damper position (AO).
 - d) Outside air humidity (AO).
 - e) Outside air temperature (AO).
 - f) Refrigeration system status (DO).
 - g) Refrigeration system operating capacity (AO).
 - h) Return air damper position (AO).
 - i) Room relative humidity (AO).
 - j) Room air temperature (AO).
 - k) Room carbon dioxide level (AO).
 - l) Supply air temperature (AO).
 - m) Supply fan motor status (DO).
 - n) Supply fan motor speed (AO).
 - o) Condensate Overflow Switch (DO)
- b. The IBCs shall communicate with the NAC via an Ethernet connection at a baud rate of not less than 10 Mbps.
- c. The IBC Sensor shall connect directly to the IBC and shall not utilize any of the I/O points of the controller. The IBC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The IBC Sensor shall provide a communications jack for connection to the BACnet communication trunk to which the IBC controller is connected. The IBC Sensor, the connected controller, and all other devices on the BACnet bus shall be accessible by the POT.
- d. All IBCs shall be fully application programmable and shall at all times maintain their BACnet Level 3 compliance. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IBC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
4. Air handling unit unitary controller shall be fully integrated to the central user interface control panel located within building as indicated on the project drawings.
5. Control Enclosure
 - a. Cabinet shall be a part of the air handling unit casing with supplemental heating and/or cooling provided as an integral part to air handling unit design.

J. Accessories

1. Factory Mounted Devices: In addition to the standard unitary control devices or successful, reliable, and safe operation, also provide the unitary controller, crankcase heater, outdoor and return air enthalpy sensors, supply-, return-, and outside-air temperature sensors, condensate overflow, fan-failure and filter pressure switches.
2. Factory Provided Field Mounted Devices: Space mounted temperature, carbon dioxide, and humidity sensors.
3. Hot-Gas Reheat Coil: As described above.
4. Unit Disconnect:
 - a. Factory-Mounted Disconnect Option:
 - 1) Circuit Breaker w/High Short Circuit Current Rating: Equip unit with electrical subsystem that will withstand fault currents up to 65kA compliant with UL 1995 and NEC 440.4 (B).
 - a) Each compressor and indoor fan shall have dedicated overcurrent protection.
 - b) Three phase motors shall be protected by Class J time delay fuses.
 - c) Single phase motors shall be protected by Class CC time delay fuses.
 - d) Protect transformers within Class CC time delay fuses.
 - e) Contactors shall be in rail mounted.
 - 2) High Short Circuit Current Rating: Equip unit with electrical subsystem that will withstand fault currents up to 65kA compliant with UL 1995 and NEC 440.4 (B).
 - a) Each compressor and indoor fan shall have dedicated overcurrent protection.
 - b) Three phase motors shall be protected by Class J time delay fuses.
 - c) Single phase motors shall be protected by Class CC time delay fuses.
 - d) All transformers shall also be protected with Class CC time delay fuses.
 - e) Contactors shall be rail mounted.
 - b. Field-Mounted Disconnect Option: If the above Factory-Mounted Disconnect Option is not available, the contractor remains responsible for an equivalent field-mounted 65kA fused disconnect.
5. Coil hail guards of painted louvered metal condenser coil covers.
6. Full-perimeter curb, as noted below.

2.2 ROOF MOUNTED EQUIPMENT CURBS

- A. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and the perimeter or the equipment base.
 1. Configuration: Self-flashing without a cant strip, with mounting flange.
 2. Overall Height: 16 inches.

PART 3 - EXECUTION

3.1 CONNECTIONS

- A. General Requirements:
 1. Install condensate drain, minimum connection size, with trap.
 2. Duct: Requirements in other Division 23 Section and shown on Project Drawings.
 3. Natural Gas: Requirements in other Division 23 Section and shown on Project Drawings.
 4. Power: Requirements in other Division 26 Section and shown on Project Drawings.

3.2 INSTALLATION

- A. Equipment and/or device(s) shall be installed in the location(s) described by the Project Drawings. If conflicting information from the manufacture's written documentation, seek clarification from the Project Architect.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- C. Tests and Inspections:
 - 1. After installation is complete, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service to complete the following:
 - 1. Verify that labels are clearly visible.
 - 2. Verify that clearances have been provided for servicing.
 - 3. Verify that controls are connected and operable.
 - 4. Verify that filters are installed.
 - 5. Clean condenser coil and inspect for construction debris.
 - 6. Remove packing from vibration isolators.
 - 7. Verify lubrication on fan and motor bearings.
 - 8. Inspect fan-wheel rotation for correct operation without vibration or binding.
 - 9. Adjust fan belts to proper alignment and tension.
 - 10. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
 - 11. Inspect and confirm performance interlocks and protective devices; verify sequences.
 - 12. Operate unit for an initial period as recommended or required by manufacturer.
 - 13. Calibrate thermostats, sensors and other control devices.
 - 14. Adjust and inspect high-temperature and high-pressure limits.
 - 15. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
 - 16. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
 - 17. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
 - 18. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

END OF SECTION 23 74 13

SECTION 23 82 39 - CABINET HEATERS

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. Cabinet unit heaters with centrifugal fans and electric-resistance heating coils.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.
- B. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.4 CLOSEOUT DOCUMENTS

- A. General: Closeout Submittals are to be submitted with Operation and Maintenance (O&M) Manuals only. Do not provide submittals information with O&M Manual:
 - 1. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 CABINET HEATERS

- A. Basis-of-Design Product: Subject to compliance, provide Trane or comparable by:
 - 1. Carrier.
 - 2. Daikin.
 - 3. Johnson Controls.
- B. Description: A factory-assembled and -tested unit complying with ARI 440.
 - 1. Electric cabinet heaters shall comply with UL 2021.
- C. Heating Section Insulation: ASTM C 1071; surfaces exposed to airstream shall be aluminum-foil facing or erosion-resistant coating to prevent erosion of glass fibers.
 - 1. Thickness: 1/2 inch.
 - 2. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.
 - 3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
 - 4. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.
- D. Cabinet: Steel with manufacturer's baked-enamel standard finish, in color selected by Architect.

1. Horizontal Recessed Unit; Exposed Bottom: Minimum 0.0528-inch thick, galvanized, sheet steel, removable panels secured with tamperproof cam fasteners and safety chain. Air inlet and outlet louvers shall be stamped into bottom panel.
 2. Recessing Flanges: Steel, finished to match cabinet for full or partial recessing.
 3. Control Access Door: Key operated.
- E. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Glass Fiber Treated with Adhesive: 80 percent arrestance and MERV 7.
- F. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
- G. Fan and Motor Board: Removable.
1. Fan: Forward curved, high static, double width, centrifugal; directly connected to motor. Thermoplastic, painted steel or aluminum wheels.
 2. Motor: Permanently lubricated, multispeed electronically commutated (EC) motor (ECM).
 3. Wiring Terminations: Connect motor to chassis wiring with plug connection.
- H. Electrical Connection: Factory wire motors and controls for a single field connection.
1. NEMA Toggle-style service disconnect switch.
 2. Motor speed controller.
- I. Controls:
1. Unitary Controller: Provide independent unitary controller with stainless steel flat plate thermistor to cycle heater to maintain heating setpoint of 65°F.

PART 3 - EXECUTION

- A. Examine areas to receive unit heaters and electrical connections for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation once satisfactory conditions are met.

3.2 INSTALLATION

- A. Install cabinet unit heaters to comply with NFPA 90A.

3.3 CONNECTIONS

- A. Comply with safety requirements in UL 1995.
- B. Ground equipment and connect wiring in according to Division 26 Sections "Grounding and Bonding for Electrical Systems" and "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

END OF SECTION 23 82 39

SECTION 26 00 05 – ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 DEMOLITION SUMMARY

- A. This Section Includes Electrical Demolition which includes but is not limited to:
 - 1. Luminaires.
 - 2. Electrical receptacles.
 - 3. Fire Alarm System or devices.
 - 4. Conduit
 - 5. Underground work
 - 6. Grounding
- B. Refer to drawings for additional requirements

1.2 DEFINITIONS

- A. Refer to abbreviations on Symbol Legend drawings
- B. Refer to Demolition Coded Notes on drawings

1.3 COORDINATION

- A. Contractor shall visit project site before bidding. Verify all conditions, electrical equipment required for demolition and additional demolition that would interfere with new construction.
- B. Refer to architectural, mechanical and plumbing demolition drawings for electrical equipment that will be removed or disconnected, and include in bid.
- C. Coordinate arrangement, mounting, and support of electrical equipment.
- D. Electrical service to the building or any section of this building shall be maintained at all times. If any outage is required, contractor shall obtain written approval from owner or cm at least 48 hours prior to outage.
- E. The integrity and functionality of the fire alarm system shall be maintained to provide continuous operation during construction. If an outage is required it must be approved in writing by the authority having jurisdiction.

PART 2 - ELECTRICAL NOTES

- 2.1 All equipment and conduit shown on the demolition drawings is existing and shall remain in service unless noted otherwise.
- 2.2 All exposed conduit noted to be removed shall be removed in its entire length, unless noted otherwise.
- 2.3 All concealed conduit noted to be removed shall be removed for exposed portions and abandoned in concealed location, unless noted otherwise. Remove all conductors and cap remaining conduit at both ends.
- 2.4 All underground conduit noted to be removed shall be removed for exposed portions and abandoned in underground location, unless noted otherwise. Remove all conductors and cap remaining conduit at both ends.
- 2.5 All conductors noted to be removed, or in conduit which is noted to be removed, shall be removed in its entirety

- 2.6 All conductors scheduled to be removed shall be disposed of, unless noted below or otherwise.
- 2.7 All luminaires scheduled to be removed, shall be carefully removed by contractor and disposed of, unless noted below or otherwise. Remove conduit drop to fixture.
- 2.8 Panel and equipment designations indicated are existing. Refer to new drawing panel board schedule for any new designations. Provide new nameplate as required.
- 2.9 Provide blank cover plates where devices are removed and flush box will remain.
- 2.10 Where walls to remain are damaged by demolition of electrical equipment, patch or repair to match adjacent surfaces and repaint.
- 2.11 All conduit that is reused shall be re-supported as required per National Electrical Code.
- 2.12 When existing circuit conductors are required to be reused, verify continuity, intercept in a new or existing junction box or wireway. Extend new conductors as required per National Electrical Code. Do not splice existing conductors in panelboards. Label conductors as each end.

PART 3 - EXECUTION

- 3.1 When existing equipment that is required to be removed shall be removed by Contractor and disposed of offsite unless noted otherwise. Non Hazardous demolition and construction waste related to the electrical scope of work shall be salvaged, or recycled as much as possible. See specification section 017419-“Construction Waste Management and Disposal” for requirements.
- 3.2 When existing equipment that is required to be relocated it shall be carefully removed with all components, stored in a dry location, protected, cleaned and re-installed where shown.
- 3.3 When existing luminaires are required to be relocated, they shall be cleaned and re-lamped with the appropriate lamp.
- 3.4 Hazardous Demolition Waste. Hazardous demolition and construction waste related to the electrical scope of work shall be disposed of or recycled. See specification section 017419-“Construction Waste Management and Disposal” for requirements. The following materials may be present and if so must be disposed of in compliance with statutory requirements.
 - A. Polychlorinated Bi-phenol liquids, (PCB's) such as but not limited to Askarel.
 - B. Liquid filled transformers with liquids such as but not limited to mineral oil, high molecular weight hydrocarbons (MWHC), Silicone, etc
 - C. PCB ballasts or capacitors
 - D. Asbestos insulation on conductors.
 - E. Lamps containing mercury, such as but not limited to compact fluorescent (CFL), mercury vapor, etc
 - F. Fluorescent lamps containing phosphors
 - G. Rechargeable batteries with heavy metals such as but not limited to Nickel Cadmium, etc
 - H. Lead acid batteries

END OF SECTION 26 00 05

SECTION 26 00 50 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Electrical equipment coordination and installation.
 2. Substitutions
 3. Sleeves for raceways and cables.
 4. Sleeve seals.
 5. Grout.
 6. Common electrical installation requirements.
 7. Plywood backing panels.

1.2 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.
- C. Provide: Furnish and Install

1.3 SUBSTITUTIONS

- A. Refer Division 01, Section 012500, Substitution Procedures for contractual requirements
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Submission of the "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least ten days prior to bid due date. If a manufacturer substitution is approved and allowed, it will be issued by Addendum.
- C. It is the Contractors responsibility to prove that the product submitted for substation is equal or exceeds the requirements. The Engineer's decision will be based on samples submitted and technical literature presented. If the information provided is not adequate, then the substation shall be denied.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 3. To allow right of way for piping and conduit installed at required slope.
 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Equipment, furnished by others but installed by Division 26 shall include, but is not limited to: variable frequency controllers, variable speed controllers, motor starters, pump controllers, disconnect switches, flow switches, pressure switches and other control devices. Refer to Mechanical system drawings and specifications, such as Division 23, which shall require equipment to be furnished by them, but installed by others. Division 26 Contractor shall review those documents and make provisions to install that equipment. Refer to specification section 26 29 13 for additional requirements.

- C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.4 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, not less than 3/4-inch nominal thickness.
 - 1. Fire-Retardant-Treated Materials: Comply with performance requirements in AWPA C27.
 - a. Use Interior Type A, unless otherwise indicated.
 - b. Fire retardant treated wood products shall be free of halogens, sulfates, ammonium phosphate, and formaldehyde.
 - 2. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.

- B. Measure indicated mounting heights to bottom of unit for suspended items and wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.
- N. Interior Sleeves for Fiber Optical and Voice and Data Communications Cables: Construct of 2-inch metallic conduit, unless otherwise indicated, with insulated bushings on each end.
 1. Length: 12 inches longer than width of wall.

2. Location: Install 12 inches above finished ceiling.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 PLYWOOD BACKING PANEL INSTALLATION

- A. Provide in main cross-connect/equipment rooms, telecommunication rooms, and other locations indicated.
- B. Install vertically, 12 inches above finished floor.
- C. Paint plywood backing panels with two coats of fire-retardant paint. Do not paint over classification marking of testing and inspecting agency.

3.5 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Firestopping."

END OF SECTION 26 05 00

SECTION 26 05 05 - ELECTRICAL TESTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for electrical field testing and inspecting of all electrical systems for this project. Each Division 26 Section shall reference components that require testing. The detailed requirements shall be defined in this section, including but not limited to the following:
1. Qualifications of testing agencies and their personnel.
 2. Suitability of test equipment.
 3. Calibration of test instruments.
 4. Coordination requirements for testing and inspecting.
 5. Reporting requirements for testing and inspecting.

1.2 QUALITY ASSURANCE

- A. Testing Agency Qualifications: As specified in each Section containing electrical testing requirements and in subparagraph and associated subparagraph below.
1. Independent Testing Agencies: Independent of manufacturers, suppliers, and installers of components to be tested or inspected.
 - a. Testing Agency's Field Supervisor for Power Component Testing: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Division 16 power component Sections.
- B. Test Equipment Suitability: Comply with NETA ATS, Acceptance Testing Specification, Section 5.2.
- C. Test Equipment Calibration: Comply with NETA ATS Acceptance Testing Specification, Section 5.3.

PART 2 - PRODUCTS

2.1 COMPONENTS TO BE TESTED

- A. Low Voltage Cables, Section 26 05 19
1. Perform the following field tests and inspections:
 - a. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - b. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 2. Test Reports: Prepare a written report to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
 3. Remove and replace malfunctioning units and retest as specified above.
- B. Grounding and Bonding, Section 26 05 26
1. Perform the following tests and inspections:
 - a. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - b. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal.
 2. Test Reports: Prepare a written report to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.

- c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements
 - 3. Report measured ground resistances that exceed the following values:
 - a. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
 - 4. Excessive Ground Resistance: If resistance to ground exceeds specified values above, notify Architect/Engineer promptly. Provide additional grounds rods connected to the building ground ring or offer recommendations to reduce ground resistance.
- C. Low-Voltage Transformers, Section 26 22 00
 - 1. Perform the following field tests and inspection:
 - a. After installing transformers but before primary is energized, verify that grounding system at substation is tested at specified value or less.
 - b. After installing transformers and after electrical circuitry has been energized, test for compliance with requirements.
 - c. Perform visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Test Reports: Prepare written reports to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective actions taken to achieve compliance with requirements.
 - 3. Remove and replace units that do not pass tests or inspections and retest as specified above.
 - 4. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.
- D. Wiring Devices, Section 26 27 26
 - 1. Perform tests and inspections and prepare test reports.
 - a. Test Instruments: Use instruments that comply with UL 1436.
 - b. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
 - 2. Tests for Convenience Receptacles:
 - a. Line Voltage: Acceptable range is 105 to 132 V
 - b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 - c. Ground Impedance: Values of up to 2 ohms are acceptable.
 - d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - e. Using the test plug, verify that the device and its outlet box are securely mounted.
 - f. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above:

PART 3 - EXECUTION

3.1 GENERAL TESTS AND INSPECTIONS

- A. If a group of tests are specified to be performed by an independent testing agency, prepare systems, equipment, and components for tests and inspections, and perform preliminary tests to ensure that systems, equipment, and components are ready for independent agency testing. Include the following minimum preparations as appropriate:
 - 1. Perform insulation-resistance tests.
 - 2. Perform continuity tests.
 - 3. Perform rotation test (for motors to be tested).
 - 4. Provide a stable source of single-phase, 208/120-V electrical power for test instrumentation at each test location.

- B. Test and Inspection Reports: In addition to requirements specified elsewhere, report the following:
1. Manufacturer's written testing and inspecting instructions.
 2. Calibration and adjustment settings of adjustable and interchangeable devices involved in tests.
 3. Tabulation of expected measurement results made before measurements.
 4. Tabulation of "as-found" and "as-left" measurement and observation results.

END OF SECTION 26 05 05

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Sections include the following:
 - 1. Division 26 Section "Common Work Results for Electrical" for sleeves and sleeve seals for cables.
 - 2. Division 27 Section "Communications Copper Horizontal Cabling" for cabling used for voice and data circuits.

1.2 SUBMITTALS

- A. Quality Assurance/Control Submittal:
 - 1. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, XHHW, and SO
 - 1. Provide No. 6 AWG and smaller conductors with color-coded insulation.
- C. Multiconductor Cable: Comply with NEMA WC 70 for Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper, No. 10 AWG, minimum.
 - 1. Feeder Conductor sizes indicated on drawings are for copper conductors, unless indicated otherwise.
 - 2. Branch Circuits: Copper. No. 12 AWG, minimum.
- B. Class 1 Control Circuits: Copper. No. 14 AWG, minimum.
- C. Class 2 Control Circuits: Copper. No. 16 AWG, minimum.

- D. Voltage drop shall not exceed 3 percent from panelboard to farthest outlet.
 - 1. Maximum permitted length of 20 amp, 120, 208, and 240 volt circuits using No. 12 AWG copper wire is 100 feet.
 - 2. Maximum permitted length of 20 amp, 120, 208, and 240 volt circuits using No. 10 AWG copper wire is 140 feet.
 - 3. Maximum permitted length of 20 amp, 277 and 480 volt circuits using No. 12 AWG copper wire is 170 feet.
 - 4. Maximum permitted length of 20 amp, 277 and 480 volt circuits using No. 10 AWG copper wire is 250 feet.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN-THWN, single conductors in raceway; or Type XHHW, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway; or Type XHHW, single conductors in raceway.
- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway; or Type XHHW, single conductors in raceway.
- D. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Installed in Accessible Ceiling Spaces and Gypsum-Board Partitions: Type THHN-THWN, single conductors in raceway; or metal-clad cable, Type MC; or manufactured wiring system.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- I. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- J. Class 2 Control Circuits: Type THHN-THWN, in raceway; power-limited cable, concealed in building finishes; or power-limited tray cable, in cable tray.
 - 1. Exposed-Structure Type Ceiling Spaces: Install Class 2 control circuits in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

- E. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- G. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. 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.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

- A. Quality Assurance/Control Submittals:
 - 1. Field quality-control test reports.
- B. Closeout Documents:
 - 1. Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
 - a. Test wells.
 - b. Building Ground rods.
 - c. Ground rods at light poles
 - d. Ground rings.
 - e. Connections to building steel
 - f. Connections to roof steel
 - 2. Photographs- Take a minimum of 15 digital photo graphs with visible dates, documenting the concealed or buried grounding components noted in the previous paragraph.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.
- C. Voice and Data Communications Equipment Grounding: Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter, and comply with ANSI-J-STD-607-A.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 4 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. All cable to cable, cable to rod, cable to steel connection shall be welded connectors: Use exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions. Exothermic welds shall use powdered copper oxide and aluminum to form a molded homogeneous copper joint connection between the copper conductor and the material being bonded to.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 5/8-inch-diameter by 8 feet in length as shown on drawings. If no drawing details are included, then provide 3/4-inch-diameter by 10 feet in length.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Comply with IEEE C2 grounding requirements.
- B. Refer to grounding details on drawings which take precedence. If no drawing details are included, then provide the following.
- C. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on insulated spacers 1 inch, minimum, from wall 24 inches above finished floor, unless otherwise indicated.
 - 2. Dimensions: 1/4-by-4-by-12-inches.
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Exothermic-welded connectors, except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Exothermic-welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Refer to grounding details on drawings which take precedence. If no drawing details are included, then provide the following.
- C. Grounding Manholes: Install a driven ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve at the top of the manhole wall. Connect ground rod to building ground ring or to ground wire in duct bank when applicable.

- D. Grounding Power Feeder Handholes: Install a driven ground rod through bottom of handhole , close to wall, and set rod depth so 4 inches will extend above bottom. If necessary, install ground rod before handhole is placed. Connect ground rod to building ground ring or to ground wire in duct bank when applicable.
- E. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
- F. Provide Grounding Triangle where required. This will consist of 3 ground rods spaced 10 feet apart, connected with a #2/0 bare copper conductor, exothermically bonded to each rod. The Grounding Triangle shall be connected to the building ground ring.
- G. Pad-Mounted Transformers, Switches, and Generators: Install one ground rod and ground ring around the equipment pad. For service entrance transformers provide a Grounding Triangle. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors. Provide a Copper-clad steel ground rod; 5/8-inch-diameter by 8 feet in length at each light pole in excess of 12 feet tall. Bond ground rod to a ground lug in the lighting pole with a minimum #6 bare solid conductor routed up through a ½ " PVC conduit.

3.4 TECHNOLOGY SYSTEM GROUNDING

- A. Voice and Data Communication Equipment: For telephone, video, voice and data, and other communication equipment.
 - 1. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
 - 2. Comply with ANSI-J-STD-607-A.
 - 3. Refer to grounding details on drawings which take precedence. If no drawing details are included, then provide the following:
 - a. MC/ER: Install 1/4-by-4-by-20-inch copper TMGB. Bond TMGB to the following:
 - 1) Electrical service entrance grounding bus with No. 3/0 AWG TMBC.
 - 2) Structural steel with No. 2 AWG insulated grounding conductor.
 - 3) Cable trays and metallic pathways.
 - 4. Refer to grounding details on drawings which take precedence. If no drawing details are included, then provide the following:
 - a. TR: Install 1/4-by-2-by-12-inch copper TGB. Bond TGB to the following:
 - 1) TMGB with No. 3/0 AWG TBB.
 - 2) Structural steel with No. 2 AWG insulated grounding conductor.

3) Cable trays and metallic pathways.

- B. Refer to grounding details on drawings which take precedence. If no drawing details are included, then provide the following. Signal and Communication Equipment: For sound, alarm, security, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.

3.5 INSTALLATION

- A. Comply with NECA 331.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- D. Ground Rods: Drive rods until tops are 2 inches below finished floor or 12 inches below final grade, unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
 3. When ground rod cannot be driven vertically due to shallow bedrock, drive at 45 degree angle so that the top is 12 inches below grade.
 4. When D2 and D3 cannot be installed, bury ground rods as deep as possible but 30 inches minimum to top.
 5. When D2, D3, and D4 cannot be installed, use electrolytic ground rod shall be 2 inch diameter, hollow Type K copper tube, drilled 12 feet deep into rock, straight shaft with No. 4/0 copper conductor exothermically welded to tube, 12 inches from top end. Conductor length shall be as required to run to main grounding bus bar in buildings. Tube shall have weep holes drilled in sides near ends and shall be prefilled with metallic salts. Provide protective access box shall be 10 inches diameter, 12 inches deep, hollow precast concrete with cast iron cover. Provide backfill material shall be as recommended by manufacturer.
- E. Handholes and Manholes: Provide a ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
- F. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts. Install at expansion joints.
 2. Catwalks: Bond straps directly to catwalks and basic structure, taking care not to penetrate any adjacent parts.
 3. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 4. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

- G. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
 - 1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
 - 2. Bury ground ring not less than 24 inches from building foundation.
- J. Only if required on drawings, provide Concrete-Encased Grounding Electrode, (Ufer Ground): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
 - 1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.6 VARIABLE FREQUENCY MOTOR CONTROLLERS

- A. Ensure that VFC and motor frame are properly bonded to the grounding conductor and that equipment grounding conductor is provided in the feeder conduit to the VFC and motor.

3.7 IDENTIFICATION

- A. Identify voice and data communications equipment grounding components, complying with TIA/EIA-606-A.
- B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
 5. Substations and Pad-Mounted Equipment: 5 ohms.
 6. Manhole Grounds: 10 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values above, notify Architect/Engineer promptly. Provide additional grounds rods connected to the building ground ring or offer recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Concrete bases.
- B. Related Sections include the following:
 - 1. Division 26 Section "Identification for Electrical Systems" for cable ties.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.4 SUBMITTALS

- A. Quality Assurance/Control Submittals:
 - 1. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 2. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 3. Channel Dimensions: Selected for applicable load criteria.

- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch-diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
 - 1. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 - 2. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
 - 3. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Not permitted.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.
 - 8. Wire Rope Systems: Galvanized steel wire rope with spring-loaded, key-releasable locking device with the following rated strength:
 - a. 0.059-inch (1.5-mm): 44 pounds.
 - b. 5/64-inch (2-mm): 100 pounds.
 - c. 1/8-inch (3-mm): 200 pounds.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

3.2 SLOTTED SUPPORT SYSTEMS APPLICATIONS

- A. Heated Interior Spaces: Painted steel.
- B. Non-Heated Interior Spaces and Outdoors: Hot-dipped galvanized steel.
- C. Swimming Pools, Swimming Pool Chemical Treatment and Chemical Storage Rooms, Dishwashing Rooms, and Corrosive Environments: Nonmetallic.

3.3 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- F. Exposed Conduits: Use one-hole or two-hole straps 8 feet or less AFF. Conduit clamps and hangers that project past the conduit wall are limited to above 8 feet AFF.
- G. Do not use wood plugs, perforated metal bands, chain, or wire to support electrical equipment, unless otherwise indicated.
- H. Open-Web Joists: Install supports only at panel points. Fasten supports to top of bottom chord of joist. Do not exceed 100 pounds working load per panel point.
- I. Roof and Elevated Floor Decks: Do not fasten supports to roof decks or elevated floor decks.

3.4 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.5 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base. Chamfer edges 1 inch.
 - 1. Base Height: 3.5 inches, unless indicated otherwise.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.6 CONCRETE CURBS

- A. Construct concrete curbs of dimensions indicated but not less than 4 inches larger in both directions than outline of electrical enclosures above, so conduits will be a minimum of 2 inches from edge of the base. Chamfer edges 1 inch.
 - 1. Base Height: Match finish wall base material, but not less than 3.5 inches.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

3.7 PAINTING

- A. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 - CONDUIT AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes conduits, fittings, boxes, outlet boxes, floor boxes, high capacity floor boxes enclosures, and cabinets for electrical wiring. The term raceway shall also apply to conduit and boxes.
- B. Related Sections include the following:
 - 1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
 - 2. Division 26 Section "Wiring Devices" for mounting heights of devices.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RMC: Rigid metal conduit.
- F. RNC: Rigid nonmetallic conduit.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. Voice and Data Communications Pathways: Install conduit, raceways, and boxes according to BICSI TDM, "Horizontal Distribution Systems" Chapter, and comply with NECA 568.

1.4 COORDINATION

- A. HVAC Control and Monitoring: Verify locations of temperature control panels with Building Management System installer.
- B. IDF: Verify locations of backboards, cable trays, equipment cabinets and racks, and conduit stub-outs with Voice and Data Communications Cable installer

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. RMC: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.

- D. FMC: Zinc-coated steel or aluminum.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Die-cast type, pot-metal type, and indenter type fittings are not permitted.
 - 2. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 3. Fittings for EMT: Steel, compression type.
- G. Joint Compound for RMC or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT

- A. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- B. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
 - 1. Gangable boxes are not permitted.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic.
- F. Cabinets:
 - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.

2.4 FLOOR BOXES

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
 - 1. Gangable boxes are not permitted.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Metal Floor Boxes: Cast metal, fully adjustable, rectangular; one, two, or three gangs as indicated.
 - 1. Slabs-on-Grade: Threaded hubs to accommodate at least four 1-inch conduits.
 - a. Minimum Box Height: 3.19 inches without base screws.
 - b. Minimum Depth of Pour: 3.75 inches.

2. Elevated Floor Slabs: Threaded hubs to accommodate at least four 3/4-inch conduits.
 - a. Minimum Box Height: 2.00 inches without base screws.
 - b. Minimum Depth of Pour: 2.00 inches.

2.5 TELCOMMUNICATIONS CONDUIT BODIES

- A. General Description: Conduit bodies specifically designed to maintain the required bend radius for data and communications cabling, complying with BISCIT DMM "Horizontal Distribution Systems" Chapter.
 1. Material: Die-cast aluminum.

PART 3 - EXECUTION

3.1 CONDUIT APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 1. Exposed Conduit: RMC or IMC.
 2. Concealed Conduit, Aboveground: RNC, Type EPC-40-PVC.
 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
 1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed and Subject to Physical Damage: RMC. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Kitchens.
 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 4. Concealed in Exterior Walls: RNC, Type EPC-40-PVC
 5. Concealed Under Slabs-on-Grade: RNC, Type EPC-40-PVC.
 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 7. Damp or Wet Locations: RMC or IMC.
 8. Conduits for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
 9. Conduits for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
 10. Conduits for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
 11. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum RMC, IMC, EMT, or RNC, Type EPC-40-PVC Size: 1/2-inch trade size, unless indicated otherwise.
- D. Minimum FMC or LFMC Size: 1/2-inch trade size, unless indicated otherwise.
- E. Conduit Fittings: Compatible with raceways and suitable for use and location.
 1. RMC or IMC: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 OUTLET AND DEVICE BOX APPLICATION

- A. Flush Boxes in Masonry Walls and Partitions: Use masonry boxes at least 3.5 inches deep.
- B. Flush Boxes in Gypsum-Board Partitions: Use square boxes at least 2.125 inches deep with raised box covers.

- C. Flush Device Boxes in Ceilings: Use square boxes at least 2.125 inches deep with raised box covers.
- D. Flush Outlet Boxes in Ceilings: Use 4-inch round or octagonal boxes at least 2.125 inches deep.
- E. Surface Boxes: Use cast-metal type with matching cover. Provide knock-out plugs in unused openings.

3.3 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support conduits as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Conceal conduit and EMT within finished walls, ceilings, and below floors, unless otherwise indicated.
- G. Conduits Beneath Concrete Slabs:
 - 1. Install conduit parallel or at right angles building lines, at least 1 inch below top of drainage fill.
 - 2. Arrange conduits to cross building expansion joints at right angles with expansion fittings.
 - 3. Do not embed conduits in concrete slabs.
- H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- I. Conduit Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- K. Install conduit sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed conduits, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install conduit sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- L. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
 - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.

3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- M. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations.
- N. Recessed Boxes in Masonry Walls: Coordinate work with masonry contractor. Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Box shall be vertically plumb and flush with plane of wall, or slightly recessed. All boxes installed improperly will be replaced at Contractors expense. Provide oversized plate for all boxes that have exposed joints.
- O. Recessed Boxes in Gypsum-Board Partitions: Coordinate work with drywall contractor. Box shall be vertically plumb and flush with plane of wall, or slightly recessed. All boxes installed improperly will be replaced at Contractors expense. Provide oversized plate for all boxes that have exposed joints.
- P. Metal Floor box installations: Install all conduit and boxes level prior to pouring concrete. Align rectangular or square boxes to be parallel and perpendicular with room walls. If owner representative is not present before the concrete is poured, take a minimum of 3 digital photograph of typical installation. Verify finished floor surface prior to pour. When installed in tile or finished concrete floor, ensure that final surface fitting and plate will be flush and not protrude above the finished plane. Install trim kit after floor is poured to fit flush with finished surface.
- Q. Conduits less than 3-inch trade size may be field bent, unless indicated otherwise. Use factory 45 and 90 degree, and special radius elbows for conduits 3-inch and larger.
- R. Conduits for Feeders: Electrically continuous, terminated with grounding and insulating bushings.
- S. Conduits for Branch Circuits: Electrically continuous.
- T. Finished Spaces: Provide escutcheons where conduits penetrate surfaces of finished spaces. Match finish of adjacent surfaces.
- U. Conduits for Optical Fiber and Voice and Data Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
 2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
 4. Elbows: Use factory elbows. Field bent elbows are not permitted for optical fiber and communications cables.
 - a. Radii of Elbows for Conduits 1-1/2-inches and Larger: At least 10 times inside diameter of conduit.
 5. Conduit Bodies: Use telecommunications conduit bodies.
- 3.4 NON METALLIC CONDUIT
- A. Provide a continuous equipment ground conductor in all conduits with branch circuits or feeders.
 - B. Do not use steel, metallic conduit for any bare grounding conductors.

3.5 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
 - 2. Handholes and boxes.

1.2 DEFINITION

- A. RNC: Rigid nonmetallic conduit.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
- B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

1.6 COORDINATION

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect/Engineer.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Galvanized Steel Conduit: Comply with ANSI C80.1. Use RGS when noted in this specification or where required on drawings.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
- B. Duct Accessories:
 - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
 - 2. Warning Tape: Underground-line warning tape specified in Division 260553 Section "Identification for Electrical Systems."

2.3 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Description: Comply with SCTE 77.
 - 1. Color:
 - a. Paved and Off-Road Locations: Gray.
 - b. Grass and Turf Locations: Green.
 - 2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering. Selected to suit system.
 - a. Legend: "ELECTRIC" for duct systems with power wires and cables for systems operating at 600 V and less.
 - b. Legend: "COMMUNICATIONS" for communications, data, and telephone duct systems.
 - 6. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.
- B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

2.4 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EB-20-PVC, in concrete-encased duct bank, unless otherwise indicated. A feeder is defined as any circuit shown on the one line diagram or any circuit with an overcurrent device in excess of 150 amperes. Underground feeders below concrete slab on grade shall be excluded from the requirement of concrete encasement.
- B. Underground Ducts for any electrical feeder or branch that is part of the Emergency System or Optional Standby System or Legally Required Standby System: RNC, NEMA Type EB-20-PVC, in concrete-encased duct bank, unless otherwise indicated.
- C. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.
- D. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, installed in direct-buried duct bank, unless otherwise indicated.
- E. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.
- F. Install underground ducts for telephone, communications, or data utility service cables at least 24 inches from underground ducts for electrical feeders or branch circuits.
- G. Underground Ducts Crossing Paved Paths, Walkways, Driveways, and Roadways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.2 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:
 - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
 - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Use one of the following:
 - a. Precast concrete. AASHTO HB 17, H-20 structural load rating.
 - b. Polymer concrete, SCTE 77, Tier 15 structural load rating.
 - c. Fiberglass enclosures with polymer concrete frame and cover, SCTE 77, Tier 15 structural load rating.
 - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Use one of the following:
 - a. Precast concrete. AASHTO HB 17, H-10 structural load rating.
 - b. Polymer concrete units, SCTE 77, Tier 8 structural load rating.
 - c. Heavy-duty fiberglass units with polymer concrete frame and cover, SCTE 77, Tier 8 structural load rating.
 - 4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin or high-density plastic, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
 - 5. Minimum Dimensions for Telephone, Communications, and Data Wiring Handholes: 30 by 42 by 36-inches deep.
 - 6. Units in Artificial Turf and Synthetic Track Material: Sports Field Pockets.

3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

3.4 DUCT INSTALLATION

- A. Comply with NECA 605.
- B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.
- D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- E. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Grout end bells into structure walls from both sides to provide watertight entrances.
- F. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Common Work Results for Electrical."
- G. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- H. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.
- I. Concrete-Encased Ducts: Support ducts on duct separators.
 - 1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - 2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
 - 3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
 - 4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
6. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
8. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
 - 1) Where steel conduit stub-ups are prohibited by the electrical utility company, use manufactured duct elbows for stub-ups. Extend concrete encasement throughout the length of the elbow
9. Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at approximately 8 inches below finished grade. As a minimum, bury warning tape approximately 12 inches above concrete envelope. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall. Space additional tapes 12 inches apart, horizontally.

J. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches in nominal diameter.
4. Install backfill as specified in Division 31 Section "Earth Moving."
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

- 1) Where steel conduit stub-ups are prohibited by the electrical utility company, use manufactured duct elbows for stub-ups. Extend concrete encasement throughout the length of the elbow
11. Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at approximately 8 inches below finished grade. As a minimum, bury warning tape approximately 12 inches above ducts. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall. Space additional tapes 12 inches apart, horizontally.

3.5 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line, 42 inches below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 1. Concrete: 3000 psi , 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.
 2. Dimensions: 10 inches wide by 12 inches deep.

3.6 GROUNDING

- A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.8 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 26 05 43

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Identification for conductors and control cable.
 - 2. Underground-line warning tape.
 - 3. Warning labels and signs.
 - 4. Instruction signs.
 - 5. Equipment identification labels.
 - 6. Factory nameplates
 - 7. Miscellaneous identification products.

1.2 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.3 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
 - 1. Power Circuits: Black letters on an orange field.
 - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend shall indicate type of underground line by name. Use yellow "ELECTRIC" for general use. Use red "HIGH VOLTAGE" for cables in excess of 600 volts. Use "LOW VOLTAGE" for communication, alarm systems telecom cables etc. Use orange "FIBER OPTIC" for fiber optic cables.

2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
- C. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches .
- D. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 IDENTIFICATION LABELS

- A. All labels required below in Part 3.0 shall meet the following requirements.
 - a. Indoor Equipment: Engraved, laminated acrylic, melamine label or metal. Mounted with corrosion-resistant screws or permanent adhesive.
 - b. Outdoor Equipment: Engraved, laminated acrylic, melamine label or metal. Mounted with corrosion-resistant screws.
 - c. Nameplates shall have a black or dark-gray background with white engraved letters and numbers
 - d. Nameplates for emergency systems or power transfer equipment shall have a red background with white engraved letters and numbers.
 - e. Minimum letter height shall be 3/8 inch.
 - f. Do not use Kroy labels, paper labels

- g. Do not use double stick tape to attach laminated labels.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, fluoropolymer cable ties suitable for ducts or plenums; and other spaces used for environmental air.
 - 1. Flammability Rating: UL94V-0.
 - 2. Minimum Width: 3/16 inch .
 - 3. Tensile Strength: 50 lb, minimum.
 - 4. Temperature Range: Minus 40 to plus 185 deg F.
 - 5. Color: Maroon.
- B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Accessible Raceways and Cables of Fire Alarm Systems: Identify junction boxes by painting boxes and covers red.
- B. Power-Circuit Conductor Identification: For primary and secondary conductors No. 4 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use marker tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- C. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number.
- D. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install as required in Div 26 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS.
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel or metal-backed, butyrate warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
 - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

- H. Instruction Signs:
1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.
- I. Factory installed nameplates. All equipment shall have a factory installed nameplates. Do not install nameplates inside of the equipment. Nameplate shall be metal. Provide the following information on the exterior of panel or inside the door.
1. UL listing.
 2. Name of manufacturer
 3. Ampere and voltage rating and phasing
 4. Short circuit rating
- J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with drawings, wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
 - 1) For single-gang motor starting switches use 3/8-inch high letters on 3/4-inch high by 2.25-inch wide label.
 - 2) For two-gang motor starting switches, use 3/8-inch high letters on 3/4-inch high by 4 inch wide label.
 - b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - c. (For example) PANEL 1AL1, 1AL2.
 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.
 - c. Electrical switchgear and switchboards.
 - d. Transformers.
 - e. Electrical substations.
 - f. Emergency system boxes and enclosures.
 - g. Motor-control centers.
 - h. Disconnect switches.
 - i. Enclosed circuit breakers.
 - j. Motor starters.
 - k. Push-button stations.
 - l. Power transfer equipment.(Identify "Emergency" and "Optional Standby")
 - m. Contactors.
 - n. Remote-controlled switches, dimmer modules, and control devices.
 - o. Battery inverter units.
 - p. Battery racks.
 - q. Power-generating units.
 - r. Uninterruptible power supply equipment.
- K. Electrical Energy Source Identification Labels: On each unit of equipment, install unique label to identify the energy source that is consistent with drawings, wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
 - a. Indoor Equipment: Unless otherwise indicated, provide a single line of text with 3/8-inch- high letters on 3/4-inch- high label; where 2 lines of text are required, use labels 1.5 inches high.
 - b. (For example) FED FROM MAIN SWITCHBOARD MSBL.
 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Electrical switchgear and switchboards.
 - c. Transformers.
 - d. Electrical substations.
 - e. Emergency system boxes and enclosures.
 - f. Motor-control centers.
 - g. Disconnect switches.
 - h. Enclosed circuit breakers.
 - i. Motor starters.
 - j. Power transfer equipment.
 - k. Contactors.
 - l. Battery inverter units.
 - m. Battery racks.
 - n. Voice and data cable terminal equipment.
 - o. Master clock and program equipment.
 - p. Intercommunication equipment.
 - q. Audio components, racks, and controls.
 - r. Fire-alarm control panel and annunciators.
 - s. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
 - t. Monitoring and control equipment.
 - u. Uninterruptible power supply equipment.
 - v. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
 - w. Junction boxes and pull boxes with covers larger than 5-by-5-inches.
 3. For wiring devices: On inside (back) of cover plate, write the panel name for energy source and circuit number with permanent, indelible ink.
 4. For small Pull Boxes, and small Junction Boxes (less than 5-by-5-inches): On front of cover plate, write the panel name for energy source and circuit number with permanent, indelible ink.
- L. Nominal System Voltage Identification Labels: On each unit of equipment, install unique nominal system voltage and color-coding label that is consistent with drawings, wiring diagrams, schedules, and Operation and Maintenance Manual.
1. Labeling Instructions:
 - a. Indoor Equipment: Unless otherwise indicated, provide a single line of text with 3/8-inch- high letters on 3/4-inch- high label; where 2 lines of text are required, use labels 1.5 inches high.
 - b. (For example) 208/120 V, 3 PH-4W
 2. Equipment to Be Labeled:
 - a. Panelboards.
 - b. Electrical switchgear and switchboards.
 - c. Motor-control centers.
 - d. Safety switches used for service entrance disconnecting means or in mechanical rooms.
 - e. Power transfer equipment
 - f. Generators
- M. Combined equipment labels. When required above a single nameplate can be created for all required information. The equipment identification label **MUST** appear on the first line and shall be notably larger font than the rest of the information, and all information shall appear on a separate line. (For example)

PANEL 1AL1
208/120 V, 3 PH-4W
FED FROM MAIN SWITCHBOARD MSBL

- N. Panelboard Circuit Directories: Provide type-written or laser printed circuit directory on heavy card stock. Arrange in two columns with odd numbered circuits on left and even numbered circuits on right. Include panelboard identification at the top and installation date. Indicate spare circuit breakers: "SPARE". Install in metal frame with clear plastic cover over directory. Handwritten directories are not acceptable. Indicating the load description for all circuit numbers installed.
- O. Feeder and Branch Circuit Load Identification Labels: On each overcurrent protective device, install unique load designation label that is consistent with drawings, wiring diagrams, schedules, and Operation and Maintenance Manual.
1. Labeling Instructions:
 - a. Panelboard Circuit Directories: Provide type-written or laser printed circuit directory on heavy card stock. Arrange in two columns with odd numbered circuits on left and even numbered circuits on right. Include panelboard identification at the top and installation date. Indicate spare circuit breakers: "SPARE". Install in metal frame with clear plastic cover over directory. Handwritten directories are not acceptable. Indicating the load description for all circuit numbers installed.
 - b. Lighting and Appliance Branch-Circuit Panelboards: Use room names and numbers furnished by Owner for the actual room numbers. **Do not** use room names and numbers indicated on Contract Drawings. Load description shall identify each circuit number with its clear, evident, and specific purpose. Load description shall include sufficient detail to allow each circuit to be distinguished from all others.
 2. Distribution Panels and Switchboards: Provide a load identification nameplate adjacent to each overcurrent protective device. Unless otherwise indicated, provide a single line of text with 3/8-inch high letters on 3/4-inch high label; where 2 lines of text are required, use labels 1.5 inches high.
 - a. Label shall identify each circuit number with its clear, evident, and specific purpose. Load description shall include sufficient detail to allow each circuit to be distinguished from all others. **Do not** use paper labels. Use room names and numbers furnished by Owner for the actual room numbers. **Do not** use room names and numbers indicated on Contract Drawings.
- P. GFI receptacles: Provide a self adhesive, factory furnished label on receptacles cover plate, "Protected from ground fault device" (or words to that effect). Apply for all standard receptacles that are fed from a ground fault circuit interrupting breaker or fed downstream from a ground fault circuit interrupting receptacle (as a thru feed device).

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Attach signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- E. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 1. Color shall be factory applied or, for sizes larger than No. 6 AWG if authorities having jurisdiction permit, field applied.
 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.

- c. Phase C: Blue.
 - d. Neutral: White.
 - e. Ground: Green.
3. Colors for 480/277-V Circuits:
- a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - d. Neutral: Gray.
 - e. Ground: Green.
4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- F. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 26 05 53

SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - 1. Distribution transformers.

1.2 SUBMITTALS

- A. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- B. Quality Assurance/Control Submittals:
 - 1. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
 - 2. Source quality-control test reports.
 - 3. Field quality-control test reports.

1.3 CLOSEOUT DOCUMENTS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where title below introduces lists, the following requirement applies for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance only when allowed in Section 260050, General Electrical Requirements.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Aluminum or copper.

2.3 DISTRIBUTION TRANSFORMERS

- A. Manufacturers:
 - 1. Eaton Corporation; Cutler-Hammer Products.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D; Schneider Electric.
- B. Comply with NEMA ST 20 and list and label as complying with UL 1561.
- C. Cores: One leg per phase.
- D. Indoor Enclosure: Ventilated, NEMA 250, Type 2.
- E. Taps for Transformers Smaller Than 3 kVA: None.
- F. Taps for Transformers 7.5 to 24 kVA: Two 5 percent taps below normal full capacity.
- G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- H. Insulation Class for Transformers Rated 14 kVA and Smaller: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- I. Insulation Class for Transformers Rated 15 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- J. Wall Brackets: Manufacturer's standard brackets.
- K. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.
- L. Terminal Boards: Provide top or bottom mounted terminal boards for transformers rated 25 kVA and larger. Loose leads are not acceptable.

- M. Equipment lugs: Provide a mechanical ground lug to the transformer enclosure. In addition, provide a separate ground bar inside the transformer enclosure from termination of all grounding conductors. Refer to grounding details on drawings for location of neutral bonding jumper and method of installation for separately derived systems.
- N. Three-Phase Transformer Minimum Impedance Requirements, Percent Z:
 - 1. 15 kVA: 5.0.
 - 2. 30 kVA: 4.9.
 - 3. 45 kVA: 4.8.
 - 4. 75 kVA: 4.4.
 - 5. 112.5 kVA: 3.9.
 - 6. 150 kVA: 4.4.
 - 7. 225 kVA: 3.9.
 - 8. 300 kVA: 5.5.
 - 9. 500 kVA: 6.0.
 - 10. 750 kVA: 5.4.

2.4 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.
- B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 409.
- B. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - 1. Brace wall-mounting transformers as specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Install and anchor floor-mounting transformers level on concrete bases, 4-inch nominal thickness. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
 2. For floor-mounting transformers, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to floor-mounting transformers.
- D. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- 3.3 CONNECTIONS
- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- 3.4 FIELD QUALITY CONTROL
- A. Perform tests and inspections and prepare test reports.
 - B. Tests and Inspections:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - C. Remove and replace units that do not pass tests or inspections and retest as specified above.
 - D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.
- 3.5 ADJUSTING
- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
 - B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
 - C. Output Settings Report: Prepare a written report recording output voltages and tap settings.
- 3.6 CLEANING
- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 22 00

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.

1.3 SUBMITTALS

- A. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- B. Quality Assurance/Control Submittals:
 - 1. Product Data: For each type of panelboard, overcurrent protective device, surge protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - 2. Field quality-control test reports including the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
 - 3. Panelboard Schedules: For installation in panelboards.

1.4 CLOSEOUT DOCUMENTS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - b. Time-current curves, including selectable ranges for each type of overcurrent protective device.
 - 2. Extra Materials: Receipt for extra materials.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 1. Ambient Temperature: Not exceeding 104 deg F.
 2. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 1. Ambient temperatures within limits specified.
 2. Altitude not exceeding 6600 feet.

1.7 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.8 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. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton Corporation; Cutler-Hammer Products.
 2. Siemens Energy & Automation, Inc.
 3. Square D; Schneider Electric.
- B. Products of other manufacturers will be considered for acceptance only when allowed in Section 260050, General Electrical Requirements.

2.2 MANUFACTURED UNITS

- A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
 1. Rated for environmental conditions at installed location.
 - a. Outdoor Locations: NEMA 250, Type 3R.
 - b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

4. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
5. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

B. Phase and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity; or tin-plated aluminum.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
3. Split Bus: Vertical buses divided into individual vertical sections.

C. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Mechanical type.
2. Ground Lugs and Bus Configured Terminators: Mechanical type.
3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Short-Circuit Current Rating: Refer to drawings for RMS symmetrical, ampere AIC ratings.

1. Series-connected ratings are not permitted.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

B. Main Overcurrent Devices: Thermal-magnetic circuit breaker.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Circuit Identification: Panelboards shall have each circuit number permanently identified, factory installed label, adjacent to breaker. Identification shall stamped into trim or installed engraved circuit numbers or paper labels. If paper labels are used, they must be covered with a continuous, clear, self adhesive, protective plastic sheet.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

- D. Fuses are specified in Division 26 Section "Fuses."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 407.
- B. Install panelboards and accessories according to NEMA PB 1.1.
- C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install overcurrent protective devices and controllers.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Flush Panelboards: Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- I. Panelboards shall not be used as junction boxes, auxiliary gutters, or raceways for conductors feeding through or tapping off to other switches or overcurrent devices. Splices shall not be allowed in any panelboard. Phase conductors shall terminate on breakers and then leave the panelboard either grouped in three phase configuration or with associated neutrals and routed into the branch circuit conduit out to the load.

3.2 IDENTIFICATION

- A. Refer to Division 260533 Section "Identification for Electrical Systems." Provide all identification for field-installed conductors in panels, labels, nameplates, warning signs, etc. including, but not limited to:
 - 1. Equipment Identification Label
 - 2. Nominal System Voltage Identification Label
 - 3. Electrical Energy Source Identification Label
 - 4. Panelboards shall have circuit Directories
 - 5. Distribution Panelboards shall have Load Identification Labels for each Feeder and Branch Circuit
- B. Provide Factory installed nameplates.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Repair exposed surfaces to match original finish.
- B. Vacuum interior of panels to remove dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Snap switches and wall-box dimmers.
 - 4. Wall-switch occupancy sensors.
 - 5. USB charging outlets
 - 6. Spring-wound interval time switches.
 - 7. Cord reels.
 - 8. Pendant cord-connector devices
 - 9. Drop Cords
 - 10. Cord and plug sets.

- B. Related Sections include the following:
 - 1. Division 26 Section "Conduit and Boxes for Electrical Systems" for conduit, metal and nonmetallic floor boxes, poke through service fitting, high capacity floor boxes, etc.
 - 2. Division 26 Section "Lighting Control Devices" for photoelectric switches and occupancy sensors other than wall-switch type.
 - 3. Division 27 Section "Communications Copper Horizontal Cabling" for workstation outlets.

1.2 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.

- B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.3 SUBMITTALS

- A. Quality Assurance/Control Submittals:
 - 1. Product Data: Provide product data sheet for each wiring device or product in this Section and on the Drawings that are specifically applicable to this project. Provide an arrow stamp pointing to the exact catalog number or product and do not merely highlight the information.
 - 2. For special purpose NEMA type receptacles, Submittal shall indicate equipment served for each special purpose receptacle type (e.g. NEMA 15-50R-- "Kiln").
 - 3. Field quality-control test reports.

1.4 CLOSEOUT DOCUMENTS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Arrow Hart/Cooper Wiring Devices; a division of Cooper Industries, Ltd. (Arrow Hart).
 - 2. Hubbell Incorporated; Bryant Electric (Bryant).
 - 3. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 4. Leviton Mfg. Co., Inc. (Leviton).
 - 5. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
- B. Products of other manufacturers will be considered for acceptance only when allowed in Section 260050, General Electrical Requirements.
- C. All wiring devices in this building shall be supplied from the same manufacturer. Use of multiple manufactures of wiring devices in the same building is not allowed.

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, DSCC W C 596G, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; 5361 (single), AH5362 (duplex).
 - b. Bryant; 5361 (single), BRY5362 (duplex).
 - c. Hubbell; HBL5361 (single), HBL5362 (duplex).
 - d. Leviton; 5361 (single), 5362 (duplex).
 - e. Pass & Seymour; 5361 (single), 5362-A (duplex), PT5362A (duplex, with separable pigtailed connector).
- B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; TR8300.
 - b. Bryant; BRY8300TR.
 - c. Hubbell; HBL8300SG.
 - d. Leviton; 8300-SG.
 - e. Pass & Seymour; TR63H, or PTR63H (with separable pigtailed connector).
 - 2. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
- C. Residential Electric Clothes Dryer Receptacles, 125/250 V, 30 A: Comply with NEMA WD 1, NEMA WD 6 configuration 14-30R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; 1257.
 - b. Bryant; 9430FR.
 - c. Hubbell; HBL9430A.
 - d. Leviton; 278.
 - e. Pass & Seymour; 3864.
- D. Residential Electric Oven/Range Receptacles, 125/250 V, 50 A: Comply with NEMA WD 1, NEMA WD 6 configuration 14-50R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; 1258.
 - b. Bryant; 9450FR.

- c. Hubbell; HBL9450A.
 - d. Leviton; 279.
 - e. Pass & Seymour; 3894.
- E. Clock Hanger Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-15R, DSCC W C 596G, and UL 498.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; 93632.
 - b. Bryant; 2828GS.
 - c. Hubbell; HBL5235.
 - d. Leviton; 5261-CH.
 - e. Pass & Seymour; S3733-SS.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; VGF20.
 - b. Bryant; GF20L.
 - c. Hubbell; GF20L.
 - d. Leviton; 7899.
 - e. Pass & Seymour; 2095, or PT2095 (with separable pigtailed connector).
- C. Listed Weather-Resistant Type Duplex GFCI Convenience Receptacles, 125 V, 20 A:
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; WRVGF20.
 - b. Hubbell; GFTR20.
 - c. Pass & Seymour; 2095-TRWR.
- D. Tamper-Resistant Duplex GFCI Convenience Receptacles, 125 V, 20 A:
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; TRVGF20.
 - b. Hubbell; GFTR20.
 - c. Leviton; T7899.
 - d. Pass & Seymour; 2095-TR, or PT2095-TR (with separable pigtailed connector).

2.4 DUPLEX RECEPTACLE WITH USB CHARGER.

- A. Duplex Convenience Receptacles, 125 V, AC, 20 A with USB Charger, Tamper-Resistant: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; TRUSB20x-BOX.
 - b. Bryant; USBB20.
 - c. Hubbell; USB20AC5.
- B. Description: duplex receptacle with two USB Type 2.0 ports, one Type A and one Type C rated 5.0 Amps (minimum) at 5 Volts DC, integral AC/DC transformer, compatible with USB 2.0/3.0 devices, compliance with battery charging specification USB BC1.2, capable of charging two devices simultaneously. Decorator style thermoplastic body and tamper resistant sliding doors will prohibit insertion of objects that are not an electrical plug. Provide device in color to match other supplied wiring devices.

2.5 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-15R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bryant; 4710.
 - b. Arrow Hart; CWL515R.
 - c. Hubbell; HBL4710.
 - d. Leviton; 4710.
 - e. Pass & Seymour; L515-R.

- B. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; CWL520R.
 - b. Bryant; 70520FR.
 - c. Hubbell; HBL2310.
 - d. Leviton; 2310.
 - e. Pass & Seymour; L520-R.

- C. Single Convenience Receptacles, 125 V, 30 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-30R, and UL 498.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; CWL530R.
 - b. Bryant; 70530FR.
 - c. Hubbell; HBL2610.
 - d. Leviton; 2610.
 - e. Pass & Seymour; L530-R.

2.6 SNAP SWITCHES

- A. Comply with NEMA WD 1, DSCC W C 896F, and UL 20.

- B. Switches, 120/277 V, 20 A:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; AH1221 (single pole), AH1222 (two pole), AH1223 (three way), AH1224 (four way).
 - b. Bryant; 4901 (single pole), 4902 (two pole), 4903 (three way), 4904 (four way).
 - c. Hubbell; HBL1221 (single pole), HBL1222 (two pole), HBL1223 (three way), HBL2224 (four way).
 - d. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - e. Pass & Seymour; PS20AC1 (single pole), PS20AC2 (two pole), PS20AC3 (three way), PS20AC4 (four way).

- C. Pilot Light Switches, 20 A:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; AH1221PL for 120 V and 277 V.
 - b. Bryant; 4901PLR120 for 120 V, 4901PLR277 for 277 V.
 - c. Hubbell; HBL1221PL for 120 V and 277 V.
 - d. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - e. Pass & Seymour; PS20AC1-RPL for 120 V, PS20AC1-RPL7 for 277 V.
 2. Description: Single pole, with red neon-lighted handle, illuminated when switch is "ON."

