

# PROJECT MANUAL

*Construct Six New Cabins  
Echo Bluff State Park  
Eminence, Missouri*

Designed By: Farnsworth Group  
20 Allen Avenue, Suite 200  
St. Louis, MO 63119

Date Issued: March 2, 2023

Project No.: X2208-01

STATE *of* MISSOURI

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OFFICE *of* ADMINISTRATION  
Facilities Management, Design & Construction

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**SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS**

**PROJECT NUMBER:** (#X2208-01) Construct Six New Cabins  
Echo Bluff State Park  
Eminence, MO

**THE FOLLOWING DESIGN PROFESSIONALS HAVE SIGNED AND SEALED THE ORIGINAL PLANS AND SPECIFICATIONS FOR THIS PROJECT, WHICH ARE ON FILE WITH THE DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION:**

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

1. Farnsworth Group, Inc.
2. Missouri State Certificate of Authority 000744. Architecture
3. Nicholas Bruner
4. License # 2018007676
5. Responsible for Divisions 01-10 Sections except where indicated as prepared by other design professionals of record.



Expiration Date:12-31-2024

B. Structural Engineer

1. Farnsworth Group, Inc.
2. Missouri State Certificate of Authority 001321. Engineering.
3. Paige Hefner
4. License # 2008019728

Responsible for Division 03, 05,06 as applicable to Structural Engineering



Expiration Date: 12-31-2024

C. Civil Engineer

1. Farnsworth Group, Inc.
2. Missouri State Certificate of Authority 001321. Engineering.
3. Kevin Hannel
4. License # 2008028535

Responsible for Division 02, 04, 33 as applicable to Civil Engineering



Expiration Date: 12-31-2024

D. Mechanical, Plumbing, and Fire Protection Engineer:

1. Farnsworth Group, Inc.
2. Missouri State Certificate of Authority 001321. Engineering.
3. Daniel A. Hose
4. License # 2006033969
5. Responsible for Division 21, 22 and 33 as applicable to Mechanical and Plumbing.



Expiration Date: 12-31-2024

E. Electrical Engineer:

1. Farnsworth Group, Inc.
2. Missouri State Certificate of Authority 001321. Engineering.
3. Daniel Molloy
4. License # 24565
5. Responsible for Division 26, 28 as applicable to Electrical.



Expiration Date: 12-31-2023

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### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section provides a comprehensive list of the drawings that comprise the Bid Documents for this project.

### PART 2 - PRODUCTS (NOT APPLICABLE)

### PART 3 - EXECUTION

#### 3.1 LIST OF DRAWINGS

- A. The following list of drawings is a part of the Bid Documents:

<u>SHEET #</u>	<u>TITLE</u>	<u>DATE</u>
<b><u>GENERAL</u></b>		
G-001	COVER	03/02/2023
G-002	SHEET LIST, SYMBOLS AND ABBREVIATIONS	03/02/2023
G-003	TWO BEDROOM CABIN LIFE SAFETY	03/02/2023
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<b><u>CIVIL</u></b>		
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C-101	EXISTING CONDITIONS & DEMOLITION PLAN	03/02/2023
C-102	LAYOUT PLAN	03/02/2023
C-103	HARDSCAPE PLAN	03/02/2023
C-104	GRADING AND EROSION CONTROL PLAN	03/02/2023
C-105	UTILITY PLAN	03/02/2023
C-301	SANITARY SEWER PROFILE	03/02/2023
C-501	CIVIL DETAILS	03/02/2023

C-502	CIVIL DETAILS	03/02/2023
C-503	CIVIL DETAILS	03/02/2023
C-504	CIVIL DETAILS	03/02/2023

**LANDSCAPE ARCHITECTURE**

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**STRUCTURAL**

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S-102	FOUR BEDROOM CABIN FOUNDATION PLAN	03/02/2023
S-103	TWO BEDROOM FLOOR AND ROOF FRAMING PLANS	03/02/2023
S-104	FOUR BEDROOM CABIN FLOOR FRAMING PLAN	03/02/2023
S-105	FOUR BEDROOM CABIN ROOF FRAMING PLAN	03/02/2023
S-601	FOUNDATION DETAILS	03/02/2023
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**ARCHITECTURAL**