- D. Key-Operated Switches, 120/277 V, 20 A; with factory-supplied key in lieu of switch handle.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; AH1221L (single pole), AH1222L (two pole), AH1223L (three way), AH1224L (four way).
 - b. Bryant; 4901-L (single pole), 4902-L (two pole), 4903-L (three way), 4904-L (four way).
 - c. Hubbell; HBL1221L (single pole), HBL1222L (two pole), HBL1223L (three way), HBL1224L (four way).
 - d. Leviton; 1221-2L (single pole), 1222-2L (two pole), 1223-2L (three way), 1224-2L (four way).
 - e. Pass & Seymour; PS20AC1-L (single pole), PS20AC2-L (two pole), PS20AC3-L (three way), PS20AC4-L (four way).

- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; 1995.
 - b. Bryant; 4921.
 - c. Hubbell; HBL1557.
 - d. Leviton; 1257.
 - e. Pass & Seymour; 1251.

- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Arrow Hart; 1995L.
 - b. Bryant; 1921-L.
 - c. Hubbell; HBL1557L.
 - d. Leviton; 1257-L.
 - e. Pass & Seymour; 1251L.

2.7 WALL-BOX DIMMERS

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Eaton
 - 2. Lithonia
 - 3. Lutron
 - 4. Hubbell
 - 5. Sensor Switch
 - 6. Wattstopper

- B. Dimmer Switches: Provide dimmer compatible with fixtures, 0-10 V LED, adjustable high and low end trim settings, pushbutton style full range dimming with indication, no leakage to load in OFF mode, soft ON and fade OFF.

- C. Device for installation in decorator opening, color to match wiring devices.

2.8 COMBINATION WALL-BOX DIMMER AND VACANCY SENSOR (Plan Type "SI"):

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Eaton
 - 2. Lithonia
 - 3. Lutron
 - 4. Hubbell
 - 5. Sensor Switch
 - 6. Wattstopper

- B. Dimmer Switches: Provide dimmer compatible with fixtures, 0-10 V LED, adjustable high and low end trim settings, pushbutton style full range dimming with indication, no leakage to load in OFF mode, soft ON and fade OFF.

- C. Vacancy Sensor: Passive infrared, with 180 degree field of view, 1000 square feet of major motion coverage, selectable time delay, with LED indicating motion.

- D. Single device for installation in decorator opening, color to match wiring devices.

2.9 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: 0.035-inch- thick, medium size, satin-finished stainless steel.
 - 3. Material for Unfinished Spaces: Galvanized steel.

4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.10 CORD REELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. EGS Electrical Group; McGill products.
 2. Industrial Electric Reels, Inc.
 3. Reelcraft Industries, Inc.
 4. Daniel Woodhead; a Woodhead Industries, Inc. Co.
- B. Description: 115 V, 35 A, 60 Hz, spring retractable electric cord reel with latch, solid steel construction, abrasion and corrosion resistant baked on powder coat finish, nylon roller cable guides, adjustable cord stop, under-hung ceiling mounted.
1. Provide 25 foot cord with No. 10 AWG stranded-copper conductors, rubber insulated, Type SO jacket, with green insulated grounding conductor, unless otherwise indicated.
 2. Provide two GFCI duplex receptacles, unless otherwise indicated.
 3. Provide cast aluminum or non-metallic portable outlet box, listed and labeled for "wet locations."
 4. External Cable Grip: Provide woven wire-mesh, cord strain relief grip, made of high-strength galvanized-steel wire strand, matched to cable diameter and with corresponding attachment connector, and the device end.

2.11 PENDANT CORD-CONNECTOR DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. EGS Electrical Group; McGill products.
 2. Industrial Electric Reels, Inc.
 3. Reelcraft Industries, Inc.
 4. Daniel Woodhead; a Woodhead Industries, Inc. Co..
- B. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R unless otherwise indicated, heavy-duty grade.
1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
 2. External Cable Grip: Provide woven wire-mesh, cord strain relief grip, made of high-strength galvanized-steel wire strand, matched to cable diameter and with corresponding attachment connector, and each end.

2.12 DROP CORDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. EGS Electrical Group; McGill products.
 2. Industrial Electric Reels, Inc.
 3. Reelcraft Industries, Inc.
 4. Daniel Woodhead; a Woodhead Industries, Inc. Co.
- B. Description: where shown on drawings, receptacles installed in cast metal boxes with stainless steel cover plates shall be used. A 3 conductor #12 AWG, type SJO cord shall be used, unless noted otherwise. Provide a stamped steel box above, at ceiling or in joist space, securely fastened to building steel. Outlet mounting height shall be 6' – 6" unless noted otherwise.
1. External Cable Grip: Provide woven wire-mesh, cord strain relief grip, made of high-strength galvanized-steel wire strand, matched to cable diameter and with corresponding attachment connector, and each end.

2.13 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.14 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color. Color as defined by NEMA WD 1 unless otherwise indicated.
 - 1. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailling existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 - 5. Connect grounding terminals of devices to device box and equipment grounding conductor using pigtails that are not less than 6 inches in length with factory-crimped flanged spade and ring terminals.
 - 6. When using side wiring with binding-head screw terminals, use solid conductor pigtails. Wrap conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.

7. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 8. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 9. Tighten unused terminal screws on the device.
 10. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
 11. Install device boxes so that finish plates do not span different types of building finishes.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
- F. Device Plates:
1. Install blank device plates on unused device boxes.
 2. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening. Do not use oversized or extra-deep plates, unless approved by engineer.
- G. Dimmers:
1. Install dimmers within terms of their listing.
 2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Install devices into floor service outlets, service poles, and high capacity floor boxes to suit arrangement of partitions and furnishings.
- J. Securely install multioutlet assemblies with screws and anchors. Comply with Division 26 Section "Hangers and Supports for Electrical Systems."
- K. GFCI Receptacles: Where double-duplex GFCI receptacles are indicated, provide one duplex GFCI receptacle and feed-through to standard straight blade convenience receptacle in same device box.
1. Unless indicated otherwise, do not feed-through to receptacles in other device boxes.
- L. Mounting Heights: Refer to drawings for mounting heights. If heights are not shown on drawings, install as follows. Measured from finished floor to bottom of outlet or device box, unless indicated otherwise.
1. General Use Receptacles: 16 inches.
 2. Snap Switches, Wall-Box Dimmers, Wall-Switch Sensors: 44 inches.
 - a. Install on strike side of door, 6 to 12 inches from door, unless otherwise indicated.
 3. Receptacles in Mechanical and Electrical Equipment Rooms: 48 inches.
 4. Wiring Devices Above 30-Inch-High Countertops: 40 inches.
 - a. Install at least 2 inches above backsplash.
 5. Wiring Devices Above 36-Inch-High Countertops: 44 inches.
 - a. Install at least 2 inches above backsplash.
 6. Wiring Devices Above 42-Inch-High Countertops: 48 inches.
 - a. Install at least 2 inches above backsplash.
 7. Wiring Devices Above Lavatories: 44 inches.
 8. Receptacles Serving Domestic Refrigerators: 56 inches.
 9. Receptacles Serving Domestic Electric Clothes Dryers and Washing Machines: 32 inches.
 10. Receptacles Serving Domestic Dishwashers: 2 inches.
 - a. Install horizontally.
 11. Recessed Motor Controls: 56 inches.
 12. Pushbuttons: 44 inches.
 13. Interior Wall Mounted Luminaire Outlets: 88 inches.
 - a. Install at least 2 inches above mirrors.
 14. Occupant Adjustable Thermostats: 44 inches.

15. Sensor Only Thermostats: 56 inches.
16. Fire Alarm Manual Stations: 44 inches.
 - a. Install within 5'-0" of door.
 - b. Install no higher than 48 inches to top of device.
17. Fire Alarm Notification Appliances: 80 inches, or 6 inches below ceiling. Whichever is lower.

- M. Utilization Equipment: Refer to Shop Drawings for mounting height of special purpose devices serving, but not limited to, the following:
1. Commercial kitchen equipment.
 2. Commercial clothes washers and dryers.
 3. Drinking water coolers.
 4. Sensor operated wash fountains and lavatories.

3.2 IDENTIFICATION

- A. Comply with Division 26 05 53 Section "Identification for Electrical Systems" for the following:
1. Receptacles: Identify panelboard and circuit number from which each receptacle is served.
 2. Provide external, manufacturers adhesive label outside of cover plate when a standard receptacle is served from an upstream GFI device.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports. Refer to Division 26 Section "Electrical Testing" for requirements.

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Cartridge fuses rated 600 V and less.

1.2 CLOSEOUT DOCUMENTS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
 - a. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1) Let-through current curves for fuses with current-limiting characteristics.
 - 2) Time-current curves, coordination charts and tables, and related data.
 - 2. Extra Materials: Receipt for extra materials.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.

1.4 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.5 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.6 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. Fuses: Quantity equal to 10 percent of each fuse type and size, but no fewer than 3 of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussman, Inc.
 - 2. Mersen; (previously Ferraz Shawmut).
 - 3. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

- B. Products of other manufacturers will be considered for acceptance only when allowed in Section 260050, General Electrical Requirements.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Service Entrance: Class L, time delay.
- B. Feeders: Class L, time delay; or Class J, time delay.
- C. Motor Branch Circuits: Class RK1, time delay.
- D. Other Branch Circuits: Class J, time delay.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 26 28 13

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers.
 - 4. Molded-case switches.
 - 5. Enclosures.

1.2 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. HD: Heavy duty.
- C. SPDT: Single pole, double throw.

1.3 SUBMITTALS

- A. Shop Drawings: Diagram power, signal, and control wiring.
- B. Quality Assurance/Control Submittals:
 - 1. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Current and voltage ratings.
 - c. Short-circuit current rating.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Field quality-control test reports including the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 CLOSEOUT DOCUMENTS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - b. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

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.
- B. Products of other manufacturers will be considered for acceptance only when allowed in Section 260050, General Electrical Requirements.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers:
 - 1. Eaton Corporation; Cutler-Hammer Products.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D; Schneider Electric.
- B. Fusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position. Provide fuses, sized as shown on drawings. Switches shall be two or three pole. Refer to Plan Drawings for location of the following sizes.
 - 1. 30 A, 60 A, 100 A, 200 A, 400 A, 600 A, 800 A, or 1200 A
- C. Nonfusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position. Switches shall be two or three pole. Refer to Plan Drawings for location of the following sizes.
 - 1. 30 A, 60 A, 100 A, 200 A, 400 A, 600 A, 800 A, or 1200 A
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
 - 3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 MANUAL FUSIBLE STARTING SWITCHES

- A. Manufacturers:
 - 1. Cooper Bussman, Inc.
 - 2. Ferraz Shawmut, Inc.

3. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

- B. Description: Box cover units for standard electrical boxes with fused outlet or fused switch protection, Type S dual-element fuse and screw in fuse holder, rated 1/2 horsepower. Provide fuses, sized as shown on drawings. Switches shall be single or two pole. Refer to Plan Drawings for location of the following sizes.
1. Single pole NEMA WD 6 configuration with a 5-15R receptacle in box.
 2. Single-pole snap switch.

2.4 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Manufacturers:
1. Eaton Corporation; Cutler-Hammer Products.
 2. Siemens Energy & Automation, Inc.
 3. Square D; Schneider Electric.
- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents. Breakers shall be two or three pole. Refer to Plan Drawings for location of the following sizes.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
- C. Molded-Case Circuit-Breaker Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical styles suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - a. Accessory Control Power Voltage: Integrally mounted, self-powered; 120-V ac.
- D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- E. Molded-Case Switch Accessories:
1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
 2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
 3. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage. Provide "dummy" trip unit where required for proper operation.
 - a. Accessory Control Power Voltage: Integrally mounted, self-powered; 120-V ac.
 4. Shunt Trip: Voltage as required on trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

2.5 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
1. General purpose locations: Nema 1
 2. Outdoor Locations: NEMA 250, Type 3R.
 3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 4. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 5. Heavy Industrial locations: Nema 12

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to 3 inch high concrete housekeeping pads.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
 - 1. Inspect mechanical and electrical connections.
 - 2. Verify switch and relay type and labeling verification.
 - 3. Verify rating of installed fuses.
 - 4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Test mounting and anchorage devices according to requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 26 28 16

SECTION 26 51 00 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following:
 - 1. Interior luminaires, lamps, ballasts, and solid-state lighting drivers.
 - 2. Exterior luminaires normally mounted on exterior surfaces of buildings.
 - 3. Exit signs.
 - 4. Luminaire supports.
- B. Related Sections include the following:
 - 1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, emergency transfer devices and
 - 2. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.2 DEFINITIONS

- A. BF: Ballast factor.
- B. CEE: Consortium for Energy Efficiency, Inc.
- C. CRI: Color-rendering index.
- D. HID: High-intensity discharge.
- E. LED: Light-emitting diode.
- F. LER: Luminaire efficacy rating.
- G. Luminaire: Complete lighting fixture, including ballast and driver housing if provided.
- H. SSL: Solid-state lighting.

1.3 SUBMITTALS

- A. Quality Assurance/Control Submittals:
 - 1. Product Data: For each type of luminaire, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - a. Physical description of lighting fixture including dimensions.
 - b. Emergency lighting units including battery and charger.
 - c. Ballast and solid-state lighting Drivers. Submit product data sheets marked or highlighted for the specific ballast or solid-state lighting driver manufacturers/models for applicable products being provided from Part 2 of this Section "Generic" or "manufacturers choice" ballasts or solid-state lighting drivers are not acceptable. Submittals missing this information will be Rejected.
 - d. Energy-efficiency data.
 - e. Life, output, energy-efficiency data, and mercury content for lamps. Submit product data sheets marked or highlighted for the lamp manufacturer/models for applicable products being provided from Part 2 of this Section. Submittals missing this information will be Rejected.
 - f. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, solid-state lighting drivers, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - 1) Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
 - 2. Field quality-control test reports.

1.4 CLOSEOUT DOCUMENTS

- A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:
 - 1. Operation and Maintenance Data: For lighting equipment and fixtures to include in operation and maintenance manuals.
 - 2. Warranties: Special warranties specified in this Section.
 - 3. Extra Materials: Receipt for extra materials.

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

- A. Special Warranty for solid-state lighting Luminaires and solid-state lighting Drivers: Manufacturer's standard form in which manufacturer of lighting unit agrees to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Solid-state lighting Luminaires and Solid-State Lighting Drivers: 5 years from date of Substantial Completion.

1.8 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. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Battery and Charger Data: One for each emergency lighting unit.
 - 3. Ballasts and Solid-State Lighting Drivers: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 4. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.
 - 5. LED Packages, Arrays and Modules: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In the Luminaire Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

- B. Products of other manufacturers will be considered for acceptance only when allowed in Section 260050, General Electrical Requirements.

2.2 LUMINAIRES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. LED Fixtures: Comply with UL 1598, in addition to the requirements contained in UL Subject 8750.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- G. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch nominal unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.
- H. Trim Work: Provide solid aluminum or solid brass bar work, finials, and similar trim on wall sconces and decorative pendent lighting fixtures. Steel or hollow tubes are not permitted.
- I. Tap Connections (Fixture Whips): Not longer than 6 feet, constructed of No. 12 AWG copper conductors.

2.3 DRIVERS FOR SOLID-STATE LIGHTING LUMINAIRES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. Sylvania.
 - 2. Philips Lighting Co.
 - 3. EldoLED (Acuity Brand).
 - 4. Energy Recovery Products (Cooper Brand).
 - 5. Thomas Research Products (Hubbell Brand).
 - 6. Lutron (1% dimming).
- B. Electronic Drivers: Comply with ANSI C82.11, NEMA SSL 1, and UL 935 in addition to the requirements contained in UL Subject 8750; UL Class 2 listed power supply, isolated output, and designed for type and quantity of LEDs served.
 - 1. Input Rating: 120 to 277 V, 60 Hz, plus or minus 10 percent.
 - 2. Output Rating: 12 or 24 V dc, based on lumen output with minimum of 350 mA, plus or minus 5 percent.
 - 3. Sound Rating: Class A.
 - 4. Total Harmonic Distortion Rating: Less than 20 percent.
 - 5. Transient Voltage Protection: IEEE C62.41, Category A or better.
 - 6. Minimum Operating Temperature: minus 40 deg F.

7. Power Factor: 0.90 or higher.
- C. Drivers for Dimmer-Controlled Lighting Fixtures: Electronic type.
 1. Dimming Range: 100 to 10 percent of rated LED lumens.
 2. Driver Input Watts: Can be reduced to 25 percent of normal.
 3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
 4. Control: 0 to 10 V dc.
- 2.4 EMERGENCY TRANSFER DEVICE, GENERATOR TRANSFER DEVICE, and WHOLE CIRCUIT TRANSFER DEVICES.
- A. Selected luminaires as shown on the drawings shall have a transfer device installed at the factory, or a whole circuit device installed in the field, to automatically transfer the branch circuit from a normal source to an emergency source. Refer to Division 26 Section "Lighting Control Devices" for additional details.
- 2.5 EXIT SIGNS
- A. Description: Comply with UL 924; Comply with NEMA EM 1; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
 - B. Internally Lighted Signs:
 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
- 2.6 SOLID-STATE LIGHTING LUMINAIRES
- A. LED Package (Component) Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers: Manufacturers of LED drivers and LED modules shall be tested by the Luminaire Manufacturers and the stated warranty shall be based on the compatibility of the tested components, and substituted manufacturers will not be allowed. Refer to the list of approved LED drivers above.
 - B. LED Luminaires: Photometric data complying with IES LM-79, Energy Star rated by the U.S. Department of Energy, CRI 80 (minimum), color temperature 4000 K, white light produced by binary complementary wavelength conversion. Color mixing red, green, and blue LEDs is not acceptable.
 1. LED Packages, Arrays, and Modules:
 - a. Binned for color consistency per NEMA SSL 3; and B50, L70 rating of at least 50,000 hours when tested according to IES LM-80.
 - b. LED packages, arrays or modules shall be field replaceable without having to replace the entire luminaire.
- 2.7 LUMINAIRE SUPPORT COMPONENTS
- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
 - B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
 - C. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
 - D. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
 - E. Chains: 12 gage, zinc-plated steel jack chain or double-loop chain.

- F. Air-Craft Cable: 3/32-inch stainless steel cable with adjustable cable holder, adjustable plus or minus 6 inches.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 500 and NECA 502.
- B. Protect all luminaires from dust, moisture and debris during construction with plastic or other suitable barriers. Clean all luminaire that are dirty.
- C. Luminaires: Set level, plumb, and square with ceilings and walls. Install lamps in each luminaire.
- D. Temporary Lighting: If it is necessary, and approved by A/E, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- E. Lay-in Ceiling Luminaires Supports: Use grid as a support element.
 - 1. Install ceiling support system wire cable or chains, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
 - 2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
 - 4. Install at least four independent support jack chains from structure to tabs on lighting fixture. Chain shall have breaking strength of the weight of fixture at a safety factor of 3.
- F. Suspended Luminaires Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 - 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- G. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Selected luminaires as shown on the drawings shall have emergency transfer capability and sensors installed. Refer to Division 26 Section "Lighting Control Devices" for all adjustments and tests required on these luminaires.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 51 00

SECTION 27 01 00 - OPERATION MANUALS OF COMMUNICATIONS SYSTEMS

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 the following:
 - 1. Operation manuals for systems, subsystems, and equipment.
 - 2. Equipment Spreadsheet
- B. Related Sections include the following:
 - 1. Division 01 General Requirements
 - 2. Division 28 Electronic Safety and Security

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. Format: Submit operations manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
- B. Initial Submittal: Submit one (1) draft copy of each manual for each building per Division 01 General Requirements. Include a complete operation manual directory. The draft copies will be returned with notes indicating whether the general scope and content of the manuals are acceptable. Required additions and corrections will also be noted.
 - 1. If the project is being constructed in Phases, provide operating manuals at the completion of each Phase of work.
- C. Final Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion or at least 15 days prior to commencing demonstration and training or as directed by Architect.

1.5 COORDINATION

- A. Where operation documentation includes information on installations by more than one manufacturer or subcontractor, assemble and coordinate all required information under one heading for each system or subsystem.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 OPERATION DOCUMENTATION

- A. Organization: Include a section in the directory for each of the following:
 - 1. Table of contents.
 - 2. List of documents.
 - 3. List of systems.
 - 4. List of equipment.
- B. List of systems and subsystems: List systems by specification section number, then Article Number.
- C. List of Equipment: List equipment for each system, by specification section number, then Article Number. For pieces of equipment not part of system, list by specification section number, then Article Number.
- D. Table of Contents.
- E. Identification: In the documentation directory and in each operation manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents.

3.2 REQUIREMENTS FOR OPERATIONS MANUALS

- 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: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager, if applicable.
 - 7. Name and contact information for A/E.
 - 8. Name and contact information for Commissioning Agent, if applicable.
- C. Table of Contents: List each product, system, or subsystem included in manual, identified by specification section number, then Article Number:
 - 1. User Manuals
 - 2. Warranty
 - 3. Test Results
 - 4. Manufacturer's Certification
 - 5. Training Materials and sign-off sheet
 - 6. Approved Submittal
- D. Manuals, Electronic Files: Submit manuals in the form of a multiple file electronic PDF.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names.

3. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Information in each digital file must be separated and identified in such a manner that individual manuals or other pieces of information can be easily located
4. Name document files to correspond to system, subsystem, and equipment names used in manual directory listed in the table of contents and specified in the Documents.
5. Configure electronic manual to display bookmark panel upon opening file.
6. Do not combine different closeout items in the same electronic files or folders. Operation and Maintenance Manuals are to be separate from Record Drawings, Test Results etc.

3.3 OPERATION MANUALS

- A. Content: Include operation data required in individual Specification Sections and the following information:
 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Operating procedures.
 3. Wiring diagrams.
 4. License requirements including renewal dates.
 5. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
 6. When using manufacturer's standard printed data include only those sheets pertinent to products or components installed. If data includes information on more than one item clearly indicate only those items used on the project.
 7. Include drawings supplementing manufacturers' printed data to illustrate the relationship of individual components of a system and to illustrate interconnectivity. Coordinate these drawings with the information contained in the Record Drawings to ensure an accurate depiction of the actual installation.
- B. Descriptions: Include the following:
 1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
- C. Operating Procedures: Include the following, as applicable:
 1. Startup procedures.
 2. Routine and normal operating instructions.
 3. Regulation and control procedures.
 4. Normal shutdown instructions.
 5. Seasonal and weekend operating instructions.
 6. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

3.4 RECORD DRAWINGS

- A. Record Drawings shall be provided to the Owner/Architect/Engineer in .pdf format. Marked up drawings or scanned field working drawings are not acceptable.
- B. CAD files will be made available to the Contractor for use in completing the Record Drawings for a nominal fee.
- C. Each drawing sheet of the record set is to be stamped "Record Drawing".
- D. The Contractor's RCDD overseeing the project must stamp and sign each Record Drawing Sheet to confirm compliance with the Documents.

- E. Notations and labels on the Record Drawings shall be typed. Handwritten notes are not acceptable.
- F. All deviations from the bid documents are to be noted. Indicate changes made by Addenda, Architect Supplemental Instructions (ASI), Change Orders, and Field Directives.

3.5 All devices are to be shown in their approximate installed location and labeled with the correct field designation.

3.6 EQUIPMENT SPREADSHEET

- A. Provide a list of each piece of electronic equipment installed.
 - 1. Electronic equipment is defined as all active electronic equipment provided as part of this project.
- B. The list must be in an Excel spreadsheet format with the following information:
 - 1. Room Number or Location
 - 2. Device Description
 - 3. Manufacturer Name
 - 4. Model Number
 - 5. Serial Number
 - 6. Date tested
 - 7. Special comments
 - 8. Additional Columns as required by owner. Submit a sample spreadsheet with draft operations manual.
- C. The spreadsheet must be provided as a part of the close out documentation.
- D. Update list after all equipment has been installed and tested.

3.7 DIGITAL REQUIREMENTS

- A. Provide all operation and maintenance manuals of communications systems in electronic format (verify the file type with the Owner).

3.8 ELECTRONIC DRAWING FILES

- A. Record Drawings shall be provided to the Architect in the latest Auto CAD releases. Marked-up drawings or scanned drawings are not acceptable.
- B. Electronic drawings files will be available for all Contractors:

1.	Printed Sheet or set	Complete set of documents	Contact Printing Company
2.	AutoCAD .dwg file	Plan base sheet - .dwg drawing file of each floor. Includes base plans and equipment, etc.	\$100 each – First 3 plans \$75 each additional plan
- C. Specifications Each Volume \$200

3.9 MANUAL PREPARATION

- A. 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. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

- B. 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.

- C. 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 01 Section "Project Record Documents."

- D. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

3.10 COMMUNICATIONS SYSTEMS

- A. Provide the operation and maintenance of communications systems for all communications systems specified.

END OF SECTION 27 01 00

**SECTION 27 01 11 – DEMONSTRATION, TRAINING, AND WARRANTY OF COMMUNICATIONS
SYSTEMS**

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 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 videos.
 - 4. Warranties.
- B. Related Sections include the following:
 - 1. Division 01 General Requirements
 - 2. Division 27 Communication for specific requirements for demonstration and training for products in those Sections.
 - 3. Division 27 Operation Manuals of Communication Systems
 - 4. Division 28 Electronic Safety and Security for demonstration and training for products in those Sections.
- C. Length of instruction time will be measured by actual time spent performing demonstration and training at required location. No payment will be made for time spent assembling educational materials, setting up, travel, or cleaning up.

1.3 SUBMITTALS

- A. Instruction Program: Submit two (2) copies of the proposed training outline. Include length of instruction time, and instructors' name(s) and certifications. Include the objective of each training session.
- B. Attendance Record: For each training session submit list of participants and length of instruction time.
 - 1. Include the lists with the Operation and Maintenance Manuals.
- C. Demonstration and Training electronic files: Submit two (2) copies within seven (7) days of end of each training session.
 - 1. Identification: On each copy, provide a label with the following information:
 - a. Name of Project.
 - b. Name of Architect/Engineer/Consultant.
 - c. Name of Contractor.
 - d. Date training was recorded.
 - 2. At the completion of the training, submit one (1) hard copy training manual and one manual in digital format (USB drive or DVD verify with owner) to the Construction Manager or Architect/Engineer for approval. If approved these manuals will be turned over to the Owner.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name of A/E.
 - c. Name of Construction Manager.
 - d. Name of Contractor.
 - e. Date of video recording.
 - 2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
 - 3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format.

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.

1.6 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. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect/Engineer.

PART 2 - PRODUCTS

2.1 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. Equipment.
 - 2. Communication systems.
 - 3. Intercommunications and program System.
 - 4. Sound reinforcement system.

5. Wireless Access Points.
 6. Misc. video equipment.
 7. Etc.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Operating standards.
 - c. Equipment function.
 - d. Operating characteristics.
 2. Documentation: Review the following items in detail:
 - a. Operating manuals.
 - b. Maintenance manuals.
 - c. Project Record Documents.
 - d. Identification systems.
 - e. Warranties and bonds.
 - f. 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. Shutdown instructions for each type of emergency.
 - c. Operating instructions for conditions outside of normal operating limits.
 - d. Sequences for electric or electronic systems.
 - e. 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. Safety procedures.
 - e. Normal shutdown instructions.
 - f. Operating procedures for emergencies.
 - g. Operating procedures for system, subsystem, or equipment failure.
 - h. Required sequences for electric or electronic systems.
 - i. Special operating instructions and procedures.
 5. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
 6. 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.
 7. 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.

2.2 WARRANTY

- A. Submit all warranties for each product, equipment as outlined and specified in the following section. Warranty shall include labor, materials, travel time, etc. Not all sections will be used on this project.

Section	Name and Number	2 year	3 year	5 year	20 year
270526	Grounding and Bonding for Communications Systems	yes	-	-	-
270528	Pathways for Communications Systems	yes	-	-	-
271100	Communications Equipment Room Fittings	-	-	yes	-
271323	Communications Fiber Optical Backbone Cabling	-	-	-	yes
271515	Communications Copper Horizontal Cabling (Category 6)	-	-	-	yes
271553	Miscellaneous Communications	-	-	-	yes
274112	Communication A/V Mounts	-	-	yes	-
274143	Integrated A/V Equipment (Televisions)	yes	-	-	-
275123	Intercommunications and Program Systems	yes	-	-	-
275125	IP Based Intercommunications and Program Systems	yes	-	-	-
275315	Wireless Clock Systems	yes	-	-	-
280523	Conductors and Cables for Electronic Safety and Security	-	-	-	yes
281310	Access Control	yes	-	-	-
282311	IP Video Surveillance	yes	-	-	-

2.3 ADJUSTING, TESTING, DEMONSTRATION, AND TRAINING

- A. Provide adjusting, testing, demonstration, and training of the systems as specified in the following sections. Not all sections will be used on this project.

Section	Name and Number	Testing	Demo	Training	Hours
271100	Communications Equipment Room Fittings	yes	yes	yes	2
271323	Communications Fiber Optical Backbone Cabling	yes	-	-	2
271515	Communications Copper Horizontal Cabling (Category 6)	yes	-	-	4
271553	Miscellaneous Communications	yes	-	-	2
274112	Communications Audio-Video Mounts	Yes	-	-	2
274143	Integrated A/V Equipment (Televisions)	yes	yes	yes	2
275123	Intercommunications and Program Systems	yes	yes	yes	12
275125	IP Based Intercommunications and Program Systems	yes	yes	yes	16
275315	Synchronous Wireless Clock Systems	-	-	yes	2
281310	Access Control	yes	yes	yes	16
282311	IP Video Surveillance	yes	yes	yes	16

2.4 FACTORY START UP AND SITE VISITS

- A. The system manufacturers shall be on site for system start up as specified in the following sections. Not all sections will be used on this project.

Section	Name and Number	Site visits			
271100	Communications Equipment Room Fittings	yes			
281310	Access Control	yes			
282311	IP Video Surveillance	yes			

2.5 TRAINING

- A. Provide training clock hours as stated above.
- B. Trainer must be certified by the manufacturer.
- C. Provide a copy of a sign off sheet (signed by District staff) for the completed training with the close out documents.

2.6 CERTIFICATION

- A. Provide a certification stating that the Communications and Security Work has been performed by qualified/trained installers and that the installation meets all codes, rules, regulations, and laws of the city and the state where the project is located etc.

PART 3 - EXECUTION

3.1 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.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
1. Architect/Engineer will furnish the designer to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
1. Schedule training with Owner, through Construction Manager, with at least seven (7) days' advance notice.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.

- E. Cleanup: Collect used and leftover educational materials and give to Owner Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEOS

- A. General: Record demonstration and training on video. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Format: Provide high-quality DVD.
- C. Recording: Camera shall be mounted on a tripod during recording unless otherwise necessary to show area of demonstration and training. Display continuous running time.
- D. Narration: Describe scenes on video by audio narration by microphone while recording or as necessary dubbing audio narration off-site after video is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- E. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- F. Instruction and Training:
 - 1. The instruction process must include real or simulated situations for hands on training.
 - 2. Training program must be coordinated with Owner to establish goals, specific concerns, review program issues and analyze staff strengths and training logistics.
 - 3. The training instructor must make recommendations concerning the optimum training program to address each level of needs from basic to advanced, to system administrator.
 - 4. All training must be supported not only by the manufacturer's documentations, but by clear and concise training guides and customized for each customer for each system specified.
 - 5. A complete user's guide must be provided for each staff member attending training and one complete electronic file of this guide.
 - 6. Training is based on 3 levels:
 - a. Level 1: Teachers/staff.
 - b. Level 2: Administrators/media personnel.
 - c. Level 3: Technical staff.
 - 7. Training procedure must be done for all levels for voice, video, data and must be submitted with shop drawing submittal for Owner's approval.
- G. System Setup and Programming
 - 1. Provide part of your shop drawing submittal a complete system setup as directed by Owner. Any changes that are needed for the first 2 years must be included in your bid. (Maximum reprogramming setup is 4 separate times).

END OF SECTION 27 01 11

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

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. When equipment furnished for or by the Owner as indicated on the Drawings or specified, this Contractor shall make all connections to Owner furnished equipment. The Contractor shall verify exact requirements and locations before installation.
- B. Support from bar joists shall be allowed only at panel points in top or bottom chords.
 - 1. Loading shall not exceed 5 lbs./S.F. or 100 lbs. per panel point applied at the panel point.
 - 2. If support must occur between panel points, then threaded rods shall be dropped from both panel points, an adequate angle attached to both, and then the support attached to the angle as required.
 - 3. Supports shall not be attached to or through steel roof decks.
 - 4. Supports shall not be attached to the ceiling grid.
- C. Related Work Specified Elsewhere: Division 07 Penetration Fire Stopping and Fire-Resistive Joint Sealants.
- D. The contractor shall seal ALL conduit sleeves above the ceiling after all the cabling are installed and tested with an approved sealant as required to match the rating of the assembly.
- E. The Contractor shall take field measurements necessary for his Work and shall be responsible for the accurate location and size of openings, recesses, slots, ferrules, and the like.
- F. The Contractor shall be required to cooperate with "Other Trades" at the site and other Contractors in the coordination of his Work to avoid interferences with installations by other trades and Contractors.
- G. Deviations from the Drawings, to avoid interferences, shall be considered a "Job Condition" and no additional compensation will be considered applicable. If such interferences occur in course of the Work, due to an error, omission, or oversight by the Contractor, no additional compensation shall be allowed. Interferences which may occur while construction shall be brought to the immediate attention of the Architect/Engineer, and the Architect/Engineer decision, confirmed in writing, shall be final.
- H. Related work specified elsewhere: Communications sleeves.
- I. Related sections include the following:
 - 1. Division 01 General Requirements.
 - 2. Division 26 Electrical
 - 3. Division 27 Communications
 - 4. Division 28 Electronic Safety and Security

1.3 REFERENCES

- A. Work shall be in accordance with codes, rules, ordinances, regulations of authorities, bodies, associations, and governments, having proper and legal jurisdiction. Specifically, the following requirements shall be met in their entirety.
 - 1. State and Local Rules, Regulations, Codes, Statutes and Ordinances
 - 2. National Fire Protection Association - applicable requirements
 - 3. National Board of Fire Protection
 - 4. National Electric Code - applicable requirements
 - 5. Other Codes and Standards as specifically noted in each Section of the Specifications
- B. Electrical equipment shall be Underwriter's approved; also, shall meet requirements established by N.F.P.A., N.E.M.A., and A.N.S.I. and as specified hereinafter.
- C. Abbreviation used in these Specifications:
 - N.E.C. - National Electric Code - Latest Edition adopted by the National Fire Protection Association
 - N.E.M.A. - National Electrical Manufacturers Association
 - I.P.C.E.A. - Insulated Power Cable Engineers Association
 - A.N.S.I. - American National Standards Institute, Inc.
 - F.C.C. - Federal Communications Commission
 - N.A.B. - National Association of Broadcasters
 - N.A.E.B. - National Association of Educational Broadcasters
 - I.T.L. - Independent Testing Laboratories
 - E.T.L. - Electrical Testing Laboratories
 - U.L. - Underwriters Laboratories
 - B.I.C.S.I. - Building Industry Consulting Service International
 - I.E.E.E. - The Institute of Electrical and Electronics Engineers, Inc.
 - T.I.A. - Telecommunications Industry Association
 - E.I.A. - Electronic Industries Association
 - R.C.D.D. - Registered Communication Distribution Designer
 - N.I.C.E.T - National Institute of Certification in Engineering Technologies

1.4 SUBMITTALS

- A. Provide shop drawing submittals and illustrations in accordance with requirements of Division 01 Submittal Procedures unless otherwise noted.
- B. Provide shop drawings for each section separately as follows:
 - 1. Provide one electronic file submittal for each section. (do not mix sections together)
 - 2. Provide an index with a complete material list in the Specification sequence.
 - 3. Each Specification Section shall have its own material list.
 - 4. Provide product cut sheet for each specified item in sequence.
 - 5. Each manufacturer's product cut sheet shall be identified/marked or highlighted.
- C. Provide wiring diagrams and system layout drawings showing all devices, equipment, home runs, labeling, dB loss, etc. for each of the following systems (one paper copy and one electronic copy):
 - 1. Local area cabling infrastructure (showing labeling, routing, etc.)
 - 2. Network electronics
 - 3. Video distribution system
 - 4. Access control/intrusion detection
 - 5. Sound systems
 - 6. Video surveillance systems
- D. Partial shop drawings from one section WILL NOT BE ACCEPTABLE.
- E. Submittals will be returned unchecked if they do not follow the outlines above.
- F. Any Shop drawing submittals that are not required will be returned unchecked.

1.5 QUALITY ASSURANCE

- A. The cabling system components and equipment shall be listed by Underwriters Laboratories, Inc., and the components shall bear the UL label. The system shall be installed in accordance with requirements set by National Electric Code.
- B. Installing Contractor shall have five years experience in cable installations.
- C. Contractor shall submit a list of Jobs performed (minimum of five) in the past five years, equal to one specified herein. Also the contractor shall arrange a site visit of any job(s) selected by Architect/Engineer. The list shall include the following:
 - 1. Job location, and date when it was completed.
 - 2. Contact person at each job location.
 - 3. Brief description of each job.
- D. Contractor shall employ on their staff or have a contract with a Registered Communications Distribution Designer (RCDD) registered with the Building Industries Consulting Services International (BICSI).
- E. Contractor shall submit the name, registration number, and seal of the RCDD on the contractors' staff as part of their shop drawing submittals.
- F. The RCDD shall certify the final installation in writing and provide written verification that they have inspected the completed installation and that the installation meets the terms and conditions of this bid, design requirements of the BICSI TDMM (Latest edition), and all TIA/EIA, NFPA, NEC, and all local codes and specifications related to this work this letter shall be provided with the closeout paperwork.
- G. All design documents, submittals, Project Record Drawings, test results, third party testing and other documentation provided by the Communications Contractor shall bear the name, registration number, and seal of the RCDD responsible for this Project.
- H. Cabling systems installation shall be provided by the Contractor's own work forces. Any subcontractor agreements for any portion of the work specified herein must meet with approval of the A/E and Owner. It is the intent of the contract to have one Contractor provides sole responsibility for material, labor, and service for the systems.
- I. Contractors shall have staffed office (secretary, project manager, technicians, etc.) within (100) miles of the project and provide a service response time of a maximum of (2) hours from time of notification of major system failure.

1.6 TECHNOLOGY ABBREVIATIONS

- A. Cable Pathway
 - 1. Shafts, conduits, surface mounted raceway, boxes, sleeves, floor boxes, cable tray, and floor penetrations that provide routing space for communications cabling.
- B. Equipment Rooms (ER)
 - 1. An Equipment Room (ER) is a special-purpose room that provides space and maintains a suitable operating environment for communications and/or computer equipment.
 - 2. An Equipment Room (ER) may contain terminations, interconnections, and cross-connects for telecommunications distribution cables as well as other low voltage equipment such as fire alarm panels, video-audio distribution, security, and other building signaling and communication systems.
- C. Main Cross-Connect (MC)
 - 1. The Main Cross-Connect (MC) is typically located with the Equipment Room (ER) and is the main cross-connect and interconnection point for first level backbone.

- D. Telecommunications Rooms (TR)
 - 1. A Telecommunications Room is a space used to make connections from the first level backbone cabling from the MC to the horizontal cabling. TR's contain telecommunications equipment, control equipment, cable terminations, and cross connect wiring.
- E. Entrance Facility (EF)
 - 1. An Entrance Facility (EF) is a space within a building for both public and private network service cables to be terminated, protected and spliced to an indoor rated cable. This space may be in the MC or ER.

1.7 PRECEDENCE

- A. Contractors shall review both Drawings and Schedules of Communications Systems for any discrepancy.
- B. If there is a discrepancy in the number of rooms and quantities between the Drawings and the Schedules, the Contractor shall include the higher of the two quantities.
- C. If the products specified are no longer available, Contractor shall provide replacement products that meet or exceed performance specifications of the original specified model at no cost to the Project.
- D. If the Contractor bids products that do not meet or exceed the performance specifications or the original specified model, the Contractor shall provide products that meet the performance specifications as approved by the Architect/Engineer at no cost to the project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXPLANATION AND PRECEDENCE OF DRAWINGS

- A. For purposes of clarity and legibility, the Telecommunication "T" drawings are essentially diagrammatic and, although size and location of equipment are closely drawn to scale whenever possible, Contractor shall make use of the data in all of the Contract Documents and shall verify this information at the building site.
- B. The Drawings indicate required size and points of termination of wiring and other related items and may suggest proper routes for such items to conform to structure, avoid obstructions and preserve clearances. It is not intended that Drawings indicate every necessary offset. It shall be the Work of the Contractor to install each item in a manner to conform to structure, avoid obstructions, preserve headroom, and keep opening and passageways clear.
- C. It is intended that apparatus be located in coordination with architectural elements and shall be installed at exact height and location stipulated.
- D. Contractor shall fully inform himself regarding peculiarities and limitations of the spaces available for the installation of work and materials provided under his Contract.
- E. Contractor shall carefully examine existing conditions, existing wiring and other materials on the premises and compare the documents with the existing conditions. Variances and necessary changes shall be adjusted by appropriate modifications.
- F. Contractor shall carefully examine the Division 26 drawings for pathway, sleeves, etc.

3.2 PERMITS, FEES, REGULATIONS, INSPECTIONS

- A. Contractor shall arrange and pay for permits, fees, and inspections required in connection with his work for this project, from local, county, state and public agencies, and shall obtain permits from railroad, state highway and utility companies.
- B. Work shall be inspected by approved local and state inspection bureaus, Electrical Inspection Agency, and/or authority, and local utilities.
- C. Upon completion of the Work, the Contractor shall furnish to the Architect/Engineer, a certification of inspection and approval from said Bureau or Agency before final payment on contract will be allowed.
- D. Contractor shall verify the right of way with all local and state agencies.

3.3 HOISTS, RIGGING, TRANSPORTATION, AND SCAFFOLDING

- A. Contractor shall provide scaffolding, staging, cribbing, tackle, hoists, and rigging necessary for placing of his materials and equipment in their proper places in the Project.
- B. Contractor shall pay costs for transportation of materials and equipment to the job site and shall include such costs in his proposal.
- C. Scaffolding and hoisting equipment shall comply with requirements of pertinent Federal, State, and Local Laws and Codes.

3.4 PROTECTION

- A. In addition to other requirements of the Contract, the Contractor shall provide various types of protection as follows:
 - 1. Protect finished floors during installation, etc.
 - 2. Protect equipment, finished surfaces from paint droppings, insulation adhesive, and sizing droppings by use of drop cloths.
 - 3. Protect countertops during cutting for grommets.
 - 4. Protect video projectors, televisions, DVD, television studio, switches, sound system, clocks, access control, IP cameras, etc. from dirt.
- B. Contractor shall be responsible for the protection of finished work from other trades from damage or defacement by his operations and shall remedy such damage at his own expense.

3.5 CUTTING AND PATCHING

- A. Contractor shall do his own cutting and patching of building materials and piping, as required for the installation of his Work, but no structural members shall be cut without the approval of the Architect and such cutting shall be done in a manner directed by the Architect.
- B. Patching of and repair of damage to Work in place shall be done in a neat and workmanlike manner, meeting with the approval of the Architect. Contractor whose operations require cutting of work in place, or who causes damage which entails repairs of such work, shall employ mechanics of the particular trade whose work must be cut or which is damaged, and shall pay the costs of such patching or repair.

3.6 SLEEVES

- A. The contractor shall examine the technology and E3 electrical drawings for sleeve locations and shall verify the locations with the Division 26 electrical contractor.
- B. The Division 27 contractor shall be responsible for any additional sleeves and cores not shown on the E3 electrical drawings should they be required.

- C. NO change order shall be issued to provide sleeves in addition to those provided under the electrical contract.

3.7 FINAL COMPLETION

- A. Communication installation shall be cleaned prior to Substantial Completion of the Work.
- B. Retouch or repaint factory painted prime and finish coats, where scratched or damaged. Whenever retouching will not be satisfactory, the Architect/Engineer may require complete repainting until the desired appearance is obtained.
- C. Contractor shall clean equipment; restore damaged materials; remove grease, oil, chemical, paint spots, and stains; and generally, leave the Work in A-1 condition.
- D. Contractor and his subcontractors, on completion of his Work, shall remove tools, equipment, surplus materials, and rubbish pertaining to his operations, and pay costs for such removal and disposal from the site.

3.8 GUARANTEE AND WARRANTY

- A. Contractor shall submit written certificates, warranting that each item of equipment furnished complies with the requirements of the Drawings and Specifications.

3.9 SUPERVISION AND COOPERATION

- A. Work by the Contractor under this Division shall include the services of an experienced superintendent, who shall be constantly in charge of the Work, together with the qualified journeymen, helpers, and laborers required to properly unload, install, connect, adjust, start, operate, and test the Work involved, including related equipment and materials furnished under other contracts or by the Owner.

3.10 COLOR CHART

- A. Refer to the technology drawings for data cables and connectors colors. Different system cables and connectors sometimes require them to be different colors.

3.11 MATERIAL LIST

- A. Contractors shall provide with their bids [or 24 hours after bid] complete materials list on THEIR LETTER HEAD showing manufacturers name, catalog numbers, description, and quantities for each item in each system, per section number as follows:
 1. Cabling/Equipment Manufacturers Name and cutsheet of products.
 2. Quantities and Locations.
 3. Rough Draft of a Training Schedule.
 4. Project manager/technician/installer's manufacturer and BICSI certificates.
 5. Installation Company Manufacturer Warranty Certificate
- B. The lowest responsible bidders shall provide unit pricing for all materials as described in Part "A" above, within 24 hours with NO exceptions.
- C. If a subcontractor is utilized for any portion of the work, all contact information, references, material list, and any other information shall be provided per the specified contract bid requirements.
- D. If the above requirements are NOT provided, then the contractor is considered a none responsive bidder subject to disqualification.

END OF SECTION 27 05 00

SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

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 methods and materials for grounding system for communications equipment:
 - 1. Grounding cable
 - 2. Communication rooms bus bar
 - 3. Grounding connectors
- B. Related section includes the following:
 - 1. Division 01 General Requirements
 - 2. Division 26 Electrical
 - 3. Division 27 Communications
 - 4. Division 28 Electronic Safety and Security

1.3 DESCRIPTION OF WORK

- A. Provide grounding and bonding from the building ground system to the MC/ER equipment cabinets and racks and from the MC/ER to each TR and shall meet all requirements as stated in this section.
- B. Provide grounding and bonding cable along with the ground bus in each TR and MC/ER.

1.4 QUALITY ASSURANCE

- A. Grounding shall be in accord with National Electrical Code ANSI/NFPA 70 (NEC), Article 250, Article 800 NFPA.
- B. The grounding system shall meet ANSI/J-STD-607A commercial building grounding and bonding standards.
- C. The grounding system shall comply with ANSI/TIA/EIA-758 standard.
- D. The grounding system shall comply with BICSI (TDMM) standards.
- E. Equipment shall be provided with a suitable ground bus in the telecommunication rooms.

1.5 DEFINITIONS

- A. TMGB: Telecommunication main grounding bus bar.
- B. TGB: Telecommunication grounding bus bar.
- C. TBB: Telecommunication bonding backbone.
- D. ACEG: Alternating current equipment ground.
- E. TBBIBC: Telecommunication bonding backbone interconnecting bonding conductor.
- F. NRTL: Nationally recognized testing laboratory.

1.6 WARRANTY

- A. The grounding and bonding for communications systems shall have a warranty, as specified in the section titled "Demonstration, Training and Warranty of Communications Systems."

1.7 TRAINING

- A. Provide training as specified in the section titled "Demonstration, Training and Warranty of Communications Systems".

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Copper Grounding Conductor (TBB)
 - 1. The copper grounding conductor shall be insulated copper.
 - 2. The copper grounding conductor shall be #6 AWG from each rack/cabinet to the telecom grounding bus.
 - 3. The copper grounding conductor shall be marked by distinctive green color.
- B. Two-Hole Lug
 - 1. Provide two-hole lug to meet J-STD 607A.
 - 2. Approved Manufacturers:
 - a. Panduit LCC6-14 EDW-L series
 - b. Harger GECLB62C
 - c. Thomas & Betts 54852BEPH
- C. The Telecommunication Main Grounding Bus Bar (TMGB)
 - 1. Provide TMGB in the main cross connect/equipment room MC/ER.
 - 2. The TMGB shall be .25 inch thick, 4 inches wide, and 12 inches in length.
 - 3. The TMGB shall be predrilled copper bus bar with standard NEMA bolt hole sizing and spacing for the type of connectors to be used.
 - 4. Approved Manufacturers:
 - a. nVent Erico TMGBA12L15P with B548A41 mounting kit.
 - b. Harger TGBI14412TMGBKT
 - c. Panduit GB4B0612TPI-1
 - d. Hubbell HBBB14412
- D. The Telecommunications Grounding Bus Bar (TGB)
 - 1. Provide TGB in the telecommunication rooms (TR's).
 - 2. The TGB shall be .25 inch thick, 2 inches wide, and 12 inches in length.
 - 3. The TGB shall have predrilled copper bus bar with standard NEMA bolt hole sizing and spacing for the type of connectors to be used.
 - 4. Approved Manufacturers:
 - a. nVent Erico TGBA12L06P
 - b. Harger TGBI14212TGB
 - c. Panduit GB2B0306TPI-1
 - d. Hubbell HBBB14212TP
- E. Telecom bonding backbone interconnecting bonding conductor (TBBIBC)
 - 1. The bonding conductor shall be a minimum of #6 insulated copper ground conductor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The grounding conductor shall be a continuous wire and carried throughout the grounding system.
- B. Each telecommunication grounding conductor shall be labeled, per J-STD-607A.

- C. Bond metallic conduit entering communications handhole and building service rooms (Demarc).
- D. Provide a grounding conductor from the ground bus at the service entrance to each telecommunication room or /and as shown on the drawings.
- E. Provide continuous grounding conductor in the cable tray, see grounding detail for more information.

3.2 GROUNDING AND BONDING

- A. All systems installed under these contracts shall comply fully with TIA/EIA 607-A and the BICSI TDMM Latest Edition as they relate with bonding and grounding systems.
- B. All bonding conductors and connectors shall be listed for the purpose intended and approved by a Nationally Recognized Testing Laboratory (NRTL).
- C. All bonding conductors shall be insulated and copper.
- D. Bonding conductors should not be placed in ferrous metallic conduit. If it is necessary to place bonding conductors in ferrous metallic conduit of any length (conduit sleeves etc), provide grounding bushing at each end of the conduit and bond the grounding conductor to the bushing at each end of the conduit with a conductor sized as a No. 6 AWG, minimum and then ground these conduit sleeves to the cable tray at each side of the wall.
- E. Labels, Color-Coding, and Markings
 - 1. Each telecommunications bonding conductor shall be labeled. Labels shall be located on conductors as close as practicable (i.e., ease of access to read the label) to their point of termination. Labels shall be nonmetallic.
 - 2. Each telecommunications bonding conductor shall be marked appropriately by a distinctive green color.

3.3 BONDING CONDUCTOR FOR TELECOMMUNICATIONS

- A. Bonding to the service equipment (power) ground:
 - 1. The bonding conductor for telecommunications shall bond the TMGB to the service equipment (power) ground.
- B. Sizing the bonding conductor for telecommunications:
 - 1. The bonding conductor for telecommunications shall be, as a minimum, the same size as the TBB.

3.4 THE TELECOMMUNICATIONS BONDING BACKBONE (TBB)

- A. The TBB is a conductor that interconnects all TGB's with the TMGB. The TBB's basic function is to reduce or equalize potential differences between telecommunications systems bonded to it. The TBB is not intended to serve as the only conductor providing a ground fault current return path.
- B. The TBB originates at the TMGB, extends throughout the building using the telecommunications backbone pathways, and connects to the TGB(s) in all telecommunications closets and equipment rooms.
- C. Description of the TBB:
 - 1. The interior water piping system of the building shall not be used as a TBB.
 - 2. The metallic cable shield shall not be used as a TBB.
- D. The TBB shall be an insulated copper conductor. The minimum TBB conductor size shall be a No. 6 AWG.

- E. The TBB may be spliced provided all applicable requirements are met.
- F. The TBB shall be connected to the TMGB as specified above.
- G. TBB conductors shall be installed and protected from physical and mechanical damage.
- H. TBB conductors should be installed without splices, where practicable. Where splices are necessary, they should be minimum and shall be accessible and located in telecommunications spaces. Joined segments of a TBB shall be connected using irreversible compression-type connectors, exothermic welding, or equivalent. All joints shall be adequately supported and protected from damage.

3.5 THE TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

- A. The Telecommunications Main Grounding Busbar (TMGB) serves as the dedicated extension of the building grounding electrode system for the telecommunications infrastructure. The TMGB also serves as the central attachment point for telecommunications bonding backbones (TBB) and equipment and shall be located such that it is accessible to telecommunications personnel.
- B. Bonding to a panelboard for telecommunications:
 - 1. Where a panelboard for telecommunications is in the same room or space as the TMGB, that panel board's Alternating Current Equipment Ground (ACEG) bus or the enclosure shall be bonded to the TMGB.
 - 2. The TMGB shall be as close to the panelboard for telecommunications as practicable and shall be installed to maintain clearances required by applicable electrical codes.
- C. Connections to the TMGB:
 - 1. The connections of the bonding conductor for telecommunications and the TBBs to the TMGB shall utilize listed 2-hole compression connectors, exothermic type welded connections, or equivalent.
 - 2. The connections of conductors for bonding telecommunications equipment to the TMGB shall be 2-hole compression connectors are preferable.
 - 3. All metallic raceways for telecommunications cabling located within the same room or space as the TMGB shall be bonded to the TMGB.

3.6 THE TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

- A. The Telecommunications Grounding Busbar (TGB) is the common central point of connection for telecommunications systems and equipment in the location served by that telecommunications closet or equipment room.
- B. Bonds to the TGB
 - 1. TBB's and other TGB's within the same space shall be bonded to the TGB with a conductor as specified above.
 - 2. The bonding conductor between a TBB and TGB shall be continuous and routed in the shortest possible straight-line path.
 - 3. Where a panelboard for telecommunications is located within the same room or space as the TGB, that panel board's ACEG bus or the enclosure shall be bonded to the TGB.
 - 4. The TGB shall be as close to the panelboard as is practicable and shall be installed to maintain clearances required by applicable electrical codes.
 - 5. Where a panelboard for telecommunications is not located within the same room or space as the TGB, consideration should be given to bonding the panel board's ACEG bus or the enclosure to the TGB.
 - 6. The TGB shall be bonded to the TBBIBC as specified above.
 - 7. All metallic raceways for telecommunications cabling located within the same room or space as the TGB shall be bonded to the TGB.
- C. Connections to the TGB:
 - 1. Connections of TBB's to the TGB shall utilize listed 2-hole compression connectors.

3.7 COMMUNICATIONS SYSTEM GROUNDING

- A. Provide a minimum of #6 ground cable from the communications room bus bar to the following:
 - 1. Each communication cabinet/rack
 - 2. Each file server cabinet/rack
 - 3. Each audio-video cabinet/rack
 - 4. Each voice communication switch (telephone)
 - 5. Each service entrance device
 - 6. Each sound systems
 - 7. Each security systems
 - 8. Access control
 - 9. Video surveillance system
 - 10. Media management
 - 11. Any other communications systems provided by the Contractors.

3.8 TESTING

- A. Perform the following field quality control testing:
 - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with the following requirements.
 - 2. Test completed grounding system at each telecommunications bus bar is located. Measure ground resistance not less than two full days after the last trace of precipitation, and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by fall-of-potential method according to IEEE 81.
 - 3. Provide drawings locating each grounding bus bar and ground attachment location. Describe measures taken to improve test results. Test results shall comply with the following minimum requirements.
 - a. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Manhole Grounds: 10 ohms.
 - 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify A/E promptly and include recommendations to reduce ground resistance.

END OF SECTION 27 05 26

SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

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, but is not limited to, the pathways for communications systems:
 - 1. Cable supports
 - 2. Sleeves
 - 3. Cable ties
 - 4. Innerduct
 - 5. Warning tape
- B. Related Sections includes the following:
 - 1. Division 01 General Requirements
 - 2. Division 26 Electrical
 - 3. Division 27 Communications
 - 4. Division 28 Electronic Safety and Security

1.3 DESCRIPTION OF WORK

- A. Provide supports, cable ties, conduits, sleeves etc and all related equipment for the pathways for communications cabling as described herein and shown on the drawings.

1.4 QUALITY ASSURANCE

- A. Materials shall be new, complete with manufacturer's guarantee or warranty, and shall be approved by the Underwriters' Laboratories, Inc.
- B. Materials shall also comply with applicable standards of the National Electrical Manufacturers' Association, Insulated Power Cable Engineers Association, National Safety Code, and the American Institute of Electrical Engineers.
- C. Work shall be executed in a workmanlike manner and shall present a neat mechanical appearance when completed. Methods and techniques of installation shall be subject to the approval of the Architect.
- D. Materials of the same type or class shall be the product of the same manufacturer.
- E. Installer shall employ or have a contract with a Registered Communications Distribution Designer (RCDD) registered with the Building Industries Consulting Services International (BICSI).
- F. Installer must have personnel certified by BICSI on staff.
 - 1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician
 - 2. Field Inspector: Currently registered by BICSI as an RCDD to perform the on-site inspection.

1.5 PROJECT CONDITIONS

- A. Contractor shall be responsible for the accurate location of their Work and for informing themselves of the nature and arrangement of the materials, equipment, and construction to which their Work attaches or passes through.
- B. In general, work shall be concealed in walls in conduit and above ceilings in wire management system, conduit in chases, in equipment room so that such work will not interfere with the proper coordinated installation work of other trades or Contractors.
- C. In general, wiring, and conduit shall be installed parallel (or at right angles) to the building walls, and at such heights as not to obstruct portions of windows, doorways, stairways, pipe space, tunnel, or passageway, and properly concealed to not interfere with the proper coordinated installation of other trades or Contractors. Where interferences develop in the field, the Work shall be offset or routed as required to clear such interferences. Consult Electrical Technology Drawings, Contractors, and other details before installing work.
- D. Contractor shall procure definite locations and connections before rough-in or installation. The contractor shall then lay out the Work and be responsible for determining proper elevations, obliquity, acclivity, measurements, and locations required for the installation.

1.6 WARRANTY

- A. Provide warranty as specified in the 27 01 11 section titled "Demonstration, Training and Warranty of Communications Systems.

1.7 TRAINING

- A. Provide training as specified in the 27 01 11 section titled "Demonstration, Training and Warranty of Communications Systems.

PART 2 - PRODUCTS

2.1 Approved Cable Support Manufacturers: Eaton, ICC, nVent, Panduit

2.2 Approved Cable Tie Manufacturers: Hubbell, Leviton, Panduit

2.3 Approved Velcro Hook and Loop (Velcro) Manufacturers: Hubbell, Leviton, Panduit

- A. **Approved Indoor Plenum Innerduct:** Carlon, Eastern, Endot, Pyramid Industries
- B. Approved Outdoor Fabric Innerduct: MaxCell, Milliken

2.4 CABLE SUPPORTS

- A. Provide adjustable cable support that meets UL, NEC and TIA/EIA requirements for structured cabling systems.
- B. Provide wide base cable support that meets UL, NEC, and TIA/EIA requirements for structured cabling system.
- C. The cable support system shall provide support for various types of low voltage cables such as Category 3, 5E, 6 and 6A UTP cables in addition to fiber optic cable, innerduct, multi-pair backbone cables, coaxial cables, intercom, security and sound system cables.
- D. The support system shall attach to the building structural elements or be wall mounted.
- E. The supports shall be made of fire retardant, low smoke emission products, which meet UL 2034 requirements for air plenum spaces.

- F. The support products shall have a minimum of a 1-inch-wide platform for the cable to rest.
- G. Individual supports shall be installed at intervals not greater than 60 inches.
- H. Cable sag between supports shall not exceed 12 inches. Sagging cables shall not touch the ceiling grid or tiles.
- I. Cable supports shall be installed a minimum of 6 inches above lay-in ceiling system.
- J. Minimum clearances from sources of EMI and RFI must be adhered to as specified in TIA/EIA-568B, TIA/EIA-569 and the latest version of the BICSI TDMM.

2.5 SLEEVES

- A. The conduit sleeves indicated on the drawings shall be provided under Division 26. Where
- B. additional sleeves are required, this contractor shall provide conduit sleeves that meet the
- C. specified requirements at no additional cost to the owner.
- D. Provide a minimum of two (2) four (4) inch sleeves between floors with plastic bushings at each end.
- E. Provide four (4) four (4) inch sleeves from the corridor cable tray to the TR/MC/ER cable tray with plastic bushings at each end.
- F. Provide a minimum of three (3) four (4) inch sleeves (unless otherwise noted) in the corridor between cable trays when the cable tray passes thru wall separations with doors with plastic bushings at each end.
- G. Provide a minimum of two (2) two (2) inch sleeve with plastic bushing at each end from the corridor cable tray to each room, install sleeve above the door. One 2" sleeve is for sound, access, intrusion detection, fire and BAS cables and the other is for Horizontal Comm cables.
- H. Firestop all sleeves inside and out.

2.6 CABLE TIES

- A. Provide plenum rated cable ties for cables installed above ceilings.
- B. Cable ties shall meet UL 94V-O and color shall be maroon.

2.7 CABLE HOOK AND LOOP FASTENERS

- A. Provide cable hook and loop fasteners to secure cable bundle to communication equipment cabinet and racks.
- B. Hook and loop fasteners may be used above ceilings if they are plenum rated.
- C. UL listed and color shall be maroon.

2.8 INNERDUCT (INDOOR)

- A. Provide 1.25-inch minimum plenum rated orange corrugated innerduct above ceiling for all non-armored fiber.
- B. Innerduct shall be UL listed and have pull tape included.

2.9 INNERDUCT (OUTDOOR)

- A. Provide multi-cell, detectable fabric innerduct in site conduits that include technology cabling as shown on the drawing.
- B. Innerduct shall be UL listed and be installed per manufacturers recommendation.
- C. Sewn-in 18AWG TFN solid copper wire suitable for direct wired toning equipment and above ground handheld locators.
- D. Features color coded, pre-installed 1250LB pull tape in each cell for 3" and 4" MaxCell. 1.25", 1.75" and 2" MaxCell have pre-installed 1250LB VisT Glide Rope in each cell.

2.10 UNDERGROUND WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed polyethylene tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Print legend shall indicate type of underground lines.

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. Contractor shall do excavating of materials encountered, including backfilling necessary for the installation of underground wiring and equipment in his Contract. Provide and maintain bracing, shoring, or sheathing necessary to support the walls of excavations.
- B. Trenches shall be opened in straight lines and bottomed out at least 4 inches below conduit or ducts. Exterior trenches shall have a minimum depth of 36 inches which shall be maintained between top of largest conduit or duct and finish grade.
- C. Where roots of live trees are encountered in excavations, they shall be carefully protected during construction. Contractor shall cut or remove interfering trees, remove stumps, and rocks in the line of the excavation; however, approval of the Architect shall be obtained before a tree is removed or cut. Shrubbery in line of excavation shall be removed with a ball of dirt and replaced at completion of installation.
- D. Where excavation is necessary in existing pavements, Contractors for whose work the excavation is required shall pay fees and costs of opening street or pavement and costs of filling and repaving in accordance with requirements of and to the satisfaction of the Municipality, Utility, or other Owners of such paving.
- E. Where existing sidewalks, drives, and roadways must be cut, they shall be cut in straight lines, and shall present a neat appearance when re-laid and shall match existing work. At such locations the backfill medium shall be concrete from the bottom of the finished surface to the bottom of the trench except as may be otherwise approved by the Architect/Engineer.
- F. Where excavation is necessary in an existing lawn, carefully remove and restore sod. After backfilling trench, replace sod or apply top dressing of black dirt and seed to match existing lawn. Care shall be exercised during the work to see that no unnecessary damage is done to lawns in the storing of dirt or other construction material. Should unnecessary damage occur, in the opinion of the Architect, the Contractor shall be required to recondition lawns at his own expense.
- G. In addition, the Contractor shall provide and maintain warning barricades, flags, and warning lights, and shall conduct his work to create a minimum amount of inconvenience to others, traffic, construction, and the like. Temporary suspension of work does not relieve the Contractor of responsibility for the above requirements.

- H. Remove and legally dispose of debris, rubbish, and excavation spoils resulting from the Work.
- I. This Contractor shall "after one year" return to the jobsite and fill all trenches that have settled.

3.2 INSTALLATION

- A. Materials installed under this Division of Work shall be supported from the building structure, independent of other pipe, duct, equipment, ceiling grid, etc.
- B. Cabling shall be supported by cable supports that meet BICSI, EIA, TIA requirements. These include J-Hooks, cable tray, basket tray or conduit. Cables shall not lie on or be supported directly on the building structural steel, tops of masonry walls, ceiling grid, ceiling supports, mechanical piping etc.
- C. Cable supports shall be independently supported from wires, rods or be independently secured to structure using approved anchors. In above ceiling applications these wires or rods shall be visually distinguishable, independent of the ceiling grid supports and be affixed at both ends to minimize movement.
- D. Cables in exposed ceiling areas such as auditorium, gymnasium, mechanical rooms, boiler rooms, chiller rooms, art rooms, classrooms, locker rooms, corridors, etc. shall be installed in conduit from the device to the nearest accessible lay-in ceiling or the nearest telecommunication room. Refer to the Division 26 drawings for conduit being provided. The contractor shall coordinate the conduit routing with the Division 26 contractor to minimize the cable distances.
- E. Sound system cables in exposed ceiling areas, such as the auditorium, gymnasium, student dining, locker rooms etc. shall be installed in conduit from the device to the area sound system cabinet. Refer to the Division 26 drawings for conduit being provided. The contractor shall coordinate the conduit routing with the Division 26 contractor to minimize the cable distances.
- F. Install underground warning tape 12 inches above the conduit in the trench.
- G. Install jacks, fitting, and connectors in properly selected outlet boxes and junction boxes.
- H. Cover and protect equipment, materials, enclosures, boxes, cabinets, racks, before and after to prevent the entrance of grit, dirt, and foreign matter. The contractor shall clean all equipment and racks or cabinets prior to final acceptance.
- I. Outdoor minimum separations from possible EMI exceeding 5KVA shall be 24 inches for power in nonmetallic pathways and 12 inches for power in grounded metal pathways. (Per table 3.1 in BICSI TDMM)

END OF SECTION 27 05 28

SECTION 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the identifications for communications systems:
 - 1. Self laminating labels
 - 2. Equipment cabinet labels
- B. Related Sections includes the following:
 - 1. Division 01 General Requirements
 - 2. Division 27 Communications
 - 3. Division 28 Electronic Safety and Security

1.3 DESCRIPTION OF WORK

- A. Provide identifications for communications and security systems as described herein and shown on the drawings.

1.4 SUBMITTALS

- A. Comply with requirements of the submittal section of the Specifications.

1.5 QUALITY ASSURANCE

- A. Materials shall be new, complete with manufacturer's guarantee or warranty, and shall be approved by the Underwriters' Laboratories, Inc.
- B. Materials shall also comply with applicable standards of the National Electrical Manufacturers' Association, Insulated Power Cable Engineers Association, National Safety Code, and the American Institute of Electrical Engineers.
- C. Work shall be executed in a workmanlike manner and shall present a neat mechanical appearance when completed. Methods and techniques of installation shall be subject to the approval of the Architect.
- D. Materials of the same type or class shall be the product of one manufacturer.
- E. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and Technology Consultant.

1.6 PROJECT CONDITIONS

- A. Contractor shall be responsible for the accurate location of his Work and for informing himself of the nature and arrangement of the materials, equipment, and construction to which his Work attaches or passes through.
- B. In general, label communication cables, equipment, cabinets, patch cord, data jacks, video jacks, cover plate, telecommunication rooms, MC/ER's video equipment, telephone system, etc.

PART 2 - PRODUCTS

2.1 SELF-LAMINATING LABELS

- A. Provide self-laminating labels to meet TIA/EIA-606-A.
- B. Labeling shall be per Class 2 and/or Class 3 requirements.
- C. Approved Manufacturers:
 - 1. Panduit S050X150VATY
 - 2. Brady M21-1500-427
 - 3. Hellermann Tyton TAG5L-105

2.2 EQUIPMENT CABINETS/RACKS IDENTIFICATION LABELS

- A. Provide engraved, laminated acrylic label secured to equipment with screws.
- B. Label shall be white letters on a black background and be a minimum letter height shall be 1/2-inch.

PART 3 - EXECUTION

3.1 IDENTIFICATION

- A. Equipment Identification:
 - 1. Provide nameplates on equipment such as Telecommunication Rooms (TR), Main Cross Connect/Equipment Room (MC/ER), patch panels, CPU, and the like.
 - 2. Lettering shall include name of equipment, the specific unit number, and other instructions that are applicable.
 - 3. Nameplates shall be laminated phenolic with a black surface and white core. Use 1/16-inch-thick material for plates up to 2 inches by 4 inches. For larger sizes use 1/8-inch-thick material. Lettering of names should correspond to nomenclature specified for apparatus, corresponding with the Drawings, details, schedules, charts, wiring diagrams, and operating instructions, as approved by the Architect/Engineer.
 - 4. Lettering shall be condensed Gothic. The space between lines shall be equal to the width of the letters. Use 1/4-inch minimum height letters which occupy four to the inch. Increase letter size to 3/4 inch on largest plates.
 - 5. Attached directly to the apparatus in a manner approved by the Architect/Engineer.
- B. Labeling
 - 1. Label each cable (voice, video, and data), video outlet, telephone and data jack at each patch panel and jack outlet clearly, neatly, and completely, including "Spares." Labels shall not be subject to moisture or fading, shall be self-adhesive and must be typewritten. Type room label above patch panel port location to allow end user ease in identification of patch panel locations. Patch panels shall be labeled with a large 1/2-inch letter to designate patch panel I.D. (A-Z). This letter will correspond to the faceplate labeling at the station faceplate. (Example: TR-B1.1 A22 where the closet "TR-B1.1" and the patch panel port "A22" number are both identified)
 - 2. Use the following format to identify plate/connectors:
 - a. Individual jack designations shall begin at the main entry point of a room or space and continue in a clockwise rotation. The following labeling codes shall be used:
 - 1) C – communication
 - 2) V – video
 - 3) I – input
 - 4) O – output
 - 5) AO - audio output
 - 6) VI - video input
 - 7) VO - video output
 - 8) FO – fiber optic
 - 9) S – security

- 10) DC – door contact
 - 11) PT – power transfer
 - 12) MD – motion detectors
 - 13) SS – sound system
 - 14) WAP – wireless access points
 - 15) CAM - camera
3. Labeling scheme shall be submitted with the system submittal drawings and approved prior to termination of devices. Contractor shall submit a detailed drawing or sample plate with connectors installed to depict the intended labeling scheme.
 4. Label shall be applied within 6 inches from end of each of the cables.
 5. Cabling at the patch panels shall be terminated in numerical order to provide a logical pattern that will provide the end user the greatest ease in system administration.
 6. For fiber cabling, labels shall be applied at the patch panels in the space that is provided. Label shall include the room and location where fiber is routed to or from.
 7. Labels shall be clean and level.
 8. Final labels should reflect the Owner's room designation scheme, which may not match the construction drawing numbers. The final room number scheme shall be confirmed with the Architect/Engineer prior to labeling the faceplate and patch panels. If the final room numbers are not available at the time of cable installation, architectural numbers shall be permitted for cable labeling only. If architectural numbers are used, a cross reference sheet shall be submitted in a spreadsheet format. This may require that the Contractor shall have to re-label the patch panels to match the final room numbers.
 9. Refer to drawing for patch panel and faceplate labeling detail.
 10. Provide blue dot with the IP address for all WAP's, Cameras, Video projectors etc, mount the label on the grid below the device.

C. Other Items

1. Provide identification as required in other subsections of these Specifications and as denoted on the Drawings.

D. It shall be the responsibility of the Cabling Contractor to label all terminal blocks, cables, and equipment (with length and room number) clearly and logically.

E. Labels shall be clearly typed and shall appear at all cable ends within 6 inches of the jack or patch panel termination on the outer jacket, on the faceplate of the station jacks, and on the patch panels. All patch cables shall be numbered 1 through X within 1/2 inch of each termination. Station runs shall be labeled indicating the room number of the station and its MC/ER and TR termination point as well as a unique identifier. (Handwritten labeling is not allowed.)

F. Telephone device labeling: All telephones shall be labeled after the programming per the owners' requirements, verify labeling with owner.

G. Security door controller labeling: The door controller shall be labeled with the electrical circuit number and patch panel/TR location.

H. Provide labeling for the following items with room name and room number:

1. Television and television remote
2. Classroom sound system and microphones
3. Cameras
4. Security devices
5. Miscellaneous equipment, etc.

END OF SECTION 27 05 53

SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes, but is not limited to, the following:
 - 1. Wall-mount hinged sectional equipment cabinet
 - 2. Uninterruptible Power Supply (UPS)
 - 3. Power strip
 - 4. Miscellaneous items
- B. Related section includes the following:
 - 1. Division 01 General Requirements
 - 2. Division 26 Electrical
 - 3. Division 27 Communications
 - 4. Division 28 Electronics Safety and Security

1.3 DESCRIPTION OF WORK

- A. Provide labor, material, equipment, cabinets, UPS's, wire managements, shelves, tie wraps, Velcro, proper grounding and bonding and accessories necessary for a complete installation of the communication equipment rooms as described in this section and as shown on the drawings.
- B. This Contractor shall coordinate the extension of the electrical service to each communications cabinet or rack with the Electrical Contractor.

1.4 QUALITY ASSURANCE

- A. See section 270500 - "Common Work Results for Communications" for more information.
- B. All equipment must be UL listed.
- C. All equipment and installation shall comply with latest ANSI/NFPA-70 National Electric Code.
- D. All equipment shall comply with the latest ANSI-J-STD-607 grounding and bonding standards.
- E. All equipment installations shall comply with the latest BICSI (TDMM) standards.
- F. All equipment racks and cabinets shall comply with the latest ANSI-EIA-310 standard.
- G. All UPS shall meet IEEE62.41 standard.
- H. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and the Technology Consultant.
- I. Installer shall employ or have a contract with a Registered Communications Distribution Designer (RCDD) registered with the Building Industries Consulting Services International (BICSI).

- J. Installer must have personnel certified by BICSI on staff.
 - 1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician
 - 2. Field Inspector: Currently registered by BICSI as an RCDD to perform the on-site inspection.

1.5 SUBMITTALS / RECORD DRAWINGS / MAINTENANCE MANUAL

- A. Shop Drawings
 - 1. The Contractor shall provide shop drawings of all equipment. Drawings shall indicate the interconnection of equipment and wiring external to the various patch panels (MC/ER and TRs). These drawings shall be included in the submittal to the Architect/Engineer for approval.
 - 2. Complete and comprehensive shop drawings shall be submitted to the Architect/Engineer for review.
 - 3. Drawings shall be provided in latest revision of AutoCAD or Revit.
 - 4. Provide equipment isometric with labeling.
 - 5. Every port shall be labeled per specs.
 - 6. The contractor must submit a labeling scheme to the Engineer for approval as part of the submittal documentation. The labeling scheme shall include the rack or equipment cabinet number identification. Labeling installed without the Engineers approval will be subject to removal.
- B. See Common Work Results for Communications section 270500 for more submittal requirements.
- C. Provide record drawings and maintenance manuals, per the section titled "Operation and Maintenance of Communications Systems".

1.6 WARRANTY

- A. Components, parts, and assemblies supplied by the Cabling Contractor/manufacturer shall be guaranteed against defects in materials and workmanship as specified in the 270111-section titled "Demonstration, Training, and Warranty of Communications Systems", commencing upon system start. Warranty services shall be provided by the installer of the equipment manufacturer during normal working hours.

1.7 TRAINING

- A. Provide training as specified in section 27 01 11 - Demonstration, Training, and Warranty of Communications Systems.

PART 2 - PRODUCTS

2.1 **Approved Cabinet Manufacturers:** B-Line, Belden, CPI, Hoffman, Hubbell, Middle Atlantic, Panduit

Approved Uninterruptable Power Supplies Manufacturers: APC, CyberPower, Emerson(Liebert), Middle Atlantic, Minuteman, Tripp Lite, Xtreme

2.2 WALL-MOUNTED HINGED SECTIONAL CABINET

- A. All communications equipment shall be housed in steel wall-mounted hinged sectional protective cabinets.
- B. The equipment cabinets shall have solid sides, Tempered Glass Door. Doors shall be lockable with all locks keyed alike.

- C. The wall-mounted hinged sectional equipment cabinets shall be 24 inches wide by 18 inches deep 24" inches high with dual pivoting system.
- D. The wall-mounted hinged sectional equipment cabinets shall be steel construction with fully welded corners.
- E. The wall-mounted hinged sectional equipment cabinets shall have powder coat finish, finish shall be black.
- F. Provide ultra quiet fans with 100 CFM in each wall-mounted hinged sectional equipment cabinet, fan shall have less than 27 dBA noise rating.
- G. Provide one horizontal power strip with 20-amp receptacles in each cabinet.
- H. At each wall-mounted hinged sectional equipment cabinet provide wire management devices between each patch panel or as shown. Horizontal managers have slotted openings and plastic wire holding clips.
- I. Provide wire management panels as shown on the drawing.
- J. Provide copper bonding bus bar (1/8 inch thick and threaded 10-32, 2-inch-wide x 12 space).
- K. Provide 100 spare mounting screws/cage nuts for each equipment cabinet.
- L. Wall-mounted hinged sectional equipment cabinet shall be UL listed.
- M. BASIS OF DESIGN: CPI #11901-724
- N. Coordinate to provide blocking in the wall for additional support as needed and mount unit on painted 3/4" plywood. The paint should match wall color.

2.3 TECHNOLOGY RACK/CABINET MOUNTED UNINTERRUPTABLE POWER SUPPLY

- A. Provide rack mounted UPS in each TR or ER cabinet or rack as specified.
- B. UPS shall be on-line double conversion type.
- C. UPS shall have an output voltage of 120 volts or 208V, as needed (verify in the field).
- D. UPS shall have an input voltage of 120 volts or 208V, as needed.
- E. The UPS shall have output receptacles as follows:
 - 1. 1000VA - (6) NEMA 5 – 15R
- F. UPS shall have sine wave waveform.
- G. UPS shall have maintenance free sealed lead acid battery.
- H. UPS shall have DB-9, RS-232; Smart SNMP network card for connection of the UPS to the data network along with manufacturer management software.
- I. UPS shall have control panel with LED status display.
- J. UPS shall have audible alarm.
- K. Provide rear mounted rails to support the UPS in the MC/ER cabinets and provide center mount shelf for equipment racks in each TR.
- L. UPS shall have two years warranty for labor and material.

- M. UPS shall be UL Listed 1778.
- N. Battery run time (minimum):
 - 1. 1000VA – 7 minutes at full load
- O. BASIS OF DESIGN: APC #SMTL1000RM2UCNC

2.4 METERED POWER STRIPS

- A. Provide horizontal power strip as follows (in the wall mount and sound system cabinets):
 - 1. 12 – 20 amp receptacles
 - 2. Cord with NEMA 5 – 20 plug
 - 3. Single circuit
 - 4. UL listed 1419
 - 5. BASIS OF DESIGN – CPI 13239-757
- B. Metered Power Strips shall be rack/cabinet mounted.
- C. Provide one (1) spare horizontal power strip.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install communications equipment room fittings as specified herein and as shown on the drawings.

3.2 LABELING AND MARKING

- A. Provide labeling and markings for all communications equipment cabinets/racks.
- B. Provide labeling for telecommunications rooms as follows:
 - 1. Black on white with ER/TR # for each cabinet. (for example, TR. A1.1 fed from ER-C1.1 panel A6-12)
- C. Section titled "Identifications for Communications Systems" for more information.

3.3 EQUIPMENT CABINETS

- A. At each telecommunication room provide complete communications equipment cabinets as shown on the drawings including patch panels, management and equipment as specified here.
- B. Coordinate with the electrical contractor for the extension of the electrical service from the electrical junction box located in the room to each communications cabinet/rack.

3.4 COMMUNICATION GROUNDING AND BONDING

- A. Provide grounding and bonding to each cabinet with ground cable from the grounding bus bar in the TR.
- B. The grounding conductor shall be green insulated copper with minimum size of #6 AWG and marked by distinctive green color.
- C. Ensure a bond to the bus bar by using an antioxidant compound to the connection point using compression 2-hole lugs.

- D. Provide a minimum of #6 ground cable from the communications room busbar to the following:
 - 1. Each installed cabinet/rack
 - 2. Each service entrance device
 - 3. Building structural steel
 - 4. Any other communications systems provided by this Contractor.

3.5 TELECOMMUNICATION ROOMS (TR's)

- A. The data cable, the telephone cable, and the video control cable shall be terminated on RJ45 copper patch panels.
- B. Provide fire-retardant grade A-C equivalent plywood terminal board, (quantity as shown) 4 feet by 8 feet by 3/4 inches (minimum of 1) mounted 24" AFF in each telecommunication room. (Paint all 6 sides with two coats of fire-retardant white paint leaving the fire-retardant rating exposed on each sheet.)
- C. Room 103 Utility, TR TBD: Provide the following:
 - 1. Provide (1) hinged wall cabinet.
 - 2. Bond to the building grounding system with #4 copper.
 - 3. Provide ground bus bar.
 - 4. Provide (1) fiber optic patch panels
 - 5. Provide (1) 6 port SC coupling panels. (MM)
 - 6. Provide (1) 6 port SC coupling panels (SM)
 - 7. Provide (1) 4 pair building service entrance protection.
 - 8. Provide (1) 48 port copper patch panels for work area outlets.
 - 9. Provide (1) 24 port copper patch panels for IP cameras and WAPs.
 - 10. Provide (1) 1,000VA, 120V, UPS, rack mounted.
 - 11. Provide horizontal and vertical wire management panels.
 - 12. Provide conduit chimney or wire management duct to bring cables from the ceiling to the equipment cabinet.
 - 13. Provide (1) rack mounted horizontal power strip, per cabinet.
 - 14. Provide shelves as specified.
 - 15. Provide space for data switches.
 - 16. Provide two (2) 1 meter and (2) 3 meter MM & SM fiber patch cords. (LC to LC)

END OF SECTION 27 11 00

SECTION 27 13 23 - COMMUNICATIONS FIBER OPTICAL BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes, but is not limited to the following:
 - 1. Indoor/outdoor OS2 single-mode fiber
 - 2. Fusion splice fiber connectors, fittings, fiber enclosures, fiber panels, patch cords etc.
 - 3. Innerduct
- B. Related section includes the following:
 - 1. Division 01 – General Requirements
 - 2. Division 26 – Electrical
 - 3. Division 27 – Communications Sections
 - 4. Division 28 – Electronic Safety and Security

1.3 DESCRIPTION OF WORK

- A. Provide labor, material, equipment, terminations, and accessories necessary for a complete and operational fiber optic backbone cabling system as indicated on the Drawings and specified herein.
- B. Provide fiber optic backbone cabling from the Main Equipment room (ER) to each telecommunications room (TR) as described here and as shown on the drawings.
- C. The OS2 fiber is a single-mode fiber optic cable designed to deliver 1Gb to 10Gb transmission rates over distances of 5,000 meters to 10 kilometers and shall comply with EIA/TIA 492 requirements and IEC 60793.
- D. All fiber optic cable shall be terminated by using fusion spliced LC type pigtail connectors.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Maintenance Proximity: Not more than 2 hours travel time from Installer's place of business to Project site.
 - 2. The cable installer company must have on staff a registered communication distribution designer (RCDD) certified by Building Industry Consulting Service International (BICSI).
 - 3. Installers' Site Project Manager must be a certified BICSI Installer or Technician.
- B. All backbone cabling system components and equipment shall be listed by Underwriters Laboratories, Inc. for telecommunication use, and the components shall bear the UL label.
- C. The system shall be installed in accordance with requirements set by ANSI/NFPA-70 National Electric Code.
- D. All equipment shall meet the latest ANSI-J-STD 607 grounding and bonding standards.
- E. All equipment shall meet the latest ANSI/TIA/EIA-568, 569, 606, and 607 standards.
- F. All OS2 single-mode fiber shall comply with the latest ANSI/TIA/EIA 492CAAA standards.

- G. All fiber optic cable shall be installed in accordance with ANSI/EIA/TIA and BICSI standards.
- H. Provide labeling per the latest ANSI/EIA/TIA-606 requirement and in accordance with the Owner and the Technology Consultant.
- I. Installer shall employ or have a contract with a Registered Communications Distribution Designer (RCDD) registered with the Building Industries Consulting Services International (BICSI).
- J. Installer must have personnel certified by BICSI on staff.
 - 1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician
 - 2. Field Inspector: Currently registered by BICSI as an RCDD to perform the on-site inspection.
- K. See 270500 section – "Common Work Results for Communications" for more information.

1.5 CERTIFICATIONS

- A. The Cabling Contractor shall certify that the backbone cabling is covered under a 20-year Extended Product Warranty with a Manufacturer Registered Install on the component performance and installation integrity and is in compliance with the requirements established by EIT/TIA 568, 569, 492, IEC 60793, and BICSI Standards.
- B. This certificate shall be provided with the shop drawings and with the close out documents.

1.6 SUBMITTALS / RECORD DRAWING / MAINTENANCE MANUALS

- A. Shop Drawings
 - 1. The contractor shall provide point-to-point connection drawings of all equipment that will be provided. Drawings shall indicate the interlocking of equipment and wiring external to the various patch panels (ER and TR). These drawings shall be included in the submittal to the Architect/Engineer for approval.
 - 2. The contractor must submit a labeling scheme to the Engineer for approval as part of the submittal documentation. The labeling scheme shall include the cable, faceplate, and patch panel identification. Labeling installed without the Engineers approval will be subject to removal.
 - 3. Submittals shall be submitted in electronic format (PDF)..
- B. See Common Work Results for Communications section 270500 for more submittal requirements.
- C. Provide complete As-Builds showing all cable locations, labels and pathways, record drawings, test results, manufacturer warranties and maintenance manual, per section – "Operation and Maintenance of Communications System".

1.7 WARRANTY

- A. Components, parts, and assemblies supplied by the manufacturer shall be warranted against defects in materials and workmanship for a period as 270111 specified "Demonstration, Training, and Warranty of Communications Systems" from date of completion.
- B. Warranties shall include all labor, material, travel expenses, test equipment, equipment rental and any other expense required to troubleshoot, remove, repair or replace equipment or components to bring the system up to the original performance criteria and operation.
- C. Warranty services shall be provided during normal working hours with a reasonable response time from initial notification.

- D. Provide warranty certificate as part of the closeout documentation.

1.8 TRAINING

- A. Provide training as specified in section 27 01 11 - Demonstration, Training, and Warranty of Communications Systems.

PART 2 - PRODUCTS

- 2.1 **Approved Fiber Optic Cabling Manufacturers:** Belden, BerkTek, Corning, General, Hitachi, Hubbell, Mohawk, Panduit, Siemon, Superior

Approved Fiber Optic Innerduct Manufacturers: Carlon, Eastern, Endot, IPEX, MAXCELL

Approved Fiber Optic Hardware Manufacturers: Belden, Corning, Hubbell, Leviton, Panduit, Ortronics, Siemon

2.2 INDOOR/OUTDOOR OS2 SINGLE MODE PLENUM FIBER

- A. Single-mode fiber shall be OS2 fiber optic cables. These are fiber optic flame-retardant (FR) cables that are designed to meet both the rigorous environment of the outdoors and be routed indoors, where flame rating requirements also apply, with no need for a transition splice when entering the building. The tight-buffered construction facilitates easier termination for low-fiber-count applications in the local area network (LAN) and eliminates the need for fan-out kits.
- B. Single-mode fiber shall comply with ICEA S-104-696.
- C. Single-mode fiber shall be UL listed OFNP, CSA FT-6.
- D. Physical specifications:
 - 1. Nominal outer diameter mm (in):
 - 2. Nominal outer diameter mm (in):
 - 3. Nominal outer diameter mm (in):
 - 4. Nominal weight kg/km (lb/1000 feet):
 - 5. Nominal weight kg/km (lb/1000 feet):
 - 6. Nominal weight kg/km (lb/1000 feet):
 - 7. Install temperature:
- E. Transmission Performance:
 - 1. Performance optical code:
 - 2. Max attenuation dB/km):
 - 3. Minimum LED bandwidth (MHz/km)
 - 4. Minimum effective bandwidth (MHz/km)
 - 5. Gigabit ethernet distance (km)
 - 6. 10 gigabit ethernet distance (km)
- F. **BASIS OF DESIGN:** Corning FREEDM® One Tight-Buffered Cable, Plenum or Approved Equal.

2.3 FIBER OPTIC ENCLOSURES & PANELS

- A. Fiber optic enclosures shall be rack mounted as shown on drawings.
- B. The enclosures shall be as many rack units and include the appropriate number panels/ couplers to accommodate all strands of fiber coming into the room and safely store all splices, spare cable, saddle clips, spools, strain relief, etc.
- C. Any open or unutilized panel spaces in the enclosure need to have blank panels installed.

- D. Panels are to have bulkheads/adapters with the colors Aqua for OM4 and Blue for OS2 which include LC connectors.
- E. Enclosures shall be constructed of rugged 16 gauge heavy steel.
- F. **BASIS OF DESIGN:** Panduit Opticom® Rack Mount Fiber Enclosures or Approved Equal

2.4 FIBER OPTIC CONNECTORS

- A. Fiber optic cable strands shall be terminated at both ends with fusion spliced connectors by a qualified technician.
- B. Fiber optic connections shall be LC UPC type fusion spliced connectors providing a reliable connectivity option that eliminates the need for splice trays inside the fiber enclosures.
- C. Connector Housing colors shall be aqua for OM4 and blue for OS2.
- D. **BASIS OF DESIGN:** Corning FuseLite® 2 Splice-on Connector or Approved Equal

2.5 OS2 LC DUPLEX PATCH CORDS

- A. The factory made duplex fiber patch cord shall be OS2 with a 1.6mm yellow jacket.
- B. It is Riser (OFNR) rated, features LC Duplex connectors, has standard insertion loss, and is 3 meters long usually. Provide lengths as needed.
- C. The fiber patch cords shall meet TIA/EIA-568-B.3 performance requirements.
- D. Minimum Bandwidth:
 1. 200 MHz-Km at 1310 nm.
 2. 500 MHz-Km at 1550 nm.
- E. **BASIS OF DESIGN:** Corning Opti-Core® 2 Fiber Patch Cord, OS1/OS2, LC Duplex, Riser or Approved Equal

2.6 FIBER OPTIC WALL MOUNTED ENCLOSURE

- A. Provide fiber optic wall mounted enclosure as shown on drawings.
- B. The enclosures shall include the appropriate number panels and couplers to accommodate all strands of fiber coming into the enclosure and safely store all splices, spare cable, saddle clips, spools, strain relief, etc.
- C. Any open or unutilized panel spaces in the enclosure need to have blank panels installed.
- D. Panels are to have bulkheads/adapters with the colors Aqua for OM4 and Blue for OS2 which include LC connectors.
- E. Enclosure shall be UL listed, made of steel and solidly secure the incoming fibers.
- F. Enclosure shall be 16 inches high, 12 inches wide, and 3.5 inches deep with key locks and have a cover to protect the fiber interconnects from service and user segments.
- G. **BASIS OF DESIGN:** Panduit Opticom® Wall Mount Fiber Enclosure, Black, 4 Ports or Approved Equal

2.7 INNERDUCT (INDOOR)

- A. Provide a plenum rated, nonmetallic, corrugated flexible orange conduit with minimum of a 1" I.D. above ceiling for all non-armored fiber.
- B. Innerduct shall be UL listed and have a preinstalled pull tape.
- C. **BASIS OF DESIGN:** PREMIER SYSTEMS PVT LIMITED | P-100T-9000 or Approved Equal

2.8 FABRIC CONDUIT INNERDUCT (OUTDOOR)

- A. Provide a detectable fabric innerduct designed to maximize the capacity of incoming conduits for network infrastructure while preserving space for future network deployments.
- B. 4" 3 –cell Innerduct has sewn-in 18AWG TFN solid copper wire suitable for direct wired toning equipment and above ground handheld locators.
- C. Features color coded, pre-installed 1250LB pull tape in each cell and is Pre-lubed for lower friction during initial install and cable installation
- D. The factory installed pull tapes in each cell must free-float during installation so manufacturer swivels must be used when pulling in innerduct
- E. **BASIS OF DESIGN:** MaxCell Edge Detectable 4"MXED86383 or Approved Equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fiber optic cables, patch cords, and connectors as specified here and as shown on the drawings.
- B. The communications optical fiber backbone cabling system shall be installed using a star topology, extending from the existing MDF to each IDF or other locations identified on the drawings.

3.2 FIBER OPTIC

- A. Provide, install, terminate, test and label fiber optic cables from the MC/ER to each TR as shown on the Drawings.
- B. The runs shall consist of the following:
 - 1. Multimode and/or single-mode fiber cables shall be installed without splices or breaks from the ER to each TR as shown on the Drawings. If any breaks or shortages happen during installation or termination it shall be replaced without cost to the project.
- C. Termination of the fiber optic cabling shall consist of the following:
 - 1. In each TR and ER, the fiber optic cabling shall be terminated with the specified fiber optic type connector and patch panel. If any terminations are found to be inoperable during cutover without test result confirmation the correcting costs will be the installer's responsibility.
- D. All outdoor fiber optic cables only shall be installed in conduit and innerduct.
- E. The armored fiber optic cable shall be grounding to the telecom grounding system.
- F. All fiber optic cable run outdoor and under slab in the conduit shall be rated indoor/outdoor or for outdoor.

- G. Provide service loops as follows:
 - 1. 25 foot in each TR
 - 2. 50 foot in each ER
 - 3. 50 foot in each communications manhole.
 - 4. Support and protect as needed.
- H. All non-armored indoor fiber shall be installed in conduit and/or innerduct.

3.3 CABLE PULLING

- A. Cable rollers can be used when pulling cable. Cable pulleys can be used when pulling cable around bends and corners of wireways. Pulleys shall have a minimum diameter of 6 inches.
- B. Contractor can use basket grips wherever possible and exercise care while pulling cable as not to exceed the maximum allowable pulling strength of the cable.
- C. Cable rollers used for pulling cable in the cable tray shall be mounted close to cable tray supports and shall be placed at the beginning of the run and spaced every 25 feet along the run.

3.4 LABELING AND MARKING

- A. The labeling indicates the type, function, and terminating position, using a scheme such as ANSI/TIA-606-C or ISO/IEC 14763-2-1.
- B. Contractor shall install labels as follows:
 - 1. Cables shall be identified at each end with one wrap around printed label.
 - 2. The same alphanumeric identifiers shall be used at both ends of the cable identifying the origin closet and cabinet/rack location and the destination closet and cabinet/rack.
 - 3. One printed label placed on the front of the TR/ER enclosure, plus one label on the inside of the enclosure identifying each of the fiber strands location.
 - 4. All markings shall be carefully done so as to present a neat, professional appearance.
 - 5. All labels shall be typed and printed. Handwritten labels will not be accepted
- C. See 270553 section – "Identification for Communications Systems" for more information.

3.5 CABLE SEPARATION FROM POWER WIRING (ARMORED FIBER)

- A. The minimum distance shall be 5 inches between the cabling system and any fluorescent, neon, incandescent, or high intensity discharge lamp fixtures.
- B. Cable may be installed closer to lighting and convenience outlet power cable (single phase, 120V, 20A maximum), in metal cable channels for limited distances if the following guidelines are observed:
 - 1. Coincident (parallel) runs of no more than 15 feet are permissible if a 1 inch separation between the power cable and the cabling system cable is maintained by separators or suitable retention hardware. If necessary, the separation may be less than 1 inch for a run of up to 6 inches if no contact between the cabling system cable and the power cable occur.
 - 2. Coincident runs of no more than 30 feet are permissible if a 2 inch separation is maintained. The separation may be less than 2 inches for a run of up to 12 inches, if no contact occurs between the cabling system cable and the power cable.

3.6 TESTING

- A. All system connectors, adapters, and jumpers must be cleaned before measurements are taken.

- B. After the cleaning of all fiber faces is complete, the fiber shall be tested bidirectionally and at their two corresponding wavelengths (i.e., multimode at 850 nm and 1300 nm, singlemode at 1310 nm and 1550 nm) and records supplied showing band width and db loss on each fiber. Provide OTDR computer generated test reports. The copies of these records shall be marked post measurements and supplied to the Engineer and Owner.
- C. All installation work shall be done in a neat, high quality manner and in conformity with local and federal building codes.
- D. Cables shall be placed with sufficient bending radius so as not to kink, shear, or damage outer jacket.
- E. Certifying tester shall be within its calibration date window and that date should be shown on the cable test results. If that date is not shown on the test results, documentation will need to be presented separately.
- F. Provide cable certification summary report for all test results in PDF format.
- G. All test results on that summary report shall have Passing results. Any Failed results will need to be recertified before acceptance.
- H. Cable test results shall be stored and presented to the architect/engineers in electronic format for approval, and cable tester records designations shall match the associated cable labels and associated patch panel label designations.

3.7 CROSSOVERS/POLARITY CONNECTIONS

- A. The backbone and horizontal premises cabling must be installed so as to pair an odd numbered optical fiber with the next consecutive even numbered optical fiber (e.g., optical fiber 1 with 2, 3, with 4) to form two fiber transmission paths. Each premises cabling segment must be installed in a pair wise crossover orientation such that:
 - 1. Odd numbered optical fiber strands are Position A at one end and Position B at the other end.
 - 2. Even numbered optical fiber strands are Position B at one end and Position A at the other end.
- B. For the duplex SC, the crossover must be achieved by using consecutive optical fiber numbering (e.g., 1, 2, 3, 4...) on both ends of an optical fiber link, but the duplex optical fiber adapters must be installed in opposite manners on each end (e.g., A-B, A-B on one end and B-A, B-A on the other).
- C. For other duplex optical fiber styles, polarity may be achieved by the same method or by using reverse pair positioning. Reverse pair positioning is achieved by installing optical fiber (strands) in consecutive numbering sequence (e.g., 1, 2, 3, 4...) on one end of an optical fiber link, and installing optical fiber (strands) using reverse pair numbering (e.g., 2, 1, 4, 3...) on the other end of the optical fiber link.

END OF SECTION 27 13 23

SECTION 271515 - COMMUNICATIONS COPPER HORIZONTAL CABLING (CATEGORY 6)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes, but is not limited to the following:
 1. Local area network
 2. Horizontal cabling
 3. Patch panels compatible with the structured cabling system
 4. Patch cords compatible with the structured cabling system
 5. Modular jacks
 6. Termination of all horizontal cabling
 7. Certified test results of all horizontal cabling
- B. Related section includes the following:
 1. Division 01 – All Sections
 2. Division 26 - Electrical
 3. Division 27 – Communications Sections
 4. Division 28 - Electronic Safety and Security.

1.3 SYSTEM DESCRIPTION

- A. Horizontal cabling is the portion of the telecommunications cabling system that extends from the mechanical termination in the outlet/connector to the horizontal cross-connect in the ER or TR.
- B. The Cat6 horizontal cabling system shall be capable of 10/100/1000 Mbps full duplex transmission via 4 PR UTP Category 6 horizontal cable and shall comply with TIA/EIA 568B requirements for color coding unless otherwise noted.
- C. Provide labor, material, equipment, and accessories necessary for a complete operational network system that is manufacturer channel approved. The Data/Cabling Contractor shall furnish the equipment, accessories and necessary material as described herein.
- D. The cabling for the voice and data cabling system shall include but not limited to the following:
 1. Provide UTP cables (horizontal).
 2. Provide channel approved patch panels and patch cords.
 3. Provide channel approved modular jacks and cover plates.
 4. Provide, terminate, test, and label all cabling within each room and the data cabinets (MC/ER's and TR's).
- E. Horizontal Cabling shall be installed in a physical star topology. Each data cable outlet/connector shall be cabled directly to its appropriate termination point within the designated data closet.
- F. The contractor shall coordinate the extension of the electrical service from the electrical junction box located in the room to each communications cabinets/rack with the Site Electrical Contractor.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Maintenance Proximity: Not more than 2 hours travel time from Installer's place of business to Project site.
 - 2. Cable installer company must have on staff a registered communication distribution designer (RCDD) certified by Building Industry Consulting Service International (BICSI)
 - 3. Installers' Site Project Manager must be a certified BICSI Installer or Technician
- B. The system shall be installed in accordance with requirements set by National Electric Code.
- C. Communications cabling system components and equipment shall be listed by Underwriters Laboratories, Inc. for Computer use, and the components shall bear the UL label.
- D. All equipment shall comply with the latest ANSI-J-STD-607 grounding and bonding standards.
- E. All equipment and installation practices shall comply with latest BICSI (TDMM) standards.
- F. All equipment shall comply with the latest ANSI/TIA/EIA-568, 569, 60, 607, and 862 standards, as applicable.
- G. Cables shall be installed in accordance with ANSI/EIA/TIA and BICSI standards.
- H. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and the Technology Consultant.
- I. All cabling shall be tested in accordance with the ANSI/TIA/EIA-568-B2 standards with the required testing equipment.

1.5 CERTIFICATION

- A. Cabling Contractor shall provide a certified passing test report from a copper cable certifier for each channel path in PDF form. If test reports are rejected or missing the contractor will be required to retest any failed or missing channels and submit new test reports to receive acceptance for the entire installation. The tester will need to be within its acceptable calibration window.
- B. This Contractor shall submit with his/her bid a certificate from the manufacturer indicating that the named customers' installation will be certified for a 25-year Extended Manufacturer Product Warranty on Registered System Installation and that the installing company is a certified installer with that manufacturer.
- C. All certificates shall be provided with the shop drawing submittal.
- D. Once the structured cabling system has been installed, registered, and validated, a System Warranty Certificate will be issued to the end user, providing them with confidence and security in their newly installed structured cabling system.

1.6 SUBMITTALS / RECORD DRAWINGS / MAINTENANCE MANUALS

- A. Shop Drawings
 - 1. Complete and comprehensive shop drawings with labeling, etc. shall be submitted to the Architect/Engineer for approval.
 - 2. Drawings shall be provided in AutoCAD Release 2002 format or higher.
- B. See front end submittals section for more information.

- C. See Common Work Results for Communications section 270500 for more submittal requirements.
- D. Provide record drawings and maintenance manual, per section – "Operation and Maintenance of Communications Systems".

1.7 WARRANTY

- A. Components, parts, and assemblies supplied by the Communications Contractor/manufacturer shall be guaranteed against defects in materials and workmanship for a period as specified in section – "Demonstration, Training, and Warranty of Communications Systems", commencing upon the building substantial completion date. Warranty services shall be provided by an installer certified by the equipment manufacturer during normal working hours.
- B. The manufacturer's statement of a complete channel warranty shall be included in the shop drawing submittals.

1.8 TRAINING

- A. Provide training as specified in section titled "Demonstration, Training, and Warranty of Communications Systems" for more information.

PART 2 - PRODUCTS

- 2.1 **Approved Plenum Cat6 Manufacturers:** Belden, BerkTek, General, Hitachi, Hubbell, Mohawk, Panduit, Siemon, Superior Essex

Approved Plenum OSP Cat6 Manufacturers: Belden, BerkTek, General, Hitachi, Mohawk, Panduit, Siemon, Superior Essex

Approved OSP Cat6 Protector Manufacturers: Circa, Cyclix, Emerson, Marconni, Tii Tech

Approved Outlet/Connector Manufacturers: Belden, Hubbell, Leviton, Panduit, Siemon

Approved Faceplate Manufacturers: Belden, Hubbell, Leviton, Panduit, Siemon

Approved Patch Panel/Patch Cable Manufacturers: Belden, Hubbell, Leviton, Panduit, Siemon

2.2 HORIZONTAL CABLING & CONNECTIVITY HARDWARE PRODUCTS

- A. Contractors shall provide a system where the connectivity hardware and cable manufacturer used for the infrastructure install have formed a partnership to create a complete channel solution. This solution shall be standards based, performance warranted by the connectivity manufacturer.

2.3 HORIZONTAL CABLE - CATEGORY 6 – PLENUM

- A. The Category 6 cable shall be four unshielded twisted pair (UTP), 23 AWG, solid bare annealed copper, Fluoropolymer; Low-Smoke, Flame Retardant insulation for all 4 pairs and is suitable for 10 Mbps 10BASE-T through 1000BASE-T Ethernet.
- B. UL listed CMP with transmission characteristics that meet or exceed those of FCC-68/EIA/TIA, 568A-5 and EIT/TIA TSB-95 performance and NEMA low loss, extended frequency; jacket shall be sequentially marked at 2 foot intervals and must be plenum rated.
- C. Pair twisting shall be maintained to meet the cable performance. Maximum UTP cable untwisting for termination allows for one half (1/2) inch.

- D. Category 6 cable must be properly installed and terminated to meet specifications. The cable must not be kinked or bent too tightly; the bend radius should be larger than four times the outer diameter of the cable.
- E. Applications include:
 - 10BASE-T through 1000BASE-T Ethernet
 - Power over Ethernet (PoE) – IEEE 802.3af
 - PoE+ – IEEE 802.3at Type 1 and 2
- F. Cable shall meet ANSI/TIA/EIA-658-B2-1 specification.
- G. Design bandwidth - 250 MHZ, cable bandwidth - 250+ MHZ, standard data rate up to 1000 Mbps.
- H. Color Code =
 - Pair #1 - White/Blue and Blue
 - Pair #2 - White/Orange and Orange
 - Pair #3 - White/Green and Green
 - Pair #4 - White/Brown and Brown
- I. The maximum allowed length of a Cat 6 cable is 100 meters (328 ft). This consists of 90 meters (295 ft) of solid horizontal cabling between the patch panel and the wall jack, plus 5 meters (16 ft) of stranded patch cable between each jack and the attached device. **If there is any doubt or possibility of length overages bring those concerns to the Designer before beginning installation of any cabling.**
- J. **BASIS OF DESIGN** – Superior Essex Series 77 - 77-2xx-xB

2.4 OUTDOOR HORIZONTAL CABLE -CATEGORY 6

- A. The Outside Plant (OSP) unshielded Broadband category cable is designed to provide an extension of the LAN beyond the premises or in situations where the NEC code requires an OSP-rated cable when it is in contact with earth, whether in a conduit or not. The cable consists of a core of four (4) balanced twisted pairs surrounded by gel that does not drip or flow. The core is jacketed with a sunlight and abrasion resistant black, polyethylene outer jacket. The jacket prevents intrusion of moisture and easily wipes clean during installation.
- B. UL listed CM with transmission characteristics that meet or exceed those of FCC-68/EIA/TIA, 568A-5 and EIT/TIA TSB-95 performance and NEMA low loss, extended frequency, jacket shall be sequentially marked at 2-foot intervals.
- C. Transition point from Plenum Cat6 to OSP Cat6 should be enclosed in a surface mount box with a service loop on both cables. Pair twisting shall be maintained to meet the cable performance, but maximum cable untwisting allowed is one half (1/2) inch.
- D. Transmission performance characterized to 500 MHz for CAT 6.
- E. Certifying shall be through the whole cable from user side patch cable to equipment side patch cable including through the transition point.
- F. Color Code =
 - Pair #1 - White/Blue and Blue
 - Pair #2 - White/Orange and Orange
 - Pair #3 - White/Green and Green
 - Pair #4 - White/Brown and Brown
- G. **BASIS OF DESIGN** - Superior Essex PN: 04-001-68

2.5 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Provide a flush mounted modular data jack RJ-45 to fit in a one or two gang 3-1/2-inch-deep box and/or to fit in the surface mounted raceway or floor boxes as shown on the Drawings and as specified herein.
- B. Data jacks shall be 8-position configurations and shall meet all the transmission performance of specified cable.
- C. The data jacks shall be UL listed and must meet TIA/EIA 568B.2 requirements.
- D. The data jacks to be wired to TIA/EIA 568B color scheme unless otherwise noted.
- E. Modular data jacks shall be mounted in modular cover plates.
- F. Different systems may use different color outlets/connectors.
- G. Provide one spare bag/box of each color of RJ45 jacks used.
- H. **BASIS OF DESIGN** – HUBBELL IFP**XX & HUBBELL HXJ6X

2.6 MODULAR COVER PLATES

- A. Telecommunications outlet/connector faceplates shall be appropriately mounted (e.g., single-gang boxes, double-gang boxes, box eliminators, surface mount boxes, floor monuments/boxes). Flush or surface mount outlets designed for mounting of wall telephones shall use the dimensions of the mounting place and outlet/connector in ANSI/TIA-570-C or local equivalent compatible with wall-mounted telephones to be attached to the faceplates.
- B. Provide modular cover plates as shown on the drawing and as specified.
- C. Color of the faceplate/cover plates shall be WHITE to match existing campus outlets.
- D. Provide decorative modular mounting frames for all jacks in surface raceway.
- E. Provide the cover plate inside floor boxes to match receptacle cover plates (verify with site electrical contractor).
- F. Jacks shall be mounted on stainless steel plate where required.
- G. Cover plate shall be adjustable either in field or by factory (1/4 inch minimum).
- H. Provide blanks in all unused openings for all cover plates and in floor boxes.
- I. **BASIS OF DESIGN** – HUBBELL IMF*XX, NS61*XX, Q106X, SP6R

2.7 STAINLESS STEEL COVER PLATES

- A. Provide stainless steel cover plates to fit the modular jacks as shown on the Drawings.
- B. Stainless steel cover plate shall be single gang or double gang.
- C. Provide stainless steel cover plates in the following areas:
 - 1. Lobby
 - 2. Corridors
 - 3. Any other areas as directed by Owner or Architect/Engineer.
- D. **BASIS OF DESIGN** – HUBBELL IMSS*

2.8 WEATHERPROOF COVERPLATE

- A. Weather resistant receptacles are designed with nylon and corrosion resistant metal components. When installed in an approved weather protective cover, weather resistant receptacles offer extra durable protection from rain, snow, ice, moisture, and humidity.
- B. Provide weatherproof cover plate for all outdoor devices.
- C. **BASIS OF DESIGN** – HUBBELL WP26XX

2.9 WIRELESS ACCESS POINT, CAMERA, AND VIDEO PROJECTOR LOCATIONS

- A. Cable Connection
 1. Provide two port plenum rated surface mount boxes to terminate the appropriately rated RJ45 jack for Cat6/Cat6A cable. Use a blank if there is an unused port.
 2. Provide 5-foot patch cord as required.
 3. Patch the wireless access point, camera and video projector to the data jack in the box above the ceiling.
 4. Place a color dot sticker on the ceiling grid to locate the cable location from the floor in common areas.
 5. If cable run is under 295', leave a 20' cable coil on these cables for flexibility of mounting the associated equipment. Do not leave this excess if the coil will make the overall cable be over footage.
- B. **BASIS OF DESIGN** – HUBBELL ISB2XXP

2.10 COPPER PATCH PANELS

- A. Provide 24 or 48 port modular patch panels to terminate unshielded twisted 4-pair, 22 – 26 AWG, 100 ohm cable and mount to standard EIA 19 inches racks.
- B. Patch panels shall be easy to identify with pre-printed numbers, write-on areas and optional label kits.
- C. Patch panels shall meet or exceed all transmission performance of the specified cable as outlined in TIA/EIA-568B.2 - 1, TSB-95.
- D. Each RJ45 jack shall be terminated with all 4 pair of UTP wire and shall be wired to meet TIA/EIA 568B color scheme.
- E. Provide one (1) extra wire management for data switches in each closet.
- F. **BASIS OF DESIGN** – HUBBELL HP6Exx OR HPJxx

2.11 PATCH CORDS

- A. Provide factory made patch cords with modular RJ45 at each end. Patch cords are usually UL listed, 1 foot (.3m), 3 foot (1m) long.
- B. Patch cord manufacturer must match connector/patch panel manufacturer to meet the channel requirements.
- C. Patch cable quantity
 1. Furnish one blue patch cord for each jack (within patch panel) with 20% spare; provide 50% one (1) foot and 50% three (3) foot patch cables.
 2. Furnish one blue station patch cable for each data jack (within faceplate) with 20% spare; provide 90% ten (10) foot patch cables and 10% fifteen (15) foot patch cables.
- D. **BASIS OF DESIGN:** HUBBELL NEXTSPEED SLIM HC6**xx

2.12 CAT 6 OSP PROTECTOR

- A. Provide solid state CAT 6 OSP protector for each 4 pair data cabling entering the building.
- B. Unit shall be rated for UL497/UL497B protection standards..
- C. Unit shall be Certified Category 6, Frequencies up to 250 MHz, Equipped with an Internal Fuse Link and 110 terminations.
- D. **BASIS OF DESIGN** – Tii TECHNOLOGIES INC. PN:606-65

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide communications copper horizontal cabling, connectors, jacks, cover plates, patch panels, cords, etc., as specified and as shown on drawings.
- B. Cabling at patch panels shall be terminated in numerical order, so as to provide a logical pattern that will provide the end user the greatest ease in the system administration.
- C. The ICT infrastructure shall be clearly labeled to identify all system components, including racks, cables, panels, and telecommunications outlet/connectors. The labeling system shall be machine printed and shall uniquely identify the cable origin and destination..

3.2 UNSHIELDED TWISTED PAIR CABLE (UTP)

- A. Provide the following additional UTP runs:
 - 1. Provide one (1) 4-pair UTP to the telephone headend equipment and also to the telephone back-up power supply in same room.
 - 2. Provide two (2) 4-pair UTP to each file server from MC/ER.
 - 3. Provide two (2) 4-pair UTP to the fire alarm panel from nearest data closet.
 - 4. Provide two (2) 4-pair UTP to the elevator controls from nearest data closet.
 - 5. Provide 20 additional 4-pair UTP cables, jacks, labeling, testing etc (180 feet each) to the nearest telecommunications rooms. (Install as directed by the Architect/Engineer.)
- B. Maximum pulling force shall be as recommended by the manufacturers and the maximum bending radius shall be (10) times the cable diameter.
- C. Outdoor computer/data cable shall be used in all floor box locations where concrete is slab on grade.
- D. Terminate the data jacks per the manufacturer's recommendations and ensure the termination bar is positioned as close as possible to the cable jacket edge.

3.3 CABLE PULLING

- A. Cable pulleys must be used when pulling cable around multiple bends and corners of wireways. Pulleys shall have a minimum diameter of 6 inches.
- B. Cable rollers used for pulling in cable shall be mounted close to wireway supports and shall be placed at the beginning of the run and spaced every 25 feet along the run.
- C. Providing cable slack is recommended to enable the possibility of future changes in the horizontal cabling system configuration:
 - In the TR:
 - 1. – Balanced twisted-pair cabling – ≈3 m (10 ft)

2. – Optical fiber cabling – ≈3 m (10 ft)
- In the work area:
3. – Balanced twisted-pair cabling – ≈0.3 m (1 ft)
4. – Optical fiber cabling – ≈1 m (3.3 ft)

Cable slack shall be taken into consideration in the total length of the horizontal cabling system segments. Loops shall be laced above the ceiling in the cable tray or support service loop above ceiling properly.

3.4 LABELING AND MARKING

- A. See Drawings for Technology Schedules for more information and notes.
- B. When labeling all cables:
 - Cables shall be identified at each end with a permanent label. The same alphanumeric identifiers shall be used at both ends of the cable and on the faceplate.
 - The labeling will indicate the type, function, and terminating position, preferably using a scheme such as ANSI/TIA-606-B or ISO/IEC 14763-2-1.
- C. Color coding the cables by function (e.g., LAN, voice, fire alarm, environmental control) may be helpful. Different cable jacket colors may be used to distinguish the service type (e.g., voice and data).
 1. Cross connect color coded shall be as follows:
 - a. Green - circuits from the central office/RBOC/Telco.
 - b. Purple - circuits from the switch ports
 - c. Yellow - circuits from the auxiliary cabinet.
 - d. Blue - wiring from the work station information outlets.
 - e. White - house pairs from cable between the equipment room and satellite closets.
 - f. Orange - wiring originating from electronic equipment.
 - g. Grey - Tie cables between satellite closets.