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A-104	FOUR BEDROOM CABIN ROOF PLAN	03/02/2023
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A-203	FOUR BEDROOM CABIN BUILDING ELEVATIONS	03/02/2023
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A-302	FOUR BEDROOM CABIN BUILDING SECTIONS	03/02/2023
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A-403	FOUR BEDROOM CABIN ENLARGED PLANS AND ELEVATIONS	03/02/2023
A-404	FOUR BEDROOM CABIN ENLARGED PLANS AND DETAILS	03/02/2023
A-501	GENERAL DETAILS	03/02/2023
A-502	GENERAL DETAILS	03/02/2023
A-503	GENERAL STAIR DETAILS	03/02/2023
A-504	GENERAL CASEWORK DETAILS	03/02/2023
A-601	GENERAL CABIN SCHEDULES AND DIAGRAMS	03/02/2023
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P-602	DIAGRAMS	03/02/2023
P-603	SCHEDULES	03/02/2023

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**END OF SECTION 000115**

## SECTION 001116 - INVITATION FOR BID

### 1.0 OWNER:

- A. The State of Missouri  
Office of Administration,  
Division of Facilities Management, Design and Construction  
Jefferson City, Missouri

### 2.0 PROJECT TITLE AND NUMBER:

- A. Construct Six New Cabins  
Echo Bluff State Park  
Eminence, Missouri  
**Project No.: X2208-01**

### 3.0 BIDS WILL BE RECEIVED:

- A. Until: 1:30 PM, Thursday, May 11, 2023
- B. **Only electronic bids on MissouriBUYS shall be accepted: <https://missouribuys.mo.gov>. Bidder must be registered to bid.**

### 4.0 DESCRIPTION:

- A. Scope: The project includes the construction of six new cabins (two four-bedroom cabins and four two-bedroom cabins) at Echo Bluff State Park and modify the original site plan for the day use area to accommodate the cabins. The cabins should be similar in layout and style to the existing cabins and will be located in vacant green space near the historic lodge. The design shall include accompanying parking and sidewalk connections necessary to comply with current code and ADA requirements and to accommodate park needs. The scope shall also include the existing water and waste water services in comparison to the water requirements and loadings for the added cabins and evaluate the electrical supply system needs.
- B. MBE/WBE/SDVE Goals: MBE 10%, WBE 10%, and SDVE 3%. **NOTE: Only MBE/WBE firms certified by the State of Missouri Office of Equal Opportunity as of the date of bid opening, or SDVE(s) meeting the requirements of Section 34.074, RSMo and 1 CSR 30-5.010, can be used to satisfy the MBE/WBE/SDVE participation goals for this project.**
- C. **\*\*NOTE:** Bidders are provided new Good Faith Effort (GFE) forms on MissouriBUYS.

### 5.0 PRE-BID MEETING:

- A. Place/Time: 11:00 AM, Monday, April 24, 2023, at Echo Bluff State Park, Betty Lea Lodge Conference Room, 34489 Echo Bluff Dr., Eminence, MO.
- B. Access to State of Missouri property requires presentation of a photo ID by all persons.

### 6.0 HOW TO GET PLANS & SPECIFICATIONS:

- A. View Only Electronic bid sets are available at no cost or paper bid sets for a deposit of \$100.00 from American Document Solutions (ADS). MAKE CHECKS PAYABLE TO: American Document Solutions. Mail to: American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433, <https://www.adsplanroom.net>. NOTE: Prime contractors will be allowed a maximum of two bid sets at the deposit rate shown above. Other requesters will be allowed only one bid set at this rate. Additional bid sets or parts thereof may be obtained by any bidder at the cost of printing and shipping by request to American Document Solutions at the address shown above. **Bidder must secure at least one bid set to become a planholder.**
- B. **Refunds: Return plans and specifications in unmarked condition within 15 working days of bid opening to American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433. Deposits for plans not returned within 15 working days shall be forfeited.**
- C. Information for upcoming bids, including downloadable plans, specifications, Invitation for Bid, bid tabulation, award, addenda, and access to the ADS planholders list, is available on the Division of Facilities Management, Design and Construction's web site: <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>.