3.5 CABLE SEPARATION FROM POWER WIRING

- A. Between the cabling system and any fluorescent, neon, incandescent, or high intensity discharge lamp fixtures, the minimum distance shall be 5 inches.
- B. Cable may be installed closer to lighting and convenience outlet power cable (single phase, 120V, 20A maximum), in metal cable channels for limited distances if the following guidelines are observed:
 1. Coincident (parallel) runs of no more than 15 feet are permissible if a 1 inch separation between the power cable and the cabling system cable is maintained by separators or suitable retention hardware. If necessary, the separation may be less than 1 inch for a run of up to 6 inches if no contact between the cabling system cable and the power cable occur.
 2. Coincident runs of no more than 30 feet are permissible if a 2 inch separation is maintained. The separation may be less than 2 inches for a run of up to 12 inches, if no contact occurs between the cabling system cable and the power cable.

3.6

3.6 TESTING

- A. The Cabling Contractor shall be responsible for testing each horizontal cable run, patch panel, and patch cables to verify the performance of the channel warranty for the horizontal cabling system as defined in TIA/EIA TSB-67.
- B. The contractor shall configure the tester for the cable and connectors used in the installation.

- C. The contractor shall calibrate the tester to the newest software.
- D. The contractor shall use the same tester(s) from the same manufacturer for the entire project(s).
- E. All test reports shall have the same appearance and layout.
- F. The contractor shall turn in all passing copper/fiber test results. Partial, failed, or quick tests shall NOT be accepted, all test results shall be PDF format when submitted with the close out documents.
- G. System and Wiring Testing, Checking, and Reports:
 - 1. Cabling Contractor shall provide necessary technical personnel and testing instruments as required to perform complete testing of all systems installed by Contractor and coordinate this testing activity with the Architect/Engineer and Owner's representative.
 - 2. All wiring, terminations, equipment, etc. shall be checked and tested by qualified field representative or equipment vendor. A report shall be submitted to Architect/Engineer and Commissioning Agent by vendor representative and/or Contractor indicating results of such final check-out and testing processes. Final payment will not be approved until such report is submitted and any "failure" results are corrected.
 - 3. Cabling Contractor shall conduct such other tests and make necessary adjustments of equipment and installation infrastructure required by Architect/Engineer and/or Commissioning Agent, as requested or necessary to verify performance requirements. Submit all data gathering information taken during such tests to Architect/Engineer and Commissioning Agent.
 - 4. Cabling Contractor must input the specified cable parameters, manufacturers' name and number in the tester. (Test results will not be accepted with generic or not applicable cable types.)
 - 5. Reporting to be done in compliance with standards and schedules published by authority and agencies defined in the Specifications.

END OF SECTION 271515

SECTION 27 15 53 – MISC. COMMUNICATIONS AUDIO-VIDEO CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes, but is not limited to the following:
 - 1. HDMI Cables
 - 2. HDMI Fiber Optic Cable Assembly
- B. Related section includes the following:
 - 1. Division 01 – All Sections
 - 2. Division 26 - Electrical
 - 3. Division 27 – Communications Sections
 - 4. Division 28, Electronic Safety and Security.

1.3 DESCRIPTION OF WORK

- A. Provide labor, material, equipment, and accessories necessary for a complete operational video wiring system as part of the Video Wiring System as indicated on the Drawings and specified herein.
- B. The horizontal cable shall be a home run from each video location to their respective telecommunication room(s), or as shown on the drawings. (Trunk and tap is not permitted.)
- C. Contractor shall coordinate the extension of the electrical service from the electrical junction box located in the room to each communications cabinets/rack with the Site Electrical Contractor.

1.4 QUALITY ASSURANCE

- A. The video wiring system and the control equipment shall bear the UL label.
- B. The wiring shall be installed in accordance with requirements set by ANSI/NFPA-70 National Electric Code.
- C. All equipment shall comply with the latest ANSI-J-STD-607 grounding and bonding standards.
- D. All equipment and installation practices shall comply with latest BICSI (TDMM) standards.
- E. All equipment shall comply with the latest ANSI/TIA/EIA-568, 569, 60, 607, and 862 standards, as applicable.
- F. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and the Technology Consultant.

1.5 SUBMITTALS / RECORD DRAWINGS / MAINTENANCE MANUALS

- A. Shop Drawings
 - 1. Complete and comprehensive shop drawings including all passive components shall be submitted to the Architect/Engineer for approval.
 - 2. "Typical" diagrams will not be acceptable.
- B. See front end submittals section for more information.

- C. See Common Work Results For Communications section 270500 for more submittal requirements.
- D. Provide record drawings and maintenance manual, per section – "Operation and Maintenance of Communications System".

1.6 WARRANTY

- A. Components, parts, and assemblies supplied by the manufacturer shall be warranted against defects in materials and workmanship for a period as specified in section – "Demonstration, Training, and Warranty of Communications Systems" from date of Final Completion. Warranty services shall be provided during normal working hours.

1.7 REQUIREMENTS BY THE LOCAL CABLE COMPANY

- A. Cabling Contractor shall coordinate the installing of the cable T.V. enclosure, conduits, and cable complete as directed or as required by the local cable T.V. company.

1.8 TRAINING

- A. Provide training as specified in section titled "Demonstration, Training, and Warranty of Communications Systems" for more information.

PART 2 - PRODUCTS

2.1 VIDEO OUTLET JACKS (VO/VI)

- A. Provide a flush mounted modular video jack, video outlet, and video input to fit in a two gang 3-1/2 inch deep box and/or to fit in the surface mounted raceway or floor boxes as shown on the drawing and specified herein.
- B. Video outlet and local input shall house a combination of any of these devices; RJ45 jacks, HDMI and other configurations. See detail for more information on the outlet configurations.
- C. Modular Video jacks must be UL listed.
- D. Modular video jacks shall be mounted in a modular wall plate for one, two, three, and or four modular opening. See detail for more information on the outlet configurations.
- E. See communications copper horizontal cabling for device colors.

2.2 MODULAR COVER PLATES

- A. Provide modular cover plates with the number of modular video jacks as shown on drawing and as specified in this Section.

2.3 VIDEO OUTLET LOCATION

- A. Provide cabling and connectors as shown on the drawings.
- B. The video outlet shall have but not limited to the following connectors:
 - 1. RJ45 jacks module: Panduit CJ688xx – series.
 - 2. Pass Thru angled HDMI connector.
 - 3. Blank module: Panduit CMB – series. (same color)
- C. Each connector shall be labeled as follows:
 - 1. #1 HDMI In or Out and #2 HDMI In or Out

2.4 VIDEO INPUT

- A. Provide cabling and connectors as shown on the drawings.
- B. The video input plate shall have but not limited to the following:
 - 1. RJ45 jacks.
 - 2. HDMI

2.5 TRUE HDMI- HIGH DEFINITION CABLES

- A. Provide true HDMI cable as follows:
 - 1. 24 (7/32) AWG Bare strand copper.
 - 2. Foam FEP insulation.
 - 3. 2 insulated conducted twisted together.
 - 4. Shield: aluminum-foil/mylar, 25% min. overlap.
 - 5. Drain: 24 AWG bare stranded copper, Mylar tape 25 % min overlap.
 - 6. 36 AWG tinned copper braid, 80% min coverage.
 - 7. Jacket: PVC alloy.
 - 8. Must support 1080p resolution.
 - 9. Must support Dolby True HD and DTS-HD Master audio.
 - 10. Supports audio return channel.
 - 11. RoHS compliance.
 - 12. Lengths: As appropriate for each location not to exceed 50 feet.
 - 13. Label cables as HDMI.
 - 14. Test cables as required.
 - 15. Cable shall be plenum rated.
- B. Approved Equal: Covid; C2G.

2.6 HDMI FIBER OPTIC CABLE ASSEMBLY

- A. Provide HDMI fiber optic cable assembly as follows:
 - 1. Must support 1080p resolution, 3D, Deep Color 36 bit, Dolby True HD, DTS-HD Master Audio, HDMI-CEC and HDCP
 - 2. Lengths: As appropriate for each location not to exceed 230 feet.
 - 3. Label cables as HDMI.
 - 4. RoHS, and NFPA 262 compliant.
 - 5. Test cables as required.
 - 6. Optical to electronic conversion shall be contained inside the connectors, cables utilizing USB power or external power supplies are not acceptable.
 - 7. Cable shall be plenum rated.

2.7 HDMI CONNECTORS

- A. Provide HDMI angled pass-through connectors with modular inserts to fit in a modular cover plate.

2.8 AUDIO/VISUAL PATCH CABLES

- A. Provide the following patch cords as shown on the drawing:
 - 1. 3 foot HDMI patch cables.

PART 3 - EXECUTION

3.1 PREMISES DISTRIBUTION SYSTEM

- A. Cables and wire shall be Underwriters Laboratories (UL) listed and meet the requirements for National Electrical Code (NEC) Section 800 for copper media for video applications.

- B. The video network interface shall be as shown in the drawings.
- C. This video work shall be performed in accordance with acknowledged industry standards and professional practices by qualified video installers.
- D. The installation of all work shall be neat and of professional quality. Minor moves or changes in equipment locations to accommodate equipment of other trades or the architectural symmetry of the facility will be completed at no additional charge.
- E. All system cover plates shall be by the same manufacturer.
- F. Provide cable service loops as follows:
 - 1. 25 foot in each TR
 - 2. 3 foot above ceiling at each face plate.

3.2 TERMINATIONS

- A. Video and control cables running to the monitor from the TR or MC/ER and local input face plate shall be installed as shown on Drawings. Lace cables into a pigtail assembly and create an accessible strain relief for the cables below the ceiling line and behind the monitor on the mount.

3.3 INSTALLATION

- A. This work shall be performed in accordance with acknowledged industry standards and professional practices.
- B. The installation of all work shall be neat and of professional quality. Execute without claim for extra payment minor moves or changes in equipment locations to accommodate equipment of other trades or the architectural symmetry of the facility.

3.4 IDENTIFICATION

- A. Provide labeling per section "Identification for Communications Systems".

3.5 MAINTENANCE

- A. Response times for major system failure during the coverage period which materially affects the operation of the system or equipment must not exceed 4 hours.
- B. Response times for minor failures must not exceed 24 clock hours, Monday through Friday, 8:00 a.m. - 5:00 p.m., excluding holidays.

3.6 TESTING

- A. A certified factory trained technician shall test the jacks, cable, etc., and must provide documentation his testing as part of the operation and maintenance manual. Any defect of wiring etc., must be corrected at his own expense.
- B. Cable test results shall be stored and presented to the architect/engineers in both hard copy and electronic format for approval, and cable tester records designations shall match the associated cable labels and associated patch panel label designations.

3.7 CERTIFICATION

- A. As a condition of final acceptance by the Owner, the Contractor shall issue to the Owner a letter of certification that the system is in compliance with the performance specifications and industry standard and as specified herein and that final testing and adjustment has been accomplished.

END OF SECTION 27 15 33

SECTION 27 41 12 - COMMUNICATIONS AUDIO-VIDEO MOUNTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes, but is not limited to the following:
 - 1. Audio - Video mounts
 - 2. Multi A/V mount
 - 3. Miscellaneous items
- B. Related section includes the following:
 - 1. Division 01 – General Requirements
 - 2. Division 08 – Ceilings
 - 3. Division 11 - Equipment
 - 4. Division 26 – Electrical
 - 5. Division 27 – Communications Sections
 - 6. Division 28 – Electronic Safety and Security

1.3 DESCRIPTION OF WORK

- A. Provide audio - video mounts for all AV equipment and all accessories to attach to the building structural steel and or walls.
- B. Provide labor, material, equipment, and accessories necessary for a complete installation of video display mounts.
- C. It shall be the responsibility of the audio - video mounts contractor to verify the video locations and provide the proper mounts as specified here and as shown on the drawings.

1.4 QUALITY ASSURANCE

- A. The audio - video mounts and accessories shall bear the UL label and must be CSA certified.
- B. All equipment installation practices shall comply with the latest BICSI (TDMM) standards.
- C. All equipment shall comply with the latest ANSI/TIA/EIA-568, 569, 606, 607, and 862 standards, as applicable.
- D. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and Technology Consultant.
- E. See section – "Common Work Results for Communication" for more information.

1.5 SUBMITTALS / RECORD DRAWINGS / MAINTENANCE MANUALS

- A. Shop Drawings
 - 1. Complete and comprehensive shop drawings including all mounting components shall be submitted to the Architect/Engineer for approval.
 - 2. A complete technical data sheet shall be included.
 - 3. Provide complete detail drawings for each type of bracket support.
 - 4. Certification letter.

- B. See Common Work Results for Communications section 270500 for more submittal requirements.
- C. Provide record drawings and maintenance manual, per section – "Operation and Maintenance of Communications Systems".

1.6 WARRANTY

- A. Components, parts, and assemblies supplied by the manufacturer shall be warranted against defects in materials and workmanship for a period as specified in section – "Demonstration and Training of Communications Systems" from date of completion. Warranty services shall be provided during normal working hours.

- 1.7 Provide training as specified in section titled "Demonstration and Training of Communications Systems" for more information.

PART 2 - PRODUCTS

2.1 AUDIO - VIDEO MOUNTS

- A. Provide audio - video amount as shown on the Drawings.
- B. Mounts shall comply with the following:
 - 1. Constructed of 14 gauge cold rolled steel and finished in black fused epoxy.
 - 2. Provide proper model for the size and weight of the television set specified.
 - 3. Mount shall be capable of adjustable tilt (0 to 30 degrees) and 360 degree swivel action.
 - 4. Provide top and front roll out protection.
- C. Wall Support
 - 1. Provide blocking or suitable reinforcement to allow a safe, secure wall bracket installation.
 - 2. Secure wall bracket with anchors suitable for installation as recommended by the manufacturer.
 - a. Provide information on the proposed anchors to the A/E for approval prior to installation.

2.2 FULL-MOTION TV WALL MOUNT BRACKET

- A. Provide correctly sized wall mount bracket for the monitor being mounted.
- B. Ensure correct mounting hardware is being used for the installation.
- C. $\pm 30^\circ$ swivel range allowing adjustment of the TV horizontally
- D. Provides a tilt range of 0° to -10° , downwards for enhanced visibility and reduced glare.
- E. The $\pm 1^\circ$ rotation range further enhances the adjustability, enabling you to fine-tune the TV's horizontal leveling to perfection.
- F. BASIS OF DESIGN: MONOPRICE Product # 44485

2.3 SOUNDBAR MOUNT BRACKET ACCESSORY

- A. Provide a soundbar mount for the TeamRoom alternate Monitor as follows:
 - 1. Adjustable Base Holder for Most brands of soundbars with a 3.4" - 6.1" Depth.
 - 2. Fits VESA pattern from 150 mm x 100 mm to 800 mm x 400mm.
 - 3. Holds up to 33 lbs.
 - 4. Enhances Audio Experience.
 - 5. Soft Anti-Skid pads that reduce vibrations and prevent scratches or scuffs.

6. Neat and Clean Design.
7. Easy Installation, can be mounted above or under the TV.
8. Made of Premium Steel

B. BASIS OF DESIGN: MONOPRICE Product # 44899

PART 3 - EXECUTION

3.1 PREMISES DISTRIBUTION SYSTEM

- A. Contractor shall be responsible for all the miscellaneous support, steel, hardware, brackets, metal stud wall plates, concrete wall plates, ceiling attachments, adapters and decouplers, safety belts, bumper guards, etc. to provide a safe and secure installation and shall comply with the manufacturer's instructions.
- B. Coordinate the location of the monitor, monitor heights, locations, etc. with the Architect/Engineer, Owner, electrical contractor and others.
- C. The Architect/Engineer will pre-approve the installation methods and verify all mounting heights of all audio/video display devices in the field. A pre-installation conference must be scheduled by the Contractor prior to the installation of the audio/video display mounts.
- D. The contractor shall provide a mock room for Owner and Architect to review and approve.

3.2 MAINTENANCE

- A. Response times for major system failure during the coverage period which materially affects the operation of the system or equipment must not exceed 4 hours.
- B. Response times for minor failures must not exceed 24 clock hours, Monday through Friday, 8:00 a.m. - 5:00 p.m., excluding holidays.

3.3 TESTING

- A. A certified trained technician shall test the video display mounts and must report his test as part of the operation and maintenance manual.

3.4 CERTIFICATION

- A. As a condition of final acceptance by the Owner, the Contractor shall issue to the Owner a letter of certification stating that the audio/video mounts were installed per the manufacturer's recommendations.

END OF SECTION 27 41 12

SECTION 27 41 43 - INTEGRATED A/V EQUIPMENT (MONITORS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes, but is not limited to the following:
 - 1. This section includes the following:
 - 1. 55 inch LCD screens.
 - 2. 75 inch LCD screens.
 - 3. Articulated wall bracket
- B. Related section includes the following:
 - 1. Division 01 – All Sections
 - 2. Division 27 – Communications Sections
 - 3. Division 28 – Electronic Safety and Security

1.3 SCOPE OF WORK

- A. The work described includes all labor, material, testing and service necessary for the installation of the monitors as indicated on the drawings and/or described herein.

1.4 SUBMITTALS

- A. Furnish to the Architect/Engineer complete shop drawings for approval, per the submittal Section.
- B. See front end submittals section for more information.
- C. See Common Work Results For Communications section 270500 for more submittal requirements.

1.5 CONTRACTOR QUALIFICATIONS

- A. The Contractor or his subcontractor shall meet the minimum requirements as outlined in section – "Common Work Results for Communications".

1.6 QUALITY ASSURANCE

- A. All equipment shall be UL listed.
- B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.
- C. All equipment Installation Practices shall comply with the Local Electric Code.
- D. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standards.
- E. All equipment and Installation Practices shall comply with the latest BICSI Telecommunications Distribution Methods Manuals Manual (TDMM).
- F. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, 862 standards.

- G. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and Technology Consultant.
- H. All equipment and installation shall comply with the latest InfoComm International Installation Handbook.

1.7 PRECEDENCE

- A. The Contractor shall review the of the monitors specifications very carefully and shall provide the best quality equipment that meets and exceeds the bid specifications.
- B. If the product specified is NO longer available, the contractor shall provide the replacement products and equipment that exceeds the absolute products with NO exceptions.
- C. If the Contractor provides the replacement products on his own that does not meet the specification, then he shall be responsible to provide the new products/equipment at NO cost to the Owner.

1.8 WARRANTY

- A. The audio video distribution system shall have a warranty as specified in section – "Demonstration and Training of Communications Systems". The warranty shall include all labor and material to replace all components that fail and or do not comply with the performance specifications.

1.9 RECORD DRAWINGS / OPERATION AND MAINTENANCE MANUALS

- A. Provide record drawings and operation and maintenance manuals, as described in Sections – "Operation and Maintenance of Communications Systems" and "Common Work Results for Communications Systems".

PART 2 - PRODUCTS

2.1 AUDIO - VIDEO MOUNTS

- A. Provide audio - video amount as shown on the Drawings and as shown on the Room Matrix Schedule.
- B. Mounts shall comply with the following:
 - 1. Constructed of 14 gauge cold rolled steel and finished in black fused epoxy.
 - 2. Provide proper model for the size and weight of the monitor set specified.
- C. Wall Support
 - 1. Provide blocking or suitable reinforcement to allow a safe, secure wall bracket installation.
 - 2. Secure wall bracket with anchors suitable for the installation as recommended by the manufacturer.
- D. Provide 47"-55" LED articulated universal wall brackets as follows:
 - 1. Arm extended from 4.5 inches to 27 inches.
 - 2. Integrated cable management.
 - 3. Adjustable tilt +15/-5 degrees.
 - 4. Scratch resistant black epoxy finish.
 - 5. Wall plate covers fasteners.
 - 6. Maximum load 80 Lbs.
 - 7. Provide all mounting hardware, stud fasteners and concrete anchors.
 - 8. Approved Manufacturers:
 - 1. MONOPRICE Product # 44485
 - 2. Peerless SA746PU series.
 - 3. Premier Mounts: AM80

- E. Provide 65"-75" LED articulated universal wall brackets as follows:
 - 1. Arm extended from 4.5 inches to 27 inches.
 - 2. Integrated cable management.
 - 3. Adjustable tilt +15/-5 degrees.
 - 4. Scratch resistant black epoxy finish.
 - 5. Wall plate covers fasteners.
 - 6. Maximum load 150 Lbs.
 - 7. Provide all mounting hardware, stud fasteners and concrete anchors.
 - 8. Approved Manufacturers:
 - 1. MONOPRICE Product # 44485
 - 2. Peerless SA771PU series.
 - 3. Premier Mounts: AM175

- F. SOUNDBAR MOUNT BRACKET ACCESSORY
 - 1. Provide a soundbar mount for the TeamRoom alternate Monitor as follows:
 - A. Adjustable Base Holder for Most brands of soundbars with a 3.4" - 6.1" Depth.
 - B. Fits VESA pattern from 150 mm x 100 mm to 800 mm x 400mm.
 - C. Holds up to 33 lbs.
 - D. Enhances Audio Experience.
 - E. Soft Anti-Skid pads that reduce vibrations and prevent scratches or scuffs.
 - F. Neat and Clean Design.
 - G. Easy Installation, can be mounted above or under the TV.
 - H. Made of Premium Steel

 - 2. BASIS OF DESIGN: MONOPRICE Product # 44899

2.2 MONITORS

- A. Provide a 55 inch Pro TV BET-H series monitor in each of the locker rooms with the following:
 - 1. Type 50Hz E-LED BLU
 - 2. Resolution 3,840 x 2,160
 - 3. Brightness(Typ.) 250nit
 - 4. Contrast Ratio(Typ.) 4,700:1
 - 5. Input HDMI x 3, HDCP 1.4 / 2.2, USB x 1, RF 1 Terrestrial / 1 Cable / 0 Satellite (EU, CIS: 1/1/1)
 - 6. Output Audio: Optical
 - 7. External Control RJ45
 - 8. Wireless WiFi 5, Bluetooth 5.2 Supported
 - 9. Operating System Tizen™ 7.0
 - 10. Supported VXT Player, Samsung business TV, Web browser, YouTube, PlayLock
 - 11. (For Brazil, Major Apps Include: Samsung business TV / Netflix / Amazon Prime / Google Play Movies and TV / YouTube / etc.)
 - 12. Adaptive Sound
 - 13. Multi Device Experience - Mobile to TV, TV Sound to Mobile, Sound Mirroring, Wireless TV On
 - 14. Web Service Microsoft 365
 - 15. Provide universal articulating wall mount.
 - 16. Energy Star.
 - 17. Approved TV Manufacturers:
 - 1. SAMSUNG BE55T-H / LH55BETHLGFXXGO
 - 2. Sharp
 - 3. PANASONIC

- B. Provide a 75 inch Pro TV BET-H series monitor in the ALTERNATE TeamRoom with the following:
 - 1. Type 50Hz E-LED BLU
 - 2. Resolution 3,840 x 2,160
 - 3. Brightness(Typ.) 250nit
 - 4. Contrast Ratio(Typ.) 4,700:1

5. Input HDMI x 3, HDCP 1.4 / 2.2, USB x 1, RF 1 Terrestrial / 1 Cable / 0 Satellite (EU, CIS: 1/1/1)
6. Output Audio: Optical
7. External Control RJ45
8. Wireless WiFi 5, Bluetooth 5.2 Supported
9. Operating System Tizen™ 7.0
10. Supported VXT Player, Samsung business TV, Web browser, YouTube, PlayLock
11. (For Brazil, Major Apps Include: Samsung business TV / Netflix / Amazon Prime / Google Play Movies and TV / YouTube / etc.)
12. Adaptive Sound
13. Multi Device Experience - Mobile to TV, TV Sound to Mobile, Sound Mirroring, Wireless TV On
14. Web Service Microsoft 365
15. Provide universal articulating wall mount.
16. Energy Star.
17. Approved TV Manufacturers:
18. SAMSUNG BE75T-H / LH75BETHLGFYGO
19. Sharp
20. PANASONIC

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install monitors as shown on the drawings. Coordinate locations with other trades.
- B. The contractor shall provide a mock-up to review the installation of the monitors for the Owner, CM and architect/engineers review and approval.
- C. Provide universal articulated wall LCD monitor brackets, mount, plates, supports, and blocking as needed for the specified monitors in all educational spaces unless otherwise noted
- D. Securely fasten the monitors to the top of the video cabinet with screws if applicable.

3.2 TESTING

- E. Upon completion of the installation, all monitors shall be tested by the manufacturer's representative and all necessary adjustments must be made to assure compliance with this specification.
- F. All testing shall be logged on a spreadsheet. See Section – "Operation and Maintenance of Communications Systems" for more information.

3.3 WARRANTY

- G. The Contractor shall warrant all components as specified. The warranty shall include labor and material to replace all components that fails or do not comply with the performance specifications.
- H. Response time shall be (2) hours for major failures and 24 hours for minor failures. A major failure shall be defined as a malfunction resulting in the loss of two or more video outlets.
- I. The Contractor shall employ factory trained technical service personnel for service and maintenance of the system. The Contractor shall also instruct the owner's technical personnel in the operation, care and maintenance of the system.

END OF SECTION 27 41 43

SECTION 27 51 25 – IP BASED

INTERCOMMUNICATIONS AND PROGRAM 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 but not limited to the following:
 - 1. 2 IP One Way Ceiling Speakers Located in the LockerRooms
 - 2. Miscellaneous item
- B. Related Section includes the following:
 - 1. Division 01, All Sections
 - 2. Division 26, Electrical
 - 3. Division 27, Communications Sections.
 - 4. Division 28, Electronic Safety and Security

1.3 SUBMITTALS

- A. Shop Drawings: Signed and sealed by a qualified professional engineer.
 - 1. Design Calculations: Calculate requirements for selecting seismic restraints for central control cabinets.
 - 2. Equipment Details: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.
 - 3. Station-Arrangement Details: Scaled drawings for built-in equipment.
 - 4. Wiring Diagrams: Power, signal, and control wiring. Include the following:
 - a. Identify terminals to facilitate installation, operation, and maintenance.
 - b. Single-line diagram showing interconnection of components.
 - c. Cabling diagram showing cable routing.
- B. Quality Control/Assurance Submittals:
 - 1. Product Data: For each item specified:
- C. See front end submittals section for more information.
- D. See Common Work Results For Communications section 270500 for more submittal requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 - 1. Maintenance Proximity: Not more than 2 hours' normal travel time from Installer's place of business to Project site.
 - 2. Cable installer must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.
 - 3. Installation shall be by personnel certified by National Institute for Certification in Engineering Technologies as audio systems Level III technician.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70 – National Electrical Code.
- D. Comply with UL 50.
- E. TIA/EIA-607 Telecommunications grounding.
- F. Latest edition of BISCI – TDMM – manual
- G. Americans with Disabilities Act (ADA)
- H. Federal Communications Commission, Part 15
- I. Sound System Engineering (Davis and Patronics) 3rd Edition 2006.
- J. Audio System Design and Installation (Giddings) 1990.
- K. NICET – Certified Audio Technician Level I
- L. NSCA – Certified Systems Installer, C-SI
- M. InfoComm International – Certified Technology Specialist, CTS.
- N. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and Technology Consultant.

1.5 WARRANTY

- A. The intercommunications and paging program system shall carry a warranty as specified in Section "Demonstration and Training of Communications Systems".

1.6 TRAINING

- A. Provide training per Section "Demonstration and Training of Communications Systems".

1.7 RECORD DRAWINGS/OPERATION AND MAINTENANCE MANUALS

- A. Provide record drawings and operation and maintenance manuals as described in Sections "Operation and Maintenance of Communications" and "Common Works Results for Communication Systems".
- B. Label each IP Based Intercommunications cabinets with the IP address.

1.8 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted speaker, microphones, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, video projectors, and all other trades.

1.9 PROGRAMMING

- A. The contractor shall price to install the two IP speakers back to the new TR only and schedule a programming meeting with the owner thru the CM/Architect/Engineers after award of bids, to review the requirement of the Intercommunications programming for zones, bell changes etc.

PART 2 - PRODUCTS

2.1 CEILING LOUDSPEAKERS WITH MATCHING TRANSFORMERS AND BAFFLE WITH VOLUME CONTROL

- A. Approved Manufacturers:
 - 1. Atlas Sound.
 - 2. Lowell Manufacturing Company.
 - 3. Quam-Nichols Company.
- B. Provide recessed lay in speaker assembly as described here and as shown on the drawings.
- C. Size: 8 inch.
- D. Power rating: 25 Watt Peak, 15 Watt RMS.
- E. Sensitivity: 97 dB average.
- F. Impedance: 8 ohms nominal.
- G. Frequency Response: 45Hz-19 kHz Nominal, 50Hz- 8kHz + 5dB.
- H. Minimum Dispersion Angle: 100-105 degrees, minus 6 dB at 2 kHz octave band.
- I. Magnetic weight: 10 oz Nominal (260g)
- J. Comply with TIA/EIA SE-103 and TIA/EIA-160
- K. Line Transformer: frequency response 100Hz-10 kHz (+1.5dB): maximum insertion loss of 1.5 dB; secondary impedance 8 Ohms; power rating 4-5 Watts; primary terminals with 6 inch com. Lead color coded cables and dual voltage 25 V/70.7 V.
- L. Multi taps at 4/5,2,1,1/2 and 1/8 watts.(45 ohm speakers will NOT be allowed)
- M. Enclosures: Metal protective enclosure, acoustically dampened, with front face of at least 0.0478-inch steel and whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; and with relief of back pressure.
- N. Tile bridges: Provide each loudspeaker with load-bearing, rust-resistant steel tile bridge to match the supplied speakers.
- O. Grills/Baffle: Provide each loudspeaker with flush mounted baffle, minimum thickness of 0.032-inch aluminum, with textured white finish, to match the supplied speakers.
- P. Vandal-Proof, High-Strength Baffle: For flush speakers, self-aging cast aluminum with tensile strength of 44,000 psi , 0.025-inch minimum thickness, countersunk heat-treated alloy mounting screws, and textured white epoxy finish.
 - 1. Provide surface loudspeakers with matching 16 gauge steel enclosure with sloped baffle.
- Q. Provide baffle mounted volume control.
- R. See drawings for volume control speakers (noted by VC next to each speaker)

2.2 GUARDS FOR PHYSICAL PROTECTION

- A. Description: Heavy chrome-plated welded wire mesh wire guard of size and shape for loudspeaker or other device requiring protection.

- B. Factory fabricated and furnished by manufacturer of device.

2.3 CONDUCTORS AND CABLES

- A. Conductors: Jacketed and twisted multi-pair, untinned solid copper. Sizes as recommended by system manufacturer, but not smaller than 4 conductor No. 22 AWG.
- B. Insulation: Thermoplastic, not less than 1/32 inch thick.
- C. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG tinned, soft-copper strands formed into a braid or equivalent foil.
 - 1. Minimum Shielding Coverage on Conductors: 60 percent.
- D. Plenum Cable: Listed and labeled for plenum use.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wiring Method: Install wiring in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces where cable wiring method may be used.
- B. Provide plenum-rated cabling for the intercommunications system.
- C. Area wiring shall go to the nearest TR/MC/ER.
- D. The IP Based Intercommunications and program Systems shall be tied to the local area network.
- E. The IP Based Intercommunications and program Systems shall be tied together with two pair cable in case the network system fails, provide all hardware and software as needed.
- F. All cables shall be concealed in raceways in all exposed spaces with no ceilings. (NO cable will be allowed in exposed areas.
- G. Secure and support cables by straps, staples, or similar fittings designed and installed to avoid damage to cables. Secure cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, or fittings.
- H. Wiring Terminations: Terminate all intercommunications wiring inside the central-control cabinet. Do not terminate above accessible ceilings or exposed in finished spaces.
- I. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Use lacing bars in cabinets.
- J. Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.
- K. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches for speaker microphones and adjacent parallel power and telephone wiring. Separate other school intercom and program equipment conductors as recommended by equipment manufacturer.
- L. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- M. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

- N. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
- O. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
- P. Connect each room speaker to a separate station circuit (Provide minimum of 4 conductor cable home run to each speaker).

3.2 GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet.
- C. Install grounding electrodes as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.3 SYSTEM PROGRAMMING

- A. Programming: Fully brief Owner on speaker and speaker wiring location. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.
- B. Station Numbers: Match numbers used for building telephone system.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 1. Schedule tests with at least seven days' advance notice of test performance.
 2. After installing school intercom and program equipment and after electrical circuitry has been energized, test for compliance with requirements.
 3. Operational Test: Test originating station-to-station, all-call, and page messages at each intercom station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
 4. Frequency Response Test: Determine frequency response of two transmission paths, including all-call and paging, by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.
 5. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at paging speakers.
 - b. Repeat test for three speaker microphones, one master station microphone, and for each separately controlled zone of paging loudspeakers.
 - c. Minimum acceptable ratio is 45 dB.
 6. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each intercom, paging, and all-call amplifier. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.
 7. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each paging zone. Maximum permissible variation in level is plus or minus 3 dB; in levels between adjacent zones, plus or minus 5 dB.

8. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.
9. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Retesting: Correct deficiencies and retest. Prepare a written record of tests.

D. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging and independent room speaker-line matching transformers.

E. Prepare written test reports.

1. Include a record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service and initial system programming.

B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.

C. Complete installation and startup checks according to manufacturer's written instructions.

3.6 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

END OF SECTION 27 51 23

SECTION 27 53 15 – BATTERY OPERATED WIRELESS WALL CLOCKS

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 specifies 2 battery operated digital wall clocks to be hung in the 2 locker rooms as directed by the owner.
- B. Related Sections:
 - 1. Division 26, Electrical
 - 2. Division 27, Communications
 - 3. Division 28, Safety and Security

1.3 DESCRIPTION OF WORK

- A. Provide labor, material, project management, start-up, testing and service necessary for the installation of the battery-operated wireless clocks as indicated on the drawings and/or described herein.
- B. There is no master clock or synchronous clock system in place.

1.4 SYSTEM DESCRIPTION

- A. There is not a synchronous wireless clock system in place that these clocks will work in conjunction with a master clock system.
- B. These are 2 independent 14.5" Large Digital Wall Clock Battery Operated with Jumbo Numbers, Temperature and Date
- C. BASIS OF DESIGN: Brand WallarGe
- D. Color Black
- E. Display Type Digital
- F. Style digital
- G. Special Feature: Large Display, Temperature Display, Daylight Saving, Foldable, Battery Indicator, Day of the Week, Calendar Large Display, Temperature Display, Daylight Saving, Foldable, Battery Indicator, Day of the Week, Calendar
- H. Product Dimensions 14"W x 6"H
- I. Power Source Battery Powered

1.5 SUBMITTALS

- A. Shop Drawings:
 - 1. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes (including available colors) for each product indicated and describe features and operating sequences, both automatic and manual, for the following:

- a. Wireless master clock transceiver and GPS antenna.
- b. Wireless repeater.
- c. Wireless secondary indicating clocks.
- d. Equipment enclosures and back boxes.
- e. Accessory components.
2. Provide qualification data for the Installer and manufacturer.
3. Field quality-control test reports.

B. Closeout Submittals:

1. Operation and Maintenance Data: For clock systems to include in emergency, operation, and maintenance manuals.

C. See front end submittals section for more information.

D. See Common Work Results for Communications section 270500 for more submittal requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Master clock manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Source Limitations: Obtain master and secondary clocks and signal-device-control components through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NFPA 70 for components and installation.

F. UL listed.

G. FCC part 15, 15247

H. Comply with the latest BICSI manual.

I. Battery operated clocks shall have a minimum of 5 year battery life.

J. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and Technology Consultant.

1.7 WARRANTY

A. The clock system shall carry a warranty as specified in Section "Demonstration and Training of Communications Systems".

1.8 TRAINING

A. Provide training per Section "Demonstration and Training of Communications Systems".

1.9 RECORD DRAWINGS/OPERATION AND MAINTENANCE MANUALS

A. Provide record drawings and operation and maintenance manuals as described in Sections "Operation and Maintenance of Communications" and "Common Works Results for Communication Systems".

PART 2 - PRODUCTS

2.1 INSTALLATION

- A. Provide one single face clock in every space as shown on the drawings and as described in the specifications.
- B. In rooms with ceilings lower than 9'-0" install so that the top of the clock is at 6" below the ceiling grid.
- C. In rooms without ceilings install clocks at 8'-6" to the center of the clock.

2.2 EXTRA MATERIALS

- A. Provide an extra 20-Pack of AA batteries.

2.3 IDENTIFICATION

- A. Comply with Division 27 Section "Identification for Communications Systems."

2.4 FIELD QUALITY CONTROL

- A. Perform the following field adjustments, tests, and inspections and prepare test reports:
 - 1. Perform operational-system tests to verify compliance with the Specifications and make adjustments to bring system into compliance. Include operation of all modes of clock correction and all programming and manually programmed signal and relay operating functions.
 - 2. Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
- B. Remove and replace malfunctioning units and retest as specified above.

2.5 PROGRAMMING AND ADJUSTMENTS

- A. Program system according to Owner's requirements. Program equipment-control output circuits to suit Owner's operating schedule for equipment controlled.
- B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance for adjusting and reprogramming system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

END OF SECTION 27 53 15

SECTION 28 05 10 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

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. When equipment furnished for or by the Owner is indicated on the Drawings or specified, this Contractor shall provide the proper electronic safety and security systems required; and make connections to Owner furnished equipment. The Security Contractor shall verify exact requirements and locations before installation.
- B. Support from bar joists shall be allowed only at panel points in top or bottom chords.
 - 1. Loading shall not exceed 5 lbs./S.F. or 100 lbs. per panel point applied at the panel point.
 - 2. If support must occur between panel points, then threaded rods shall be dropped from both panel points, an adequate angle attached to both, and then the support attached to the angle as required.
 - 3. Supports shall not be attached to or through steel roof decks.
 - 4. Supports shall not be attached to the ceiling grid.
- C. Related Work Specified Elsewhere: Division 07 Penetration Fire Stopping and Fire-Resistive Joint Sealants.
- D. The Electronic Safety and Security Contractor shall take field measurements necessary for his Work and shall be responsible for the accurate location and size of openings, recesses, slots, ferrules, and the like.
- E. The Electronic Safety and Security Contractor shall be required to cooperate with "Other Trades" at the site and other Contractors in the coordination of his Work to avoid interferences with installations by other trades and Contractors.
- F. Deviations from the Drawings, to avoid interferences, shall be considered a "Job Condition" and no additional compensation will be considered applicable. If such interferences occur in course of the Work, due to an error, omission, or oversight by the Contractor, no additional compensation shall be allowed. Interferences which may occur while construction shall be brought to the immediate attention of the Architect/Engineer, and the Architect/Engineer decision, confirmed in writing, shall be final.
- G. Related work specified elsewhere: Communications sleeves
- H. Related sections include the following:
 - 1. Division 1 General Requirements.
 - 2. Division 26 Electrical
 - 3. Division 27 Communications
 - 4. Division 28 Electronic Safety and Security
 - 5. Division 270100 Operation and Maintenance of Communications System
 - 6. Division 270111 Demonstration, Training, and Warranty of Communications Systems

1.3 REFERENCES

- A. Work shall be in accordance with codes, rules, ordinances, regulations of authorities, bodies, associations, and governments, having proper and legal jurisdiction. Specifically, the following requirements shall be met in their entirety.
 - 1. State and Local Rules, Regulations, Codes, Statutes and Ordinances

2. National Fire Protection Association - applicable requirements
 3. National Board of Fire Protection
 4. National Electric Code - applicable requirements
 5. Other Codes and Standards as specifically noted in each Section of the Specifications
- B. Electrical equipment shall be Underwriter's approved; also, shall meet requirements established by N.F.P.A., N.E.M.A., and A.N.S.I. and as specified hereinafter.
- C. Abbreviation used in these Specifications:
- N.E.C.-National Electric Code
 - Latest Edition adopted by the National Fire Protection Association
- N.E.M.A. - National Electrical Manufacturers Association
 I.P.C.E.A. - Insulated Power Cable Engineers Association
 A.N.S.I. - American National Standards Institute, Inc.
 F.C.C. - Federal Communications Commission
 N.A.B. - National Association of Broadcasters
 N.A.E.B. - National Association of Educational Broadcasters
 I.T.L. - Independent Testing Laboratories
 E.T.L.- Electrical Testing Laboratories
 U.L.- Underwriters Laboratories
 B.I.C.S.I.- Building Industry Consulting Service International
 I.E.E.E.- The Institute of Electrical and Electronics Engineers, Inc.
 T.I.A.- Telecommunications Industry Association
 E.I.A.- Electronic Industries Association
 R.C.D.D.- Registered Communication Distribution Designer
 N.I.C.E.T.- National Institute of Certification in Engineering Technologies

1.4 SUBMITTALS

- A. Provide shop drawing submittals and illustrations in accordance with requirements of Division 01 Submittal Procedures unless otherwise noted.
- B. Provide shop drawings for each section separately as follows:
1. Provide one electronic file submittal for each section. (do not mix sections together)
 2. Provide an index with a complete material list in the Specification sequence.
 3. Each Specification Section shall have its own material list.
 4. Provide product cut sheet for each specified item in sequence.
 5. Each manufacturer's product cut sheet shall be identified/marked or highlighted.
- C. Wiring diagrams and system layout drawings shall show all devices, equipment, home runs, labeling, etc. for the following systems:
1. Access control
 2. Intrusion detection
 3. Video surveillance system
 4. Area of Refuge system.
- D. Partial shop drawings WILL NOT BE ACCEPTABLE.
- E. Each piece of shop drawing must be in the sequence of the specifications and must be clearly marked.
- F. Submittals will be returned unchecked if they do not follow the outlines above.
- G. Any Shop drawing submittals that are not required and will be returned unchecked.

1.5 QUALITY ASSURANCE

- A. The security cabling system components and equipment shall be listed by Underwriters Laboratories, Inc., and the components shall bear the UL label. The system shall be installed in accordance with requirements set by National Electric Code.
- B. Installing Security System Contractor shall have five years experience in cable installations.
- C. Security System Contractor shall submit a list of Jobs performed (minimum of five) in the past five years, equal to one specified herein. Also, the contractor shall arrange a site visit of any job(s) selected by Architect/Engineer. The list shall include the following:
 - 1. Job location, and date when it was completed.
 - 2. Contact person at each job location.
 - 3. Brief description of each job.
- D. Security cabling systems installation shall be provided by the Contractor's own work forces. Any subcontractor agreements for any portion of the work specified herein must meet with approval of the A/E and Owner. It is the intent of the contract to have one Contractor provide sole responsibility for material, labor and service for the systems.
- E. Security Contractor shall have a staffed office (secretary, project manager, technicians, etc.) within (100) miles of the project and provide a service response time of a maximum of (2) hours from time of notification of major system failure.
- F. The Security System Contractor must have on-staff, qualified security system engineers. The engineer shall test and certify the security systems installation.

1.6 TECHNOLOGY ABBREVIATIONS

- A. Cable Pathway
 - 1. Shafts, conduits, surface mounted raceway, boxes, sleeves, floor boxes, cable tray, and floor penetrations that provide routing space for security cabling.
- B. Equipment Rooms (ER)
 - 1. An Equipment Room (ER) is a special-purpose, security room that provides space and maintains a suitable operating environment for communications and/or computer equipment.
 - 2. An Equipment Room (ER) may contain terminations, interconnections, and cross-connects for telecommunications distribution cables as well as other low voltage equipment such as fire alarm panels, video-audio distribution, security, and other building signaling and communication systems.
- C. Main Cross-Connect (MC)
 - 1. The Main Cross-Connect (MC) is typically located with the Equipment Room (ER) and is the main cross-connect and interconnection point for first level backbone.
- D. Telecommunications Rooms (TR)
 - 1. A Telecommunications Room is a space used to make connections from the first level backbone cabling from the MC to the horizontal cabling. TRs contain telecommunications equipment, control equipment, cable terminations, and cross connect wiring.
- E. Entrance Facility (EF)
 - 1. An Entrance Facility (EF) is a space within a building for both public and private network service cables to be terminated, protected and spliced to an indoor rated cable. This space may be in the MC or ER.

1.7 PRECEDENCE

- A. Security System Contractors shall review both Drawings and Schedules of Security Systems.
- B. If there is a discrepancy in the number of rooms and quantities between the Drawings and the Schedules, the Security Contractor shall include the higher of the two quantities.
- C. If the products specified are no longer available, Security System Contractor shall provide replacement products that meet or exceed performance specifications of the original specified model at no cost to the Project.
- D. If the Security System Contractor bids products that do not meet or exceed the performance specifications or the original specified model, the Security System Contractor shall provide products that meet the performance specifications as approved by the Architect/Engineer at no cost to the project.

1.8 COORDINATION

- A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
 - 1. To allow maximum possible headroom, unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components, as they are constructed.
- C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces, or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames".
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "penetration Firestopping".

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXPLANATION AND PRECEDENCE OF DRAWINGS

- A. For purposes of clarity and legibility, the Telecommunication "T" drawings are essentially diagrammatic and, although size and location of equipment are closely drawn to scale whenever possible, Contractor shall make use of the data in all of the Contract Documents and shall verify this information at the building site.
- B. The Drawings indicate required size and points of termination of wiring and other related items and may suggest proper routes for such items to conform to structure, avoid obstructions and preserve clearances. It is not intended that Drawings indicate every necessary offset. It shall be the Work of the Security System Contractor to install each item in a manner to conform to structure, avoid obstructions, preserve headroom, and keep opening and passageways clear.
- C. It is intended that apparatus be located in coordination with architectural elements, and shall be installed at exact height and location stipulated.

- D. Communications Contractor shall fully inform himself regarding peculiarities and limitations of the spaces available for the installation of work and materials provided under his Contract.
- E. Security System Contractor shall carefully examine existing conditions, existing wiring and other materials on the premises and compare the documents with the existing conditions. Variances and necessary changes shall be adjusted by appropriate modifications.
- F. Security System Contractor shall carefully examine the Division 26 drawings for pathway, sleeves, conduits, power requirements, etc.

3.2 PERMITS, FEES, REGULATIONS, INSPECTIONS

- A. Security System Contractor shall arrange and pay for permits, fees, and inspections required in connection with his work for this project, from local, county, state and public agencies, and shall obtain permits from railroad, state highway and utility companies.
- B. Work shall be inspected by approved local and state inspection bureaus, Electrical Inspection Agency, and/or authority, and local utilities.
- C. Upon completion of the Work, the Security System Contractor shall furnish to the Architect/Engineer, a certification of inspection and approval from said Bureau or Agency before final payment on contract will be allowed.

3.3 HOISTS, RIGGING, TRANSPORTATION, AND SCAFFOLDING

- A. Security System Contractor shall provide scaffolding, staging, cribbing, tackle, hoists, and rigging necessary for placing of his materials and equipment in their proper places in the Project.
- B. Security System Contractor shall pay costs for transportation of materials and equipment to the job site and shall include such costs in his proposal.
- C. Scaffolding and hoisting equipment shall comply with requirements of pertinent Federal, State, and Local Laws and Codes.

3.4 PROTECTION

- A. In addition to other requirements of the Contract, the Security System Contractor shall provide various types of protection as follows:
 - 1. Protect finished floors during installation, etc.
 - 2. Protect equipment, finished surfaces from paint droppings, insulation adhesive, and sizing droppings by use of drop cloths.
 - 3. Protect countertops during cutting for grommets.
 - 4. Protect cameras, door controllers, motion detectors, etc. from dirt.
- B. Communications Contractor shall be responsible for the protection of finished work from other trades from damage or defacement by his operations and shall remedy such damage at his own expense.

3.5 CUTTING AND PATCHING

- A. Contractor shall do his own cutting and patching of building materials and piping, as required for the installation of his Work, but no structural members shall be cut without the approval of the Architect and such cutting shall be done in a manner directed by the Architect.
- B. Patching of and repair of damage to Work in place shall be done in a neat and workmanlike manner, meeting with the approval of the Architect. Contractor whose operations require cutting of work in place, or who causes damage which entails repairs of such work, shall employ

mechanics of the particular trade whose work must be cut or which is damaged, and shall pay the costs of such patching or repair.

- C. Contractor shall be responsible for any additional sleeves and cores should they be required. NO change order shall be issued to provide sleeves in addition to those provided under the electrical contract.

3.6 FINAL COMPLETION

- A. Security system installation shall be cleaned prior to Substantial Completion of the Work.
- B. Retouch or repaint factory painted prime and finish coats, where scratched or damaged. Whenever retouching will not be satisfactory, the Architect/Engineer may require complete repainting until the desired appearance is obtained.
- C. Security System Contractor shall clean equipment; restore damaged materials; remove grease, oil, chemical, paint spots, and stains; and generally, leave the Work in A-1 condition.
- D. Security System Contractor and his subcontractors, on completion of his Work, shall remove tools, equipment, surplus materials, and rubbish pertaining to his operations, and pay costs for such removal and disposal from the site.

3.7 GUARANTEE AND WARRANTY

- A. Security System Contractor shall submit written certificates, warranting that each item of equipment furnished complies with the requirements of the Drawings and Specifications.

3.8 SUPERVISION AND COOPERATION

- A. Work by the Security System Contractor under this Division shall include the services of an experienced superintendent, who shall be constantly in charge of the Work, together with the qualified journeymen, helpers, and laborers required to properly unload, install, connect, adjust, start, operate, and test the Work involved, including related equipment and materials furnished under other contracts or by the Owner.

3.9 COLOR CHART

- A. All security cables and connectors to have the following colors:

Description Item	Jack	Cable	I.D.	Notes
Security Cable	-	White	S	Multi-conductors
Door Contact	-	White	DC	22/2
Power Transfer	-	Gray	PT	12/6 and 18/6
Request for Exit	-	Blue	REQ	18/4 or 22/4
Card Reader	-	Orange	CR	22/6
Motion Detector	-	White	MD	22/4
CCTV – IP	-	White	CCTV	4 pair UTP cable
Key Pad	-	White	K	22/6

Knox Box	-	Orange	KB	18/4
Lock Down	-	Red	LD	18/4
Door Release	-	Red	DR	18/4

3.10 MATERIAL LIST

- A. Contractors shall provide with their bids [or 24 hours after bid] complete materials list on THEIR LETTER HEAD showing manufacturers name, catalog numbers, description, and quantities for each item in each system, per section number as follows:
1. Manufacturers Name and Cut Sheets.
 2. Quantities and Locations.
 3. Rough Draft of a Training Schedule.
 4. Project manager/technician/installer's manufacturer certificates.
 5. Installation Company Manufacturer Warranty Certificate
- B. The lowest responsible bidders shall provide unit pricing for all materials as described in Part "A" above, within 24 hours with NO exceptions.
- C. If a subcontractor is utilized for any portion of the work, all contact information, references, material list, and any other information shall be provided per the specified contract bid requirements.
- D. If the above requirements is NOT provided, then the contractor is considered a none responsive bidder subject to disqualification.

3.11 RECORD DRAWINGS

- A. Record Drawings shall be provided to the Owner/Architect/Engineer in the latest Auto CAD releases. Mark-up drawings or scanned drawings are not acceptable.

END OF SECTION 28 05 10

SECTION 28 05 23 - CONDUCTORS AND CABLES FOR SECURITY

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, but is not limited to the following:
 - 1. RS-232 cabling.
 - 2. Door Contact
 - 3. Card Reader.
 - 4. Key Pad.
 - 5. Electric lock.
 - 6. Door Release.
 - 7. Lock Down.
 - 8. RS485.
 - 9. Mics. cabling
- B. Related Sections:
 - 1. Division 26, Electrical
 - 2. Division 27, Communications
 - 3. Division 28, Safety and Security

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. EMI: Electromagnetic interference.
- C. IDC: Insulation displacement connector.
- D. RCDD: Registered Communications Distribution Designer.
- E. UTP: Unshielded twisted pair.
- F. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- G. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

1.4 SUBMITTALS

- A. Quality Assurance/Control Submittals:
 - 1. Product Data: For each type of product indicated.
 - a. For coaxial cable, include the following installation data for each type used:
 - 1) Nominal OD.
 - 2) Minimum bending radius.
 - 3) Maximum pulling tension.
 - 2. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
 - 3. Source quality-control reports.
 - 4. Field quality-control reports.

- B. Closeout Submittals:
 - 1. Maintenance Data: For wire and cable to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 50.
- D. TIA/EIA-607 Telecommunications grounding.
- E. Latest edition of BISCI – TDMM – manual
- F. Americans with Disabilities Act (ADA)
- G. Federal Communications Commission, Part 15
- H. Sound System Engineering (Davis and Patronics) 3rd Edition 2006.
- I. Audio System Design and Installation (Giddings) 1990.

1.6 WARRANTY

- A. The security system shall carry a warranty as specified in Section "Demonstration and Training of Communications Systems".

1.7 TRAINING

- A. Provide training per Section "Demonstration and Training of Communications Systems".

1.8 RECORD DRAWINGS/OPERATION AND MAINTENANCE MANUALS

- A. Provide record drawings and operation and maintenance manuals as described in Sections "Operation and Maintenance of Communications" and "Common Works Results for Communication Systems".

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

- A. Manufacturers:
 - 1. Belden CDT Inc.; Electronics Division.
 - 2. Carol Brand; a division of General Cable Technologies Corporation.
 - 3. Coleman Cable Inc.
 - 4. Genesis Cable Products; Honeywell International, Inc.
 - 5. West Penn Wire; a division of Belden CDT Inc.

2.2 PATHWAYS

- A. Support of Open Cabling: NRTL labeled for support of 4 pair UTP, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.

2. Lacing bars, spools, J-hooks, and D-rings.
 3. Straps and other devices.
 4. Cable Ties: Comply with Division 27 Section "Identification of Communications Systems."
- B. Cable Trays: Comply with requirements in Division 26 Section "Cable Trays for Electrical Systems."
- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
1. Card reader.
 2. Door contact.
 3. Request for exit motion detector
 4. Keypad
 5. 1/2-inch conduit in door frames for all security devices, as shown on Drawings.

2.3 RS-232 CABLES

- A. Standard Cable: NFPA 70, Type CM.
1. Paired 1,2,3,4 pair(s), No. 22 AWG, stranded (7x30) copper conductors.
 2. Polypropylene insulation.
 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 4. PVC jacket.
 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) copper drain wire.
 6. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired 1,2,3,4 pair(s), No. 22 AWG, stranded (7x30) copper conductors.
 2. Plastic insulation.
 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 4. Plastic jacket.
 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) copper drain wire.
 6. Flame Resistance: Comply with NFPA 262.

2.4 DOOR CONTACT AND WINDOW SWITCHES

- A. Manufacturers:
1. Honeywell.
 2. Amseco; Division of Kobishi America, Inc.
 3. FBI; Pittway Corporation.
 4. GE Interlogix; General Electric Company.
 5. GRI
 6. DSC
- B. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to 80 percent of switch capacity. Bias magnet and minimum of two encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.
- C. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.
- D. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounting magnet and floor-mounting switch unit.

2.5 DOOR CONTACT CABLE

- A. Standard Cable: NFPA 70, Type CM
1. Paired, 1 pair, No. 22 AWG, stranded (7 x 30) copper conductors.
 2. Polyolefin insulation.
 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 4. PVC jacket.

5. Pairs are cabled on common axis with No. 22 AWG, stranded (7 x 30) copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-rated Cable: NFPA 70, Type CMP

1. Paired, 1 pair, No. 22 AWG, stranded (7 x 30) copper conductors.
2. Fluoropolymer installation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 22 AWG, stranded (7 x 30) copper drain wire.
6. Flame Resistance: Comply with NFPA 262

2.6 CARD READER CABLES

A. Standard Cable: NFPA 70, Type CM.

1. Paired 3 pair(s), No. 22 AWG, stranded (7x30) copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired 3 pair(s), No. 22 AWG, stranded (7x30) copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.7 KEYPAD CABLES

A. Standard Cable: NFPA 70, Type CM.

1. Paired 3 pair(s), No. 22 AWG, stranded (7x30) copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired 3 pair(s), No. 22 AWG, stranded (7x30) copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.8 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. 18 AWG, 2 pair stranded (7 x 26) bare copper conductors.
2. PVC insulation.
3. Individually shielded.
4. PVC overall jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. 18 AWG, 2 pair stranded (7 x 26) bare copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Individually shielded.

4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.
6. Jacket color: Gray
7. Operating voltage: 300 V RMS

2.9 ELECTRIC LATCH/LOCK CABLE

- A. 18 AWG, 6 conductors, stranded bare copper conductors, unshielded with an overall jacket.
 1. 6 conductor, 18 AWG
 2. Stranded 7 x 26
 3. Polymer alloy insulation
 4. Flexible plenum jacket material
 5. Operating voltage: 300 V RMS
 6. Unshielded with overall jacket
 7. Flame resistance: NFPA262
 8. UL listed
 9. CMP rated for plenum

2.10 DOOR RELEASE CABLE

- A. 18 AWG, 4 conductors, stranded bare copper conductors, unshielded with an overall jacket.
 1. 4 conductor, 18 AWG
 2. Stranded 7 x 26
 3. Polymer alloy insulation
 4. Flexible plenum jacket material
 5. Operating voltage: 300 V RMS
 6. Unshielded with overall jacket
 7. Flame resistance: NFPA262
 8. UL listed
 9. CMP rated for plenum

2.11 LOCK DOWN CABLE

- A. 18 AWG, 4 conductors, stranded bare copper conductors, unshielded with an overall jacket.
 1. 4 conductor, 18 AWG
 2. Stranded 7 x 26
 3. Polymer alloy insulation
 4. Flexible plenum jacket material
 5. Operating voltage: 300 V RMS
 6. Unshielded with overall jacket
 7. Flame resistance: NFPA262
 8. UL listed
 9. CMP rated for plenum

2.12 LOW-VOLTAGE CONTROL CABLE

- A. Paired Lock Cable: NFPA 70, Type CMG.
 1. 1 pair, twisted, No. 16 AWG, stranded (19x29) copper conductors.
 2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.
 5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.
 1. 1 pair, twisted, No. 16 AWG, stranded (19x29) copper conductors.
 2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.
 5. Flame Resistance: Comply with NFPA 262.

2.13 ACCESS CONTROLLER INPUT CABLE

- A. Paired Input Cable: 1 pair, twisted, No. 22 AWG, stranded (7x30) copper conductors, polypropylene insulation, overall aluminum foil-polyester tape shield with No. 22 AWG, stranded (7x30) copper drain wire, 100 percent shield coverage, and PVC jacket.
 - 1. NFPA 70, Type CMR.
 - 2. Flame Resistance: UL 1666 Riser Flame Test.
- B. Plenum-Type, Paired Input Cable: 1 pair, twisted, No. 22 AWG, stranded (7x30) copper conductors, fluorinated-ethylene-propylene insulation, aluminum foil-polyester tape shield (foil side out), with No. 22 AWG drain wire, 100 percent shield coverage, and plastic jacket.
 - 1. NFPA 70, Type CMP.
 - 2. Flame Resistance: NFPA 262 Flame Test.

2.14 AC TRANSFORMER CABLE

- A. Paired AC Transformer Cable: 1, 2, 3 or 4 pair, twisted, No. 18 AWG, stranded (7x26) copper conductors, PVC insulation, unshielded, and PVC jacket.
 - 1. NFPA 70, Type CMG.
- B. Plenum-Type, Paired AC Transformer Cable: 1,2,3 or 4 pair, twisted, No. 18 AWG, stranded (19x30) copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.
 - 1. NFPA 70, Type CMP.
 - 2. Flame Resistance: NFPA 262 Flame Test.

2.15 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway; power-limited cable, concealed in building finishes; or power-limited tray cable, in cable tray complying with UL 83; unless indicated otherwise.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

- A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- B. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.
- C. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- D. Pathway Installation in Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard when entering room from overhead.
 - 4. Extend conduits 3 inches above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

- E. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Provide all cabling for the access control system.
- B. Provide all cabling for the Intrusion alarm system.
- C. Provide all cabling for the CCTV camera system.
- D. Comply with NECA 1.
- E. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Chapter. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - 7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - 9. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- F. UTP Cable Installation: Comply with Division 27 Section "Communications Copper Horizontal Cabling."
- G. Optical Fiber Cable Installation: Comply with Division 27 Section "Communications Fiber Optical Backbone Cabling."
- H. Coaxial Cable Installation: Comply with Division 27 Section "Communications Coaxial Horizontal Cabling."
- I. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
 - 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- J. Installation of Cable Routed Exposed under Raised Floors:
 - 1. Install plenum-rated cable only.
 - 2. Install cabling after the flooring system has been installed in raised floor areas.
 - 3. Coil cable 72 inches long shall be neatly coiled not less than 12 inches in diameter below each feed point.
- K. Separation from EMI Sources:
 - 1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 CABLE APPLICATION

- A. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."
- B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.
- C. RS-232 Cabling: Install at a maximum distance of 50 feet.
- D. RS-485 Cabling: Install at a maximum distance of 4000 feet.
- E. Card Readers:
 1. Install number of conductor pairs recommended by manufacturer for the functions specified.
 2. Unless manufacturer recommends larger conductors, install No. 20 AWG wire if maximum distance is 500 feet.
 3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the Controller.
 4. Install minimum No. 18 AWG shielded cable to readers that draw 50 mA or more.
- F. Install minimum No. 16 AWG cable from Controller to electrically powered locks. Do not exceed 500 feet.
- G. Install minimum No. 18 AWG ac power wire from transformer to Controller, with a maximum distance of 25 feet.

3.4 CONNECTIONS

- A. Comply with requirements in Division 28 Section "Intrusion Detection" for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Division 28 Section "Access Control" for connecting, terminating, and identifying wires and cables.
- C. Comply with requirements in Division 28 Section "Video Surveillance" for connecting, terminating, and identifying wires and cables.

3.5 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Firestopping."

B. Comply with TIA/EIA-569-A, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 27 Section "Identification for Communications Systems."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test and inspect optical fiber cabling according to Division 27 Section "Communications Fiber Optical Backbone Cabling."
2. Test and inspect UTP cabling according to Division 27 Section "Communications Copper Horizontal Cabling."
3. Test and inspect coaxial cabling according to Division 27 Section "Communications Coaxial Horizontal Cabling."
4. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

C. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 28 05 23

SECTION 28 13 10 – ACCESS CONTROLS

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, but is not limited the following:
 - 1. Controller
 - 2. HID Card Reader
 - 3. Cards
 - 4. Fobs
 - 5. Power supplies
 - 6. Door magnetic contacts
 - 7. Interfaces
 - 8. Alarm panel
 - 9. Cabling
 - 10. Miscellaneous items
- B. This Section includes but is not limited to a security access system consisting of a Central Station, [one or more networked workstation computers, operating system and application software, and field-installed Non-proprietary Controllers connected by a high-speed electronic data transmission network. The security access system shall have the following:
 - 1. Access Control:
 - a. Regulating access through doors and gates.
 - b. Visitor assignment access supported or optional application.
 - c. Surge and tamper protection.
 - d. Credential cards and readers.
 - e. Monitoring of field-installed devices.
 - f. Both Central and Remote Reporting.
 - 2. Security:
 - a. Video and camera control.
 - b. Interface HVAC, Burglar Alarm Systems.
- C. Related Sections:
 - 1. Division 8 Sections, Door Hardware
 - 2. Division 14 Sections, Conveying Equipment
 - 3. Division 23 Sections, Heating, Ventilation, and Air Conditioning
 - 4. Division 26 Sections, Electrical
 - 5. Division 27 Sections, Communications
 - 6. Division 28 Sections Electronic Safety and Security

1.3 DEFINITIONS

- A. ABA Track: Magnetic stripe that is encoded on track 2, at 75-bpi density in binary-coded decimal format; for example, 5-bit, 16-character set.
- B. CCTV: Closed-circuit television.
- C. Central Station: A PC with software designated as the main controlling PC of the security access system. Where this term is presented with initial capital letters, this definition applies.

- D. Controller: An intelligent peripheral control unit that uses a computer for configuring its operational data and stores the data to manage and control device controllers in a fully distributed manner. Where this term is presented with an initial capital letter, this definition applies.
- E. Sub-Controller: A remotely managed field-installed device controller connected to a user specified main Controller to manage site control and monitoring devices for access control, alarm access, alarm monitoring and site control outputs. Where this term is presented with initial capital letters, this definition applies.
- F. Non-Proprietary: Control hardware that has a commercially available operational protocol allowing multiple developing manufacturers to write code to support the hardware. Where this term is presented with an initial capital letter, this definition applies.
- G. CPU: Central processing unit.
- H. Credential: Data assigned to an entity and used to identify that entity.
- I. Dpi: Dots per inch.
- J. File Server: A PC in a network that stores the programs and data files shared by users.
- K. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.
- L. I/O: Input/Output.
- M. LAN: Local area network.
- N. LED: Light-emitting diode.
- O. Location or Site: A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with RS-485 communications loop. Where this term is presented with an initial capital letter, this definition applies.
- P. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.
- Q. PCI Bus: Peripheral component interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).
- R. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.
- S. RF: Radio frequency.
- T. ROM: Read-only memory. ROM data are maintained through losses of power.
- U. RS-232: A TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.
- V. RS-485: A TIA/EIA standard for multipoint communications.
- W. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

- X. TWAIN: (Technology without an Interesting Name.) A programming interface that lets a graphics application, such as an image editing program or desktop publishing program, activate a scanner, frame grabber, or other image-capturing device.
- Y. UPS: Uninterruptible power supply.
- Z. WAN: Wide area network.
- AA. WAV: The digital audio format used in Microsoft Windows.
- BB. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.
- CC. Windows: Operating system by Microsoft Corporation.
- DD. Workstation: A PC with software that is configured for specific limited security system functions.
- EE. WYSIWYG: (What You See Is What You Get.) Text and graphics appear on the screen the same as they will print.

1.4 SYSTEM DESCRIPTION

- A. The system shall consist of a PC-based Central Station, one or more networked PC-based workstations, and field-installed Non-proprietary Controllers and Sub-controllers, connected by a high-speed electronic data transmission network.
 - 1. System Software: Based on 32-bit, Microsoft Windows central-station, workstation operating system, server operating system, and application software. Software shall have the following capabilities:
 - a. Multiuser multitasking to allow for independent activities and monitoring to occur simultaneously at different workstations.
 - b. Support of undocked windows allowing the user to place operational windows on to different workstation monitors for manage, monitoring and control operations.
 - c. Graphical user interface to show pull-down menus and a menu tree format that complies with interface guidelines of Microsoft Windows operating system.
 - d. System license shall be for the entire system and shall include capability for future additions that are within the indicated system size limits specified in this Section.
 - e. System shall have open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with Microsoft Windows operating system.
 - f. Password-protected operator login and access.
- B. Network(s) connecting PCs and Controllers shall consist of the following:
 - 1. Local area, IEEE 802.3 Fast Ethernet 10/1000 BASE-TX, star topology network based on TCP/IP.

1.5 PERFORMANCE REQUIREMENTS

- A. The security access system shall use a single database for access-control and credential-creation functions.
- B. Distributed Processing: System shall be a fully distributed processing system so that information, including time, date, valid codes, access levels, and similar data, is downloaded to Controllers so that each Controller shall make local access-control and any pre-configured user operational decisions for that Location. Do not use intermediate Controllers for access control. If communications to Central Station are lost, all Controllers shall automatically buffer event transactions until communications are restored, at which time buffered events shall be uploaded to the Central Station.

- C. Number of Locations: The Central Station Software shall have the expansion capability to Support an unlimited number of separate Locations and Sites and support combinations of direct-connect or TCP/IP LAN connections to each Location.
1. Each Location shall have its own database and history in the Central Station. Locations may be combined to share a common database.
- D. Configuration and Data Capacity:
1. 140 Readers (Determined by number of expansion regional servers)
 2. 20,000 card holders (limited locally only by Controller data capacity)
 3. Multiple Cards per Card Holder
 4. Up to 32,767 Access Levels per Location or Site
 5. Up to 16,320 card reader assignments per Location or Site
 6. Up to 60,000 Fully Supervised Input Monitoring points per Location or Site
 7. Up to 60,000 Relay Control Outputs per Location or Site
 8. Default Map assignment for Modules, Readers, Inputs and Outputs
 9. Up to 9,999 Alarm or Event Priority selections
 10. Up to 50 Character I/O point description per point
 11. Up to 256 Character Alarm Message Description for Alarm Events
 12. Up to 256 Character Event Message Description per Event
 13. Up to 255 Elevator Floor Codes with support for up to 64 floors each per Location or Site
 14. Up to 255 Controllers per server (unlimited server support)
 15. Up to 32 Sub-Controllers per Controller
 16. Controller communication configuration support for TCP/IP, RS-232, RS-485 and Dialup
 17. Up to 255 Sites per Regional Server
 18. Up to 255 Time zones per Location or Site
 19. Up to 255 variable duration Holidays per Location or Site with support for up to 8 holiday groups each
 20. Up to 32 Access Levels per Card
 21. User definable Multi-Functional Tasks
 22. User definable Unattended Hours Remote Reporting
 23. User defined PIN Keypad Functionality for Open/Close Management
 24. User Alarm PIN Management
 25. User Assignable Alarm Zones and Alarm Zone Management
 26. Multi-Monitor Support
 27. Unlimited User Definable Text Fields per Cardholder
 28. Unlimited Inputs and Alarm Monitoring with Graphical Maps
 29. Hierarchical Device Tree with Active Status Icons
 30. Automatic Card Holder Enrollment Readers
 31. Alarm Routing with Variable Annunciation Delay/Scheduling
 32. Macro and Report Scheduling
 33. Unlimited Programmable Outputs
 34. Up to 8 different Card-Reader Formats per Controller, up to 255 Controllers per PC server with expansion capability for multi-server operation.
 35. Pre Assigned Operator Response Comments.
 36. Multiple Industry Standard Graphic file types for importing maps.
- E. Desired Features and Optional Capabilities:
1. Desired and optional features if required will be defined in the specification; however, these capabilities shall be an operational feature of the software for future selection by the user at time of purchase.
 - a. Alternate (Backup) Communications Channel for Controllers
 - b. Database Partitioning
 - c. Hot Fail-Over Redundancy using Microsoft Cluster Server
 - d. Support for SQL Server Database Engine
 - e. Card Groups for Card Activation and Card Expiration
 - f. Automatic Database Record Level Auditing
 - g. TWAIN support for picture and signature capture devices
 - h. WDM (Windows Driver Model) support for picture and signature capture devices
 - i. Prints to any printer supported by the operating system
 - j. Built in Badge Designer

- k. Built-in DVR Integration
- l. Built-in Intercom Integration
- m. Built-in CCTV Switcher integration
- n. Built-in Email and Pager notifications
- o. Built-in Terminal Server (thin client)
- p. Built-in Biometric Device Support
- q. Built-in Third Party Alarm Panel Integration

F. System Network Requirements:

1. Interconnect system components and provide automatic communication of status changes, commands, field-initiated interrupts, and other communications required for proper system operation using a high level security interrogation response protocol.
2. Communication shall not require operator initiation or response, and shall return to normal after partial or total network interruption such as power loss or transient upset.
3. System shall automatically annunciate communication failures to the operator and identify the communication link that has experienced a partial or total failure.

G. Central Station shall provide operator interface, interaction, display, control, and dynamic and real-time monitoring using an interrogation response protocol to all Controllers. Central Station shall control system networks to interconnect all system components, including workstations and field-installed Controllers.

H. Field equipment shall include Controllers, sensors, and controls. Controllers shall serve as an interface between the Central Station and sensors and controls. Data exchange between the Central Station and the Controllers shall use a real-time interrogation and response protocol. Down-line transmission to the Controllers for commands, software, and databases to Controllers, the up-line transmission from the Controller to the Central Station shall include status data such as intrusion alarms, status reports, access and/or egress events and any status changes generated by local or HOST generated events. Controllers are classified as alarm-annunciation or entry-control type.

I. System Response to Alarms: Field device network shall provide a system end-to-end response time of [3] <Insert number> second(s) or less typical for every device connected to the system. Controller initial response shall be 1 second or less with corresponding notification and pre-configured alternate response following. Alarms shall be annunciated at the Central Station within 3 second of the alarm occurring at a Sub-controller connected device controlled by a local Controller, and displayed at the associated Sub-controller within 100 ms of the alarm activation. Alarm and status changes shall be acted upon within 500 ms at the Controller and typically displayed at the Central Station within 1 second after receipt from the Controller. All graphics shall be displayed, including graphics-generated map displays, on the console monitor within 5 seconds of alarm receipt at the security console.

J. False Alarm Reduction: The design of Central Station and Controllers shall contain features to reduce false alarms.

K. Data Line Supervision: System shall initiate an alarm or trouble event in response to opening, closing, shorting, or grounding of data transmission lines.

L. Door Hardware Interface: Coordinate with Division 08 Sections that specify door hardware required to be monitored or controlled by the security access system. The Controllers in this Section shall have electrical characteristics that match the signal and power requirements of door hardware. Integrate door hardware specified in Division 08 Sections to function with the controls and PC-based software and hardware in this Section.

1.6 SUBMITTALS

A. Shop Drawings:

1. Wiring Diagrams. Show typical wiring schematics including the following:

- a. Door controller.
 - b. Central hardware assemblies.
 - c. Local controller.
 - d. Card readers
 - e. Power supplies.
 - f. Door contact
 - g. Motion detectors.
 - h. Interfaces
 - i. Misc. items
 - j. Patch panels.
2. Battery and charger calculations for Central Station, workstations, and Controllers.
- B. Quality Assurance/Control Submittals:
- 1. Product Data: For each type of product indicated. Include operating characteristics, furnished specialties, and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.
 - 2. Project planning documents as specified in Part 3.
 - 3. Samples: For workstation outlets, jacks, jack assemblies, and faceplates for color selection and evaluation of technical features.
 - 4. Field quality-control test reports.
- C. Closeout Submittals:
- 1. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data" include the following:
 - a. Microsoft Windows software documentation.
 - b. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include system restore, emergency boot diskettes, and drivers for all installed hardware. Provide separately for each PC.
 - c. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
 - d. System installation and setup guides, with data forms to plan and record options and setup decisions.
 - 2. Extra Materials: Receipt for extra materials.
- D. See front end submittals section for more information.
- E. See Common Work Results For Communications section 270500 for more submittal requirements.
- F. See Common Work Results For Electronic Safety and Security 280510 for more submittal requirements.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: The contractor shall be a certified dealer for the product they propose and shall be fully trained and approved by manufacturer.
 - 1. Cable installer must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.
 - B. Source Limitations: Obtain Central Station, workstations, Controllers, Identifier readers, and all software through one source from a single manufacturer.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70, "National Electrical Code."
- E. Comply with NFPA 730- Guide for Premises Security.
- F. Comply with NFPA 731- Standard for the Installation of Electronic Premises Security.
- G. Comply with SIA DC-03 and SIA DC-07.
- H. TIA/EIA-607 Telecommunications grounding.
- I. Latest edition of BISCI – TDMM – manual
- J. Americans with Disabilities Act (ADA)
- K. Federal Communications Commission, Part 15
- L. Sound System Engineering (Davis and Patronics) 3rd Edition 2006.
- M. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and Technology Consultant.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Central Station, Workstations, and Controllers:
 1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F, and not more than 80 percent relative humidity, non-condensing.
 2. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.
 3. Mark packing list with designations that have been assigned to materials and equipment for recording in the system labeling schedules that are generated by cable and asset management system specified in Part 2.
 4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.9 PROJECT CONDITIONS

- A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F and a relative humidity of 20 to 80 percent, non-condensing.
 2. Interior, Controlled Environment: System components, except central-station control unit, installed in air-conditioned interior environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosure.
 3. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F dry bulbs and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 4 enclosures.
 4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation

where exposed to rain as specified in NEMA 250, winds up to 85 mph. NEMA 250, Type 3R enclosures.

5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
6. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

1.10 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. Card readers: Quantity of two.
 2. Credential card blanks, ready for printing. : Provide TEN (10) spare.
 3. Fobs: Provide TEN (10) spare.
 4. Fuses of all kinds, power and electronic, equal to 10 percent of amount installed for each size used, but no fewer than three units.

1.11 WARRANTY

- A. The access control system shall carry a warranty as specified in Section "Demonstration and Training of Communications Systems".

1.12 TRAINING

- A. Provide training per Section "Demonstration and Training of Communications Systems".

1.13 PROGRAMMING

- A. The contractor shall schedule a programming meeting with the owner through the CM/Architect/Engineers after award of bids, to review the requirement of the Access Control programming for zones, sequence of operations etc.

1.14 RECORD DRAWINGS/OPERATION AND MAINTENANCE MANUALS

- A. Provide record drawings and operation and maintenance manuals as described in Sections "Operation and Maintenance of Communications" and "Common Works Results for Communication Systems".

1.15 ACCESS CONTROL/INTRUSION DETECTION SEQUENCE OF OPERATIONS.

- A. All interior and exterior doors with security devices shall be on a timed lock and unlock.
- B. The front entrance interior doors at the student arrival times shall automatically programmed to relock once the time frame has elapsed.
- C. The lock time shall be adjustable per owner request.
- D. The timed open shall be by programming cards/fobs as directed by owner(Principal, custodian, so when one of these card/fobs are swiped the system will disarm)
- E. After hours, enter by using a card/fob which opens the doors and also disarm the intrusion detection system at doors with key pad arming/disarming station.
- F. At doors with card readers ONLY (without a keypad arming/disarming station), access will only be granted during times that the system is disarmed. (This will allow teachers/students to exit and enter through these doors during recess).

- G. Staff shall enter and exit the building from a designated door with a keypad arming/disarming station as directed by owner.
- H. The system shall be armed at a set up time like 11:00pm in case someone left the building and forget to arm it, or as directed by owner.
- I. When exiting **the building**, a code number **XX** shall be entered at the keypad to arm the system.
- J. Fob or card shall be programmed to arm or disarm the system as directed by owner.
- K. Provide a relay closure to trigger the school paging system to make an interior call announcing that the system is ready to be armed and that everyone should exit the building.
- L. Coordinate the above sequence of operations with owner.
- M. The security system shall have the capability to tie to freezer/cooler.

PART 2 - PRODUCTS

2.1 SECURITY ACCESS SYSTEM

- A. Approved manufacturers:
 1. LENEL S2 – Matches existing system on campus.

2.2 APPLICATION SOFTWARE

- A. System Software: Based on 64-bit, Microsoft Windows central-station and workstation operating system and application software. Software shall have the following features:
 1. Multiuser multitasking to allow independent activities and monitoring to occur simultaneously at different workstations.
 2. Graphical user interface to show pull-down menus and a menu tree format.
 3. Capability for future additions within the indicated system size limits.
 4. Open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with operating system.
 5. Password-protected operator login and access.
 6. Shall be web based, so any owners personal with proper credentials can access it from anywhere.
- B. Application Software: Interface between the alarm annunciation and entry-control Controllers, to monitor sensors, operate displays, report alarms, generate reports, and help train system operators. Software shall have the following functions:
 1. Resides at the Central Station, workstations, and Controllers as required to perform specified functions.
 2. Operate and manage peripheral devices.
 3. Manage files for disk I/O, including creating, deleting, and copying files; and automatically maintain a directory of all files, including size and location of each sequential and random-ordered record.
 4. Import custom icons into graphics views to represent alarms and I/O devices.
 5. Locally link I/O so that any I/O can link to any other I/O within the same Controller, without requiring interaction with the host PC. This operation shall be at the Controller.
 6. Locally code I/O links so that any access-granted event can link to any I/O within the same Controller without requiring interaction with the host PC. This operation shall be at the Controller.

7. A Local Controller shall support up to 64 card readers and 128 inputs and 128 outputs for Location or Site linkage.
8. Globally link any event with any Controller system wide with automated Macro functionality and/or user manual operations.
9. Messages from PC to Controllers and Controllers to Sub-Controllers shall be on an interrogation response network that utilizes check summing and acknowledgment of each message. Communication shall be automatically verified, buffered, and retransmitted if message is not acknowledged.
10. Selectable poll frequency and message time-out settings shall handle bandwidth and latency issues for TCP/IP, RF, and other PC-to-Controller communications methods by changing the polling frequency and the amount of time the system waits for a response.
11. Automatic backups for database and history backups shall be automatically stored at the central control PC. Only an authorized USER shall have the capability to restore or read data contained in backup.
12. Operator audit trail for recording and reporting all changes made to database and system software.

C. Workstation Software:

1. Password levels shall be individually customized in the system to allow or disallow operator access to system functions for all workstations throughout the system.
2. Workstation event filtering shall allow user to define events and alarms that will be displayed at each workstation. If an alarm is unacknowledged (not handled by another workstation) for a preset amount of time, the alarm will automatically appear on the filtered workstation.

D. Controller Software:

1. Controllers shall operate as an autonomous intelligent processing unit. Controllers shall be fully distributed allowing each Controller to make local decisions regarding access control, alarm monitoring, linking functions, and door locking schedules for all connected device Sub-controllers, and independent of other system components. Controllers shall be part of a fully distributed processing control network. The portion of the database associated with a Controller and consisting of parameters, constraints, and the latest value or status of points connected to that Controller, shall be maintained in the Controller and in the HOST system.
2. Functions: The following functions shall be fully implemented and operational within each Controller:
 - a. Monitoring inputs.
 - b. Controlling outputs.
 - c. Automatically reporting alarms to the Central Station.
 - d. Reporting of sensor and output status to Central Station on request.
 - e. Maintaining real time, automatically updated by the Central Station. If dial line connected at least once a day if no event changes required reporting to the HOST during the update period.
 - f. Communicating with the Central Station.
 - g. Executing Controller resident programs.
 - h. Diagnosing.
 - i. Downloading and uploading data to and from the Central Station.
 - j. Maintaining all Task conditioning and fully supporting automated controls locally.
3. Controller Operations at a Location or Site:
 - a. Up to 32 Sub-Controllers connected to one or multiple RS-485 communications ports. Globally operating I/O linking functions between Sub-Controllers within the same Controller without central-station or workstation intervention. Linking shall remain fully functional within the same Controller even when the Central Station or workstations are off line.

- b. Locations or Sites shall support multiple Controller and Sub-controller hardware systems. A single Controller shall support up to 64 access points and/or a combination of access points and up to 512 inputs or 512 outputs.
 - c. In the event of communications failure between the Central Station and a Location, there shall be no degradation in operations at the Controller systems at that Location. Each Controller at each Location shall have a memory buffer with a capacity to store up to 10,000 events; there shall be no loss of transactions in system history files until the buffer overflows.
 - d. Buffered events shall be handled in a first-in-first-out FIFO mode of operation.
4. Individual Sub-Controller Operation:
- a. Sub-Controllers shall transmit alarms, status changes, and other data to their assigned Controller and then to the Central Station when communications circuits are operable. If communications are not available, Controllers shall function in a stand-alone mode and operational data, including the status and alarm data normally transmitted to the Central Station, shall be stored for later transmission to the Central Station.
 - b. Card-reader ports of a Controller or Sub-controller shall be custom configurable for any industry standard card-reader or keypad formats. Multiple reader or keypad formats may be used simultaneously at different Sub-controllers or within the same Controller.
 - c. Controllers shall provide a response to card-readers or keypad entries in less than 0.5 seconds, regardless of system size.
 - d. Controllers that are reset, or powered up from a non-powered state, shall automatically start up using stored programming and system configuration stored locally in Flash Memory, and user configurations stored in battery backed up RAM memory. At start up the Controller shall request a download to verify any potential changes made during the Controller power down. This start up process shall occur without operator intervention.
 - e. Initial Startup: When Controllers are brought on-line, database parameters shall be automatically downloaded to them. After the initial download is completed, any database changes shall be automatically downloaded to each specifically affected Controller.
 - f. Failure Mode: On failure for any reason, if possible Controllers shall perform an orderly shutdown and all Sub-Controllers shall manage outputs to a predetermined failure mode state, consistent with pre-determined operations user configured for the associated control devices.
 - g. Startup after Power Failure: After power is restored, startup software shall initiate self-test diagnostic routines, after which Controllers shall resume normal operation.
 - h. Startup after Controller Failure: On failure, if the database and application software are no longer resident, Controllers shall not restart, but shall remain in the failure mode until repaired. If database and application programs are resident, Controllers shall immediately resume operation. If not, software shall be restored automatically from the Central Station.
5. Communications Monitoring:
- a. System shall monitor and report the status of RS-485 communications loop of each Location or Site. This is processed through each Controller communication circuit.
 - b. A system status screen shall display which Controllers are currently communicating. The status screen shall display the following status information:
 - 1) System Statistics
 - a) Total Cards
 - b) Active Cards
 - c) Active Controllers
 - d) Active Sub-Controllers
 - e) Active Readers
 - f) Active Inputs
 - g) Active Outputs

- h) Unlocked Doors
- 2) System Warnings
 - a) Pending Alarms
 - b) Unsecured Doors
 - c) Unsecured Inputs
 - d) Offline Controllers
 - e) Offline Sub-Controllers
- 3) Today's Scheduled Events
 - a) Card Activations
 - b) Card Deactivations
- 4) Workstations/Users/Options
 - a) Log-on
- 5) Software License
 - a) Applications Active
 - b) Application Statistics
 - c) Options Active
- 6. The system status screen shall be operator selected by User assignment.
- 7. A system diagnostic screen shall indicate all system level communications allowing the user to view current and past activity. The diagnostic shall allow the user to set and clear the display to accurately view specific communication periods. This display shall be electronically available to send to the integrator or manufacture for in depth review when necessary.
- 8. Operating systems shall include a real-time clock function that includes international time zone settings by Controller. The system clock shall maintain seconds, minutes, hours, day, date, and month internally and international time zones settings for all Controllers. The real-time clock shall be automatically synchronized with the Central Station at least once a day to plus or minus 10 seconds. The time synchronization shall be automatic, without operator action and without requiring system shutdown.

E. PC-to-Controller Communications:

- 1. Central-station or workstation communications shall use the following:
 - a. Direct connection using RS232 serial port(s) at the PC HOST.
 - b. Direct connection using RS485 serial port(s) at the PC HOST
 - c. Dial-up connection using industry standard dial modems at the PC HOST and associated Controller
 - d. Ethernet connection using TCP/IP with direct on board or secondary network interface cards. Ethernet addressing shall be provided (Static) or obtained (DHCP) as required by the user.
- 2. Serial Port Configuration: Each serial port used for communications shall be individually configurable for "direct communications," "modem communications incoming and outgoing," or as an ASCII output port.
- 3. Multiport Communications Board: Use if more than two serial ports are needed.
 - a. Expandable RS232 design. The computer provided shall support Multi-port (Digi) Board RS232 configuration. This shall be based on specific site requirements.
 - b. Expandable RS485 design. Use an 8-serial port configuration MUX module that is expandable in blocks of 8 ports. This shall be based on specific site requirements.
 - c. Connect the first board to an internal PCI bus adapter card within the PC.
- 4. Direct serial, TCP/IP, and dial-up communications shall provide the same monitoring and control capabilities system wide.

5. TCP/IP network interface card shall automatically set the poll frequency and message response time-out settings to optimum. It shall not be required of the user to set poll frequency or message response time-out settings for typical operation.
 6. PC-to-Controller and Controller-to Sub-Controller communications (direct or TCP/IP) shall use a polled-communication interrogation and response protocol that checks sum and acknowledges each message. All communications shall be verified and buffered and retransmitted automatically within the Controller programming.
- F. Direct Serial or TCP/IP PC-to-Controller Communications:
1. Communication software on the PC shall continuously supervise the PC-to-Controller communications link.
 2. Loss of communications to any Controller shall result in an alarm at the PC HOST and all associated workstation(s) for operator assigned response.
 3. During a loss of communications with any Controller, the associated Controller(s) shall store all activity locally in battery backed up RAM memory. Typical transaction memory storage shall be set to a minimum of 10,000 events.
 4. When communications are restored, all buffered (stored) events shall automatically upload to the PC HOST, and any database changes made at the PC HOST during the communication loss shall be automatically sent to the effected Controller(s).
- G. Controller-to Sub-Controller Communications:
1. Controller-to Sub-Controller Communications shall be accomplished using an IEEE industry standard 2-wire, RS-485 multi-drop parallel network using an interrogation response protocol that checks sum and acknowledges each message.
 2. If a MUX RS-485 module is used for RS485 port expansion the communications signals shall be regenerated at the MUX to each down-line Sub-Controller.
- H. Database Downloads:
1. All data transmissions from PC HOST to a Location or Site, and to the Controllers at each Location or site, shall include a complete database checksum to check the integrity of the transmission. If the data checksum does not match, a full data download shall be automatically retransmitted to any effected Controller(s) at any Location or Site.
 2. If a Controller is reset for any reason, it shall automatically request and receive a database download from the PC HOST. The download shall restore data stored at the Controller to their normal working state and shall take place with no operator intervention.
- I. Operator Interface:
1. The system shall support multiple display screens that can be docked within a single computer monitor or undocked and displayed across a multi-monitor PC. The selection of docked and undocked windows shall be user selectable.
 2. The system shall support three separate display screens within the system as follows:
 - a. An Events screen for activity of inputs that the user assigns for display and logging only or are general status conditions
 - b. An Alarm screen for all assigned alarm points user assigned for operator view, acknowledgement and response. This also shall support video verification if required by the User.
 - c. A Map screen for visual display of event/alarm points within a specific area or multi-location area display. Map screen shall support full command and control including alarm acknowledgement, alarm clear and alarm video verification if required by the user.
 3. General inputs in system when assigned as alarms shall have two alarm map graphic icon representations (states), normal and abnormal for the following general input events:
 - a. Input Secure (normal)

- b. Input Alarm (abnormal)
 - c. Input Supervisory Fault (abnormal)
 - d. Entry Delay in Progress (abnormal)
4. The user shall have the ability to define each input event type with the following management settings:
 - a. Annunciation Type – Disregard, Log-Only, Log and Display and Alarm
 - b. Input event priority – 1 to 99
 - c. Macro Assignment – Any user defined HOST generated response or command
 - d. Alarm Message – User defined Operator Response Message
 - e. Sound File Assignment – Allows the user to define a system Wave file for audible annunciation of the event type.
 - f. Commentary Required – User assigned operator selected or typed event response detail. This shall allow for pre-defined responses and/or typed entry.
 - g. Message Field – Allows the user to define additional specific event details describing the event type or location detail.
 5. Inputs assigned as an alarm type shall be available for alarm graphics display and command functions. The input shall have a selection for default graphic map display and to allow an automatic map display upon alarm.
 6. Inputs assigned as an alarm type shall allow the user to select an automatic clear after operator acknowledgement of the alarm or to maintain the alarm in an alarm window until the input has returned to its normal (secure) state.
 7. The Map graphic display shall support real-time status update processing of all assigned alarm points. Icons displayed shall automatically change to the proper state or input condition in real time. Icons shall also display the input's state, whether armed or bypassed due to a pre-configured condition (Task or Macro), time zone or an operator manual command.
 8. Alarm input, General Output and Reader shall be available for display with and interactive command and control capability for an authorized operator in the event system screen, system alarm screen and system map display screen. Operator selection of these display and control function shall be supported using standard Microsoft mouse right and left key operations or drop down selections within each of these noted system window selections as follows:
 - a. Event Screen: A mouse click on event selection shall establish the control function(s) for the specific event. A left mouse click in the menu bar shall provide a drop down command display window for operator selection, a left mouse click on the selected event shall display a drop down window of command and control selection for the operator
 - b. Alarm Screen: A mouse click on event selection shall establish the control function(s) for the specific event. A left mouse click in the menu bar shall provide a drop down command display window for operator selection, a left mouse click on the selected event shall display a drop down window of command and control selection for the operator
 - c. Map Graphic Screen: When the cursor is placed over a map graphic icon a display window shall show the real time status of the point alarm, output or reader specifically, a right mouse click shall select the icon and automatically display a user defined default command for one click operation of the pre defined command, a left mouse click shall display a drop down of all command and control selection, for the selected point, for the operator
 9. General outputs assigned in system shall have two map graphic display icon representations, activated and deactivated (locked or unlocked).
 10. Icons displaying status of the I/O points shall be constantly updated to show their current real-time condition without prompting by the operator.
 11. Graphic maps or drawings containing inputs, outputs, readers and alarm zones shall support the following:

- a. Database to import and store full-color maps or drawings and allow for input, output, reader and alarm zone icons to be placed on maps.
 - b. Maps to provide real-time display of assigned inputs, outputs, readers to be placed on different maps.
 - c. Software to allow the user to assign an alarm priority to each device that automates the display of a map while a point is being review by and operator.
12. Task, Macro and Alarm Zones Containing I/Os:
- a. The Central System shall incorporate pre-defined override functionality that provides an authorized operator with the status, command and control and automation over user-defined Alarm Zones of I/Os, which can be linked to a user defined icon for easy operator selection or system activation.
 - b. Alarm Zone icons shall change automatically to show status of an alarm zone.
 - c. Alarm Zone shall provide a method to manually control the points defined and to set an Alarm Zone to time zone control.
 - d. The Alarm Zone icon shall highlight the group of inputs, outputs and readers associated in the zone. The Alarm Zone icon shall have the ability to be placed in the back ground behind point icons to allow individual activations to show within the Alarm Zone icon.
13. Schedule Overrides of I/Os and Alarm Zones:
- a. To accommodate temporary schedule changes that do not fall within a general time zone or a pre-defined the holiday parameter, the operator shall have the ability to override schedules individually for each input, output, reader or Alarm Zone.
 - b. Each schedule shall be composed of a minimum of a start date and start time and a duration selection as follows:
 - 1) Once – Specific start date and time
 - 2) By minute – Specific start date and time with the total number of minutes
 - 3) By Hour – Specific start date and time with the total number of hours
 - 4) By Day – Specific start date and time with the number of days selected
 - 5) By Week – Specific start date and time with the day(s) in the week selected
 - 6) By Month – Specific start date and time with the day in the Month selected.
14. Copy command in database shall allow for like data to be copied and then edited for specific requirements, to reduce redundant data entry.

J. Operator System Access Management:

- 1. The Central System software shall provide for operator access authorization by User Group and User and password.
- 2. Users groups shall define system access privileges to groups of system operators, administrators, managers, supervisors, operators and/or guards as Users with various operator settings and security levels. Access permissions shall be set up to control the level of access that members of a user group will have to all of the data files, configuration files and utilities with No Access, View Only, New, Delete or Edit records or fields as follows:
 - a. Cardholder Fields
 - b. Card Fields
 - c. Reports
 - d. Badge Types
 - e. Servers
 - f. Workstations
 - g. Sites
 - h. Main or Branch Sites
 - i. Alarm and Event Filters
 - j. Alarm Delay
 - k. Alarm Color Display

I. Event Color Display

3. Users shall be define system operators within a User Group selection that allows the User to access pre-defined database fields and operate command and control functions. User shall have the ability to select their password without assistance from a system administrator. Operator security access levels shall determine by their user group assignments that the User assigns a name to the actual operator assigned within the User Group.
4. User passwords shall not be displayed or printed.

K. Operator Commands:

1. Command Input: Plain-language text shall allow operators to use the system without extensive training or data-processing backgrounds. System prompts shall be in plain language text typically user entered.
2. Command inputs shall allow user configured for acknowledgement and shall be processed by the system in typically less than 1 second after operator selection.
3. System functions that are executed by an operator shall include the following:
 - a. Acknowledgement of Alarms: Used to acknowledge that an alarm has been observed by an operator and is in process.
 - b. Clearing of Alarms: Used to remove an alarm from the system display screen after an operator has responded to the event as defined in any Alarm Messages presented to them at the time the alarm is being cleared.
 - c. Clearing alarms shall offer user defined operational processes:
 - 1) Removing the alarm from the alarm screen
 - 2) Responding to pre-defined alarm messages or process
 - 3) Adding mandatory commentary regarding the alarm and/or the response process.
 - d. Alarm Access, overriding system points to allow physical use, shall be a standard feature within the Central System and managed in the remote Controllers using readers (card, fob or biometrics), display terminal keypads, time zones, schedules, manual commands, tasks and macros as follows:
 - 1) Alarm Zone Disarmed - When active shall represent a zone is disarmed and no devices were in alarm condition.
 - 2) Alarm Zone Disarmed Already Disarmed – When active shall represent a zone has been disarmed again while already in a disarmed state.
 - 3) Alarm Zone Override Armed – When active shall represent a zone has been override armed with one or more devices in alarm condition and the disarm count has been set to zero.
 - 4) Alarm Zone Override Disarm Count Set – When active shall represent a zone has been override disarmed and the disarm count has been set to a non-zero value.
 - 5) Alarm Zone Force Arm Zone Armed – When active shall represent a zone has been force armed with one or more devices in alarm condition.
 - 6) Alarm Zone Force Arm Disarm Count – When active shall represent a zone arming attempt with one or more devices in alarm condition and the disarm count has been decremented.
 - 7) Alarm Zone Armed – When active shall represent a zone is armed and no devices were in alarm condition.
 - 8) Alarm Zone Not Armed Zone Active – When active shall represent a zone arming attempt with one or more devices in alarm condition and the zone is not armed.
 - 9) Alarm Zone Arm Still Disarmed – When active shall represent a zone disarm count has been decremented; however, is still greater than zero and the alarm zone is still disarmed.
 - 10) Alarm Zone Override Arm – When active shall represent a zone is override armed with one or more devices in alarm condition and the disarm count has been set to zero.

- 11) Alarm Zone Override Arm Still Disarmed – When active shall represent a zone disarm count has been decremented but is still greater than zero and the alarm zone is still disarmed.
 - e. Display Graphics: This application module shall display any graphic standard design file incorporated by the user. As a standard, graphic displays shall be completed and shown on an operator terminal within 20 seconds from time of operator selection.
 - f. The Central Station shall support a system status display screen showing system status and structure upon system start-up, operator log-in or upon operator selection.
 - g. Generate and format reports.
 - h. Request help with the system operation.
 - 1) Include in main menus.
 - 2) Provide unique, descriptive, context-sensitive help for selections and functions with the press of one function key.
 - 3) Provide navigation to specific topic from within the first help window.
 - 4) Help shall be accessible outside the applications program.
 - i. Entry-Control Commands:
 - 1) Lock (secure) or unlock (open) each controlled entry and exit up to twelve times a day through time-zone interval configuration.
 - 2) Arm or disarm each monitored input up to twelve times a day through time-zone intervals configuration.
 - 3) Enable or disable readers or keypads up to twelve times a day through time-zone interval configuration.
 - 4) Activate or Deactivate general relay outputs up to twelve times a day through time-zone interval configuration.
- L. Alarms:
1. System Setup:
 - a. Assign manual and automatic responses to incoming point status change or alarms.
 - b. Automatically respond to input changes with a link to other inputs, outputs, operator-response plans, unique sound with use of WAV files, and maps or images that graphically represent the point location.
 - c. 256 character Alarm Message field for each alarm to define operator responses.
 - d. 50 character Message field for each event to define point details.
 - e. Messages shall be assignable by the operator for printing to provide further information and shall be editable by the operator.
 2. Operator System Access Errors :
 - a. The Central Station shall support a User Group and User assignment application that eliminates access by specific system users within segments of the systems database. If a system user has partial Edit authorizations to a menu selection and attempts to modify an unauthorized section an alert will be provided to the operator and the attempt logged into a user audit file.
 - b. The Central Station shall not allow write access to system transcript files by any person, regardless of their authorization level.
 3. System user access to system transcript files shall be user configurable in the User Group and User access structure. Typically this selection will be reserved for Administration level operators; however, may be assigned as required.
 4. Fully Interactive Graphics Displays: Highlight alarms with flashing icons on graphic maps; display and constantly update the current status of alarm inputs and outputs in real time through animated icons.
 - a. An authorized system operator shall be able to move the system cursor over an icon on any graphic map display and view current detail status in a drop down display. A left click on the system mouse shall active the icon display and the default command

- assigned a right click on the mouse shall open the command drop down selection display.
- b. Multimedia Alarm Annunciation: WAV files shall be associated with any user defined events for audio annunciation or instructions. Events shall be user definable for Macro actions, automatic graphic display and automatic camera views for any event or alarm in the system.
5. Alarm Handling: The Central System shall provide specific operator monitoring and response processing of site alarms and events as follows:
- a. The Central System shall activate an audible sound from the PC for any alarm defined in the system. WAV files assigned to any event or alarm shall be activated as well.
 - b. The Central System shall provide a separate 'Silence' selection button allowing an operator to silence an alarm or event audible without acknowledging the alarm or clearing it from the system.
 - c. Each input user assigned as an alarm shall require operator acknowledgement and clearing from the system.
 - d. Each input shall be user configured so that an alarm cannot be cleared unless it has returned to normal.
 - e. Each input shall be user configured to require an operator to provide response commentary, typed entry, or pre-defined disposition commentary from a drop down list, for an input before it can be cleared from the system. Allow operator to silence alarm sound when alarm is acknowledged.
6. Contractor shall provide the integration as defined in the next three paragraphs at any site where intrusion detection or video surveillance is a requirement of the Location or Site:
- a. Access Alarm Integration: The Central System shall provide a totally engineered Access Control System (ACS) with fully integrated local and remote Intrusion Detection System (IDS) functionality. Remote alarm integration shall incorporate a separate serial enabled auto-dial processor for user specified Controllers to provide remote central station connectivity for alarm monitoring and response 24/7 during unattended hours. Alarm reports shall be fully supported and displayed in the Central Station system as well as at the remote central station site. The integrated processor shall be a non-proprietary solution and commercially off-the-shelf.
 - b. Third Party IDS Panel Integration: The Central Station shall provide a high-level integration module that will allow down-line communication from a third party IDS panel using a serial or Ethernet connection (TCP/IP) to Central Station systems. The integration module shall allow input activation to be passed to the PC HOST for standard operator response and reporting as well as to a user selected central station. The integration module shall allow the user to define specific command that can be sent from the Central Station PC HOST to the IDS panel to automate Arm and Disarm functionality. The pre-approved third party IDS panels are:
 - 1) Bosch 7412 and 9412
 - 2) DMP Xr100 and Xr500
 - 3) Honeywell V128B and V250B
 - c. CCTV Alarm Interface: The video integration module shall allow the user to select CCTV Switchers or Matrix products as well as DVR or NVR video system products for video surveillance at a Location or site. This integration module shall automate video alarm verification with the Central Station and on any workstation selected by the user. The video integration module shall allow the user to retrieve stored video based on alarm or event transactions or time-of-day for review. Video review shall be automated to allow a user reviewing an activity report on the Central Station or workstation to request any associate video clips directly from the on-line report. Selection of video views shall be real-time and automated with the system Map Graphics display as well as the Alarm and Event screens.
- M. Alarm Monitoring: Monitor sensors and Controllers shall notify operators of any user defined alarm condition.

1. Alarms shall be displayed by user defined priority, oldest unacknowledged and highest priority first. Operator acknowledgment of one alarm shall not acknowledge of other alarms nor shall it inhibit reporting of subsequent alarms.
2. The Central Station software shall support filtering of alarms and events by user group to display pre-selected alarm to pre-selected operator logins.
3. Alarms that have been received and not acknowledged by an operator are "pending" alarms. Pending alarms shall activate an icon change where displayed as well as activating an audible, PC or pre-defined sound WAV file and shall automatically display the alarm for each input assigned to a pre-defined graphic map display.
4. Pending alarms shall require two processing steps to be cleared by an operator:
 - a. First Operator Step: "Acknowledged." This action shall silence sounds associated with the alarm. The alarm remains in the system "Acknowledged" but "Un-Cleared."
 - b. Second Operator Step: If defined by the user the operator clearing an alarm shall be required to enter a resolution or operator comment, giving the disposition of the alarm event before the alarm can be cleared from the system. Resolution response shall be available to the operator as an entry form for typing a resolution message or for selecting a pre-determined resolution message from a drop-down window.
5. Each workstation shall have the ability to display the total pending alarms and total unresolved alarms.
6. Each alarm point shall be configurable to allow simple resolution of the alarm point without operator comment to clear an alarm.
7. Each alarm point shall be configurable to disallow the resolution of alarms until the alarm point has returned to its normal state. If this configuration is elected by the user the alarm message shall stay displayed within the alarm screen until the physical condition is back to normal or user default.
8. Alarms shall transmit to the Central Station in real time.
9. Alarms shall be displayed and managed from a minimum of two different windows; Alarm Log Transaction Window and the Graphic Map Display Window.
 - a. The alarm log transaction window shall have the following display information tables: Date/Time, Site Name, Card #, Facility Code, Card Holder, Description, Location, Priority, Acknowledged By and Unsecured fields. Selecting the text line shall select the point and allow acknowledgement and/or command selections for the alarm by an authorized system operator. Text display lines shall be color coded based on a user pre-defined display configuration.
 - b. The graphic map display shall show a steady colored icon representing for each alarm input location on the map; change the icon to flashing red when an alarm occurs and change the icon from flashing red to steady red when the alarm is acknowledged. The alarm graphics Map display shall also provide a point status drop down when the system cursor is placed over any icon on the map.
10. System events shall be displayed and managed from an Event Log Transaction Window. The event display shall have the following display information tables: Date/Time, Site Name, Card #, Facility Code, Card Holder, Description and a cardholder photo image display field. The cardholder image display is operator selected for display. Selecting the text line shall select the event command/selection drop down to allow an authorized operator to do adhoc journal entries.
11. The time and name of the operator who acknowledged and resolved the alarm shall be recorded in the database.
12. Consecutive alarm occurrences from same alarm point shall be acknowledged at same time the operator acknowledges the first alarm. Identical alarms shall be resolved when the first alarm is resolved.
13. Alarm functions shall have priority over downloading, retrieving, and updating database from workstations and Controllers.

14. When a reader-controlled output (relay) is opened, the corresponding alarm point shall be automatically bypassed in the form of a general request to exit.
 15. Printed alarm data shall include type of alarm, location of alarm, date and time of occurrence.
- N. Monitor Display: Display text and graphic maps that include zone status integrated into the display shall support user defined color codes. Colors are used for the various components and current data. Colors shall be uniform throughout the system as defined by the user.
1. Color Codes:
 - a. Alarm colors control shall manage how alarms are displayed in the alarms window. Four priority ranges shall be available for user selection from a low and high limit for both pending and acknowledged alarms allowing higher priority alarms to visually differentiate from lower priority alarms.
 - b. Event colors control shall manage how events are displayed in the events window. Five different categories of events shall be available for user selection. Both the background (highlight) color and the font or text color shall be user selected to draw the attention of an operator to a certain category of events.
 2. Graphics:
 - a. The map designer in the Central Station software shall be used to create new or modify existing graphical map designs. The map designer shall allow the user to design site and or area maps in with many different styles and functions. The map designer shall be similar in function to a paintbrush style application allowing objects and hardware devices to be added to one or multiple maps. Device selection shall determine the functionality of the objects placed on a map.
 - b. The user shall have the ability to select a map image or background picture by either entering the full path to an image or background pictures file or by browsing for the file from any standard storage device connected to the Central Station. At a minimum the following file type shall be supported for map image or background pictures: Windows Bitmap (.BMP), JPEG (.JPG), Windows Metafile (.WMF), Enhanced Windows Metafile (.EMF) and AutoCAD Drawings (.dxf or .dwg).
 - c. The Maps module shall support an unlimited number of points and graphic display images. Applying a device or image to a map shall incorporate a drag and drop method. Pre-defined icon images for devices shall be fully scalable once attached to a map.
 - d. The Maps module shall display all maps in the database in a hierarchical listing or tree format. The map tree shall be displayed in the left window pane of the maps window. The maps window shall either be docked within the main application window or displayed in a separate window using the view option on the system menu, docking or undocking selection. Displaying the maps in a separate shall be required to utilize a multiple monitor system design. System software that does not support docking and undocking of the alarm, events and maps window screens shall be considered non-compliant.
 - e. Operators shall be able to view the inputs, outputs, the point's name and the status of the device and/or associated device points by moving the mouse cursor over the point icon on graphic map.
 - f. Inputs or outputs may be placed on multiple graphic maps. The operator shall be able to toggle to view graphic maps or apply specific map selection icons to a map to move from and to different maps.
 - g. Each graphic map shall have a display-order sequence associated with it to provide a predetermined order when toggled to different views from the map tree.
 - h. Camera icons, when selected by an operator, shall open a video window, display the camera associated with that icon, and provide camera system controls if available.
 - i. All device commands shall be available for operator action by selecting and associate icon and opening a drop down menu selection.

3. Tool Bar:
 - a. Alarm notification shall also be displayed by flashing the workstation taskbar icon if the security application is minimized or another application is being used on the local workstation' indicating to an operator that an alarm has been received by the Central Station.

- O. System reports shall allow an operator to select the status of the entire system or of a particular portion of the system.
 1. Status Report: The results of a status report shall be stored for future display or printout. The report shall document the operational status of system components on the date or period selected by the operator.
 2. System Status Display: The system shall support a system wide display showing system status and system details. This display shall be displayed after a system login or by operator request.

- P. Report Generator Software: Include commands to generate reports for displaying, printing, and storing on disk and tape. Reports shall be stored by type, date, and time. Report printing shall be the lowest priority activity. Report generation mode shall be operator selectable but set up initially as periodic, automatic, or on request. Include time and date printed and the name of operator generating the report. Report formats may be configured by operators.
 1. Automatic Printing: Setup shall specify, modify, or inhibit the report to be generated; the time the initial report is to be generated; the time interval between reports; the end of period; and the default printer.
 2. Printing on Requests: An operator may request a printout of any report base on User Group authorization.
 3. At a minimum the Central Station software shall include the following standard reports:
 - a. Access By Access Level - This report provides a list of all cardholders and cards that have been assigned the selected access levels.
 - b. Access By Reader - This report provides a list of cardholders and cards that have access to the selected readers. This report includes the time zone/floor code that corresponds to the selected readers.
 - c. Access Level History - This report provides a list of all database updates for the selected access levels.
 - d. Access Level Listing - This report provides a list of the selected access levels and their various properties.
 - e. Access Levels By Reader - This report provides a list of all access levels that contain the selected readers. This report includes the time zone/floor code that corresponds to the selected reader.
 - f. Active Card Listing - This report provides a list of all active cards, along with the access levels and precision access assigned to the cards.
 - g. Alarm Acknowledgements And Clears - This report provides a list of all alarm acknowledgements and clears for the selected users.
 - h. Card Access Denied Events - This report provides a list of all access denied card usage events for the selected cards.
 - i. Card Access Events - This report provides a list of all access card usage events for the selected cards.
 - j. Card Access Granted Events - This report provides a list of all access granted card usage events for the selected cards.
 - k. Card Antipassback Events - This report provides a list of all antipassback events for the selected cards. The report includes both access grants and access denies.
 - l. Card Audit History - This report provides a list of all card database update events for the selected cards.
 - m. Card Group History - This report provides a list of all database update events for the selected card groups.

- n. Card Group Listing - This report provides a list of the selected card groups and their various properties.
- o. Card History - This report provides a list of all history for the selected cards. This report includes all database updates as well as all card usage.
- p. Card Listing - This report provides a list of the selected cards, along with the access levels and precision access assigned to the cards.
- q. Card Status Listing - This report provides a list of status information for the selected cards. The report includes cardholder, card number, facility code, card status, classification and last modified information.
- r. Cardholder Access Denied Events - This report provides a list of all access denied card usage events for the selected cardholders.
- s. Cardholder Access Events - This report provides a list of all access card usage events for the selected cardholders.
- t. Cardholder Access Granted Events - This report provides a list of all access granted card usage events for the selected cardholders.
- u. Cardholder Antipassback Events - This report provides a list of all antipassback events for the selected cardholders. The report includes both access grants and access denials.
- v. Cardholder Audit History - This report provides a list of all cardholder and card database update events for the selected cardholders.
- w. Cardholder History - This report provides a list of all history for the selected cardholders. This report includes all database updates as well as all card usage for the cardholders.
- x. Cardholder Listing - This report provides a list of the selected cardholders, along with all cards issued to the cardholders. This report also includes access levels and precision access assigned to cards.
- y. Cardholder Photo Gallery - This report provides a list of cardholder names and photos.
- z. Cardholder Reader Access - This report provides a list of all readers that the selected cardholders have access to. This report includes the time zone/floor code that corresponds to the selected reader.
- aa. Cardholder Time and Attendance - This report provides a list of in and out times at readers designated as time and attendance readers, as well as the time elapsed between in and out events. The report includes total elapsed time for the selected cardholders.
- bb. Cardholders Last Location - This report provides a list of the selected cardholders along with the location and time of the last card usage.
- cc. Cardholders Without Cards - This report provides a list of cardholders that do not have any associated cards.
- dd. Cards Expiring In Less Than One Week - This report provides a list of all cards that will expire in one week or less. The report includes the cardholder name, card number, facility code and expire date.
- ee. Cards Without Access - This report provides a list of cards that have no valid access. The report includes the cardholder name, card number and
- ff. Channel History - This report provides a list of all database updates for the selected channels.
- gg. Channel Listing - This report provides a list of the selected channels and their various properties.
- hh. Custom Report – This is a report modified by an operator and stored for future use and/or scheduling.
- ii. Detail Card Listing - This report provides a list of the selected cards. This report includes all cardholder information, photo, signature, as well as all access levels and precision access assigned to the cards.
- jj. Detail Cardholder Listing - This report provides a list of the selected cardholders. This report includes all cardholder information, photo and signature.

- kk. Detailed Card Audit History - This report provides a list of all cardholder and card database update events for the selected cards. The report includes current card status, classification and access information.
- ll. Dossier - This report provides a full page photo and name of the selected cardholders.
- mm. Evacuation Report - This report provides a list of cardholders that are currently IN the selected areas.
- nn. Event Listing - This report provides a list of all user selectable events.
- oo. Floor Code History - This report provides a list of all database updates for the selected floor codes.
- pp. Floor Code Listing - This report provides a list of the selected floor codes and their various properties.
- qq. General Building Access Report - This report provides a list of all history for the selected cardholders. This report includes all database updates as well as all card usage for the cardholders.
- rr. Hardware Map - This report provides a hierarchical listing of all hardware attached to the selected SCPs. This report includes SCPs, SIOs, readers, inputs and outputs.
- ss. Holiday History - This report provides a list of all database updates for the selected holidays.
- tt. Holiday Listing - This report provides a list of the selected holidays and their various properties.
- uu. Input Activity - This report provides a list of all input activity for the selected inputs.
- vv. Input Audit History - This report provides a list of all database updates and user issued commands for the selected inputs.
- ww. Input History - This report provides a list of all database updates, user issued commands and input activity for the selected inputs.
- xx. Input Listing - This report provides a list of the selected inputs and their various properties.
- yy. Macro History - This report provides a list of all database updates to the selected macros as well as macro execution history.
- zz. Macro Listing - This report provides a list of the selected macros and their various properties.
- aaa. Output Activity - This report provides a list of all output activity for the selected outputs.
- bbb. Output Audit History - This report provides a list of all database updates and user issued commands for the selected outputs.
- ccc. Output History - This report provides a list of all database updates, user issued commands and output activity for the selected outputs.
- ddd. Output Listing - This report provides a list of the selected outputs and their various properties.
- eee. Reader Access Denied Events - This report provides a list of all access denied card usage events for the selected readers.
- fff. Reader Access Events - This report provides a list of all access card usage events for the selected readers.
- ggg. Reader Access Granted Events - This report provides a list of all access granted card usage events for the selected readers.
- hhh. Reader Activity - This report provides a list of all reader activity for the selected readers.
- iii. Reader Antipassback Events - This report provides a list of all antipassback events for the selected readers. The report includes both access grants and access denies.
- jjj. Reader Audit History - This report provides a list of all database updates and user issued commands for the selected readers.
- kkk. Reader History - This report provides a list of all database updates, user issued commands and reader activity for the selected readers.
- lll. Reader Listing - This report provides a list of the selected readers and their various properties.