### 7.0 POINT OF CONTACT:

- A. Designer: Farnsworth Group, Nick Bruner, (309) 429-6689, email: nbruner@F-W.com
- B. Project Manager: Ryan Abbott, (573) 298-1967, email: Ryan.Abbott@oa.mo.gov

### 8.0 GENERAL INFORMATION:

- A. The State reserves the right to reject any and all bids and to waive all informalities in bids. No bid may be withdrawn for a period of 20 working days subsequent to the specified bid opening time. The contractor shall pay not less than the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed, as determined by the Missouri Department of Labor and Industrial Relations and as set out in the detailed plans and specifications.
- B. Bid results will be available at <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans> after it is verified that at least one bid is awardable and affordable.

## Very Important MissouriBUYS Instructions to Help Submit a Bid Correctly

- A. The bidder shall submit his or her bid and all supporting documentation on MissouriBUYS eProcurement System. No hard copy bids shall be accepted. Go to <https://missouribuys.mo.gov> and register. The bidder must register and complete a profile fully with all required documents submitted prior to submitting a bid.
- B. Once registered, log in.
1. Under "Solicitation" select "View Current Solicitations."
  2. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8", then click "Filter Solicitation" button.
  3. Select "Active Solicitations" tab.
  4. To see the Solicitation Summary, click on the Project Number and the summary will open. Click each heading to open detailed information.
- C. Here are simplified instructions for uploading the bid to MissouriBUYS:
1. Find the solicitation by completing Steps 1 through 4 above.
  2. Select the three dots under "Actions." Select "Add New Response."
  3. When the Quote box opens, give the response a title and select "OK."
  4. The detailed solicitation will open. Select "Check All" for the Original Solicitation Documents, open each document, and select "Accept." If this step is not completed, a bid cannot be uploaded. Scroll to the bottom of the page and select "Add Attachments." If you do not see this command, not all documents have been opened and accepted.
  5. The Supplier Attachments box will open. Select "Add Attachment" again.
  6. The Upload Documents box will open. Read the instructions for uploading. Disregard the "Confidential" check box.
  7. Browse and attach up to 5 files at a time. Scroll to bottom of box and select "Upload." The Supplier Attachments box will open. Repeat Steps 5 through 7 if more than 5 files are to be uploaded.
  8. When the Supplier Attachments box opens again and uploading is complete, select "Done." A message should appear that the upload is successful. If it does not, go to the Bidder Response tab and select "Submit."
  9. The detailed solicitation will open. At the bottom select "Close."
- D. Any time a bidder wants to modify the bid, he or she will have to submit a new one. FMDC will open the last response the bidder submits. The bidder may revise and submit the bid up to the close of the solicitation (bid date and time). Be sure to allow for uploading time so that the bid is successfully uploaded prior to the 1:30 PM deadline; we can only accept the bid if it is uploaded before the deadline.
- E. If you want to verify that you are uploading documents correctly, please contact Paul Girouard: 573-751-4797, [paul.girouard@oa.mo.gov](mailto:paul.girouard@oa.mo.gov) ; April Howser: 573-751-0053, [April.Howser@oa.mo.gov](mailto:April.Howser@oa.mo.gov) ; or Mandy Roberson: 573-522-0074, [Mandy.Roberson@oa.mo.gov](mailto:Mandy.Roberson@oa.mo.gov).
- F. If you are experiencing login issues, please contact Web Procure Support (Proactis) at 866-889-8533 anytime from 7:00 AM to 7:00 PM Central Time, Monday through Friday. If you try using a userid or password several times that is incorrect, the system will lock you out. Web Procure Support is the only option to unlock you! If you forget your userid or password, Web Procure Support will provide a temporary userid or password. Also, if it has been a while since your last successful login and you receive an "inactive" message, contact Web Procure (Proactis). If you are having a registration issue, you may contact Office of Administration Division of Purchasing at 573-751-3491.

## IMPORTANT REMINDER REGARDING REQUIREMENT FOR OEO CERTIFICATION

A. SECTION 002113 – INSTRUCTIONS TO  
BIDDERS: Article 15.0, Section D1:

**As of July 1, 2020**, all MBE, WBE, and MBE/WBE contractors, subcontractors, and suppliers must be certified by the State of Missouri, Office of Equal Opportunity. No certifications from other Missouri certifying agencies will be accepted.

## **SECTION 002113 – INSTRUCTIONS TO BIDDERS**

### **1.0 - SPECIAL NOTICE TO BIDDERS**

- A. If awarded a contract, the Bidder's employees, and the employees of all subcontractors, who perform the work on the project must adhere to requirements in Section 013513 – Site Security and Health Requirements as applicable per Agency.
- B. The Bidder's prices shall include all city, state, and federal sales, excise, and similar taxes that may lawfully be assessed in connection with the performance of work, and the purchased of materials to be incorporated in the work. THIS PROJECT IS NOT TAX EXEMPT.