- mmm. Recipient History - This report provides a list of all database updates for the selected recipients.
 - nnn. Recipient Listing - This report provides a list of the selected recipients and their various properties.
 - ooo. Report Listing - This report provides a list of all reports available, as well as report category and a description.
 - ppp. SCP History - This report provides a list of all history for the selected SCPs. This report includes all database updates as well as all hardware activity.
 - qqq. SCP Listing - This report provides a list of the selected SCPs and their various properties.
 - rrr. Server Listing - This report provides a list of the selected servers and their various properties.
 - sss. SIO History - HistoryThis report provides a list of all history for the selected SIOs. This report includes all database updates as well as all hardware activity.
 - ttt. SIO Listing - This report provides a list of the selected SIOs and their various properties.
 - uuu. Site Listing - This report provides a list of the selected sites and their various properties.
 - vvv. Task Listing - This report provides a list of all tasks for the selected SCPs. This report includes execute conditions as well as task steps.
 - www. Time zone History - This report provides a list of all database updates for the selected time zones.
 - xxx. Time zone Listing - This report provides a list of the selected time zones and their various properties.
 - yyy. Unused Cards - This report provides a list of all cards that have not been used for a user inputted number of days or have never been used.
 - zzz. User Group History - This report provides a list of all database updates for the selected user groups.
 - aaaa. User Group Listing - This report provides a list of the selected user groups and their various properties.
 - bbbb. User Listing - This report provides a list of the selected users and their various properties.
 - cccc. User Transaction History - This report provides a list of all transactions for the selected users including database updates, commands to devices and alarm processing.
 - dddd. Workstation Listing - This report provides a list of the selected Workstations and their various properties.
4. Custom Reports: Reports tailored to exact requirements of who, what, when, and where based on the system report selected by the operator. As an option, custom report formats may be stored for future printing.
 5. Automatic Reports: Named, saved, and scheduled for automatic generation.
 6. Reports shall have the following four options:
 - a. View on screen.
 - b. Print to system printer. Include automatic print spooling and "Print To" options if more than one printer is connected to system in a user selected document format.
 - c. "Save to File" with full path statement and in a user selected document format.
 - d. System shall have the ability to produce a report indicating status of system inputs and outputs or of inputs and outputs that are abnormal, out of time zone, manually overridden, not reporting, or in alarm.
 7. The reports of system database shall allow options so that every data field may be printed.
 8. The reports of system database shall be constructed so that the actual position of the printed data shall closely match the position of the data on the report designer.

9. User shall have the ability to modify the report design to move positioning of data fields.

Q. Visitor Assignment:

1. The Central Station software shall support a visitor badging function allowing an operator to assign credentials and enroll cardholders as visitors. Allow only access levels that have been designated as approved for visitors in a user defined card group.
2. Provide a specific User Group restricting the access level for operators managing visitors.
3. Provide an automated log of visitor name, time and doors accessed, and whom visitor contacted.
4. Allow operator to recall visitors' credential holder file, once a visitor is enrolled in the system.
5. The operator shall have the ability to designate a reader as one that deactivates a visitor credential after use at the designated reader. The history log shall show the use of the reader and as such the return of a visitor credential.
6. System shall have the ability to use the visitor designation in searches and reports. Reports shall be able to print all or any visitor activity.

R. Operator Training: The Central Station software shall allow the configuration of a training operation to allow operators to practice system operational functions with alarm acknowledgment, alarm assessment, response force deployment, and response force communications. The Central Station shall continue normal operation during training exercises allowing the operator to terminate any exercises in an adhoc manner.

S. Entry-Control Enrollment Software: The following Database management functions are required to allow an operator to add, delete, and modify access data as needed.

1. The enrollment station shall not have alarm response or acknowledgment functions.
2. Provide multiple, password-protected operator access levels. Database management and modification functions shall require a higher operator access level than personnel enrollment functions or alarm response operators.
3. The program shall provide a single screen method for entering personnel identifying information into the entry-control database from user defined enrollment stations and shall provide options to include biometric data. All data entry processing shall use menu selections and data fields. The program shall allow for a minimum of twenty data field names to be customizable during setup to suit user and site needs. Personnel identity verification subsystems selected for use with the system shall fully support the enrollment function and shall be compatible with the entry-control database files.
4. Cardholder Data: The Cardholder data file shall allow an operator to change the display order for cardholder user fields.
5. Display Names: Display names for each of the user definable data entry field shall use simple text entry allowing friendly names for the displays to be entered by a system operator.
6. Display Name: The display name field shall support a minimum 50 characters for each display name.
 - a. The system operator shall have a selection of edit tool and types for the cardholder user fields. Edit control shall determine the look and functionality of the cardholder user field displayed on the cardholder form.
 - b. The following types of edit controls shall be available:
 - 1) *Text Box* - A text box edit control tool shall be provided to allow an operator to enter free form alpha-numeric characters. A minimum of up to 50 characters shall be allowed for entry into these text fields. An input mask shall also be definable to control the way that data is entered into a text user field. Mask conditioning shall be support to define specific data entry processing.
 - 2) *Drop Down List* - A drop down list edit control tool shall be provided to allow an operator present a list of pre-defined items to choose from during data entry. An

unlimited number of list items can be entered into each drop down list incorporated.

- 3) *Date Combo* - A date combo edit control tool shall be provided to allow an operator to entry of dates into a user field. A calendar pop-up shall be provided for easy date entries.
7. Personnel Search Engine: A report generator with capabilities such as search by last name, first name, group, or any predetermined user-defined data field; by codes not used in definable number of days; by skills; or by seven other methods.
8. Multiple Deactivate Dates for Cards: User-defined fields to be configured as additional stop dates to deactivate any cards assigned to the cardholder.
9. Copy and paste functionality shall be supported to allow card data to be pasted into a cardholder record to speed data entry for sites where most card data may be similar.
10. An optional Import/Export utility shall be supported to allow the importing of cardholder data and images from multiple electronic data formats.
11. A card expire function shall be supported to automatically deactivate a card based on non-use and/or data and time.

2.3 SYSTEM DATABASE

- A. Database and database management software shall define and modify each point in database using operator commands. Definition shall include parameters and constraints associated with each system device.
- B. Database Operations:
 1. System data management shall be in a hierarchical menu tree format, with navigation through expandable menu branches and manipulated with use of menus and icons in a main menu and system toolbar.
 2. Navigational Aids:
 - a. Toolbar icons for add, delete, copy, print, capture image, activate, deactivate, and muster report.
 - b. Point and click feature to facilitate data manipulation.
 - c. Next and previous command buttons visible when editing database fields to facilitate navigation from one record to the next.
 - d. Copy command and copy tool in the toolbar to copy data from one record to create a new similar record.
 3. All data entry shall be automatically checked for duplicate and illegal data and shall verify that data are in a valid format.
 4. Provide a memo or note field for each item that is stored in database, allowing the storing of information about any defining characteristics of the item. Memo field is used for noting the purpose the item was entered for, reasons for changes that were made, and the like.
- C. File Management:
 1. Provide database backup and restoration system functionality, allowing selection of storage media to industry standard memory devices (DVD, Fixed Memory, Thumb Drives, etc.)
 2. Provide manual and automatic mode for database backup operations. The operator shall have a selection tool that will automatically sequence backups before the oldest backup becomes overwritten; FIFO mode shall be operator selectable.
 3. Backup program shall provide manual operation from any PC on the LAN and shall operate while system is in normal operation.
- D. Operator Passwords:
 1. Software shall support an unlimited number of individual system operators, each with a unique password.

2. Operator Password: One to eight alphanumeric characters.
 3. Allow passwords to be case sensitive.
 4. Passwords shall not be displayed when entered.
 5. Provide each password with a unique and customizable password profile, and allow several operators to share a User Group profile; however, shall maintain the password file specific to each operator. Include the following features in the password profile:
 - a. Allow for an unlimited number of User Group and User profiles.
 - b. User Group and User profiles shall be specific and shall not use password levels.
 - c. Allow or disallow operator access to any program operation, including the functions of View, Add, Edit, and Delete and to specific file records with in the database.
 - d. Restrict which doors an operator can assign access to.
 6. Operators shall use a user name and password to log on to system.
 - a. The operator user name and password shall allow the operator to access database areas and programs as determined by the associated User Group profile.
 7. The system shall be designed to operate specific services that will allow an operator to exit and close the workstation application without closing the system program allow the software to continue full system operation. The system shall support a view that will allow an operator to log-out without fully exiting the program and shall display a new log-in window for the next operator to log into the system.
- E. Access Card/Code Operation and Management: Access authorization shall be accomplished using user definable reader mode selections such as; however, not limited to access by card credential-only, by a manually entered biometrics code Personal Identification Number PIN-only, a combination of both (card plus PIN) or by presenting a card or entering a PIN.
1. Access authorization shall verify the facility code first, the card or card-and-PIN validation second, and the access level (time of day, day of week, date), and number of credential uses last.
 2. Use data-entry windows to view, edit, and issue access levels. Access authorization entry management system shall maintain and coordinate all access levels field.
 3. Allow assignment of an unlimited number of cards/codes to any cardholder.
 4. Allow assignment of up to 32 access levels per cardholder in each Controller. Each access level may contain any combination of doors.
 5. Each door may be assigned to any access level and any time zone to any access level.
 6. Software shall allow the grouping of locations or sites so cardholder data can be shared by all locations or sites in the group.
 7. Visitor Access shall not allow a visitor badge to be issued, without assigning a cardholder name.
 8. Cardholder Tracing: The system shall allow for cardholder tracing. Make a special audible and visual annunciation at the control station when a selected card or code is used at a reader. Annunciation shall include an automatic display of the cardholder image. The system shall support alarm annunciation base of up to 25 separate access events in any card file/cardholder record.
 9. Allow each cardholder to be given either an unlimited number of uses or a number from 1 to 9998 that regulates the number of times the card can be used before it is automatically deactivated.
 10. Provide for cards and codes to be activated and deactivated manually or automatically by date. Provide for multiple deactivate dates to be preprogrammed.
- F. Security Access Integration:

1. Photo ID badging and photo verification shall use the same database as the security access system and may query data from cardholder, group, and other personal information to build a custom ID badge.
 2. Automatic or manual image recall shall be supported. Photo recall shall support visual alarm verification to process cardholders into and out of controlled areas.
 3. The system shall allow sorting of cardholders by group or other characteristic for a fast and efficient method of reporting on, and enabling or disabling, cards or codes.
- G. Facility Codes: System shall accommodate up to 2048 facility codes per Location or Site, with the option of allowing facility codes to work at all doors or only particular doors.
- H. Operator Comments:
1. With the press of one appropriate button on toolbar, the user shall be permitted to make operator comments into history at anytime.
 2. Automatic prompting of operator comment shall occur before the resolution of each alarm. This feature shall be user definable per point.
 3. Operator comments shall be recorded by time, date, and operator number.
 4. Comments shall be sorted and viewed through reports and history.
 5. The operator may enter comments in two ways; either or both may be used:
 - a. Manually entered through keyboard data entry (typed) message per alarm.
 - b. Predefined and stored response messages for retrieval selected by the operator.
 6. System shall have a minimum of 999 predefined operator comments.
- I. Group:
1. Group names may be used to sort cardholders into groups that allow the operator to determine the tenant, vendor, contractor, department, division, or any other designation of a group to which the person belongs.
 2. System software shall have the capacity to assign multiple group names to an access authorization.
 3. Make provision in software to deactivate and reactivate all access authorizations assigned to a particular group.
 4. Allow sorting of history reports and code list printouts by group name.
- J. Time Zones:
1. Each zone consists of a start and stop time for 7 days of the week and up to 8 holiday groups. A time zone is assigned to inputs, outputs, or access levels to determine when an input shall automatically arm or disarm, when an output automatically opens or secures, or when access authorization assigned to an access level will be denied or granted.
 2. Up to 12 time zone intervals may be assigned to inputs and outputs allowing up to 12 arm or disarm periods per day or 12 lock or unlock periods per day; up to 8 holiday override schedules may be assigned to a time zone.
 3. Data-entry window shall display a dynamically linked bar graph showing active and inactive times for each day and holiday, as start and stop times are entered or edited.
 4. System shall have the capacity for 32,000 time zones for each Location or site.
- K. Holidays:
1. Eight different holiday groups may be assigned to a time zone. Holiday groups consist of dates in a MM/DD/YYYY format and a description. When the holiday dates match the current date of the time zone, the holiday schedule replaces the time zone schedule for that period.
 2. System shall have the capacity for 32,000 holidays.

3. Holidays have an option to be designated as occurring on the designated date each year. These holidays remain in system and will not be purged.
4. Holidays not designated to occur each year shall be automatically purged from database after the date expires.

L. Access Levels:

1. System shall allow for the creation up to 32,000 access levels.
2. One level shall be predefined as the Master Access Level. The Master Access Level shall work at all doors at all times and override any antipassback.
3. System shall allow for access to be restricted to any area by reader and by time. Access levels shall determine when and where an Identifier (card credential, PIN or other biometrics) is authorized.
4. System shall be able to create multiple door and time zone combinations under same access level so that an Identifier may be valid during different time periods at different readers even if the readers are on the same Controller.

M. User-Defined Fields:

1. System shall provide a minimum of 20 user-defined fields, each with up to 50 characters, for specific information about each credential holder.
2. System shall accommodate a title for each field; field length shall be 20 characters.
3. A "Required" option may be applied to each user-defined field that, when selected, forces the operator to enter data in the user-defined field before the credential can be saved.
4. A "Unique" option may be applied to each user-defined field that, when selected, will not allow duplicate data from different credential holders to be entered.
5. Data format option may be assigned to each user-defined field that will require the data to be entered with certain character types in specific spots in the field entry window.
6. A user-defined field, if selected, will define the field as a deactivate date. The selection shall automatically cause the data to be formatted with the windows MM/DD/YYYY date format. The credential of the holder will be deactivated on that date.
7. A search function shall allow any one user-defined field or combination of user-defined fields to be searched to find the appropriate cardholder. The search function shall include search for a character string.
8. System shall have the ability to print cardholders based on and organized by the user-defined fields.

N. Code Tracing:

1. System shall perform code tracing selectable by cardholder and by reader.
2. Any code may be designated as a "traced code" with no limit to how many codes can be traced.
3. Any reader may be designated as a "trace reader" with no limit to which or how many readers can be used for code tracing.
4. When a traced code is used at a trace reader, the access-granted message that usually appears on the monitor window of the Central Station shall be highlighted with a different color than regular messages. A short singular beep shall occur at the same time the highlighted message is displayed on the window.
5. The traced cardholder image (if image exists) shall appear on workstations when used at a trace reader.

2.4 SURGE AND TAMPER PROTECTION

- A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.

2.5 DOOR CONTROLLERS

- A. Controllers: Intelligent peripheral control unit, complying with UL 294, that stores time, date, valid codes, access levels, and similar data downloaded from the Central Station or workstation for controlling its operation.
- B. Subject to compliance with requirements in this Article, manufacturers may use multipurpose Controllers.
- C. Alarm Annunciation Controller:
 - 1. The Controller shall automatically restore communication within 10 seconds after an interruption with the field device network.
 - a. Inputs: Monitor dry contacts for changes of state that reflect alarm conditions. Provides at least eight alarm inputs, which are suitable for wiring as normally open or normally closed contacts for alarm conditions.
 - b. Alarm-Line Supervision:
 - 1) Supervise the alarm lines by monitoring each circuit for changes or disturbances in the signal, and for conditions as described in UL 1076 for line security equipment by monitoring for abnormal open, grounded, or shorted conditions using dc change measurements. System shall initiate an alarm in response to an abnormal current, which is a dc change of 10 percent or more for longer than 500 ms.
 - 2) Transmit alarm-line-supervision alarm to the Central Station during the next interrogation cycle after the abnormal current condition.
 - c. Outputs: Managed by Central Station software.
- D. Entry-Control Controller:
 - 1. Function: Provide local entry-control functions including one- and two-way communications with access-control devices such as card readers, door strikes, magnetic latches, and gate and door operators.
 - a. Operate as a stand-alone portal Controller using the downloaded database during periods of communication loss between the Controller and the field-device network.
 - b. Accept information generated by the entry-control devices; automatically process this information to determine valid identification of the individual present at the portal:
 - 1) On authentication of the credentials or information presented, check privileges of the identified individual, allowing only those actions granted as privileges.
 - 2) Privileges shall include, but not be limited to, time of day control, day of week control, group control, and visitor escort control.
 - c. Maintain a date-, time-, and Location-stamped record of each transaction. A transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.
 - d. Door controller shall control 2, 3 or 4 doors.
 - 2. Inputs:
 - a. Data from entry-control devices; use this input to change modes between access and secure.
 - b. Database downloads and updates from the Central Station that include enrollment and privilege information.
 - c. LAN connection: 10/100/1000Mbps network interface IP card.

3. Outputs:
 - a. Indicate success or failure of attempts to use entry-control devices and make comparisons of presented information with stored identification information.
 - b. Grant or deny entry by sending control signals to portal-control devices and mask intrusion alarm annunciation from sensors stimulated by authorized entries.
 - c. Maintain a date-, time-, and Location-stamped record of each transaction and transmit transaction records to the Central Station.
 - d. Door Prop Alarm: If a portal is held open for longer than 20 seconds, alarm sounds.
4. With power supplies sufficient to power at voltage and frequency required for field devices and portal-control devices. Provide power plug to plug in the receptacle in the junction box above each door.
5. Data Line Problems: For periods of loss of communications with Central Station, or when data transmission is degraded and generating continuous checksum errors, the Controller shall continue to control entry by accepting identifying information, making authentication decisions, checking privileges, and controlling portal-control devices.
 - a. Store up to 1000 transactions during periods of communication loss between the Controller and access-control devices for subsequent upload to the Central Station on restoration of communication.
6. Controller Power: NFPA 70, Class II power supply transformer, with 12- or 24-V ac secondary, backup battery and charger.
 - a. Backup Battery: Premium, valve-regulated, recombinant-sealed, lead-calcium battery; spill proof; with a full 1-year warranty and a pro rata 19-year warranty. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
 - b. Backup Power Supply Capacity: 90 minutes of battery supply. Submit battery and charger calculations.
 - c. Power Monitoring: Provide manual dynamic battery load test, initiated and monitored at the control center; with automatic disconnection of the Controller when battery voltage drops below Controller limits. Report by using local Controller-mounted LEDs and by communicating status to Central Station. Indicate normal power on and battery charger on trickle charge. Indicate and report the following:
 - 1) Trouble Alarm: Normal power off load assumed by battery.
 - 2) Trouble Alarm: Low battery.
 - 3) Alarm: Power off.
 - d. Provide power plug to plug in the receptacle in the junction box above each door.
7. Enclosure:
 - a. Provide a minimum of 24" x 20" x 6" hinged enclosure to house all the multiple board configurations, auxiliary inputs and outputs,, back-up battery, power supply, RJ45 jack, 120 volt receptacle, power cord, etc., and/or as required.
 - b. Provide plywood as needed.
8. Provide two door controllers, three door controllers or four door controllers as required.

2.6 POWER SUPPLY

- A. Power Supply Unit shall be 12VAC, 5 Amp power supply for primary power supply with battery unit(s) as secondary power supply (backup).
- B. Provide battery unit(s) for backup for system control panel(s) to maintain supervisory functions for 24 hours and operation of access control and alarm monitoring system hardware for a period of not less than 90 minutes in the event of a power outage.
- C. Submit battery calculations indicating compliance with this requirement.

2.7 PROXIMITY CARD READERS AND PROXIMITY CARDS

- A. Provide proximity reader (card reader) at entry/exit doors as shown on the drawings.
- B. Proximity card reader shall be powered from its associated door controller or access control panel including its standby power source.
- C. Reader shall fit on a standard single gang electrical box.
- D. Reader shall be 4.6 "H x 3 "W and .4 " thick.
- E. Reader shall be suitable for outdoor application.
- F. Reader range from 4-8 inches.
- G. Reader shall be HID compatible.
- H. Reader shall be Black or White as selected by the owner and to match existing.
- I. Provide one spare reader.
- J. Provide one reader in the main access control location for programming.
- K. Proximity card reader shall have the following requirements:
 - 1. Proximity iClass (Wiegand 26, 34, 40 or 56 bit) entry card reader shall be mounted with a recess mounted single-gang back box and stainless steel cover plate. Entry proximity card readers shall be located on the unsecure side of each door requiring card readers.
 - 2. Approved Manufacturer
 - a. HID R40/ 6120C series
 - b. Keri System p300 series and/or P500 series
 - c. AMAG Symmetry S820 series
 - d. Farpointe P-500 HID series.
 - e. DMP Proxpro II /PR5455 series
 - f. Honeywell
 - g. RS-2
 - h. Kantech P325/P325KP series
 - i. Assa Abloy RP40 series, RP15 mullion mount
- L. Proximity Card Requirements: PVC & Composite PVC, Card width/length ISO CR-80-ISO 7810, 2.125" x 3.385", .030" thickness, cards must have HID proximity antenna. Provide proximity cards per the following requirements:
 - 1. Proximity KEYFOBS: Provide proximity keyfobs that are compatible with the system/readers, external card numbering - sequentially, horizontally hole/slot punched for strap clip, 26 bit wiegand format, passive, 137 billion unique codes, read range 3 inch minimum. Provide a quantity of 250 fobs and 250 cards
 - 2. Approved manufacturer
 - a. HID I Class 2050PKNMN.
 - b. Keri Systems PS-x-xx series
 - c. Philips MIFARE - series
 - d. DMP ProxKEY III or II fobs / ISOPROX II cards
 - e. Honeywell PX-KEY-H fobs/ 469012 or 469305 cards.
 - f. Kantech P40KEY fobs / P30DMG cards
 - g. Farpointe PSK-3H fobs and .PSM-2H cards.

2.8 CARD READERS

- A. Power: Card reader shall be powered from its associated Controller, including its standby power source.

- B. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the Controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.
- C. Enclosure: Suitable for surface, semi-flush, or pedestal mounting. Mounting types shall additionally be suitable for installation in the following locations:
 - 1. Indoors, controlled environment.
 - 2. Indoors, uncontrolled environment.
 - 3. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.
- D. Display: LED or other type of visual indicator display shall provide visual and audible status indications and user prompts. Indicate power on/off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.
- E. Stripe Swipe Readers: Bidirectional, reading cards swiped in both directions, powered by the Controller. Reader shall be set up for ABA Track.
 - 1. Readers for outdoors shall be in a polymeric plastic enclosure, with all electronics potted in plastic. Rated for operation in ambient conditions of minus 40 to plus 160 deg F in a humidity range of 10 to 90 percent.
- F. Touch Plate and Proximity Readers:
 - 1. Passive detection proximity card readers shall use a swept-frequency, RF field generator to read the resonant frequencies of tuned circuits laminated into compatible credential cards. The resonant frequencies read shall constitute a unique identification code number.
 - 2. The card reader shall read proximity cards in a range from contact with to at least 6 inches from the reader.
 - 3.

2.9 DOOR CONTACT AND WINDOW SWITCHES

- A. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral over current device to limit current to 80 percent of switch capacity.
- B. Bias magnet and minimum of two encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.
- C. Contact and magnetic housing shall snap lock into the 3/4 diameter hole.
- D. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.
- E. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounting magnet and floor-mounting switch unit.

2.10 PIR SENSORS (MOTION DETECTORS)

- A. Description: Sensors detect motion by monitoring infrared wavelengths emitted from a human body within their protected zone and by being insensitive to general thermal variations.
 - 1. Wall-Mounting Unit Maximum Detection Range: Not less than 50 feet.
- B. Device Performance:
 - 1. Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F or less, and movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps across 2 adjacent segments of detector's field of view.

2. Test Indicator: LED test indicator that is not visible during normal operation. When visible, indicator shall light when sensor detects motion. Locate test enabling switch under sensor housing cover.
 3. Detector shall be dual technology unit.
- C. Provide wire guard for motion detectors in the Gym.

2.11 DOOR AND GATE HARDWARE INTERFACE

- A. Electric Door Strikes: Use end-of-line resistors to provide power line supervision. Signal switches shall transmit data to Controller to indicate when the bolt is not engaged and the strike mechanism is unlocked, and shall report a forced entry. Power and signal shall be from the Controller. Electric strikes are specified in Division 08 "Door Hardware."
- B. Electrically Retractable Latches: Electrically retractable latches integrated into panic hardware. End-of-line resistors shall provide power line supervision. Signal switches shall transmit data to Controller to indicate when the bolt is not engaged and the mechanism is unlocked, and shall report a forced entry. Power and signal shall be from the Controller. Electrically retractable latches, electric power transfer, and panic hardware are specified in Division 08 Section "Door Hardware."
- C. Electromagnetic Locks: End-of-line resistors shall provide power line supervision. Lock status sensing signal shall positively indicate door is secure. Power and signal shall be from the Controller. Electromagnetic locks are specified in Division 08 Section "Door Hardware."
- D. Vehicle Gate Operator: Interface electrical operation of gate with controls of this Section. Vehicle gate operators shall be connected, monitored, and controlled, by the security access Controllers. Vehicle gate and accessories are specified in Division 32 Section "Chain Link Fences and Gates."
- E. RS-232 ASCII INTERFACE SPECIFICATIONS
1. Retain this Article if integration with video surveillance, intrusion detection, digital paging, and similar systems is required. RS-232 communications connections are not recommended for distances of more than 50 feet, although transmission over distances of 300 feet is possible with specialized equipment.
- F. ASCII interface shall allow RS-232 connections to be made between the control station operating as the host PC and any equipment that will accept RS-232 ASCII command strings, such as CCTV switchers, intercoms, and paging systems.
1. Each alarm input in system shall allow for individual programming to output up to four unique ASCII character strings through two different COM ports on the host PC.
 2. Each input shall have the ability to be defined to transmit a unique ASCII string for alarm and one for restore through one COM port, and a unique ASCII string for a non-alarm abnormal condition and one for a normal condition through the same or different COM port.
 3. The predefined ASCII character strings shall have the ability to be up to 420 characters long with full use of all the ASCII control characters, such as return or line feed. The character strings shall be defined in database of system and then assigned to the appropriate inputs.
 4. The COM ports of the host PC used to interface with external equipment shall be defined in the setup portion of the software. The COM port's baud rate, word length, stop bits, and parity shall be definable in the software to match that of the external equipment.
- G. Pager System Interface: Alarms shall be able to activate a pager system with customized message for each input alarm.
1. RS-232 output shall be capable of connection to a pager interface that can be used to call a paging system or service and send a signal to a portable pager. System shall allow an individual alphanumeric message per alarm input to be sent to the paging system. This interface shall support both numeric and alphanumeric pagers.

H. Alarm System Interface:

1. RS-232 output shall be capable of transmitting alarms from other monitoring and alarm systems to central-station automation software.
2. Alternatively, alarms that are received by this access control system are to be transferred to alarm automation system as if they were sent through a digital alarm receiver.
 - a. System shall be able to transmit an individual message from any alarm input to a burglar alarm automation monitoring system.
 - b. System shall be able to append to each message a predefined set of character strings as a prefix and suffix.

2.12 VIDEO AND CAMERA CONTROL

A. Control station or designated workstation displays live video from a CCTV source.

1. Control Buttons: On the display window, with separate control buttons to represent Left, Right, Up, Down, Zoom In, Zoom Out, Scan, and a minimum of two custom command auxiliary controls.
2. Provide at least seven icons to represent different types of cameras, with ability to import custom icons. Provide option for display of icons on graphic maps to represent their physical location.
3. Provide the alarm-handling window with a command button that will display the camera associated with the alarm point.

B. Display mouse-selectable icons representing each camera source, to select source to be displayed. For CCTV sources that are connected to a video switcher, control station shall automatically send control commands through a COM port to display the requested camera when the camera icon is selected.

C. Allow cameras with preset positioning to be defined by displaying a different icon for each of the presets. Provide control with Next and Previous buttons to allow operator to cycle quickly through the preset positions.

2.13 CABLES

A. Access control cable shall be provided by the cabling contractor, the access control system contractor SHALL verify all cabling and shall provide any additional cabling as required for their system.

B. The Access Control Contractor Shall verifies all existing cabling (IF ANY) and provides all cabling per manufacturers recommendations for a complete operational system.

C. The Access Control Contractor shall interface the Access control System with the Automatic Door Operators (ADO) and SHALL provide all cabling, hardware as needed.

2.14 TRANSFORMERS

A. NFPA 70, Class II control transformers, NRTL listed. Transformers for security access-control system shall not be shared with any other system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

- B. Examine roughing-in for LAN and control cable conduit systems to PCs, Controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with recommendations in SIA CP-01.
- B. Comply with EIA/TIA-606, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings."
- C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.
 - 1. Record setup data for control station and workstations.
 - 2. For each Location, record setup of Controller features and access requirements.
 - 3. Propose start and stop times for time zones and holidays, and match up access levels for doors.
 - 4. Set up groups, facility codes, linking, and list inputs and outputs for each Controller.
 - 5. Assign action message names and compose messages.
 - 6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
 - 7. Prepare and install alarm graphic maps.
 - 8. Develop user-defined fields.
 - 9. Develop screen layout formats.
 - 10. Discuss badge layout options; design badges.
 - 11. Complete system diagnostics and operation verification.
 - 12. Prepare a specific plan for system testing, startup, and demonstration.
 - 13. Develop acceptance test concept and, on approval, develop specifics of the test.
- D. In meetings with Architect/Engineer and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

3.3 CABLING

- A. Comply with NECA 1, "Good Workmanship in Electrical Contracting."
- B. The security contractor shall be responsible for ALL the cabling for the access control system as shown and/or as recommended by the system manufacturer for a complete operational system.**
- C. The access control system shall be integrated with the Intrusion alarm system for arming and disarming functions as directed by the owner, any system that does not meet this requirement SHALL be replaced with a new system at the security contractor's expense.**
- D. Install cables and wiring according to requirements in Division 28 Section "Conductors and Cables for Electronic Safety and Security."
- E. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

- F. Install LAN cables using techniques, practices, and methods that are consistent with Category 5E/6 rating of components and that ensure Category 5E/6 performance of completed and linked signal paths, end to end.
- G. Install cables without damaging conductors, shield, or jacket.
- H. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
- I. Install end-of-line resistors at the field device location and not at the Controller or panel location.

3.4 CABLE APPLICATION

- A. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."
- B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.
- C. RS-232 Cabling: Install at a maximum distance of 50 feet.
- D. RS-485 Cabling: Install at a maximum distance of 4000 feet.
- E. Card Readers:
 - 1. Install number of conductor pairs recommended by manufacturer for the functions specified.
 - 2. Unless manufacturer recommends larger conductors, install No. 20 AWG wire if maximum distance is 500 feet.
 - 3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the Controller.
 - 4. Install minimum No. 18 AWG shielded cable to readers that draw 50 mA or more.
- F. Install minimum No. 16 AWG cable from Controller to electrically powered locks. Do not exceed 500 feet.
- G. Install minimum No. 18 AWG ac power wire from transformer to Controller, with a maximum distance of 25 feet.

3.5 GROUNDING

- A. Comply with Division 26 and 27 Section "Grounding and Bonding for Electrical and Communications Systems."
- B. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."
- C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- D. Bond shields and drains conductors to ground at only one point in each circuit.
- E. Signal Ground:
 - 1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
 - 2. Bus: Mount on wall of main equipment room with standoff insulators.

3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.6 INSTALLATION

- A. Push Buttons: Where multiple push buttons are housed within a single switch enclosure, they shall be stacked vertically with each push-button switch labeled with 1/4-inch- high text and symbols as required. Push-button switches shall be connected to the Controller associated with the portal to which they are applied, and shall operate the appropriate electric strike, electric bolt, or other facility release device.
- B. Install card readers.

3.7 IDENTIFICATION

- A. In addition to requirements in this Article, comply with applicable requirements in Division 26 Section "Identification for Electrical Systems" and with TIA/EIA-606.
- B. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.
- C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
 2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

3.8 SYSTEM SOFTWARE

- A. Develop, install, and test software and databases for the complete and proper operation of systems involved. Assign software license to Owner.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 5 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-568-1, "Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA-568-B.
 2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
 3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

- C. Remove and replace malfunctioning devices and circuits and retest as specified above.

3.10 STARTUP SERVICE

- A. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.
 - 1. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.11 PROTECTION

- A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured, with an activated burglar alarm and access-control system reporting to a Central Station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

3.12 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain security access system. Refer to Division 01 Section "Demonstration and Training"
- B. Develop separate training modules for the following:
 - 1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
 - 2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
 - 3. Security personnel.
 - 4. Hardware maintenance personnel.
 - 5. Corporate management.

END OF SECTION 28 13 10

SECTION 28 23 11 – IP VIDEO SURVEILLANCE

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, but is not limited to the following:
 1. Dome indoor camera.
 2. Wall indoor camera.
 3. Dome outdoor camera.
 4. Wall outdoor camera.
 5. Camera housing.
 6. Camera mounts.
 7. Power supplies
 8. Cabling.
 9. Patch panels.
 10. Miscellaneous
- B. Related Sections
 1. Division 26, Electrical
 2. Division 27, Communications Sections.
 3. Division 28, Sections, Electronics Safety and Security

1.3 DEFINITIONS

- A. AGC: Automatic Gain Control
- B. B/W: Black and White
- C. CCD: Charge-Coupled Device
- D. MPEG: Moving Picture Experts Group
- E. NTSC: National Television System Committee
- F. UPS: Uninterruptible Power Supply
- G. POE: Power Over Ethernet
- H. IP: Internet Protocol

1.4 SUBMITTALS

- A. Shop Drawings: Detail assemblies of standard components that are custom assembled for a specific application on this Project.
 1. Shop drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by a manufacturer in video surveillance system design.
 - b. NICET – certified video surveillance systems designer, Level II minimum.
 2. Function Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
 3. Dimension plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
 4. UPS: Sizing calculations.
 5. Wiring Diagrams: Power, signal, control wiring, and grounding.

- B. Quality Assurance/Control Submittals:
 1. Product Data: For each type of product indicated, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
 2. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation.
 3. Manufacturer Seismic Qualification Certification: Submit certification that cameras, camera-supporting equipment, accessories, and components will withstand seismic forces for this project location.
 4. Field quality-control test reports.
- C. Closeout Submittals
 1. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, Section "Operation and Maintenance Data" include the following:
 - a. Lists of spare parts and replacement components recommended to be store at the site for ready access.
 2. Warranty: Special warranty specified in this Section.
- D. See front end submittals section for more information.
- E. See Common Work Results For Electronic Safety and Security 280510 for more submittal requirements.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representatives, who is trained and approved for installation of units required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.
- D. Comply with NFPA 730- Guide for Premises Security.
- E. Comply with NFPA 731- Standard for the Installation of Electronic Premises Security.
- F. Electronic data exchange between IP video surveillance systems with an access control system shall comply with SIA TVAC.
- G. TIA/EIA-607 telecommunications grounding.
- H. Latest edition of BISCII – TDMM – manual
- I. Americans with Disabilities Act (ADA)
- J. The camera shall meet FCC, Part 15 standard.
- K. The camera shall meet ICES003, standard.
- L. The camera shall meet MPEG-4 standard.
- M. The camera shall meet IEEE 802.3 af (P.O.E. standard)
- N. Provide labeling per ANSI/EIA/TIA-606 requirement and in accordance with the Owner and Technology Consultant.

- O. FCC class B.
- P. NEMA Type 4AX
- Q. NTSC/EIA.
- R. ISO/IEC 14496-2 MPEG-4
- S. H.262
- T. Latest ANSI TIA/EIA-568,569,606 and 607 Standard.

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage, or degradation of operating capability:
 1. Control Station: Rated for continuous operation in ambient temperatures of 60 to 85 degrees F, and a relative humidity of 20 to 80 percent, non-condensing.
 2. Interior, Controlled Environment: System components, except central-station control unit, installed in air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 degrees F, dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosures.
 3. Interior, Uncontrolled Environment: System components installed in non-air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 degrees F, dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250 Type 4 enclosures.
 4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 degrees F, dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain, as specified in NEMA 250, and winds up to 85 mph. NEMA 250, Type 3R enclosures.
 5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
 6. Corrosive Environment: System components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones. NEMA 250, Type 4X enclosures.
 7. Security Environment: Camera housing for use in high-risk areas, where surveillance equipment may be subject to physical violence.

1.7 WARRANTY

- A. The IP video surveillance system shall carry a warranty as specified in the Section, "Demonstration and Training of Communications Systems".

1.8 TRAINING

- A. Provide training per the Section, "Demonstration and Training of Communications Systems".

1.9 PROGRAMMING

- A. The contractor shall schedule a programming meeting with the owner thru the CM/Architect/Engineers after award of bids, to review the requirement of the IP Video Surveillance programming for zones, sequence of operations etc.
- B. The cameras shall be interfaced with the lighting/HVAC Building control, so when the camera start recording during a break in that the lighting will be triggered to come on.

1.10 RECORD DRAWINGS/OPERATION AND MAINTENANCE MANUALS

- A. Provide record drawings and operation and manuals, as described in the Sections "Operation and Maintenance of Communications" and "Common Work Results for Communication Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following are approved camera manufactures:
 - 1. Axis – Matches all existing campus cameras.
- B. The software shall support Windows, Mac and shall have mobile apps for iPhone, iPad and Androids.
- C. Video Surveillance cameras shall be integrated with the Lighting and Temperature control system, verify requirements with Electrical and Mechanical contractors.
- D. Shall be web based, so any owners personal with proper credentials can access it from anywhere.

2.2 FIXED DOME NETWORK INDOOR CAMERA CEILING OR WALL MOUNT

- A. The camera shall be 1 to 1.3 MP, Lightfinder, Vandal Resistance, with audio I/O ports
- B. The camera shall provide Motion video at 30 frames per second for all resolutions.
- C. The camera shall operate on an open source.
- D. The camera shall use a high quality 1/3-inch progressive scan CCD sensor.
- E. The camera shall be fitted with a high quality F1.3 varifocal DC-iris lens and provide pictures down to 0.75 lux at F1.3.
- F. The camera shall be equipped with a built-in microphone.
- G. The camera shall used a dedicated video compression chip and be equipped with a minimum 8MB flash memory and 32MB random access memory (RAM).
- H. The camera shall be provided with 9MB memory for pre-alarm and post-alarm recordings.
- I. The camera shall provide at least 11 different compression levels.
- J. The camera shall be capable of providing bit rates between 1 kbps and 12 Mbps, per video stream.
- K. The camera shall support half duplex audio using G7.11 or G7.26 compression.
- L. The camera shall be capable of providing 8-bit audio at up to 64Kbit/sec.
- M. The camera shall contain a built-in web server making video and configuration available in a standard browser environment using HTTP, without the need for additional software.
- N. The camera shall not require any additional software to operate, and shall support full functionality when operating in the following environment:
 - 1. Operating Systems: Windows 2007, Windows XP. Mac.
 - 2. Browsers: MS Explore 6.X and higher, Fire Fox and Safari.
- O. The camera shall support simultaneous viewing by up to 20 clients from the web server.

- P. The camera's integral web server shall provide support for defining usernames and passwords.
- Q. The camera shall support both fixed IP addresses and dynamically assigned IP addresses provided by a dynamic host control protocol (DHCP) server.
- R. The camera shall allow for automatic detection when using a PC with an operating system supporting this feature.
- S. The camera shall provide the ability to control network traffic by limiting the maximum bandwidth to a selected value.
- T. The camera shall provide the capability to limit the frame rate per viewer to a selected value, as well as the duration of each viewing session.
- U. The camera shall support quality of service (QoS).
- V. The camera shall be equipped with an integrated event functionality, which can be triggered by:
 1. External inputs
 2. Video motion detection
 3. Audio detection
 4. Schedule
 5. Notification, using TCP, SMTP, or HTTP
 6. Image upload, using FTP, SMTP, or HTTP
 7. Activating external output
- W. The camera event functions shall be configurable via the web interface.
- X. The camera shall incorporate support for at least IP, HTTP, HTTPS, SSL/TLS, TCP, ICMP, SNMPv1/v2c/v3 (MIBII), RTSP, RTP, UDP, IGMP, RTCP, SMTP, FTP, DHCP, UPnP, ARP, DNS, DynDNS, SOCKS, NTP, and Bonjour
- Y. The camera shall provide embedded on-screen text in the video, with support for date and time, and a customer-specific text, camera name of at least 45 ASCII characters. The camera shall accept external time synchronization from an NTP (network time protocol) server.
- Z. The camera shall provide an ability to apply a privacy mask to the image, and shall allow for the overlay of a graphical image, such as a logo, into the image.
- AA. The camera shall provide support for restricting access to pre-defined IP addresses only, so-called IP address filtering.
- BB. The camera shall be fully supported by an open and published API (application programmers interface), which shall provide necessary information for integration of functionality into third party applications.
- CC. The camera shall be supplied with Windows-based management software which allows the assignment of IP addresses, upgrade of firmware, and back-up of the cameras configuration.
- DD. The camera shall provide the ability to force-open the iris to improve the ability to adjust the cameras focus.
- EE. The camera shall support the use of SNMP-based management tools according to SNMP v1, 2c and 3/MIB-2.
- FF. The camera shall allow updates of the software (firmware) over the network, using FTP or HTTP.

- GG. The camera shall be equipped with a minimum of three LEDs, capable of providing visible status information in green, red, and amber. LEDs shall indicate the camera's operational status and provide information about power, communication with the receiver, the network status, and the camera status.
- HH. The camera shall be monitored by a Watchdog functionality, which shall automatically re-initiate processes, or restart the unit if a malfunction is detected.
- II. The camera shall be equipped with 3.5mm jack for line/mic input and 3.5mm jack for line out.
- JJ. The camera shall be equipped with digital (alarm) input and digital output, accessible via a removable terminal block. The input shall be configurable to respond to normally open (NO), or normally closed (NC) dry contacts.
- KK. The camera shall be equipped with 100baseTXFast Ethernet port, using a standard RJ-45 socket, and shall support auto sensing of network speed.
- LL. The camera enclosure shall be tamper resistant housing.
- MM. The camera enclosure shall provide the ability to adjust the camera modules angle with at least $\pm 180^\circ$ horizontal, $\pm 85^\circ$ vertical, $\pm 170^\circ$ rotation, while maintaining an image that is not interfered with by the camera housing.
- NN. The camera shall be powered with Power over Ethernet, according to IEEE802.3af – Class 2.
- OO. Provide recessed housing and support from the structure steel.
- PP. Provide wire guard for cameras in the Gym.

QQ. Manufacturers

Manufacturer	Axis
Camera No.	P3364V
Housing	Recessed Ceiling Plate
Mount	Dome
POE	Yes

2.3 FIXED DOME NETWORK OUTDOOR CAMERA CEILING OR WALL MOUNT

- A. The camera shall be 1 to 1.3 MP, Lightfinder, Vandal Resistance, with audio I/O ports
- B. The camera shall provide Motion video at 30 frames per second for all resolutions.
- C. The camera shall operate on an open source.
- D. The camera shall use a high quality 1/3-inch progressive scan CCD sensor.
- E. The camera shall be fitted with a high quality F1.3 varifocal DC-iris lens and provide pictures down to 0.75 lux at F1.3.
- F. The camera shall be equipped with a built-in microphone.
- G. The camera shall used a dedicated video compression chip and be equipped with a minimum 8MB flash memory and 32MB random access memory (RAM).
- H. The camera shall be provided with 9MB memory for pre-alarm and post-alarm recordings.

- I. The camera shall provide at least 11 different compression levels.
- J. The camera shall be capable of providing bit rates between 1 kbps and 12 Mbps, per video stream.
- K. The camera shall support half duplex audio using G7.11 or G7.26 compression.
- L. The camera shall be capable of providing 8-bit audio at up to 64Kbit/sec.
- M. The camera shall contain a built-in web server making video and configuration available in a standard browser environment using HTTP, without the need for additional software.
- N. The camera shall not require any additional software to operate, and shall support full functionality when operating in the following environment:
 - 1. Operating Systems: Windows 2007, Windows XP, Mac.
 - 2. Browsers: MS Explore 6.X and higher, Fire Fox, Safari.
- O. The camera shall support simultaneous viewing by up to 20 clients from the web server.
- P. The camera's integral web server shall provide support for defining usernames and passwords.
- Q. The camera shall support both fixed IP addresses and dynamically assigned IP addresses provided by a dynamic host control protocol (DHCP) server.
- R. The camera shall allow for automatic detection when using a PC with an operating system supporting this feature.
- S. The camera shall provide the ability to control network traffic by limiting the maximum bandwidth to a selected value.
- T. The camera shall provide the capability to limit the frame rate per viewer to a selected value, as well as the duration of each viewing session.
- U. The camera shall support quality of service (QoS).
- V. The camera shall be equipped with an integrated event functionality, which can be triggered by:
 - 1. External inputs
 - 2. Video motion detection
 - 3. Audio detection
 - 4. Schedule
 - 5. Notification, using TCP, SMTP, or HTTP
 - 6. Image upload, using FTP, SMTP, or HTTP
 - 7. Activating external output
- W. The camera event functions shall be configurable via the web interface.
- X. The camera shall incorporate support for at least IP, HTTP, HTTPS, SSL/TLS, TCP, ICMP, SNMPv1/v2c/v3 (MIBII), RTSP, RTP, UDP, IGMP, RTCP, SMTP, FTP, DHCP, UPnP, ARP, DNS, DynDNS, SOCKS, NTP, and Bonjour
- Y. The camera shall provide embedded on-screen text in the video, with support for date and time, and a customer-specific text, camera name of at least 45 ASCII characters. The camera shall accept external time synchronization from an NTP (network time protocol) server.
- Z. The camera shall provide an ability to apply a privacy mask to the image, and shall allow for the overlay of a graphical image, such as a logo, into the image.
- AA. The camera shall provide support for restricting access to pre-defined IP addresses only, so-called IP address filtering.

- BB. The camera shall be fully supported by an open and published API (application programmers interface), which shall provide necessary information for integration of functionality into third party applications.
- CC. The camera shall be supplied with Windows-based management software which allows the assignment of IP addresses, upgrade of firmware, and back-up of the cameras configuration.
- DD. The camera shall provide the ability to force-open the iris to improve the ability to adjust the cameras focus.
- EE. The camera shall support the use of SNMP-based management tools according to SNMP v1, 2c and 3/MIB-2.
- FF. The camera shall allow updates of the software (firmware) over the network, using FTP or HTTP.
- GG. The camera shall be equipped with a minimum of three LEDs, capable of providing visible status information in green, red, and amber. LEDs shall indicate the camera's operational status and provide information about power, communication with the receiver, the network status, and the camera status.
- HH. The camera shall be monitored by a Watchdog functionality, which shall automatically re-initiate processes, or restart the unit if a malfunction is detected.
- II. The camera shall be equipped with 3.5mm jack for line/mic input and 3.5mm jack for line out.
- JJ. The camera shall be equipped with digital (alarm) input and digital output, accessible via a removable terminal block. The input shall be configurable to respond to normally open (NO), or normally closed (NC) dry contacts.
- KK. The camera shall be equipped with 100baseTXFast Ethernet port, using a standard RJ-45 socket, and shall support auto sensing of network speed.
- LL. The camera enclosure shall be tamper resistant housing.
- MM. The camera enclosure shall provide the ability to adjust the camera modules angle with at least $\pm 180^\circ$ horizontal, $\pm 85^\circ$ vertical, $\pm 170^\circ$ rotation, while maintaining an image that is not interfered with by the camera housing.
- NN. The camera shall be powered with Power over Ethernet, according to IEEE802.3af – Class 2.
- OO. Provide recessed housing and support from the structure steel.
- PP. Provide wire guard for cameras in the Gym.
- QQ. Manufacturers

Manufacturer	Axis
Camera No.	P3364-VE
Housing	Recessed Ceiling Plate
Mount	Dome
POE	Yes
Housing with Heater	No
Power	POE with POE heater integrated

2.4 MOUNTING HARDWARE

- A. Provide vandal resistant housing for indoor dome cameras.
- A. Provide wall bracket and housing for indoor wall mounted cameras.
- B. Provide weather proof vandal resistant housing for outside dome cameras.
- C. Provide weather proof wall bracket and housing for outdoor wall cameras.
- D. Provide weather proof dome housing for PTZ outdoor cameras.
- E. Provide pole mount for pole mounted PTZ cameras.
- F. Provide Gooseneck wall mount for pole cameras.
- G. Provide corner mount for corner mount wall cameras.
- H. Provide parapet mount for outdoor cameras if needed.
- I. Provide heaters, power supplies etc for all outdoor cameras.
- J. Provide wire guard for cameras in the Gym.

2.5 POWER SUPPLIES

- A. Power Supplies: Low-voltage power supplies matched for voltage and current requirements of cameras and accessories, type as recommended by the camera and lens manufacturer.
 - 1. Enclosure: NEMA 250, Type 1
- B. Provide power supplies in each telecommunications room, as required for all cameras and heaters.

2.6 EXISTING VIDEO MANAGEMENT SYSTEM SOFTWARE FEATURES

- A. Operating Modes
 - 1. The VMS software shall have three main modes of operation depicted by the three icons:
 - a. Live Display Mode Icon allows users the ability view live video.
 - b. Search Mode Icon allows users the ability to search for recorded video.
 - c. Setup Mode Icon allows Administrators and Power Users the ability configure systems.
 - d. Clicking on any of these icons shall change the mode of operation.
- B. Live Display Mode Features
 - 1. A live display mode shall have features for users to view live video. The live display mode shall have the following features to navigate and view live video:
 - 2. Layout Icons – shall have features to organize your camera video view panel in the following patterns:
 - a. 1 camera (full screen) layout
 - b. 4 camera (2 x 2) layout
 - c. 9 camera (3 x 3) layout
 - d. 12 camera (4 x 3) layout
 - e. 16 camera (4 x 4) layout
 - f. 20 camera (5 x 4) layout
 - g. 30 camera (6 x 5) layout
 - h. 48 camera (8 x 6) layout

- C. Navigation Tree – shall display cameras, alarms, monitor & audio icons that are connected to the VMS server.
1. Navigation Pane – shall display a hierarchy of cameras, audio input and serial port input icons organized by Cameras (cameras connected to servers), Groups (logical grouping of cameras) and Views (Saved live display layouts). Clicking on navigation pane bars shall switch the navigation tree into the desired navigation tree display.
 2. Video View Panel – shall display video of cameras. Cameras can be dragged from the navigation tree into the view panel and live video will be displayed. If there are multiple video view panels in a layout (example: 4 camera (2 x 2) layout), video can be moved (switched) by dragging video from one view panel to another panel.
 3. About Icon – shall provide information about the version number of the client software you are using.
 4. Help Icon – shall provide context sensitive documentation from the on-line user's manual specific to the screen you are viewing.
 5. Show/Hide Navigation Tree Icon – expands the display by hiding the Navigation Tree.
 6. Full Screen Icon – shall enlarge the video display area by hiding the title and task bars.
 7. PTZ Control Icon – shall provide PTZ control which allows you to maneuver a PTZ camera.
 8. Date and Time – shall display the current date and time.
- D. Auto Replay of Recorded Video from Live Display Mode
1. The VMS software shall replay recorded video from the Live Display Mode by right clicking in the appropriate video view panel and selecting Replay. You will have the option of reviewing video in increments of 5 or 30 seconds or 1, 5, or 15 minute. Once you select the desired video replay increment, the Replay window will open and begin downloading the recorded video. A Scrub Bar will track the progress of the download. The total number of frames in the video segment as well as the number that have been downloaded will also be displayed in the status bar. If you wish to stop the download, click the Stop Download button at the bottom of the window.
- E. Event Monitoring and Virtual Matrix Switching
1. The VMS software shall activate event monitoring and virtual matrix switching by right clicking in one of the live video panels and selecting Event Monitor from a drop down dialog menu and then selecting a profile you would like to view.
 2. A Virtual Matrix switching profile shall automatically show video as it is triggered. For example, if you have a series of entrances in one profile, each time any of the entrances is triggered, the video panel will switch to the camera displaying the most recent door motion. If you configured your profile in Virtual Matrix Mode, when motion triggers recording, it automatically switches between cameras and pops them into the video panel as motion occurs.
 3. An Event Monitoring profile shall bring up a list of events which the user can click on to view giving you much more control. If you configured your profile for Event Monitoring mode, an Event Monitoring Box will appear just below a live video panel. You can move it and resize it as you need. Once a video event takes place, it will be automatically listed in the box. Using the same entrance example, instead of the video panel automatically switching to the camera displaying the most recent door opening, the event would be added to a list in the Event Monitoring Box. You could then click on the item to display the video. This may be useful if a guard needs to leave the monitor for a period of time. It is also helpful when you have events occurring on two cameras at the same time. Instead of seeing each event for a split second, you can view each event for as long as you need to.
 4. Event Monitoring and Virtual Matrix Switching shall be stopped by right clicking in the active video panel and disabling the active event monitoring profile.
- F. Viewing Logical Camera Groups
1. The VMS software shall have a feature for viewing logical groups of cameras. The VMS software shall also have a feature creating camera groups (see Group Setup). This will enable you to efficiently view cameras in logical order you choose. Once you setup the camera groups, you shall select the cameras in those groups by clicking on the Group button in the Navigation Pane.

G. Creating, Saving and Accessing Views

1. The VMS software shall have a feature to organize your cameras into preset Views. Select a Layout button in the Live mode and drag the cameras to the appropriate spot on the Video View Panel. Once you have the cameras laid out the way you want it, select the save view feature.
2. Once you have saved your view, you shall access it by clicking the View button from the Navigation Pane. Select your view from the Live Views Site Tree and the camera layout you saved will be recreated in the Video View Panel. The VMS software shall have the capability to create and organize your views into folders.

H. Video Tours

1. The VMS software shall have the capability to automatically cycle through two or more saved views to create a Video Tour. Select the desired views to add to a tour and type a description of the tour. A dwell time sets the amount of time, in seconds; each view will remain in the Video View Panel before cycling to the next view. Once you have named the tour, added the views and a description, and selected the appropriate dwell time, click the Apply button to save the settings.
2. The tour shall be activated by clicking on the saved tour description icon visible in the View Navigation pane.

I. Search Mode Overview

1. The VMS software shall have features to search for and playback recorded video, audio and events from a VMS servers. The system must also be capable of performing searches on multiple camera based on a given criteria. The VMS search software shall have the following features:
2. Input Selection Tree – select the camera(s), audio input(s) or text data to search.
3. Navigation Pane – displays cameras, video, audio, and events in organized groups and views.
4. Video Time Line – time line of video that is displayed. The video time line shall be displayed in increments of 5 minutes, 1, 8 and 24 hours.
5. Zoom In (+) and Zoom Out (-) Buttons – Zooms in and out on the video time line.
6. Camera Selection List – cameras that have been selected with the camera selection tree.
7. Video Cursor – the video cursor is used to select the segment of video you would like to playback. One click will move the video cursor to a new location. Double click will begin video playback.
8. Recorded Bar – bars that represent recorded video or audio.
9. Video Playback Controls – there shall be seven playback controls:
 - a. Play video in reverse fast (double) speed
 - b. Play video in reverse in normal speed
 - c. Stop video play
 - d. Play video forward in normal speed
 - e. Play video forward in fast speed
 - f. Play video forward one frame at a time
 - g. Play video backward one frame at a time
 - h. Calendar – used to select the day of the video search
 - i. Start Search Time – used to change the desired time of the video search
 - j. Search Button – the search button initiates a new video search based on changes that have been made in the camera selection tree, calendar, and start time.
 - k. Video Playback Window – video window that video is played in.
 - l. Export Buttons – Save Picture, Save Video, Print Picture, and Burn to CD or DVD.
 - m. Scrub Bar & Scrub Handle – used to quickly scrub back and forth through video.
 - n. Stop Download Button – used to stop the down the download.

J. Multi Camera Search and Playback

1. In addition to searching and playing back recorded video from a single camera the VMS software shall have the capability to search for and playback multiple cameras simultaneously. Recorded video shall be played back in the following screen layouts:
 - a. 4 camera (2 x 2) layout
 - b. 9 camera (3 x 3) layout
 - c. 12 camera (4 x 3) layout
 - d. 16 camera (4 x 4) layout

- e. 20 camera (5 x 4) layout
 - f. 30 camera (6 x 5) layout
 - g. 48 camera (8 x 6) layout
2. All video recording shall be played back and displayed in a synchronized multi camera layout as the video was recorded.
- K. Audio Search and Playback
1. The VMS software shall have a feature search and playback audio in synchronization with video.
- L. Exporting Files
1. The VMS software shall have the capability to export video and audio files. To export a file, you must first mark the starting and ending point of the video and audio you wish to export. Once the video and audio has been marked, select the export feature. The VMS software shall give you the option of exporting the file in the following formats:
 - a. Standalone Exe (*.exe) – includes an executable player with the video & audio data
 - b. AVI File (*.avi) – Audio Video Interleave is a multimedia container format
 - c. PS File (*.ps) – Program stream is a format for multiplexing video & audio
 - d. Once the VMS software has exported a video and/or audio file it shall have an option to be burned to a CD or DVD.
 - e. The VMS software shall also have features to save and print a picture (image).
 - f. The VMS software shall have the capability to copy a picture to a clip board and paste it into a document. When you find the image you need, right click anywhere in the video playback window and select Copy Image to Clipboard. The image will be stored, and you can paste it into a document.
- M. Standalone Player
1. The VMS software shall have the capability to export video and audio files with an executable Standalone Player. Double clicking on the executable Standalone Player shall start the application and open the video and/or audio files. The Standalone Player shall have the following features:
 - a. Screen Layouts:
 - 1) 1 camera – Full screen layout
 - 2) 4 camera (2 x 2) layout – simultaneous multi camera playback
 - 3) 9 camera (3 x 3) layout – simultaneous multi camera playback
 - 4) 16 camera (4 x 4) layout – simultaneous multi camera playback
 - b. Video Playback Controls – there shall be seven playback controls:
 - 1) Play video in reverse fast (double) speed
 - 2) Play video in reverse in normal speed
 - 3) Stop video play
 - 4) Play video forward in normal speed
 - 5) Play video forward in fast speed
 - 6) Play video forward one frame at a time
 - 7) Play video backward one frame at a time
 - c. Scrub Bar & Scrub Handle – used to quickly scrub back and forth through video.
 - d. Camera & Audio Tree – used to select video and audio for playback
 - 1) File:
 - a) Open
 - b) Save Image
 - c) Copy to Clipboard
 - d) Save as AVI
 - e) Print
 - f) Exit
 - e. Options:
 - 1) Show Camera Name
 - 2) Show Timestamp
 - 3) Show Status Boarder
 - 4) Time-lapse Playback Interval
 - 5) Show Camera Tree
 - 6) Show Full Screen
 - 7) Font

- f. Tools: Authenticate - used to verify the video hasn't been tampered with or corrupted.
- g. A keyed-Hash Message Authentication Code, or HMAC, is a type of message authentication code (MAC) calculated using a specific algorithm involving a cryptographic hash function in combination with a secret key. As with any MAC, it may be used to simultaneously verify both the data integrity and the authenticity of the data.
- h. Right Click on Video:
 - 1) Clear this video panel
 - 2) Digital PTZ

N. Setup Mode Overview and Features

- 1. The VMS software shall have features for Administrators and Power Users to configure systems. A Setup Mode shall consist of a hierarchy of icons for configuring the systems also referred to as a "configuration tree". Clicking on any of the icons in the configuration tree shall take you to new screen for configuring the item you selected. The configuration tree shall consist of the following icons and features:
 - a. My Systems
 - b. Adding System
 - c. Client Setup
 - d. Joystick Setup
 - e. Event Monitoring
 - f. Group Setup
 - g. System Information
 - h. System Setup
 - i. Add IP Cameras
 - j. IP Camera Recording Setup
 - k. IP Camera Setup
 - l. Audio Input Setup
 - m. Trigger Input Setup
 - n. Alarm Output Setup
 - o. Storage Setup
 - p. Serial Profile Setup
 - q. Serial Port Setup
 - r. Notifications
 - s. Instant Recall Setup

O. My Systems

- 1. The VMS software shall have a feature for displaying systems that have been added to the Client software including the system names, system status (connected or not connected) the IP address of the systems, licensing status and software subscription status. If there is one standalone system (VMS Client & Server software running on the same server hardware) you will see one system listed with this feature. If you have multiple systems configured with the Adding System feature (see below) you will see the status of multiple systems.

P. Adding Systems

- 1. The VMS software shall have features to configure your client application to connect to VMS servers. Enter your VMS username, password & the IP address of the server and click apply to connect your client application to the VMS for viewing live and recorded video. Multiple VMS can be added to the system list. Client applications can connect to multiple servers simultaneously. Once a system has been added to the Systems List, the Client will automatically connect to the system. All authorized video viewing; searching and system configuration functions will be available to your client application.

Q. Client Setup

- 1. The VMS software shall have features to configure your client software based on your personal preferences. Personal preferences shall include:
 - a. Live Video Border display status (on or off) & PTZ focus
 - b. VGA Acceleration options
 - c. Time-lapse Playback Speed

- d. Configuration Icon for Restricted Users (show / don't show)
 - e. Event Button customization
 - 2. Color customization display options for:
 - a. Motion Recording
 - b. Alarm Recording
 - c. Free Run Recording
 - d. PTZ Focus
 - e. Event Monitoring
- R. Event Monitoring Setup
1. The VMS software shall have features to configure the VMS Client to react to events that take place in the server or servers to which it is connected.
 2. To activate the event monitoring feature, you must first create and define a new event monitoring profile. A profile shall be a set of actions (e.g. the playing of live video or an alarm sound) triggered by sources such as video motion, input triggers, etc. Each profile can then be activated and assigned to a specific video panel by the user.
 3. There shall be two types of event monitoring profiles:
 - a. Virtual Matrix
 - 1) A Virtual Matrix profile will automatically show video as it is triggered. For example, if you have a series of entrances in one profile, each time any of the entrances is triggered, the video panel will switch to the camera displaying the most recent door motion.
 4. Event Monitor
 - a. An Event Monitor profile shall bring up a list of events which the user can click on to view giving you much more control. Using the same Main Entrances profile as our example, instead of the video panel automatically switching to the camera displaying the most recent door opening, the event would be added to a list. You could then click on the item to display the video. This may be useful if a guard needs to leave the monitor for a period of time. It is also helpful when you have events occurring on two cameras at the same time. Instead of seeing each event for a split second, you can view each event for as long as you need to.
 5. Once the Event Monitoring Profiles have been created, you shall activate them in the VMS Client software.
- S. Group Setup
1. The VMS software shall have features to create logical groups of cameras from cameras connected to a single or multiple VMS servers. The logical groups of cameras shall be displayed in the navigation tree hierarchy of cameras.
 2. The group setup featured shall be used when you have multiple VMS servers with a fairly large number of cameras spread across a large building or campus that you would like to place in logically named groups such as 1st floor, 2nd floor, and 3rd floor and so on. In this example you might have two VMS servers with 50 IP cameras each, and you have a four story building that you want to place 25 cameras on each floor. Instead of viewing your cameras as they are physically connected to your VMS server, you create four named groups consisting of 25 cameras each. It's much easier for a user to find cameras when they are located in named groups that match the logical layout of their building.
 3. In addition to monitoring live video, groups shall be used for searching video. In the search video feature, click on the Groups navigation pane then select the group and search.
- T. System Information
1. The VMS software shall have features for displaying system information about users that are currently logged into the system, plug-in file version information number and status, and a system log. The system log shall be viewed by selecting the start and end date and time and clicking on the search button. The system log shall also be export to a file name and open with a text editor. The system log is a useful tool for viewing a detailed history of all the processes that take place on the system.
 2. A log settings feature shall give you the ability to set the maximum days that logged alarms and the system logs are kept on the system.

U. Add IP Cameras

1. The VMS software shall have features to add IP cameras to your VMS server. Once IP cameras have been added to a list of IP cameras on your VMS server your VMS Client software shall be able to configure the IP camera settings and view live and recorded video.

V. IP Camera Recording Setup

1. Once IP cameras have been added to the VMS server the VMS software shall have features to enable IP cameras to record video, set the recording resolution and set the image per second (IPS) recording rate. Each IP camera shall be individually set.
2. If a camera has been connected to a VMS server and the camera is producing a video signal, the VMS Client software shall automatically detect the video signal. If a video signal is detected it is indicated with a video detection feature and by default a record enabled feature shall be selected. To disable recording uncheck the enable check box.
3. The VMS software shall have features to change individual camera resolutions by clicking on a record resolution drop down menu and selecting QCIF, CIF, 2CIF, D1, VGA, 1M, 1.2M, 1.3M, 1.9M, 2M, 3.1M and 5M resolutions. Camera resolutions shall vary depending on the IP cameras selected and added to the VMS server.

W. IP Camera Setup

1. The VMS software shall have features for configuring individual IP camera settings such as camera name, on-screen display, PTZ preset settings and tours, digital PTZ presets, video settings, recording quality, compression format, crop window, motion masks and video masks. Some of the settings shall vary depending on the type, model and features of IP camera selected and added to the VMS server.

X. Audio Input Setup

1. The VMS software shall have features for configuring audio input names and enabling audio inputs for recording. The VMS software shall install with the audio input disabled due to legal restraints on audio recording in some jurisdictions.
2. To assign a new, logical name for the audio input channel, highlight the default name and type the new name. Enable the audio input channel by checking a record enable box.
3. A listen feature shall allow verification of the audio input connected to a channel. Check a listen box to hear the audio for the corresponding input channel. To stop the live audio feed, deselect the listen box.

Y. Trigger Input Setup

1. The VMS software shall have features to configure input trigger names and to set the Normal State (NO = Normally Open and NC = Normally Closed) of the triggers. You shall assign new logical names and optionally change the Normal State from the default of NO to NC.
2. You shall verify the proper operation of the input state by going to the Trigger Input setup screen and observing the "Status" state, which toggles back and forth between "Normal" and "Alarm". By default the "Normal State" is set to NC (Normally Closed). If you trip a sensor by opening the door you will see the "Status" state toggle from a green 'NORMAL' to a red "ALARM" indicating an alarm has been detected. The alarm shall be linked to an action such as recording video or triggering a relay by use of the Event Linking feature and configuring the desired action.

Z. Alarm Output Setup

1. The VMS software shall have features to configure alarm output names and set the Normal State of the IP cameras output triggers. You shall assign new logical names and change the Normal State of the Alarm Outputs from the default of Hi (5 VDC) to Lo (0 VDC). The Status is "NORMAL" in either the Hi or Lo Normal State setting until an event from the Event Linking feature activates an ALARM status. You shall verify the proper operation of the output state by observing the "Status" state, which toggles back and forth between "Normal" and "Alarm". By default the "Normal State" is set to Hi (5 VDC).

AA. Storage Setup

1. The VMS software shall have features to configure your hard drives for video storage.

2. The VMS software shall be installed on your C: drive and separate disk drives shall be used for video storage. The video storage disk drives shall be designed for high duty cycle operation as it is likely that video will be recorded on a continual basis.
3. Disk drives shall be visible during configuration for review and adjustment. The VMS software shall enable or disable a drive for video storage by selecting or deselecting the enabled feature during storage setup. The entire disk drive shall be used or set an upper limit by adjusting a video space slider. If the C: drive is used for video storage, set the video space at no more than 90% to reserve space for other operating system tasks.
4. The VMS software shall have a feature to display the used space that lets you know how much of the disk drive capacity you are currently using. The VMS software shall display the status of a healthy or missing disk drive. There shall also be a feature which indicates the age of the oldest video recorded on this system.
5. The VMS software shall have a feature to take a periodic snapshot (time lapse recording) even if the cameras are set to record upon motion or alarm. Configure to the desired time lapse increment and then select the Hours, Minutes, or Seconds feature. Selecting zero will disable this feature.

BB. Serial Profile Setup

1. The VMS software shall have features for creating and viewing transaction profiles so character strings such as cash register receipts, ATM transactions or access control transactions can be viewed with live or recorded video. Event keyword shall trigger a system alarm or action when certain character strings is read by a serial port. Recorded video shall be searched and retrieved using a search serial feature.

CC. Serial Port Setup

1. The VMS software shall have features to configure serial ports on your VMS server so that they can be used to communicate with serial devices such as point of sale (POS) terminals or pan-tilt-zoom (PTZ) cameras. Once the serial device is connected to the serial port with a cable the serial port shall be configured. The VMS software shall provide a choice for configuring the serial port including Unused, POS (Point Of Sale), or PTZ (Pan Tilt Zoom). Generally, a POS option is used to record transactions from a cash register. The PTZ option is used to control the motion of a PTZ camera. The VMS software shall default to unused until it is configured. Once the serial port has been selected for Use, a unique name shall be assigned to the port, such as Express Lane.
2. The Baud Rate, Data Bits, Stop Bits, Parity, and Flow control must match the device you are connecting. Check the User Manual for the device you are using to determine the appropriate settings and use the VMS feature to set your selections.

DD. Notifications

1. The VMS software shall have features to configure an e-mail server and message profile that will send an email message when an event occurs. Once you have configured the e-mail server and message profile you will need to go to the Event Linking feature (below) to configure the events that will cause an email message to be sent. The E-mail Server Configuration feature is where you configure the outgoing SMTP mail server that you will use to send email from the VMS server.

EE. Instant Recall Setup

1. The VMS software shall have a feature to export a video segment from specific cameras or audio inputs to a CD or DVD upon an input trigger or other event being activated. The software shall also send an email or text message notifying a contact that the input trigger has been activated.
2. The VMS software shall have a feature to create a profile that will determine the number of minutes of recorded video you want to export before and after the instant recall is activated. Once the profile has been created go to the Event Linking feature (below) to link the profile to the type of event that will cause the video and audio segment to be exported.

FF. Event Linking

1. The VMS software shall have features to connect different types of events such as an input triggers to a desired action such as recording video or triggering an alarm. An Event <Activates> an Action and is stored in a database for you to quickly find.

2. The reason for linking an event to an action is to create a logical relationship between your physical security devices to improve your ability to quickly search and find them when an event occurs. Event linking helps to narrow the information you are searching for.
3. The VMS software shall have the following event types:
 - a. Video Motion
 - b. Video Loss
 - c. Input Trigger
 - d. POS Port
 - e. POS Profile
 - f. Health
 - g. IP Camera Connection
 - h. Manual Event-Soft Trigger
4. The VMS software shall have the following action types:
 - a.
 - b. None
 - c. Record Video
 - d. Output Trigger
 - e. Output Video 1
 - f. Notify – email & text notification
 - g. Instant Recall
 - h. PTZ Preset
5. Pre and Post Triggers shall be used to trigger some action types before and/or after the event occurs. For example, if a door opening is set to trigger video recording, a Pre and/or Post Trigger can be set to capture the video for up to 100 seconds before and/or after the door opened.

GG. Event Buttons

1. The VMS software shall have a feature to assign manual events or soft triggers to event buttons. When an event button has been assigned an event such as turning on a light, the VMS software shall activate the light by manually clicking on an event button.

HH. Schedule

1. To maximize the amount of storage on your VMS server, you shall schedule camera, audio and event recording based on your individual needs. For example, you may want continuous record video during business hours, but after business hours you may want your cameras to record based on motion or a specific event.
2. The VMS software shall have a feature to configure your camera and event recording schedule. The VMS software shall ship with Motion (Blue) recording as the default schedule because this is the most common and efficient (disk saving) way to record video. The default Event schedule is shipped Enabled (Red) so that when events are setup in the Event Linking feature (above) they will automatically function once created.
3. There shall be four modes of video recording:
 - a. Motion (Blue) means video is recorded when motion is detected
 - b. Free Run (Green) means video is continually recorded nonstop
 - c. Alarm (Red) means video is recorded when there is a triggering event
 - d. Off (White) means video is not recorded at this time
4. There shall be four scheduling features:
 - a. Day – customize the recording schedule by day
 - b. Camera – customize the recording by camera
 - c. Event – enables or disables events for a particular time and day
 - d. Audio – customize the audio recording schedule

II. Users Setup

1. The VMS software shall have features to add or delete users to and from the VMS server. The User Setup screen is also where you set a users group access level and the cameras they have access to viewing. Once a user has been added to the system he/she will have the ability to login to view live and recorded video.
2. Adding a new user to the VMS server shall consist of creating a username, password and group access level (also know as privileges or access rights)
3. Users shall be assigned to one of four groups that have different level of access to system features.

4. The three group access levels are:
 - a. Administrator: Has access to all features of the system.
 - b. Power User: Has access to all features except adding or deleting users.
 - c. User Admin: Has access to viewing live video, searching recorded video and the ability to add and delete users.
 - d. Restricted: Has access to viewing live video and searching recorded video.

2.7 WIRE AND CABLE FOR CCTV CAMERA SYSTEM

- A. Provide video cables as follows:
 1. Indoor video cable shall be 4PR UTP type, plenum rated.
 2. Outdoor video cable shall be 4PR UTP type, water blocked.
 3. See Communications Copper Horizontal Cabling for more information.
- B. Provide 24/VAC12VDC camera power cable as follows:
 1. Indoor power cable shall be 16AWG three conductor unshielded, plenum rated.
 - a. Approved Manufacturer: Belden 6201 UE (#16).
 2. Outdoor power cable shall be 16 AWG three conductor, unshielded.
 - a. Approved Manufacturer: Belden 5201 UE (#16).
 3. Approved Manufacturers: West Penn, Commscope.

2.8 CABLES

- A. IP Video Surveillance cable shall be provided by the cabling contractor, the IP Video Surveillance system contractor SHALL verify all cabling and shall provide any additional cabling as required for their system.

2.9 Licenses

- A. Provide at least 10 user licenses for the IP video security system

PART 3 - EXECUTION

3.1 WIRING

- A. Wiring Method: Install cables in raceways except in accessible indoor ceiling spaces and as otherwise indicated. Conceal raceways and wiring except in unfinished spaces.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- C. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. 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.
- D. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.
- E. Provide all necessary cores sleeves or penetrations for cabling to connect the cameras.
- F. All Penetration must be fire stopped and labeled with the date the fire-stopping took place and the name of company who performed the fire-stopping.

3.2 VIDEO SURVEILLANCE SYSTEM INSTALLATION

- A. Install cameras level and plumb.
- B. Install cameras with 84-inch (2134-MM) minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.
- C. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms and adjust.
- D. Install power supplies and other auxiliary components at control stations at pole base, unless otherwise indicated.
- E. Avoid ground loops by making ground connections at only the control station.
 - 1. For 12- and 24-V dc cameras, connect the coaxial cable shields only at the monitor end.
- F. Connect the video surveillance system to the building data network system, to the building video distribution system, and the to the building security system.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation and supervise pre-testing, testing, and adjusting of video surveillance equipment.
- B. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
- C. Pre-testing: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video surveillance equipment for acceptance and operational testing as follows:
- D. Prepare equipment list described in Part 1 "Submittals" Article.
 - 1. Verify operation of auto-iris lenses.
 - 2. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
 - 3. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
 - 4. Set and name all preset positions; consult Owner's personnel.
 - 5. Set sensitivity of motion detection.
 - 6. Connect and verify responses to alarms.
 - 7. Verify operation of control-station equipment.
- E. Test Schedule: Schedule tests after pre-testing has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of the test schedule.
- F. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
- G. Remove and replace malfunctioning items and retest as specified above.
- H. Record test results for each piece of equipment.

- I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.4 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions and to optimize performance of the installed equipment. Tasks shall include, but are not limited to, the following:
 - 1. Check cable connections.
 - 2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
 - 3. Adjust all preset positions; consult Owner's personnel.
 - 4. Recommend changes to cameras, lenses, and associated equipment to improve Owner' utilization of video surveillance system.
 - 5. Provide a written report of adjustments and recommendations.

3.5 CLEANING

- A. Clean installed items using methods and materials recommended in writing by manufacturer.
- B. Clean video surveillance system components, including camera-housing windows, lenses, and monitor screens.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain video surveillance equipment.
 - 1. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment.
 - 2. Demonstrate methods of determining optimum alignment and adjustment of components and settings for system controls.
 - 3. Review equipment list and data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."
- B. Provide a complete step-by-step training manual in paper (2 copies) and electronic format (2 disks).

END OF SECTION 28 23 11

SECTION 28 31 11 – DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Fire-alarm control unit.
 2. Manual fire-alarm boxes.
 3. System smoke detectors.
 4. Heat detectors.
 5. Notification appliances.
 6. Addressable interface device.
 7. Fire alarm wire and cable.

1.2 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.3 SYSTEM DESCRIPTION

- A. An extension of the existing Simplex fire alarm system serving the North Hall building. Provide new equipment fully compatible with existing equipment and provide all programming as necessary for new devices. This is a delegated design. The fire alarm vendor shall provide full layout and calculations stamped by a NICET certified designer for submission to A/E as well as AHJ and state and local authorities as required.
- B. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.4 SUBMITTALS

- A. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work. Submit simultaneously with Product Data. Include the following as a minimum shop drawing requirement.
1. Submit to authorities having jurisdiction for approval, submittals reviewed and marked "No Exceptions Taken" by Architect.
 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.
 3. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 4. Include voltage drop calculations for notification appliance circuits.
 5. Include battery-size calculations.
 6. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 7. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 8. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.

9. Include 1/8-inch scale floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
10. Provide written Warranty as follows
 - a. The Fire System shall have a 1 year warranty starting for the date of Beneficial Occupancy.
 - b. Batteries shall have a full 1-year warranty and a 10-year pro rata warranty starting for the date of Beneficial Occupancy.

B. Quality Assurance/Control Submittals:

1. Product Data: For each type of product indicated.
2. Qualification Data: Provide Certification form, from the manufacturer, that the Installer and Persons preparing Shop Drawings are Qualified by the manufacturer. Submit qualifications simultaneously with Product Data.
3. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Field quality-control reports.

1.5 CLOSEOUT DOCUMENTS

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals:

1. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - a. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - b. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - c. Record copy of site-specific software.
 - d. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - 1) Frequency of testing of installed components.
 - 2) Frequency of inspection of installed components.
 - 3) Requirements and recommendations related to results of maintenance.
 - 4) Manufacturer's user training manuals.
 - e. Manufacturer's required maintenance related to system warranty requirements.
 - f. Abbreviated operating instructions for mounting at fire-alarm control unit.
2. Software and Firmware Operational Documentation:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - c. Device address list.
 - d. Printout of software application and graphic screens.
3. Extra Materials: Receipt for extra materials.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

1. Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
2. Distributors shall also be certified by the manufacturer.

- B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- C. Fire Alarm Wire and Cable Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 50 or less.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 1. Notify Construction Manager or Owner no fewer than two weeks in advance of proposed interruption of fire-alarm service.
 2. Do not proceed with interruption of fire-alarm service without Construction Manager's or Owner's written permission.

1.8 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.9 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 1. Provide 30 days' notice to Owner to allow scheduling and access to system.

1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
 4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
 5. Keys and Tools: One extra set for access to locked and tamperproofed components.

6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Simplex, no alternates.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
1. Manual stations.
 2. Heat detectors.
 3. Smoke detectors.
 4. Duct smoke detectors.
 5. Automatic sprinkler system water flow.
 6. Heat detectors in elevator shaft and pit.
 7. Fire-extinguishing system operation, including kitchen hoods.
 8. Water flow switches
 9. Fire standpipe system.
- B. Fire-alarm signal shall initiate the following actions:
1. Continuously operate alarm notification appliances.
 2. Identify alarm at fire-alarm control unit and remote annunciators.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Unlock electric door locks in designated egress paths.
 5. Release fire and smoke doors held open by magnetic door holders.
 6. Activate voice/alarm communication system.
 7. Switch designated heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 8. Close smoke dampers in air ducts of designated air-handling duct systems.
 9. Transmit an alarm signal to building management system per air-handling systems zone.
 10. Recall elevators to primary or alternate recall floors by designated detectors.
 11. Activate elevator shunt-trip circuit breakers by designated detectors.
 12. Activate kitchen equipment shunt-trip circuit breakers on fire-extinguishing system operation.
 13. Activate emergency lighting control for theatrical lighting system.
 14. Activate emergency shutoffs for gas and fuel supplies, including emergency generators where required by local codes.
 15. Record events in the system memory.
 16. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
 2. Low-air-pressure switch of a dry-pipe sprinkler system.
 3. Elevator shunt-trip supervision.
 4. Kitchen equipment shunt-trip supervision.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at fire-alarm control unit.
 4. Ground or a single break in fire-alarm control unit internal circuits.
 5. Abnormal ac voltage at fire-alarm control unit.
 6. Break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at fire-alarm control unit or annunciator.

9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

- A. Existing unit to remain.
- B. Circuits:
1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
 - a. Initiating Device Circuits: Style A.
 - b. Notification Appliance Circuits: Style Y.
 - c. Signaling Line Circuits: Style 4.
 - d. Install no more than 70 percent rated capacity of addressable devices on each signaling line circuit.
 - e. Install no more than 70 percent rated capacity of notification appliances on each notification appliance circuit.
- C. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
1. Dual-action mechanism, push-pull type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 2. Station Reset: Key- or wrench-operated switch.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
1. Comply with UL 268; operating at 24-V dc, nominal.
 2. Detectors shall be four-wire type. If detectors are UL listed with the Fire Alarm Control Panel for power, alarm and trouble using a 2 wire system, then 2 wire detectors may be used.
 3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 5. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
 6. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
 - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F .
 - c. Provide multiple levels of detection sensitivity for each sensor.

- B. Photoelectric Smoke Detectors:
 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 4. Each sensor shall have multiple levels of detection sensitivity.
 5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

2.6 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.

- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, with screw terminals for system connections, and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

- C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
 - 1. Rated Light Output: 110 cd, unless indicated otherwise.
 - 2. Mounting: Wall mounted unless otherwise indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
 - 6. Mounting Faceplate: Factory finished, red.
- D. Weatherproof Bells: Electric-vibrating, 24-V dc, under-dome type; with provision for housing operating mechanism behind bell. Bells shall produce a sound-pressure level of 94 dBA, measured 10 feet from bell. 10-inch size, unless otherwise indicated.

2.8 NOTIFICATION APPLIANCE CIRCUIT POWER SUPPLY UNITS

- A. General Requirements for Notification Appliance Circuit Power Supply Unit:
 - 1. Power-limited design, complying with UL 864 and listed and labeled by an NRTL.
- B. Notification Appliance Circuits: NFPA 72, Class B, Style Y.
 - 1. Install no more than 70 percent rated capacity of notification appliances on each notification appliance circuit.
- C. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, trouble signals, and supervisory signals shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire notification appliance circuit power supply unit shall not exceed 80 percent of the power-supply module rating.
- D. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Backup Battery: Premium, valve-regulated, recombinant-sealed, lead-calcium battery; spill proof; with a full 1-year warranty and a pro rata 19-year warranty. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
 - 2. Backup Power Supply Capacity: Comply with NFPA 72, but not less than 24 hours normal and 30 minutes alarm operation.

2.9 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to the following:
 - 1. Elevator controller to initiate elevator recall.
 - 2. Circuit-breaker shunt trip for power shutdown.
 - 3. Theatrical lighting controller for panic lighting.
 - 4. Heating, ventilating, and air-conditioning equipment controllers for power shutdown.
 - 5. Smoke dampers for closing.
 - 6. Magnetic door holders, electric locks, coiling doors and grilles for releasing.
 - 7. Building management system for equipment shutdown and alarm notification.
 - 8. Gas and fuel solenoid valves for emergency shut-off.
- C. Voltage Sensing Relay: Capable of detecting presence of 120 V ac for supervision of control power for shunt-trip circuit breakers.

2.10 PATHWAYS

- A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
 - 4. Cable Ties: Comply with Division 26 Section "Identification of Electrical Systems."
- B. Cable Trays: Comply with requirements in Division 26 Section "Cable Trays for Electrical Systems."
- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
 - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.11 FIRE ALARM WIRE AND CABLE

- A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
 - 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

2.12 IDENTIFICATION PRODUCTS

- A. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

- A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.

3.2 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems," and cable tray except as follows: within consoles, cabinets, desks, and counters and except in accessible ceiling spaces where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces. All vertical cable exposed to abuse, inside walls or surface mounted up to 12 feet above finished floor, shall be in conduit.

- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- F. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 REMOVAL OF CONDUCTORS AND CABLES

- A. For existing building that require demolition, remove abandoned conductors and cables. Refer to Division 26 Section " Electrical Demolition" Specification.

3.4 EQUIPMENT INSTALLATION

- A. Comply with NECA 305.
- B. Comply with NFPA 72 for installation of fire-alarm equipment.
- C. Equipment Mounting: Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.
- D. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 1. Connect new equipment to existing control panel in existing part of the building.
 2. Connect new equipment to existing monitoring equipment at the supervising station.
 3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- E. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser on return-air opening.
- F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
 1. Provide for air-handling units with capacity of 2000 cfm or greater.
 2. Provide for variable air volume type fan-powered terminal units served by return air plenums with capacity of 2000 cfm or greater.
 3. Provide within 5 feet of smoke dampers.
- G. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
 1. Install flush in ceiling below duct smoke detectors, unless otherwise indicated.
 2. Install in public space near device they monitor. Do not install in normally unoccupied spaces.

- H. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.
- J. Notification Appliance Circuit Power Supply Units: Provide quantity of units required for notification appliances indicated.
 - 1. Provide system smoke detector at each group of units.
 - 2. Provide 120 V, 20 A circuit to each unit.
- K. Mechanical Equipment Rooms and Kitchens: Provide 190 deg F fixed heat detectors.
- L. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- M. Additional mounting heights are specified in Division 26 Section "Wiring Devices."

3.5 CONNECTIONS

- A. For fire-protection systems related to overhead coiling fire doors and coiling counter fire doors in fire-rated walls and partitions and in smoke partitions, comply with requirements in Division 08 Section "Overhead Coiling Fire Doors" and Division 08 Section "Coiling Counter Fire Doors." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Smoke dampers in air ducts of designated air-handling duct systems.
 - 2. Air-handling unit controllers of designated air-handling systems.
 - 3. Variable air volume type fan-powered box controllers of designated air-handling systems.
 - 4. Unlock electric door locks in designated egress paths.
 - 5. Release magnetic door holders.
 - 6. Activate circuit breaker shunt-trip to elevator controller.
 - 7. Activate circuit breaker shunt-trip to designate kitchen equipment.
 - 8. Alarm-initiating connection to building management system of designated air-handling duct system.
 - 9. Alarm-initiating connection to elevator recall system and components.
 - 10. Alarm-initiating connection to activate theatrical lighting control.
 - 11. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 - 12. Alarm-initiating connection to overhead coiling fire doors and coiling counter fire doors.
 - 13. Supervisory connections at valve supervisory switches.
 - 14. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 - 15. Supervisory connections at elevator shunt trip breaker.
 - 16. Supervisory connections at kitchen equipment shunt trip breakers.
 - 17. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 - 18. Supervisory connections at fire-pump engine control panel.

3.6 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.7 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Firestopping."

3.8 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 28 31 11

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes 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.
 7. Temporary erosion and sedimentation control measures.
- 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 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
 4. 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 sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil 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 SYSTEM DESCRIPTION

- A. Requirement of Regulatory Agencies: All work shall conform to regulations, codes, safety requirements, ordinances, and laws of federal, state, and local governing bodies having jurisdiction. Keep a copy of the Soil Erosion and Sediment Control Plan on-site at all times during construction.
- B. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or air borne dust to adjacent properties and sidewalks according to requirements of authorities having jurisdiction, sediment and erosion control drawings, and/or EPA 832/R-92-005, whichever is more stringent.

1.5 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain as or on Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site and disposal of in an acceptable manner.

- B. When the Contractor's excavating operations encounter remains of prehistoric people's dwelling sites or artifacts of historical or archaeological significance, the operations shall be temporarily discontinued. The A/E or Owner will contact archaeological authorities to determine the disposition thereof. After consultation with the archaeological authorities, the Owner may elect to discontinue the work in the area indefinitely, resume normal excavation, or excavate for artifacts.
 - 1. When directed by the Owner to excavate for artifacts, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and shall remove them for delivery to the custody of the proper authorities. Such excavation will be considered and paid for as extra work.

1.6 SUBMITTALS

- A. Quality Assurance/Control Submittals
 - 1. Product Data: Silt fence data, including capacities.
 - 2. Contractor shall supply a copy of the log kept of erosion control monitoring and repairs, as well as means and methods for temporary controls.
 - 3. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
 - 4. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.7 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination". Hold in conjunction with the preinstallation conferences for the following sections:
 - 1. Division 31 Section "Earth Moving."
 - 2. Division 33 Section "Common Work Results for Utilities."
 - 3. Division 33 Section "Utility Services."
 - 4. Division 33 Section "Subdrainage."

1.8 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. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Notify corporations, companies, individuals, and local authorities owning conduits, wires, or pipes that will be affected by this Work. Arrange for removal of wires running to or on the property that will interfere with the execution of the Work.
 - 1. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- E. Protect and maintain conduit, drains, sewers, pipes, and wires that are to remain. Provide and maintain markers for location of underground facilities.

- F. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.
- B. Soil Erosion and Sedimentation Control
 - 1. Straw Bale Filters, Sediment Traps, and Silt Fence.
 - 2. Rip Rap: Sound and durable rock shall be free of soil and placed as a rock fill for the protection of slopes so denoted on the Drawings. Thin, slablike pieces shall not be used. Rock shall consist of sizes such that the amount of material passing a 3 inch sieve shall not be more than 15 percent by weight of the total material, and the amount of material passing a 6 inch square opening shall not be more than 50 percent by weight of the total material.
 - 3. Temporary seeding.
 - a. Northern States Temporary Seeding Mix; Seeding Rate: 8 lbs/1,000 sq.ft.
 - 1) 85 percent Perennial Ryegrass
 - 2) 15 percent Annual Ryegrass
 - 4. Mulch shall be one of the following:
 - a. Straw to be dry, unchopped, free of undesirable seeds.
 - 5. Erosion control blankets.

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 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to a sediment and erosion control plan, specific to the site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- B. Sequence of Construction Activities
 - 1. Install silt fence, sediment traps, and straw bale filters as part of initial phase of any work to ensure maximum silt retention.
 - 2. Mass grade the site keeping disturbed areas to a minimum at all times. Seed and mulch sides of swales, mounds, and ponds immediately upon completion. Application of temporary seeding will be required for all disturbed areas that cannot be final seeded within a time period that will prevent slope erosion. Temporary seeding will be required on all areas to be left disturbed in excess of 30 days. All temporary seeded areas shall be straw mulched in conformance with Division 32 Section "Turf and Grasses".

3. Control mud accumulation on all streets surrounding project by installing stone surface at each location where construction traffic leaves the site. Keep dust to a minimum by utilizing sprinkling, calcium chloride, vegetative cover, spray on adhesives, or other approved methods.
4. Maintain all filters and traps during construction to prevent any blockages from accumulated sediment. Clean sediment traps, filters, and fencing after each storm event and on a weekly basis. Replace all materials that are clogged or ineffective, 20 percent of capacity lost or obstructed.
5. As storm sewer lines are installed, install a silt barrier at each inlet and on each drainage swale at maximum 50 foot intervals.
6. Remove temporary erosion control and sediment controls only when sufficient growth of ground cover is established to prevent further erosion.
7. Place riprap in areas of high velocity water flow or as noted on the Drawings.

C. Temporary Seeding

1. If swale banks and slopes of five horizontal to one vertical or greater cannot be permanently seeded immediately after grading, temporarily seed these areas using erosion control blankets in conformance with Division 32 Section "Turf Grasses".
2. Mulch shall be one of the following with a coverage of at least 75 percent of the soil surface:
 - a. Install straw or hay mulch at a rate of 1-1/2 to 2 tons/acre, spread by hand or machine. Anchor it immediately, using one of the following methods: Crimp with mulch anchoring tool; a weighted farm disc with dull serrated blades set straight; track cleats of a bulldozer; hydro mulch with short cellulose fibers; or apply liquid tackifier or cover with biodegradable netting secured with staples.
3. Check for erosion damage after each storm event and on a weekly basis. Reseed and mulch as required.
4. If grading occurs during December, January, or February, no seeding is to take place until Spring planting time. All sediment filters and traps are to be in place prior to bulk earth moving and clearing.
5. All areas along streets (approximately 25 feet behind curb or edge of road) shall be seeded with permanent seed mixture as soon as grade is established. Reseeding may be required after utility companies have installed their mains.
 - a. Mow monthly, regardless, from March through October.
6. All existing lawns and seeded areas as defined shall be maintained in accordance with Division 32 Section "Turf and Grasses".
 - a. If area remains undisturbed, it must be mowed monthly beginning in March through October.

D. Monitoring: Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

1. Monitor soil erosion control practices at least weekly to determine the effectiveness of the installation and make any repairs required. Keep a detailed log of these observations and remedies taken.
2. Clean out siltation filters when siltation reduces capacity by 20 percent. Material removed may be dried and used as embankment material only in areas approved by the A/E.

E. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 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 accordance with ANSI A300.
 - 1. Replace trees that cannot be repaired and restored to full-growth status, as determined by Architect.

3.4 UTILITIES

- A. Contractor to arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing. Coordinate with the Owner and Construction Manager before disconnecting service
 - 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.
 - 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 Construction Manager 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 Sections covering site utilities.

3.5 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. Cut roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Completely remove stumps of trees, shrubs, and other vegetation including the roots.
 - 4. Remove stumps 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. Remove tree branches and 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.
 - 2. Fill stump holes with structural fill.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.

- B. Strip topsoil to whatever depths topsoil materials are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
 - 2. At seeding areas, a minimum of 6 inches of topsoil is required after final grading. Where changes in contours are indicated in these areas, topsoil is not required to be removed to its full depth as indicated finish contours will allow, or have, 6 inches of topsoil after final grading.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and surround with a silt fence.
 - 1. Limit height of topsoil stockpiles to 72 inches.
 - 2. Do not stockpile topsoil within tree protection zones.
 - 3. Dispose of excess topsoil as specified for waste material disposal.
 - 4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 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.
- C. Where catch basins or other underground structures are removed and drainage lines are encountered that cannot be abandoned, provide and install the necessary sewer tile so that maintenance of the lines can be assured. This will particularly apply to subsurface drainage lines, which should be maintained to assure proper drainage. Obtain Architect/Engineer approval for rerouting such lines.
 - 1. Fill the open ends of abandoned sewers or drains encountered in excavation with concrete or mortared masonry, as per Local and State Codes.

3.8 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.
 - 1. Burning of combustible cleared and grubbed materials is not permitted on Owner's property.
 - 2. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 31 10 00

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and exterior plants.
 2. Excavating and backfilling for buildings and structures.
 3. Subbase course for concrete walks, and pavements.
 4. Subsurface drainage backfill for walls and trenches.
 5. Excavating and backfilling for utility trenches.
 6. 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 rock excavation and authorized additional excavation provisions.
 3. Division 01 Section "Construction Progress Documentation" for recording preexcavation and earthwork progress.
 4. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
 5. Division 01 Section "Milestone Schedule" for compacted fill settlement monitoring.
 6. Division 03 Section "Cast-in-Place Concrete" for drainage fill (coarse) and vapor retarder/barrier beneath the slab-on-grade.
 7. Divisions 21, 22, 23, 26, 27, and 28 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
 8. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
 9. Division 32 Section "Turf and Grasses" for topsoil analysis.
 10. Division 32 Section "Plants" for planting bed establishment and tree and shrub pit excavation and planting.
 11. Division 33 Section "Subdrainage" for drainage of foundations, slabs-on-grade, walls, and landscaped areas.

1.3 UNIT PRICES

- A. Unit prices for earthwork are included in Division 01 Section "Unit Prices."
- B. Quantity allowances for earthwork are included in Division 01 Section "Allowances."
- C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
 1. 24 inches outside of concrete forms other than at footings.
 2. 12 inches outside of concrete forms at footings.
 3. 6 inches outside of minimum required dimensions of concrete cast against grade.
 4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 5. 6 inches beneath bottom of concrete slabs-on-grade.

6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

1.4 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. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- E. 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 Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 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 Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- F. Fill: Soil materials used to raise existing grades.
- G. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 50 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D 1586.
- 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 (Aggregate): Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and 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.
- L. Topsoil: Organic plant growth material that is cleaned of debris, roots, rocks, soils clumps, weeds and other non-soil contaminants prior placement whether stockpiled or transported on-site.
- M. Manufactured Free-Draining Topsoil: Soil produced off-site by homogeneously blending soils and sand with stabilized organic soil amendments to produce topsoil or planting soil for use in rain gardens and bioretention areas..

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct preexcavation conference at Project site.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
 - a. Personnel and equipment needed to make progress and avoid delays.
 - b. Coordination of Work with utility locator service.
 - c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
 - d. Extent of trenching by hand or with air spade.
 - e. Field quality control.

1.6 SUBMITTALS

- A. Quality Assurance/Control Submittals:
 1. Product Data: For the following:
 - a. Each type of plastic warning tape.
 - b. Geotextile.
 - c. Controlled low-strength material, including design mixture.
 2. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - a. Classification according to ASTM D 2487 of each borrow soil material proposed for fill and backfill.
 - b. Laboratory compaction curve according to ASTM D 698 for each on-site and borrow soil material proposed for fill and backfill.

1.7 QUALITY ASSURANCE

- A. Blasting: Is not 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. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination". Hold in conjunction with the preinstallation conferences for the following sections:
 1. Division 31 Section "Site Clearing."
 2. Division 31 Section "Rammed Aggregate Pier Foundation Systems."
 3. Division 33 Section "Common Work Results for Utilities."
 4. Division 33 Section "Utility Services."
 5. Division 33 Section "Subdrainage."

1.8 PROJECT CONDITIONS

- A. Site Information: Data furnished by Owner in Soils Exploration Report (following Information Available To Bidders) of indicated subsurface conditions is not intended as representations or warrants of continuity of such conditions between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn there from by Contractor. Data is made available for the convenience of Contractor.
 1. Contractor at no cost to Owner may make additional test borings and other exploratory operations.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
 1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Architect immediately for directions as to procedure. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
 2. Notify Construction Manager not less than two days in advance of proposed utility interruptions.
 3. Do not proceed with utility interruptions without written permission.

4. Contact utility-locator service for area where Project is located before excavating.
- C. 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.
- D. Fill placement for the building pad will impose added weight to the existing soils. This added weight will cause the existing soils to consolidate. Construction of structures including pavements shall not proceed until it has been verified that the rate of settlement of the native soils has attenuated. Installation and monitoring of settlement points on the surface of the finished subgrade fill will be conducted by the on-site construction testing company hired by the owner. The settlement points shall be monitored routinely to verify the settlement of the new fill caused by the consolidation of the underlying native soils. Once the settlement rates have been verified as having attenuated to no greater than 0.01 feet per week for at least two consecutive weeks, construction of structures including pavements may commence. Surface elevations of the subgrade shall be monitored by placing settlement points at spacing no greater than 100 feet. Monitoring should be done at a frequency no greater than weekly. This elevation data shall be monitored by the testing company to assess the progression of settlements and to make any necessary changes or recommendations. Soil settlement due to fill placement will occur over time and may delay the beginning of foundation excavations. It is estimate that 1.5 inches of settlement may occur and it will take approximately 4 weeks for 90 % of that settlement to attenuate.
- E. Contractor is to reference the project milestone schedule.

PART 2 - PRODUCTS

2.1 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 product by the manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or a combination of these groups.
 1. Soils classified as CL and ML that have less than 50% silt particle size shall be considered as satisfactory soils.
 2. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of crushed gravel, crushed stone, and crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

- E. Engineered Fill/Granular Fill: “Satisfactory Soils” or naturally or artificially graded mixture of crushed gravel, crushed stone, and crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve, unless otherwise noted.
 - 1. Aggregates used for subsurface storm water storage, underdrains, or storm sewer backfill shall be washed limestone, washed gravel, or river rock. The aggregates shall be 100 percent crushed in all cases.
 - 2. “Satisfactory Soil” material shall be compacted in controlled lifts as verified by a representative of the geotechnical engineer by monitoring and testing to have achieved the minimum specified density and stability required based on its location and function.
- F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2 sieve and 0 to 5 percent passing a No. 8 sieve.
- H. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.3 TOPSOIL

- A. Topsoil (Planting Soil): ASTM D 5268, pH range of 5.5 to 7, a minimum of 6 percent organic material content; screened to be free of stones 1/2 inch or larger in any dimension and other extraneous materials harmful to plant growth.
 - 1. Topsoil Source (Disturbed Areas): Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean stripped topsoil of roots, plants, sod, stones, clay clumps, and other extraneous material harmful to plant growth.
 - a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.
 - 2. Topsoil Source (Undisturbed): Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Provide surface soil free of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - a. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.
 - 3. Additional Properties of Imported Topsoil or Manufactured Topsoil:
 - a. Provide screened surface soil free of stones 1/2 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth.
 - b. Free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes, grubs, other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration.
 - c. Continuous, air-filled, pore-space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.

2.4 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater 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: 157 lbf; ASTM D 4632.
 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
 4. Tear Strength: 56 lbf; ASTM D 4533.
 5. Puncture Strength: 56 lbf; ASTM D 4833.
 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- 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; ASTM D 4632.
 3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
 4. Tear Strength: 90 lbf; ASTM D 4533.
 5. Puncture Strength: 90 lbf; ASTM D 4833.
 6. Apparent Opening Size: No. 60 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.
- C. Reinforcing Fabric
1. Reinforcing fabric shall be made from woven polypropylene containing heavy monofilament and fibrillated yarns with the minimum physical properties:
 - a. Grab Strength ASTM D4632 250 lbs
 - b. Mullen Burst ASTM D3786 750 psi
 - c. Trapezoidal Tear ASTM D4533 110 psi
 - d. Water Flow Rate ASTM D4491 40 gpm
 2. Typically used as subgrade stabilization
- D. Reinforcing Geogrid
1. Reinforcing geogrid shall be made from polypropylene with the minimum physical properties:
 - a. True Initial Modulus In Use Type I 17,140 lb/ft.
 - b. Flexural Stiffness Type I 250,000 cm
 - c. Aperture Stability Modulus Type I 3.2 deg
 - d. Resistance to Installation Damage Type I 70% GP
 2. Typically used as subgrade stabilization

2.5 CONTROLLED LOW-STRENGTH MATERIAL (FLOWABLE FILL)

- A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:
1. Portland Cement: ASTM C 150, Type I or III.
 2. Fly Ash: ASTM C 618, Class C or F.
 3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch nominal maximum aggregate size.
 4. Water: ASTM C 94/C 94M.
 5. Air-Entraining Admixture: ASTM C 260.
- B. Maximum Water Cementitious Ratio: Concrete mixes shall be limited to the water-cement ratios specified in the Concrete Schedule in these Specifications (DIV. 3 - CS-1). Water reducers and fly ash may be used to increase the slump while maintaining or reducing the water-cementitious ratio at or below the maximums specified values, except where specifically prohibited in these specifications.

- C. Mix designs for flowable fill shall generally conform to the following guideline mixes:

<u>Material</u>	Type 1 (for utility trench backfill) <u>(lbs/cu yd)</u>	Type 2 (for backfill under structures) <u>(lbs/cu yd)</u>
Cement	50	50-100
Fly Ash	250	
Fine Aggregate	2910	2420
Water	500	210-300
Entrained Air	0%	5 % +/- 1 ½ %

1. Alternate mix designs may be submitted in lieu of the above. Mix designs shall have an unconfined compressive strength when tested according to ASTM D4832 as shown in the Concrete Schedule. Long term (12 months) unconfined compressive strength for utility trench backfill shall be less than 100 psi. Mixes shall be flowable. Mixes shall conform to the requirements of ACI 229 for "Controlled Low Strength Material".
2. Mixes shall set up in less than 12 hours. Flowable fill shall be ready-mixed material.

2.6 ACCESSORIES

- A. 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 EXAMINATION

- A. Examine the areas and conditions under which excavating, filling, and grading are to be performed and notify the A/E in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Proof Rolling: After topsoil has been stripped per Division 31 Section "Site Clearing" and excavation made to required subgrade elevations, proof roll areas to be occupied by the new buildings and paved surface areas using a medium weight roller. A representative from the Soil Testing and Inspection Laboratory shall be present during all proof rolling operations.
1. Excavation of unsuitable proof roll bearing materials
 - a. Lawn Areas
 - 1) Unsuitable bearing materials in lawn areas shall not be excavated without written authorization from the architect.
 - 2) Unsuitable bearing materials excavated in lawn areas shall be considered unauthorized excavation and shall be replaced with suitable bearing materials with no additional payment.
 - b. Paved Areas
 - 1) Unsuitable bearing materials in areas to receive a bituminous or aggregate pavement structure shall not be undercut without written authorization from the A/E.
 - 2) Unsuitable bearing materials excavated in paved areas without written approval from the A/E shall be considered unauthorized excavation. No contract adjustments will be made for unauthorized excavation.
 - 3) Prior to excavation of unsuitable materials, the contractor shall report to the soils engineer, Construction Manager, and A/E the quantity of unsuitable soil to be excavated. The contractor shall report the following information:
 - a) Quantity in cubic yards

- b) Quantity square yards
 - c) The average depth of cut.
- 2. Using the quantity information, the architect will consult with the soils engineer regarding alternative methods to remedy the unsuitable soil. Alternatives include:
 - a. Installation of an approved reinforcing fabric or reinforcing geogrid
 - b. Mechanical stabilization using hydrated lime, calciment or kiln dust, whichever is appropriate based on soil type and intent to "modify" or "stabilize" the soil mass.
 - c. Removal and replacement of the unsuitable material
 - 1) The depth of additional excavation shall be based on the depth of deflection measured during the proofroll operation:
 - a) 0 to 1/2 inch – no additional excavation
 - b) >1/2 inch to 1 inch – 12" of additional excavation
 - c) >1 inch to 1.5 inch – 18" of additional excavation
 - d) >1.5 to 2.5 inch – 24" of additional excavation plus an approved reinforcement geosynthetic, if applicable.
 - 2) Replacement material shall consist of crushed concrete, 100 percent crushed gravel or 100 percent crushed limestone or other satisfactory soil material at the discretion of the A/E and soils engineer.
 - a) The size of replacement aggregate material, if utilized, shall be based on the security of the instability.
 - d. Disc and Dry
 - 1) No additional payment will be made to disc and dry.
 - e. Other remedy as suggested by the soils engineer or contractor.
- 3. The A/E will recommend to the owner implementing an alternative or combination of alternatives based upon cost, effectiveness, scheduling impact and recommendations from the soils engineer. The owner shall issue final approval of the remedy.
- 4. Contract adjustments, if any, shall be in accordance contract provisions.
- 5. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by A/E, without additional compensation.

3.2 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 "Site Clearing," during earthwork operations.
- D. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- E. Provide erosion control measures in accordance with erosion control plan to prevent erosion or displacement of soils and discharge of soil bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 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.

3.4 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.5 EXCAVATION, GENERAL

- A. 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 Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. 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.
- B. Additional Excavation: When excavation has reached required subgrade elevations, notify Soils Engineer and A/E so he can observe conditions.
 - 1. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by the Representative of Soils Testing and Inspection Laboratory after approval by A/E.
 - 2. Removal of unsuitable material and its replacement, as directed, will be paid on the basis of contract conditions relative to changes in work.
 - 3. The assumed quantity of additional excavation for bidding is zero cubic yards, unless otherwise noted. As such, all future estimated quantities of additional excavation should be considered a substantial change in quantity.
 - 4. All additional excavation or rock excavation performed without written authorization by the A/E shall be considered unauthorized excavation for which no additional payment will be made.
 - 5. Additional excavation and its replacement will be paid for based on contract provisions for changes in the work or unit prices where applicable.
- C. Stability of Excavations: Slope sides of excavations to comply with codes and ordinances having jurisdiction. Shore and brace where sloping is not possible either because of space restriction or stability of material excavated.
 - 1. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
 - 2. Comply with OSHA, "Construction Standards for Excavations, 29 CFR".
- D. Shoring and Bracing: Provide materials for shoring and bracing such as sheet piling, uprights, stringers, and cross-braces in good serviceable condition.
 - 1. Provide minimum requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
 - 2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- E. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of pavement subgrade, foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, sumps, suction, and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. Convey water removed from excavations and rainwater to collecting or runoff areas. Provide and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

3.6 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. 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. 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. Do not disturb bottom of excavations intended as bearing surfaces.

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.8 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 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 higher than top of pipe or conduit, unless otherwise indicated.
 1. Clearance: 12 inches each side of pipe or conduit, unless otherwise noted.
- 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. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
 2. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.
 3. For pipes or conduit 5 inches or less in nominal size and for flat-bottomed multiple-duct conduit units, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
 4. For pipes or conduit 6 inches or larger in nominal size, tanks and other mechanical/electrical work indicated to receive subbase, excavate to subbase depth indicated, or, if not otherwise indicated, to 6 inches below bottom of work to be supported.
 5. Except as otherwise indicated, excavate for exterior water bearing piping (water, steam, condensate, drainage) so top of piping is not less than 5 feet below finished grade.
 6. Grade bottoms of trenches, notching under pipe bells to provide solid bearing for entire body of pipe.

7. Where welded and wrapped black iron pipe, wrought iron pipe, or soft type "K" copper tubing with silver soldered joints is specified, a narrow trench made with special trenching machines will be acceptable, providing it can maintain a straight, true-to-line trench bottom in undisturbed earth to prevent damage to the pipe.
8. Excavation for manholes and other accessories to have 12 inches minimum and 24 inches maximum clearances on all sides.
9. Trenches interior to the building shall be excavated of sufficient width to allow ample working space and performed so walls and footings are not disturbed, weakened, or injured.

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, or controlled low-strength material may be used when approved by A/E.
 1. Fill unauthorized excavations under other construction or utility pipe as directed by A/E.

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.
 2. Dispose of excess soil material and waste materials as specified hereinafter.

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.
 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. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. 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.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings, piers, or foundations with satisfactory soil; fill with concrete or controlled low-strength material to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete and/or Miscellaneous Cast-in-Place Concrete."
 1. Wrap pipe with one inch glass fiber blanket by pipe installer prior to placement of concrete.
- D. Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways or paving. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
 1. Backfill when piping or conduit is greater than 30 inches below surface of roadways and paving may be either controlled low-strength material or granular fill.

- E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit, unless otherwise noted.
 - 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.
 - 2. Backfill within the building and for piping or conduit below sidewalk shall be granular fill.
- F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.
- G. Trench Backfilling for PVC or PE Storm Piping Outside the Building: Backfill storm piping in four phases. Bedding, haunching, initial and finish backfill. Place each lift to equal depths on both sides of pipe. Each lift shall extend from the side of the pipe to the trench wall.
- H. Trench Backfilling for Underdrains: Line the trench for underdrains with a nonwoven filter fabric. Completely encase the washed river rock.
 - 1. Backfill material shall be 3/4 inches diameter washed river rock. Continue the rock from the top of the pipe to the base of the surface material.
- 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. Properly compact and stabilize fill before permitting weight or traffic on the backfill.
- K. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Disc, 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 soil material to where topsoil begins.
 - 2. Under walks and stoops, use satisfactory soil material to 4 inches below concrete then use subbase material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill to establish subgrade.
 - a. Refer to Division 03 Section "Cast-in-Place Concrete" for drainage fill.
 - 5. Under footings and foundations, lean concrete or controlled low-strength material, unless otherwise approved by A/E and geotechnical engineer.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 TOPSOIL PLACEMENT

- A. Limit topsoil placement to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade 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 topsoil to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if topsoil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately 1/2 the thickness of topsoil over loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil mix.
 - b. Reduce elevation of topsoil to allow for soil thickness of sod.
- C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
 - a. Apply fertilizer and soil amendments directly to surface soil before loosening per results of topsoil analysis.
 3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- D. Finish Grading: Grade to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- E. Before placing topsoil, restore areas if eroded or otherwise disturbed after finish grading.

3.15 FLOWABLE FILL PLACEMENT

- A. Flowable Fill Placement: Discharge the flowable fill material from the ready-mix truck by any reasonable means into the space of the plan intended usage. Bring material up uniformly to the fill line shown on the plans.
- B. The Contractor may begin placing other fill materials, as required, over flowable fill as soon as the surface water on the flowable fill is gone.
- C. Reinforcing steel for foundations to be placed over flowable fill may be placed 24 hours after placement of flowable fill.

3.16 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content as indicated in geotechnical report.
 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.

3.17 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 values in the soils report and the following percentages of maximum dry unit weight according to ASTM D 698 (Standard):
 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 least 100 percent.
 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at least 100 percent.
 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at least 100 percent within areas under buildings, structures, walks and pavements and to 92 percent minimum within lawn or other areas.

3.18 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 grades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1/2 inch.
 2. Walks: Plus or minus 1/2 inch.
 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.19 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Division 33 Section "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
 2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.20 SUBBASE AND BASE COURSES

- A. Place subbase course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course under pavements and walks as follows:
 1. Install separation geotextile, where specified, 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 course to required crown elevations and cross-slope grades.
 4. Place subbase course 6 inches or less in compacted thickness in a single layer.
 5. Place subbase 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 course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

- 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 100 percent of maximum dry unit weight according to ASTM D 698.

3.21 FIELD QUALITY CONTROL

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

Verification and Inspection Task	Continuous During Task Listed	Periodically During Task Listed
1. Verify materials below footings are adequate to achieve the design bearing capacity.	--	X
2. Verify excavations are extended to proper depth and have reached proper material.	--	X
3. Perform classification and testing of controlled fill materials.	--	X
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of controlled fill.	X	--
5. Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly.	--	X

- 1. Determine footings have been excavated to proper depths by observing surveying of at least one location for each foundation depth indicated.
- 2. Determine prior to placement of fill that site has been prepared in compliance with requirements by observing proof rolling operations.
- 3. Determine that fill material and maximum lift thickness comply with requirements.

- B. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

- C. 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.

- D. 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 A/E, except that a minimum of one test shall be performed for each 15,000 sq.ft. of building area.

- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, ASTM 6938 and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

- 1. Paved and Building Slab 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 or building slab, but in no case fewer than 3 tests.
- 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
- 3. 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.

- F. 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.

3.22 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 Architect; 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.

3.23 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 Architect.
 - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 20 00

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Hot-mix asphalt patching.
 - 2. Hot-mix asphalt paving.
 - 3. Pavement-marking paint.
- B. Related Sections:
 - 1. Division 31 Section "Site Clearing" for removal of above ground improvements.
 - 2. Division 31 Section "Earth Moving" for aggregate subbase courses and for aggregate pavement shoulders.
 - 3. Division 32 Sections for other paving installed as part of crosswalks in asphalt pavement areas.

1.3 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. DOT: Department of Transportation.

1.4 SYSTEM DESCRIPTION

- A. Provide hot mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specification of the Ohio Department of Transportation.
- B. Bituminous concrete utilized for this project will conform to Ohio DOT Item 441. Base and binder course material shall meet job formula outlined in section 441.02-1, Type 2. Surface course shall fall within Type 1 limits. All pavements to be designed for medium traffic. The asphalt binder used shall be PG 64-22.
- C. Special Conditions
 - 1. Protection of work in place
 - a. All paving work shall be protected from construction traffic at all times after completion. All damaged work shall be replaced with no additional payment.

1.5 SUBMITTALS

- A. Quality Assurance/Control Submittals:
 - 1. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - 2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 - a. Certification: Provide material certificates signed by the material producer and the Contractor, certifying that trac surface mixture does not contain ferrous material or ferrous minerals.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the State Department of Transportation Standard Specifications for asphalt paving work, except where modified, changed or added to in this specification:
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
- C. Preinstallation Conference: Conduct conference at Project site. A/E will schedule and conduct meeting.
 - 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review condition of subgrade and preparatory work.
 - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Tack Coat: Minimum surface temperature of 60 deg F.
 - 2. Slurry Coat: Comply with weather limitations in ASTM D 3910.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials and 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 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 product by the manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for A/E's approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 COMPACTED AGGREGATE BASE MATERIAL

- A. General: Use materials and gradations that have performed satisfactory in previous installations.
 - 1. Aggregates shall meet ODOT requirements and as indicated.
- B. Compacted aggregate base for all pavement types shall consist of natural aggregate. The aggregate shall contain 95 to 100 percent crushed content.
 - 1. Provide crushed limestone. The contractor may provide 95 to 100 percent crushed gravel. Class B or higher aggregates shall be used in all cases.
 - 2. Compacted aggregate base material shall conform to the gradation shown in the table for each class of paving.
 - 3. All compacted aggregate for bituminous paving shall be constructed in two lifts. In no case shall compacted aggregate lifts be thicker than 4 inches.
 - 4. Compacted aggregate shall contain 0% soft particles, 0 percent shale and 0 percent flat elongated particles.

2.3 MATERIAL GRADATIONS (Percent Passing is shown):

SIEVE SIZE mm (US Sieve)	PARKING AND DRIVES SURFACE COURSE	PLAYGROUND SURFACE	BINDER COURSE	BASE COURSE	COMPACTED AGGREGATE
37.5 (1 ½)				100	100
25.0 (1)			100	80-99	80-100
19.0 (¾)			80-98	67-90	70-90
12.5 (½)	100	100	56-80	42-74	55-80
9.5 (⅜)	85-98	96-100	43-68	33-60	45-70
4.75 (No. 4)	57-67	70-80	30-40	25-35	35-60
2.36 (No. 8)	31-62	36-66	14-40	12-34	25-50
1.18 (No. 16)	17-50	19-50	8-32	7-28	---
600mm (No. 30)	8-37	10-38	5-24	4-22	12-30
300mm (No. 50)	3-25	5-26	2-16	1-16	---
150mm (No. 100)	0-14	2-17	0-10	0-10	---
75mm (No. 200)	0-3	0-4	0-3	0-3	5-10
% Bitumen	5.5-7.0	5.7-7.2	4.1-5.2	4.0-5.1	N/A

2.4 PAVING MATERIALS

- A. General: Use locally available materials and gradations, which exhibit a satisfactory record of previous installations.
- B. Mineral Filler: Limestone dust, portland cement, or other inert material complying with State Department of Transportation Standard Specifications.
- C. Asphalt Cement: Use Performance Grade liquid asphalt's in accordance with State Department of Transportation Standard Specifications.
- D. Tack Coat: ASTM D977, emulsified asphalt or ASTM D2397, cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

2.5 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

- B. Joint Sealant: ASTM D 6690 or AASHTO M 324, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.
- C. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N or Type F; colors complying with FS TT-P-1952. Quality Assurance requirement for pavement markings within public rights-of-ways to be in accordance with US Manual on Uniform Traffic Control Devices.
 - 1. Color: White and Yellow.
- D. Accessibility Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
 - 1. Color: Blue.
- E. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 5-1/2 inches high by 8 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.6 MIXES

- A. All mix design parameters shall be measured in accordance and comply with State Department of Transportation Standard Specifications

1. VMA%	15
2. Air Voids %	3.5
3. Fines/Binder Ratio	1.2
4. Fine Aggregate Angularity	3
5. Flow (mm)	2.0 – 4.0
6. L.A. Abrasion Loss	40
7. Soft Particle Max.	8
8. Stability Min.	4.0 kN

2.7 RECYCLED ASPHALT PAVEMENT

- A. Recycled asphalt pavement may be used in bituminous base or bituminous binder, provided the recycled asphalt does not contain objectionable material or materials that are not compatible with other pavements, and do not exceed DOT recommended percentages. No recycled content in the surface course, virgin material only.

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. Limit vehicle speed to 3 mph.
 - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

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 into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact 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.
 - 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 in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
 - 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 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 wide. Fill flush with surface of existing pavement and remove excess.

3.4 INSTALLATION OF COMPACTED AGGREGATE BASE

- A. The entire area to receive compacted aggregate shall be proof rolled with a tandem dump truck loaded with approximately 15 tons. The proof rolling shall be executed prior to installing the compacted aggregate. All soft and yielding areas shall be repaired.
 - 1. The acceptable observed subgrade deflection shall be 1/2 inch or less measured at the rear tire.
- B. Compacted aggregate shall be installed immediately after acceptance of the subgrade proof roll operation by the soils engineer and Architect.
 - 1. The subgrade shall be repaired and the proof roll operation repeated in the event the approved subgrade is disturbed by construction traffic, rain or other circumstance prior to placing the compacted aggregate.
 - 2. The proof roll operation shall be repeated in the event the subgrade is left exposed for 3 work days or more prior to placing the compacted aggregate.
- C. Place the aggregate material in accordance with applicable sections of the State Department of Transportation Standard Specifications and as hereinafter specified.
- D. Aggregate material shall be compacted to thickness indicated on the Drawings. Each lift shall be compacted with approved rollers to no less than 100 percent of the maximum dry density as determined by Method C of AASHTO T99, as modified in Article 2.03.24.
- E. All compacted aggregates for all bituminous pavements shall be installed in 2 lifts.

- F. Grade Control: During construction maintain lines and grades, including crown and cross-slope of compacted aggregate course.
- G. Shoulders: Where curbs are not indicated, place shoulders along edges of aggregate subbase course to prevent lateral movement. Construct shoulders of acceptable aggregate materials, placed in such quantity to compact to thickness of each aggregate base course layer. Compact and roll at least a 12 inch width of shoulder simultaneously with compacting and rolling of each layer of aggregate subbase course.

3.5 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. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 - 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.

3.6 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread HMA base mix at minimum temperature of 250 deg F and HMA Surface Mix at a minimum temperature of 280 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.
- D. Special Conditions
 - 1. Fenced areas: All fence fabric shall be removed from poles prior to paving fenced areas.
 - 2. The paving machine shall not be allowed to track over or back track over any finished course of freshly placed bituminous mixture while the mixture is still hot or warm. Tracking the paving machine over freshly placed bituminous courses shall render that section of pavement unacceptable. All unacceptable pavements shall be removed and replaced with no additional payment.

3.7 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
 - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.8 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.

2. Surface Course: 3/16 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.10 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
 1. Compacted thickness shall not be less than indicated.
- C. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using a 10-foot straightedge applied parallel with, and at right angles to, centerline of paved area. Surfaces will not be accepted if exceeding the following tolerances for smoothness:
 1. Binder Course: 1/4 inch.
 2. Surface Course: 3/16 inch.
 3. Check surface areas at intervals as directed by the Architect.
- D. Flood Test
 1. Schedule: After the pavement is complete, perform a flood test in the presence of the Architect.
 2. Method: Perform the flooding by use of water tank truck or available water.
 3. If depressions exist where water is ponding to a depth of more than 1/8 inch, fill with fresh hot asphalt concrete to provide proper drainage. Feather and smooth the edges of fill so that the joint to original surface is not visible.
- E. Test uncompacted asphalt concrete mix and report the following:
 1. Sampling: AASHTO T168 (ASTM D979).
 2. Asphalt Cement Content: AASHTO T164 (ASTM D2172).
 3. Perform at least one initial test for paving, unless otherwise specified or directed.
- F. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 500 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- G. Replace and compact hot-mix asphalt where core tests were taken.

- H. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.12 FINAL ACCEPTANCE CRITERIA FOR HEAVY AND STANDARD DUTY PAVING

- A. Final acceptance for heavy duty and standard duty paving shall be based on asphalt coring within the test area limits as shown on the Drawings. Arrange for and execute core sampling by an independent testing agency. The cost of this testing shall be included in the bid by Contractor.
- B. Core Requirements
 1. Cores shall be a minimum of 2 inches in diameter and 24 inches in depth.
 2. Cores shall be taken at a rate of 1 core every 3000 sq.yds. for each pavement type in each test area. In any case, no less than 4 cores shall be taken in each test area for each type of pavement.
 3. The location of the cores shall be at painted lines and as determined by the Engineer and marked on the Drawings after the surface course has been constructed.
 4. The total thickness of the surface plus the binder course for each core shall be determined. The total thickness of the compacted aggregate base for each core shall be measured and recorded.
 5. The average thickness of each aggregate course for each pavement type shall be determined and recorded for each test area. The average thickness of the surface course plus the binder course shall be determined and recorded for each test area.
 6. Voids created as a result of the coring shall be filled using concrete, mortar or other bituminous material as directed.
- C. Acceptance Criteria
 1. The thickness of each asphalt course as shown on the Drawings is the compacted minimum not an average. If the average thickness of any asphalt or aggregate course is less than that shown on the Drawings, then the entire test area shall be resurfaced using a bituminous surface mixture with appropriate aggregate size to obtain 90 pound per square yard yield without breaking or scratching the aggregate.
 2. If the average thickness of the surface plus the binder or the average thickness of the compacted aggregate equals or exceeds the required thickness and if any course in any individual core is less than that shown on the Drawings then, at the discretion of the Engineer, that portion of the test area shall be resurfaced using 90 pound per square yard bituminous surface. Areas requiring resurfacing due to inadequate core samples shall not be less than 2400 square feet.
 3. No asphalt materials shall be removed to correct insufficient compacted aggregate once the binder or surface has been placed. The only acceptable corrective measure for insufficient compacted aggregate is additional bituminous material. Substantially insufficient compacted aggregate shall be corrected by additional resurface work constructed at a rate of 1 compacted inch of asphalt for every 2 inches of insufficient aggregate.
 4. No additional payment will be made for additional construction necessary due to insufficient cores.
- D. Acceptance Submittals
 1. No bituminous pavements will be accepted until it has been demonstrated by the Contractor that the pavements are in accordance with the Drawings and Specifications. The Contractor shall submit the following:
 - a. Pavement coring report with a drawing illustrating the location of each core taken, asphalt and aggregate thicknesses and subgrade moisture content.
 - b. Modified proctor maximum dry density soil data for each soil type used as subgrade within the pavement. The soils data sheet(s) shall indicate which asphalt core or cores the soil corresponds to.
 - c. Job mix formula for each type of bituminous mixture. The job mix formula shall contain, at minimum, the aggregate gradation, percent bitumen, source and type of bitumen and the laboratory maximum compacted density for the mixture.
 - d. In-place asphalt compaction density test results illustrating the corresponding core to which the test applies.

- E. Variation from Job Mix Formula or Required Gradations:
 - 1. Compliance Criteria
 - a. Paving work shall be considered in compliance if the gradations and % bitumen noted in the table are within the specified ranges. No contract adjustments shall be made for all work that is in compliance with these specifications.
 - 2. Substantial Compliance Criteria
 - a. Paving work shall be considered within substantial compliance if the gradations and percent bitumen noted in the table are within plus or minus 0.20
 - b. A deduct contract adjustment shall be made at the rate of \$0.50 per square yard for each square yard of paving that varies from the Job Mix Formula or the Required Gradations.
 - 3. Non-Compliance: Paving work shall be considered non-compliant if the gradations and percent bitumen deviate greater than 0.20 of the values in the table.

3.13 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 32 12 16

SECTION 32 13 13 – SITE CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Misc. concrete slabs
 - 2. Walkways
 - 3. Curbs
 - 4. Tactile Warning Plates
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
 - 2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
 - 3. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

- A. Quality Assurance/Control Submittals:
 - 1. Product Data: For each type of manufactured material and product indicated.
 - 2. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 3. Qualification Data: For manufacturer and testing agency.
 - 4. Field quality-control test reports.
 - 5. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
- C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

- E. Concrete ramps and curbs shall be provided to conform to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications in this Section.
 - 1. Detectable warnings shall conform to ADAAG, Articles 4.7.7 and 4.29.

- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete producer.
 - d. Concrete pavement subcontractor.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement, when applicable.
- B. Collect unused reinforcing steel and place in designated area for recycling.

1.7 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves with a radius 100 feet or less.

- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

- B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- D. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.
- E. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.
- F. Plain Steel Wire: ASTM A 82, as drawn.
- G. Deformed-Steel Wire: ASTM A 496.
- H. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- I. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- J. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- K. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
- L. Zinc Repair Material: ASTM A 780.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:
 - a. Portland Cement: ASTM C 150, Type I or III, gray
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.
 1. Maximum Coarse-Aggregate Size: 1 inch nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

- F. Water/Moisture Control admixtures.
 - 1. Barrier One PIA admixture to be included in all concrete mixes at track events and other concrete surfaces to received track surface overlay.

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
 - 1. Products:
 - a. Axim Concrete Technologies; Cimfilm.
 - b. Burke by Edeco; BurkeFilm.
 - c. ChemMasters; Spray-Film.
 - d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film.
 - f. Euclid Chemical Company (The); Eucobar.
 - g. Kaufman Products, Inc.; Vapor Aid.
 - h. Lambert Corporation; Lambco Skin.
 - i. L&M Construction Chemicals, Inc.; E-Con.
 - j. MBT Protection and Repair, ChemRex Inc.; Confilm.
 - k. Meadows, W. R., Inc.; Sealtight Evapre.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
 - n. Sika Corporation, Inc.; SikaFilm.
 - o. Symons Corporation; Finishing Aid.
 - p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
 - 1. Products:
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. Burke by Edoko; Aqua Resin Cure.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
 - f. Euclid Chemical Company (The); Kurez DR VOX.
 - g. Kaufman Products, Inc.; Thinfilm 420.
 - h. Lambert Corporation; Aqua Kure-Clear.
 - i. L&M Construction Chemicals, Inc.; L&M Cure R.
 - j. Meadows, W. R., Inc.; 1100 Clear.
 - k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
 - l. Symons Corporation; Resi-Chem Clear.
 - m. Tamms Industries Inc.; Horncure WB 30.
 - n. Unitex; Hydro Cure 309.
 - o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Penetrating Anti-Spalling Sealer: Sealer shall be a siloxane-based compound which has a 92 percent chloride ion screen and a repellency factor of 92 percent when tested in accordance with NCHRP #244, Test Method. In addition, sealer-treated concrete must exhibit no scaling when exposed to 125 cycles of freezing and thawing. System shall conform to requirements with ASTM C957-81. Tests must be by an independent testing laboratory.
 - 1. Products: Subject to compliance with requirements, provide products by one of the following:
 - a. Euco-Guard Vox (VOC Compliant); Euclid Chemical Co.
 - b. Environseal; Hydrozo.
 - c. Saltguard WB; PROSOCO, Inc.
 - d. Aquapel Plus; L & M Construction Chemical Co.

2.7 DETECTABLE WARNING PLATES

- A. Cast Iron Detectable Warning Plates: Manufactured in accordance with the requirements set forth in the Americans with Disabilities Act (ADA). Tiles are to be designed to be cast in place. Cast Gray Iron materials to ASTM A-48, Class 30a Cast.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Neenah Foundry Company, Model R-4984-240LT, Qucik Connect
 - b. EJCO, Model Duralast Tactile Warning Plates
 - c. Reliance Foundry, Model R-4984-24Q Cast Iron Detectable Warning Plate

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): Refer to Concrete Schedule.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: Refer to Concrete Schedule.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture, high-range, water-reducing admixture, high-range, water-reducing and retarding admixture, plasticizing and retarding admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements as follows:
 - 1. Fly Ash or Pozzolan: 25 percent.

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete, unless otherwise noted: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.
 - 3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 - 2. Provide tie bars at sides of pavement strips where indicated.
 - 3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals not to exceed 50 feet or as noted on plans.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes to provide a "tooled and traced" or "window pane" appearance, unless otherwise noted. Eliminate groover marks on concrete surfaces.
 - 2. Sawed Joints: Do not saw cut joints.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

- E. Do not add water to concrete during delivery or at Project site.
- F. Do not add water to fresh concrete after testing.
- G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- I. Screed pavement surfaces with a straightedge and strike off.
- J. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- K. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- L. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
- M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.8 FORMWORK

- A. General: See section 033000 for formwork and finishing of vertical exposed surfaces. Final surfaces shall have a smooth rubbed finish.

3.9 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - 1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
- F. Apply anti-spalling sealer per Manufacturer's installation instructions and recommendations.

3.10 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 - 1. Elevation: 1/4 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/4 inch.
 - 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 - 5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
 - 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
 - 8. Joint Spacing: 3 inches.
 - 9.
 - 10. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 11. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

- a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
- 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
- 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
- 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
- 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
- 6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 13 73 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 1. Isolation and contraction joints within cement concrete pavement.
 2. Joints between cement concrete and asphalt pavement.

1.3 SUBMITTALS

- A. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- B. Quality Assurance/Control Submittals:
 1. Product Data: For each joint-sealant product indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.5 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
 2. When joint substrates are wet or covered with frost.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for A/E's approval must be accompanied by the Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

- A. Multicomponent Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated, provide one of the following:
 - 1. Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.
 - a. Products:
 - 1) Pecora Corporation; Urexpam NR-200.
 - 2) Sonneborn Building Products, Inc., Sonolastic SL2.
 - 3) Tremco Inc., Vullcem 245.
 - 4) Sika Corp., Sikaflex 2C SL.
- B. Single-Component Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.
 - 1. Products:
 - a. Sonneborn, Div. of ChemRex, Inc.; Sonolastic SL-1.
 - b. Pecora Corp.; NR-201 Urexpam.
 - c. Tremco Inc.; Vulkem 45.
 - d. Sika Corp.; Sikaflex ICSL.
- C. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
 - 1. Products:
 - a. CrafcO Inc.; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.
 - c. Sikasil-728 NS
- D. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
 - 1. Products:
 - a. CrafcO Inc.; RoadSaver Silicone SL.
 - b. Dow Corning Corporation; 890-SL.
 - c. Sikasil-728 SL
- E. Multicomponent Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.
 - 1. Products:
 - a. Meadows, W. R., Inc.; Sof-Seal.

2.4 HOT-APPLIED JOINT SEALANTS

- A. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.
 - 1. Products:
 - a. Koch Materials Company; Product No. 9005.
 - b. Koch Materials Company; Product No. 9030.
 - c. Meadows, W. R., Inc.; Sealtight Hi-Spec.

2.5 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.6 PRIMERS

- A. Primers: Product 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.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where 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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- 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 sealants from surfaces adjacent to joint.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.
 - G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.
- 3.4 CLEANING
- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.
- 3.5 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 and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 32 13 73

SECTION 32 92 00 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Seeding.
 - a. Turf Type Tall Fescue Lawn
 - 2. Lawn renovation.
 - 3. Erosion-control materials.
- B. Related Sections:
 - 1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling and for soil erosion and sedimentation control that may affect the Work of this Section.
 - 2. Division 31 Section "Earth Moving" for excavation, filling and backfilling, topsoil placement and finish grading.

1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Soil: Screened soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.
- E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- F. Topsoil: Plant growth medium cleaned of debris, roots, rocks, soil clumps, weeds and other non-soil contaminants prior placement.
- G. Lawn Maintenance: All materials and operations necessary to establish and maintain a healthy stand of turf following initial seeding operations. Including but not limited to, mowing, fertilization, watering and treatment for weeds, fungus and disease as needed. Maintenance remains responsibility of Contractor until Project closeout or a minimum of one full growing season.

1.4 SUBMITTALS

- A. Quality Assurance/Control Submittals:
 - 1. Product Data: For each type of product indicated.
 - 2. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 3. Qualification Data: For qualified landscape Installer.
 - 4. Product Certificates: For soil amendments and fertilizers from manufacturer.

5. Material Test Reports: For existing surface soil and imported topsoil.
6. Planting Schedule: Indicating anticipated planting dates for each type of planting.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.
 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
 1. Report suitability of topsoil for lawn growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.
- D. Seeds: Packages of seed shall bear official State or Federal stamps or certificates indicating type, quality, and content of seed packages. Deliver packages unopened. Do not open until observed by Architect/Engineer.
- E. Requirements of Regulatory Agencies: Comply with all Federal and State laws governing fertilizers.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.
- B. Bulk Materials
 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas on 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.

1.7 PROJECT CONDITIONS

- A. Contractor shall notify A/E, in writing, when Work on this Project has progressed sufficiently to commence work of seeding. Thereafter, seeding operations shall be conducted under favorable weather conditions during next season or seasons, which are normal for such work as determined by accepted practice in locality of Project. At option and on full responsibility of Contractor, seeding operations may be conducted under unseasonable conditions without additional compensation. Contractor is to provide in writing to the CM and AE a watering and maintenance schedule including a listing of water sources prior to conducting seeding operations out of season.

1.8 SCHEDULING

- A. Planting Restrictions: Plant during one of following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of seeding.

1. Turf Type Tall Fescue:
 - a. Spring Planting: May 1, beginning date.
 - b. Fall Planting: October 1, ending date.
 - c. Summer Planting: June 15 through September 1, when water is available. Submit maintenance schedule and water source in writing prior to seeding.
- 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.
- C. Irrigation: Do not begin seeding operations until some type irrigation system is in place and operating to provide uniform coverage of all areas to receive seed.

1.9 MAINTENANCE

- A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but not for less than the following periods:
 1. Seeded Lawns: 60 days after date of Contract Completion.
 - a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established at that time, continue maintenance during next planting season.

1.10 WARRANTY AND REPLACEMENT

- A. Warranty: Lawns shall be warranted for minimum duration of one full year, to include one full growing season after seeding, and shall be alive and in satisfactory growth at end of warranty period. Growing season is defined as beginning May 1 and ending October 1.
- B. Replacement: At end of warranty period, A/E upon written notice requesting such inspection, submitted by Contractor at least 10 days before anticipated date, will make observation. If lawns do not show a healthy, uniform stand of grass, those areas shall be reseeded as soon as conditions permit, but during spring or fall seeding periods.
- C. Architect/Engineer will observe seeded areas within one-year warranty. Seeded areas requiring replacement during warranty period shall be warranted one additional full year from date of reseeding.
- D. Owner's Responsibility: If an area of seeding during warranty and replacement period is found to be damaged or destroyed due to vandalism, malicious mischief, vehicle ruts and tracks, or acts of God such as flooding, storm debris, then Owner will have responsibility of replacing those lawn areas without cost or responsibility to Contractor.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: Seed of grass species as follows, with not less than 85 percent germination, not less than 98 percent pure seed, not more than 0.05 percent weed seed and 0.00 percent noxious weed seed:
 1. Turf Type Tall Fescue: Proportioned by weight as follows:
 - a. 90 percent Tall Fescue (*Festuca arundinacea*)
 - 1) Three Varieties (30/30/30 blend.)
 - b. 5 percent perennial rye grass (*Lolium perenne*)
 - c. 5 percent Kentucky bluegrass (*Poa pratensis*)

2.2 TOPSOIL

- A. Topsoil (Planting Soil): ASTM D 5268, pH range of 5.5 to 7, a minimum of 6 percent organic material content; screened to be free of stones 1 inch or larger in any dimension and other extraneous materials.

2.3 INORGANIC SOIL AMENDMENTS

- A. General: Use any of the following soil amendments as recommended by "topsoil analysis" to produce topsoil suitable for lawn growth.
 - 1. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - a. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
 - b. Provide lime in form of dolomitic limestone.
 - 2. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.
 - 3. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
 - 4. Aluminum Sulfate: Commercial grade, unadulterated.
 - 5. Perlite: Horticultural perlite, soil amendment grade.
 - 6. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.
 - 7. Sand: Clean, washed, natural or manufactured, free of toxic materials.
 - 8. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
 - 9. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.4 ORGANIC SOIL AMENDMENTS (DO NOT USE)

2.5 FERTILIZER

- A. Fertilizer: Commercial fertilizer shall be used for initial preparation and shall conform to applicable state fertilizer laws. Use of organic lawn fertilizer shall be used for surface application after grass is up. Fertilizer shall be uniform in composition, dry and free flowing, and shall be delivered to site in original, unopened containers, each bearing manufacturer's guaranteed analysis. Fertilizer, which becomes caked or otherwise damaged, making it unsuitable for use, will not be acceptable. Commercial-grade complete fertilizer of neutral character, consisting of fast and slow release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium.
 - 1. Fertile areas to receive Turf Type Tall Fescue.
 - 2. Do Not fertilize areas to receive Native Warm Season Grasses or Wet Meadow seeding.

2.6 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew, weed, and seed-free, threshed straw of wheat, rye, oats, or barley.
- B. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.7 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting 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.
- 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 and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect grade stakes set by others until directed to remove them.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 LAWN PREPARATION

- A. Apply fertilizer and soil amendments directly to spread topsoil per results of topsoil analysis.
 - 1. Thoroughly blend planting soil mix
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a three days.
 - b. Mix lime with dry soil before mixing fertilizer.
- B. Unchanged Subgrades (7 months or greater): If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - 1. Strip existing grass, vegetation, and turf. Do not mix into surface soil.
 - 2. Loosen surface soil to a depth of at least 6 inches.
 - 3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
 - 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
 - 5. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
 - a. Apply fertilizer and soil amendments directly to surface soil before loosening per results of topsoil analysis.
 - 6. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- C. Moistened prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface ponding to soak in before planting. Do not create muddy soil.
- D. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Lawn Preparation" Article.
- B. For erosion-control blanket or mesh, install as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- C. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

- A. Sow seed with billion seeding machine. Do not broadcast or drop seed. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 1. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 5 to 8 lb/1000 sq. ft.
- C. Roll lightly and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with erosion-control mats where shown, installed and anchored according to manufacturer's written instructions.
- F. Protect seeded areas by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

3.6 LAWN RENOVATION

- A. Renovate existing lawn.
- B. Renovate existing lawn damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
 - 1. Reestablish lawn where settlement or washouts occur or where minor regrading is required.
 - 2. Provide new topsoil as required.
- C. Strip sod and vegetation from diseased or unsatisfactory lawn areas; do not bury in soil.
- D. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.
- E. Mow, dethatch, core aerate, and rake existing lawn.
- F. Remove weeds before seeding. Where weeds are present, apply selective herbicides as required. Do not use pre-emergence herbicides.
- G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

- I. Apply soil amendments and initial fertilizers required for establishing new lawns and mix thoroughly into top 4 inches of existing soil. Provide new planting soil to fill low spots and meet finish grades.
- J. Apply seed and protect with straw mulch as required for new lawns.
- K. Water newly planted areas and keep moist until new lawn is established.

3.7 LAWN MAINTENANCE

- A. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation.
 - 1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
- B. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water lawn with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
 - 1. May – June Every 3-4 days
 - 2. July – Early August Every 5 days
 - 3. August – November Every 3-4 days
- D. Fertilization: Apply fertilizer after initial mowing and when grass is dry. Continue fertilization through maintenance period in accordance with following rates and schedule:

LAWN				
Date	Rate (lb. N/1000 ft ²)	Fertilizer Ratio (N-P-K)	Examples to Purchase	Nitrogen Source
May 1-10th	0.75	1-0-1	25 0-25 20-0-20	>50% soluble Nitrogen
June 1-10th	0.5	1-0-1	25-0-25 20-0-20	>50% soluble Nitrogen
July 1-6th	0.75	1-0-0	33-0-0 35-5-4	<35% soluble Nitrogen
September 5-10th	1	1-1-1	12-12-12 19-19-19	<35% soluble Nitrogen
November 5-15th	1	1-0-0	33-0-0 Sulfur coated urea	<35% soluble Nitrogen

3.8 SATISFACTORY LAWNS

- A. Lawn installations shall meet the following criteria as determined by Architect:
 - 1. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm)]

- B. Use specified materials to reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.
- C. Promptly remove soil and debris, created by lawn work, from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- D. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after lawn is established.
- E. Remove nondegradable erosion-control measures after grass establishment period.

3.9 FIELD QUALITY CONTROL

- A. Architect will make observation of the Work of lawns to determine completion of Contract work at conclusion of maintenance period, upon written notice requesting such observation submitted by Contractor at least 10 days prior to anticipated date. Architect will note condition of lawns and determine in writing whether maintenance shall continue.

END OF SECTION 32 92 00

SECTION 33 05 00 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes following:
 1. Piping joining materials.
 2. Transition fittings.
 3. Sleeves.
 4. Grout.
 5. Flowable Fill
 6. Piped utility demolition
 7. Piping system common requirements.

1.3 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- C. ABS: Acrylonitrile-butadiene-styrene plastic.
- D. CPVC: Chlorinated polyvinyl chloride plastic.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.

1.4 QUALITY ASSURANCE

- A. Comply with NSF 61, "Drinking Water Systems Components – Health Effects," for materials for potable water.
- B. Comply with NFPA 24, "Installation of Private Fire Service Mains and their Appurtenances," for materials, installation, tests, flushing and valve and hydrant supervision.
- C. Water main testing shall be performed in accordance with local agency jurisdiction. Pressure testing – comply with AWWA (American Water Works Association) guidelines.
- D. Utility Compliance: Comply with regulations pertaining to water distribution systems.
- E. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- F. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

- G. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

- A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of manufacturers specified.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed material requirements and functional qualities of specified product. Requests for A/E's approval must be accompanied by Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PIPING 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 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 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.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solvent Cements for Joining Plastic Piping:
 1. ABS Piping: ASTM D 2235.
 2. CPVC Piping: ASTM F 493.
 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 4. PVC to ABS Piping Transition: ASTM D 3138.

- E. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.3 TRANSITION FITTINGS

- A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. Transition Couplings NPS 1-1/2 and Smaller:
 - 1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
 - 2. Aboveground Piping: Specified piping system fitting.
- C. AWWA Transition Couplings NPS 2 and Larger:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of following:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.; DMD Div.
 - c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
- D. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of following:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities.
 - 2. Description: ASTM C 1173 with elastomeric sleeve ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.4 SLEEVES

- A. Mechanical sleeve seals for pipe penetrations are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.5 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.6 FLOWABLE FILL

- A. Description: Low-strength-concrete, flowable-slurry mix.
 - 1. Cement: ASTM C 150, Type I, portland.
 - 2. Density: 115- to 145-lb/cu. ft.
 - 3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
 - 4. Aggregates: ASTM C 33, natural sand, fine.
 - 5. Admixture: ASTM C 618, fly-ash mineral.
 - 6. Water: Comply with ASTM C 94/C 94M.
 - 7. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

- A. Refer to Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING INSTALLATION

- A. Install piping according to following requirements and Division 33 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.

- I. Sleeves are not required for core-drilled holes.
- J. Permanent sleeves are not required for holes formed by removable PE sleeves.
- K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas **[2 inches]** <Insert dimension> above finished floor level.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - a. **PVC Pipe Sleeves:** For pipes smaller than NPS 6.
- L. Verify final equipment locations for roughing-in.
- M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to following requirements and Division 33 Sections specifying piping systems.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- D. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- E. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- F. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End PE Pipe and Fittings: Use butt fusion.
 - 2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

3.4 PIPING CONNECTIONS

- A. Make connections according to following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.5 GROUTING

- A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.

- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 33 05 00

SECTION 33 05 10 - UTILITIES SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: General utility services, including but not limited to the following:
 - 1. Storm sewer pipe and tube.
 - 2. Concrete structures.
 - 3. Drainage castings.
 - 4. Water main piping.
 - 5. Catch basins.
 - 6. Inlets.
 - 7. Field verification.
- B. Related Sections:
 - 1. Division 31 Section "Site Clearing".
 - 2. Division 31 Section "Earth Moving".
 - 3. Division 33 Section "Common Work Results for Utilities".

1.3 DEFINITIONS

- A. The term utilities as hereinafter stated or indicated is that part of the storm, sanitary, and water system beginning 5 feet from the outer face of the outside building wall, and conveying it to the local utility mains or other disposal terminals. Exceptions from the 5 foot dimension are extensions of the building drains and gas piping including the meter and regulator.
- B. Site water lead/main includes, but is not limited to, the following:
 - 1. Providing water lead/main piping and fittings, special connections and related materials and labor adjunct to the completion of the site water main.
- C. Site drainage work includes, but is not limited to, the following:
 - 1. Providing stormwater drainage pipe and fittings outside the buildings, new stormwater manholes, catch basins, perforated plastic underdrain systems, and related materials and labor adjunct to the completion of site drainage work.
 - 2. The Contractor for the Work under this Section will be responsible for installing or constructing special sewer structures that are a part of the storm drainage system.

1.4 SUBMITTALS

- A. Shop Drawings: For the following:
 - 1. Manholes: Include plans, elevations, sections, details, and frames and covers.
 - 2. Catch Basins and Stormwater Inlets: Include plans, elevations, sections, details, and frames, covers, and grates.
- B. Quality Assurance/Control Submittals
 - 1. Product Data: For each material specified herein.
 - a. Special pipe fittings.
 - b. Backwater valves.
 - 2. Field Quality Control Test Reports: From Contractor.

1.5 QUALITY ASSURANCE

- A. Environmental Agency Compliance: Comply with regulations pertaining to water sanitary sewerage and storm drainage systems.
- B. Utility Compliance: Comply with local regulations pertaining to the site work. Include all costs in bid associated with the utilities installation.
- C. Unless otherwise instructed, Work is to be observed by the Architect/Engineer; and tests and observation work are to meet his approval at each stage before backfilling. When public authorities require observation and approval by, or supervision of, the Work is required, comply with their requirements. Re-excavate any Work covered before observation and approval at no additional cost to Owner.
- D. Install pipe and fittings in strict accordance with best, acceptable practice to insure proper functioning, freedom from trouble, and neatness of appearance.
- E. Provide proper fittings for the installation of, and connection to, sewer lines. Where an underground branch connection is required, provide a "Y" branch and 30 degree curve type fitting. Connections made by cutting holes in pipe will not be permitted.
- F. Prior to final observation flush sewers with water in sufficient volume to obtain free flow through each line. Remove all obstructions and correct defects discovered.
- G. Verify connection requirements with the utility owners.
- H. Preinstallation Meeting: Conduct meeting at project site to comply with requirements in Division 01 Section "Project Management and Coordination". A/E will schedule and conduct meeting.
 - 1. Before excavation begins, review and coordinate documents with related disciplines, including governmental and utility. Review local, state and federal guidelines and utility requirements. Require representatives, including the following, of each entity directly concerned with utility services, to attend meeting:
 - a. Contractor's superintendent
 - b. Local utility representative
 - c. A/E's representative
 - 2. Send written notification of the meeting to each entity at least 7 day's in advance stating date, time, and location.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.

1.7 PROJECT CONDITIONS

- A. Existing Sewers or Drain Lines
 - 1. When existing sewers are encountered, whether indicated on the Drawings or not, make adequate provisions for diverting the flow of such existing sewers so that the excavation will be kept dry during the progress of construction. Reroute such existing sewers as required to maintain proper functioning. Before completion of the construction work, restore the existing sewers as called for on the Drawings, or otherwise provide with an adequate outlet, as directed by the Architect/Engineer. Under no conditions abandon or plug an underground line until sufficient tests have been made to indicate that it is not a functioning line, and then only when so directed by the Architect/Engineer in writing.
 - 2. Reconnect existing drain lines which are to remain in service and which would otherwise be cut off and blocked by new Work.

3. Interruption of Existing Storm Drainage 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 service according to the following requirements:
 - a. Notify Owner no fewer than two days in advance of proposed interruption of service.
 - b. Do not proceed with interruption of service without Owner's written permission.

- B. Public Rights-Of-Way: Construct sewers to be installed in public rights-of-way, including rights-of-way that are to be dedicated to public use, in strict accordance with standards and methods established by the public authority having jurisdiction over same, and requirements of their specifications shall be complied with. Install other Work occurring on the Owner's property or adjacent property within contract limits in accordance with the requirements of this Section.

- C. Relationship to Water Lines
 1. Sewer lines that cross over or under water lines and do not have an 18-inch vertical separation between pipes, must be water grade ductile iron with mechanical joints. The ductile pipe shall comply with ANSI/AWWA C104/A21.4, joints to comply with ANSI/AWWA C111/A21.11. Pipe and fittings to be Class 51. This material is to extend 10 feet on each side of the water line.
 2. Where it is necessary to lay sewer pipes adjacent to existing water lines, where the flow line of the sewer pipe is above or level with the water lines, and the distance between them is less than 10 feet, construct the sewer line of extra heavy cast iron, water seal and test, and relocate the water line, as directed by the Architect/Engineer.
 3. Sewer lines are to have the right-of-way over underground water lines.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Storm Sewer Pipe and Tubing
 1. Supply piping and fittings as required to complete the Work.
 2. Where indicated, piping shall be ductile-iron, Schedule 150, with ductile-iron mechanical joints. Pipe and fittings shall be according to ANSI/ASTM C151/A21.51.
 3. Provide reinforced concrete pipe (RCP) conforming to latest ASTM C76 Class III specifications with rubber gaskets (ASTM C443) for pipe sizes 12 inch diameter and larger.
 4. Provide polyvinylchloride (PVC) pipe, SDR 35 (ASTM D3034), for pipe sizes smaller than 12 inch diameter.
 5. Bushings, reducers, and couplings shall be PVC conforming to requirements of ASTM C-594-70.
 6. Where indicated, provide corrugated metal pipe culvert, helically corrugated 14 gauge steel, with aluminized Type 2 coating. Conform to AASHTO Spec. M-274-791. Corrugations shall be 2-2/3 by 1/2 inch. Provide prefabricated metal end sections for both, corrugated metal and reinforced concrete pipe.
 7. Where "HDPE" is indicated, provide pipe meeting AASHTO M252 Type S or AASHTO M294 Type S High density polyethylene pipe.
 8. Underdrains in gravel areas, playground "soft-surface areas," and berm drains shall be perforated, filter wrapped plastic tubing, 4 to 6 inches in diameter. Berm drains shall be 6-inch diameter.
 9. Fittings shall be supplied as required to complete the Work. Fittings produced by manufacturers other than the supplier of the pipe shall not be permitted.
 10. Provide a manufacturers certification for all storm sewer piping prior to any storm sewer trench excavation.
 11. Exposed piping from downspout shall be hub type cast iron.

- B. Concrete Structures
 1. Manholes and catch basins may be constructed with components of precast concrete.

- C. Drainage Castings
 1. Castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion, or other defects. Castings shall be smooth and well cleaned by shot blasting and shall be coated with coal tar epoxy (SSPC Paint 16).
 2. Castings shall be equal to those as manufactured by Neenah Foundry Company, Neenah, Wisconsin; East Jordon Iron Works, East Jordan, Michigan; or Zurn, Sanford, North Carolina.
 3. Furnish only the following castings for installation under Division 03 Section "Cast-In-Place Concrete".

- D. Water Lead/Main Pipingedit
 1. Piping 3 inches or larger shall be C900 with cement mortar lining complying with ANSI/AWWA C104/A21.4. Fittings shall be ductile iron mechanical joint or push-on type according to ANSI/AWWA C111/A21.11. Fittings shall be Class 51. Provide 8-mil polyethylene tube encasement around pipe per ANSI/AWWA – C105/A21.5
 2. Piping 2 inches or smaller shall be Type K copper according to ASTM B88-96. Cast fittings shall meet the requirements of ASTM B61 or ASTM B62.
 3. The fire protection lines are to be tested to 200 psi and meet all current NFPA requirements.
 4. Install water as per NFPA requirements.

2.2 STORM DRAINAGE STRUCTURES

- A. Unless otherwise approved by the Architect/Engineer or called for on the Drawings, structures shall be precast concrete made up of vertical sections of appropriate length and diameter to meet drawing requirements. The precast sections shall be reinforced with steel, in accordance with ASTM C478 standards, with tongue and groove joints.

- B. The top section shall be flat or tapered to the size required to make a proper base for the cover and frame called for (see plan for type required). The bottom section shall have openings cast therein to receive sewer lines that are to be connected thereto. In the event that a sewer line empties into the manhole at an elevation above the first section, it shall have an opening cast therein to receive such lines.

- C. The manufacturer shall cast openings in the sections of the manholes to receive standard rungs of proper design to permit access to the structure without the use of a ladder. Openings for these rungs shall be located in such a way that they will permit the installation of the rungs in a straight, vertical line. The manufacturer shall furnish shop drawings showing the location and size of openings to receive sewer lines, the location of the holes for the access rungs in relation to the openings, the height of the special section, if and when required, to achieve the necessary elevation for the manhole cover and frame, and the contour of the tapered section required to fit the frame called for.

- D. All structures shall be provided with size and shape to receive all pipe shown on the Drawings and maintain structure integrity.

- E. All pipe connections to the structure shall be ground both inside and outside of the structure.

PART 3 - EXECUTION

3.1 FIELD VERIFICATION

- A. The term field verify or similar as related to the utilities shall be defined as a complete exposure of the pipe, manhole or other utility related item. Take field survey measurements to determine the top and invert elevations. Determine the existing material type and/or all other related field features.

- B. The Contractor shall locate and expose the existing utility line prior to commencing the general trench excavation for the installation of the new utility lines.

- C. The Contractor shall report to the Architect and Construction Manager the existing depth, size, material type, and invert elevation of the utility line.
- D. The information determined in the field shall be coordinated with the new utility lines prior to commencing with the general trench excavation.
- E. The Architect shall use the additional information obtained in the field and verify the compatibility of the existing utility with the new utility.
- F. In the event the existing utility is compatible with the new utility no adjustments to the Drawing will be made.
- G. In the event the existing utility is not compatible with the new utility, adjustments to the Drawing or contract will be made in accordance with the General Conditions.

3.2 LAYOUT

- A. The Work under this Section shall include the making of a complete layout on the site of storm sewer lines indicating the location of sewer structures, in accordance with the design drawings. Carefully check this layout against the finished grades and other improvements called for on the Drawings. Call conflict or deviation from drawing requirements to the Architect's attention for instructions before proceeding with the Work. Perform layout in cooperation with other Contractors in establishing the exact routing, crossings, and points of connection with the Work of other Contractors.
- B. Verify the location, as close as possible, of existing and new utilities prior to excavation. Exercise the utmost care to avoid contact and injury to electrical underground cables and underground utilities. Proper protection of said services must be maintained.
- C. Sizes indicated on accompanying Drawings and as specified refer to nominal inside diameter of the pipe, unless otherwise indicated.

3.3 GENERAL PIPE AND STRUCTURE INSTALLATION

- A. Excavating, trenching, backfilling, grading, and related work shall follow the Specifications as outlined in Division 31 Section "Earth Moving" and as hereinafter noted.
- B. Exercise care in trenching, preparation of the bedding, and installation of the piping materials so that the pipe will be held in a straight line, conforming to the gradients called for on the Drawings.
- C. Make sure pipe is properly mated and sealed as it is installed.
- D. Maintain a dry trench to avoid sediment entry into the system and to achieve a firm and secure bed. Protect joint work as the Work progresses. When required, perform piping and bailing to meet this requirement.
- E. Place a properly designed stopper in the open end of each pipeline when work is not in progress. Where "Y" branches are installed, locate as close as possible to the points shown on the Drawings. Place secure, temporary caps or plugs in branch openings, pending the installation of branch sewers.
- F. Where dissimilar pipe is to be connected, install PVC bushings, reducers, or couplings and secure in place with stainless steel bands. Perform installation in accordance with manufacturer's instructions.
- G. Exercise care in placing sections of the manhole so as to achieve proper alignment of the holes prepared to receive the manhole rungs.

- H. After the manhole has been properly constructed, grout the rungs into the openings provided, so as to achieve a permanent and substantial attachment to the manhole.
- I. Make sure that the ends of sewer lines and fittings, which connect into sewer structures, are properly positioned and held in position at the proper elevation and location, so the connections may be constructed as called for on Drawings or in accordance with best trade practice.
- J. Where pipe is introduced into manholes or sewer structures after it has been constructed, use methods and take all precautions necessary to insure a watertight, permanent connection. Use a hot poured bituminous compound at such points of connection.
- K. Sewer pipe terminating in manholes or sewer structures, installed before such structure is built, shall be completely coated with a uniform layer of hot mix bituminous compound just prior to the construction of the structure and its base, so that a watertight connection will be achieved.
- L. Wherever sanitary manholes have inlets with the invert 2 feet or more above the flow line of the outlet base of effluent invert, provide a drop pipe and fittings from the top flow grade to empty onto the floor of the manhole. Encase the drop pipe and fittings in concrete, bonded to the exterior of the manhole and extending from the manhole base, so as to completely encase the drop line and fittings. Provide necessary opening at the bottom of the manhole to permit the incoming water to flow to the outlet. Provide a flow channel from the opening in the manhole connected to the outlet channel. Provide additional width of concrete base to support the drop pipe and enclose.
- M. Install gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements.
- N. Verify the location of existing and new utilities prior to excavation. Exercise the utmost care to avoid contact or injury to electrical underground cables and underground utilities. Proper protection of said services must be maintained.
- O. When tying in new sewer lines which are required to take the place of existing sewer lines, maintain service and make the new tie-in in such a way that there will be no interruption of service through existing sewage lines.
- P. When existing sewers are encountered, whether indicated on the Drawings or not, make adequate provisions for diverting the flow of such existing sewers so that the excavation will be kept dry during the progress of construction. Reroute such existing sewers as required to maintain proper functioning. Before completion of the construction work, restore the existing sewers as called for on the Drawings or otherwise provide with an adequate outlet, as directed by the Architect. Under no conditions abandon or plug an underground line before making sufficient tests to indicate that it is not a functioning line, and then only when directed by the Architect/Engineer in writing.
- Q. Install sewers so that infiltration of ground water in any section of the line will not exceed a rate of 100 gallons per inch of pipe diameter per lineal mile of sewer line in 24 hours. Wherever, in the opinion of the Architect/Engineer, the flow in line or section thereof indicates that such rates of infiltration may be exceeded, furnish the necessary equipment and conduct a test by a method acceptable to the Architect/Engineer to prove that the requirements of this subsection have been complied with. Conduct such test in the presence of the Architect/Engineer or his representative. In the event that the test reveals that the infiltration limit specified herein has been exceeded, make such repairs as are necessary to bring the sewer line up to the specification requirements.

- R. When the storm sewer system is complete, and except at the building connection where care must be exercised to achieve a uniform grade and straight alignment, make a light test by flashing a light from manhole to manhole or from the manhole to the cleanout connection. Where a cleanout connection is used, use an appropriate mirror for this test. If the view through the pipe does not show a vertical axis on full pipe diameter and a horizontal axis on at least 3/4 of the pipe diameter, remove and relay the pipe as necessary to meet these requirements. Conduct the light test in the presence of the Architect/Engineer or his representative.
 - 1. The light test is the responsibility of the Contractor including all items required and scheduling the test.
- S. The Contractor under the supervision of the governing agency shall test all PVC and other flexible pipe used for sanitary sewers for deflection. Tests shall not be conducted until at least 60 days after final full backfill has been placed. Maximum allowable deflection shall be 5%. If test is to be accomplished by pulling a mandrel through the pipe, no mechanical equipment shall be used to assist. Sewers that fail this test shall be relayed and re-tested to meet this requirement.
- T. All sanitary sewer manholes shall be vacuum tested using the following procedures from ASTM C-1244: All lift holes shall be plugged. All pipes entering the manhole shall be temporarily plugged taking care to securely brace the pipes and plugs to prevent them being drawn into the manhole. The testing equipment shall be placed in the casting to allow the joint between the casting and manhole to be tested. A vacuum of 10" of mercury shall be drawn on the manhole. The valve on the vacuum line of the test head closed and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9" of mercury. The manhole shall pass the test if the time for the vacuum reading to drop from 10" of mercury to 9" of mercury is greater than one minute. If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall be re-tested until a satisfactory test is obtained.

3.4 REINFORCED CONCRETE PIPE INSTALLATION

- A. Buried concrete pipe shall rest on a firm bearing, undisturbed earth surface along the entire length of the pipe. Bell or grooved ends shall lay upgrade in a hollowed out bed.
- B. Follow manufacturer's recommendations in joining sections of pipe and fittings. Concrete pipe joints shall be sealed with flexible watertight rubber gaskets conforming to ASTM C443 standards.
- C. Make line or grade changes and junction with a proper fitting.

3.5 PVC PIPE INSTALLATION

- A. Buried PVC pipe shall rest on a firm bearing, bedding material along the entire length of the pipe. Bell or grooved ends shall lay upgrade in a hollowed out bed.
- B. Follow manufacturer's recommendations in joining sections of pipe and fittings. PVC joints shall be sealed with flexible, watertight rubber gaskets conforming to ASTM C3212 standards.
- C. Line or grade changes and junction shall be made with a proper fitting.
- D. Contractor must strictly adhere to Uni-Bell UNI-B-5, recommended practice, except that natural compaction is not allowed for the installation of polyvinyl chloride (PVC) pipe. (Water main and force main piping)

3.6 PERFORATED UNDERDRAIN TUBING AND FRENCH DRAIN INSTALLATION

- A. Install drainage pipe pitched down in direction of flow, at a minimum slope of 0.5 percent, unless otherwise indicated.
- B. Provide ell's at 90-degree turns, adapters, tees, and transitions as noted or required. Cap laterals at open-end terminals.

3.7 HIGH DENSITY POLYETHYLENE PIPE INSTALLATION

- A. Install high-density polyethylene pipe in strict accordance with manufacturer's recommendations.

3.8 INLET INSTALLATION

- A. The concrete base shall not be less than 4 inches thick, reinforced. The base shall sit on a minimum 1-1/2 inch thick sand cushion placed over an undisturbed or thoroughly compacted earth excavation. Carefully establish the entire height of the unit so as to meet the top elevation of the inlet lid and as denoted on the Drawings.
- B. Set the inlet level to meet elevations as denoted on the Drawings.

3.9 CATCH BASIN INSTALLATION

- A. The concrete base shall not be less than 6 inches thick, reinforced as denoted, and shall extend a minimum of 4 inches beyond the exterior wall of the barrel. The base shall sit on a minimum 1-1/2 inch thick sand cushion placed over an undisturbed or thoroughly compacted earth excavation. Carefully establish the entire height of the unit so as to meet the top elevation of the catch basin lid and as denoted on the Drawings.
- B. Set the barrel section on the base with a heavy consistency of approved bituminous material so as to provide watertight connections.
- C. Grout the top section cover pad to sit level and to meet grade elevations as denoted on the Drawings.

3.10 MANHOLE/MANHOLE - INLET INSTALLATION

- A. Verify the location of utilities prior to excavation. After properly preparing the excavation, cast the concrete base for each manhole or structure in accordance with the following:
 - 1. The concrete used shall be of 2500-pound strength as specified in Division 3, Concrete Work. It shall be reinforced with welded wire road mesh not less than 6 by 6-6/6. The concrete base shall be not less than 6 inches thick and extend a minimum of 4 inches beyond the exterior walls of the structure. The height of the base thus prepared shall be carefully established so as to meet the invert elevation requirements of the manholes.
 - 2. After the base has sufficiently set, place the first section of the manhole with the grooved side up. Coat the inside of the manhole for a distance of approximately 6 inches above the base with a heavy consistency of approved bituminous material, so as to provide a watertight connection between the precast manhole and the sewer floor.
 - 3. After the first section has been properly placed and oriented, pour the floor of the manhole, using concrete similar to the quality called for above. The manhole floor shall be not less than 4 inches thick or greater, if the size of the sewers entering same so requires, in order to permit formation of the flow channels hereinafter specified, and so as to maintain not less than 2 inches of concrete below the bottom of flow channels. Form flow channels in the floor of the manhole and locate so as to conform to the sewer lines entering and leaving same. Smoothly finish such flow channels and provide semi-circular section, conforming to the inside diameter of the connecting sewers. The depth of such flow channels shall be approximately 75 percent of the inside diameter of the sewers they connect. Make changes in size or grade gradually. Where changes of direction are required, work them out to form true curves. Provide such channels for connection sewers in each manhole.
 - 4. Continue setting the subsequent sections, using a heavy consistency of asphalt cement at each joint. The channel or groove in the bottom section is to be completely filled with this cement and the tongue of the section above is to be placed in such a way that a watertight connection will be achieved.

5. As the top section of the structure is prepared for setting, carefully check the top elevation and if it fails to conform to the required elevation, it is to be adjusted as may be necessary and approved by the Architect/Engineer so that the finished grade of the manhole frame and cover will occur at the correct elevation, as called for on the Drawings, and to meet job requirements.

3.11 DRAINAGE CASTINGS INSTALLATION

- A. After concrete subbase is prepared, accurately set castings in position with top surfaces, coinciding with proposed elevations of concrete slabs and connect as required to storm sewer.
- B. Backfill around castings to previous elevation of prepared subbase and compact to same density of remaining prepared subbase.

3.12 DOMESTIC WATER MAIN

- A. All water mains shall be pressure tested and disinfected in accordance with ANSI/AWWA C600-93 and C651-92 standards and local jurisdictions requirements for cleaning, testing, and disinfecting of the water main piping.
- B. Install ductile iron piping in a manner similar to that of cast iron soil pipe, except that joints as fittings shall be mechanical joints, with installation as recommended by the manufacturer.
- C. Deflections from a straight line or grade, as required by vertical or horizontal curves or offsets, shall not exceed 6/D inches per foot of pipe where "D" represents the nominal pipe diameter expressed in inches with deflections measured between the extended center lines of any two connecting lengths of pipe. For alignment in excess of above, shorter lengths or fittings shall be employed.
- D. Firmly anchor fittings at bends with concrete thrust blocks and suitably rod to adjacent connecting lines to prevent fittings from being blown off the lines when under service. Provide anchors and yokes at fittings exceeding a turn equivalent to a 1/16 bend.
- E. Clamps shall be of the type approved by the National Board of Fire Underwriters. Clamps, rods, washers, and nuts shall be coated with bitumastic coating.
- F. Coat exposed threads after nuts are tightened. Tighten bolts to a torque range as follows: 5/8-inch bolt, 40-60 ft.lbs. with 8 inch wrench; 3/4 inch bolt, 60-90 ft.lbs. with 10- inch wrench; 1 inch bolt, 70-100 ft.lbs. with 12 inch wrench, and 1-1/4 inch bolt, 90-120 ft.lbs. with 14 inch wrench. Tighten in a manner so that the gland is brought up toward the pipe flange evenly.
- G. Where water mains cross sewers, install the water main above the sewer whenever possible. Provide one full length of water main centered over the sewer so that both joints will be as far from the sewer as possible. Lay water mains with a cover of not less than 5'-0" from top of pipe to finish grade.
- H. Use a permanently pliable waterproof material. Special wall sleeve fittings with soft rubber seals are approved. Provide a swing joint on water lines just outside the building to compensate for pipe movement. Anchor lines entering the building to keep fittings from sliding off.
- I. Follow piping installation procedures as outlined by the piping manufacturer shall be followed. The Contractor shall be responsible for one year of tightness of joints made by him.

END OF SECTION 33 05 10

SECTION 33 46 00 - SUBDRAINAGE

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 subdrainage systems for the following:
 - 1. Landscaped areas.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for downspout boots.
 - 2. Division 33 Section "Utility Services" for downspout boots.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. HDPE: High-density polyethylene plastic.
- C. PE: Polyethylene plastic.
- D. PP: Polypropylene plastic.
- E. PS: Polystyrene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. Subdrainage: Drainage system that collects and removes subsurface or seepage water.

1.4 SUBMITTALS

- A. Quality Assurance/Control Submittals:
 - 1. Product Data: For the following:
 - a. Perforated-wall pipe and fittings.
 - b. Solid-wall pipe and fittings.
 - c. Geotextile filter fabrics.
- B. Approval of waterproofing manufacturer's service agent for use of drainage panels against and for waterproofing membrane protection.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, tube, fitting, and joining materials.

2.2 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings:
 - 1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
 - 2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.

3. Couplings: Manufacturer's standard, band type.

B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.3 SOLID-WALL PIPES AND FITTINGS

A. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.

1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.

B. PE Pipe and Fittings: AASHTO M 294, Type S, corrugated, with smooth waterway, for coupled joints.

1. Couplings: AASHTO M 294, corrugated, band type, matching tubing and fittings.

C. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.

1. Gaskets: ASTM F 477, elastomeric seal.

2.4 SPECIAL 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.

1. Sleeve Materials:

a. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

b. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant metal tension band and tightening mechanism on each end.

3. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant metal tension band and tightening mechanism on each end.

2.5 CLEANOUTS

A. Cast-Iron Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.

B. Copper-Alloy Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing with clamping device; and scoriated, Light-Duty Loading class, copper-alloy cover. Include countersunk, brass cleanout plug.

C. PVC Cleanouts: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.

2.6 SOIL MATERIALS

A. Backfill, impervious fill, and satisfactory soil materials are specified in Division 31 Section "Earth Moving."

B. Drainage Fill: 1/2 to 3/4 inch open graded washed gravel.

2.7 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

1. Structure Type: Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament.

2. Style(s): Flat and sock.

- B. Weed Control Barrier; Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric 4.8 oz./sq.yd.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.3 PIPING APPLICATIONS

- A. Underground Subdrainage Piping; provide one of the following:
 - 1. Perforated PE pipe and fittings, couplings, and coupled joints.
 - 2. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.
- B. Header Piping:
 - 1. ABS pipe and fittings, **gasketed** joints.
 - 2. Cast-iron soil pipe and fittings, **Service** class; gaskets; and gasketed joints.
 - 3. PE drainage tubing and fittings, couplings, and coupled joints.
 - 4. PVC sewer pipe and fittings, couplings, and coupled joints.

3.4 CLEANOUT APPLICATIONS

- A. In Underground Subdrainage Piping:
 - 1. At Grade in Earth: PVC cleanouts, unless otherwise noted.
 - a. Provide cast-iron cleanouts, where indicated.
 - 2. At Grade in Paved Areas: Cast-iron cleanouts.

3.5 LANDSCAPING DRAINAGE INSTALLATION

- A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.
- E. Add drainage course to top of drainage conduits.
- F. After satisfactory testing, cover drainage conduit to within 12 inches of finish grade.
- G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.
- I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.6 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - 1. Mechanical Yard and Playground Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent.
 - 2. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.
 - 3. Lay perforated pipe with perforations down.
 - 4. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install PE piping according to ASTM D 2321.
- D. Install PVC piping according to ASTM D 2321.

3.7 PIPE JOINT CONSTRUCTION

- A. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."
- B. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.
- C. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.
- D. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.
- E. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.8 CLEANOUT INSTALLATION

- A. Cleanouts for Foundation, Retaining-Wall, Landscaping and Playground Subdrainage:
 - 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in nonvehicular-traffic areas.
 - 3. In nonvehicular-traffic areas, use NPS 4 cast-iron or PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches in depth. Set top of cleanout plug 1 inch above grade.

- B. Cleanouts for Underslab Subdrainage:
 - 1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

3.10 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping.
 - 1. Install PE warning tape or detectable warning tape over ferrous piping.
 - 2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 FIELD QUALITY CONTROL

- A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- B. Drain piping will be considered defective if it does not pass test and inspections.
- C. Prepare test and inspection reports.

3.12 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 46 00