### **2.0 - BID DOCUMENTS**

- A. The number of sets obtainable by any one (1) party may be limited in accordance with available supply.
- B. For the convenience of contractors, sub-contractors and suppliers, copies of construction documents are on file at the office of the Director, Division of Facilities Management, Design and Construction and on the Division's web site - <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>.

### **3.0 - BIDDERS' OBLIGATIONS**

- A. Bidders must carefully examine the entire site of the work and shall make all reasonable and necessary investigations to inform themselves thoroughly as to the facilities available as well as to all the difficulties involved in the completion of all work in accordance with the specifications and the plans. Bidders are also required to examine all maps, plans and data mentioned in the specifications. No plea of ignorance concerning observable existing conditions or difficulties that may be encountered in the execution of the work under this contract will be accepted as an excuse for any failure or omission on the part of the contractor to fulfill in every detail all of the requirements of the contract, nor accepted as a basis for any claims for extra compensation.
- B. Under no circumstances will contractors give their plans and specifications to another contractor. Any bid received from a contractor whose name does not appear on the list of plan holders may be subject to rejection.

### **4.0 - INTERPRETATIONS**

- A. No bidder shall be entitled to rely on oral interpretations as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction. Every request for interpretation shall be made in writing and submitted with all supporting documents not less than five (5) working days before opening of bids. Every interpretation made to a bidder will be in the form of an addendum and will be sent as promptly as is practicable to all persons to whom plans and specifications have been issued. All such addenda shall become part of the contract documents.
- B. Approval for an "acceptable substitution" issued in the form of an addendum as per Paragraph 4A above, and as per Article 3.1 of the General Conditions; ACCEPTABLE SUBSTITUTIONS shall constitute approval for use in the project of the product.
- C. An "acceptable substitution" requested after the award of bid shall be approved if proven to the satisfaction of the Owner and the Designer as per Article 3.1, that the product is acceptable in design, strength, durability, usefulness, and convenience for the purpose intended. Approval of the substitution after award is at the sole discretion of the Owner.
- D. A request for "Acceptable Substitutions" shall be made on the Section 006325 Substitution Request Form. The request shall be sent directly to the project Designer. A copy of said request should also be mailed to the Owner, Division of Facilities Management, Design and Construction, Post Office Box 809, Jefferson City, Missouri 65102.



## **5.0 - BIDS AND BIDDING PROCEDURE**

- A. Bidders shall submit all submission forms and accompanying documents listed in SECTION 004113 – BID FORM, Article 5.0, ATTACHMENTS TO BID by the stated time or their bid will be rejected for being non-responsive.

Depending on the specific project requirements, **the following is a GENERIC list** of all possible bid forms that may be due with bid submittals and times when they may be due. Please check for specific project requirements on the proposal form (Section 004113). ***Not all of the following bid forms may be required to be submitted.***

### **Bid Submittal – due before stated date and time of bid opening (see IFB):**

004113	Bid Form (all pages are always required)
004322	Unit Prices Form
004336	Proposed Subcontractors Form
004337	MBE/WBE/SDVE Compliance Evaluation Form
004338	MBE/WBE/SDVE Eligibility Determination for Joint Ventures
004339	MBE/WBE/SDVE GFE Determination
004340	SDVE Business Form
004541	Affidavit of Work Authorization
004545	Anti-Discrimination Against Israel Act Certification form

- B. All bids shall be submitted without additional terms and conditions, modification or reservation on the bid forms with each space properly filled. Bids not on these forms will be rejected.
- C. All bids shall be accompanied by a bid bond executed by the bidder and a duly authorized surety company, certified check, cashier's check or bank draft made payable to the Division of Facilities Management, Design and Construction, State of Missouri, in the amount indicated on the bid form, Section 004113. Failure of the contractor to submit the full amount required shall be sufficient cause to reject his bid. The bidder agrees that the proceeds of the check, draft or bond shall become the property of the State of Missouri, if for any reason the bidder withdraws his bid after closing, or if on notification of award refuses or is unable to execute tendered contract, provide an acceptable performance and payment bond, provide evidence of required insurance coverage and/or provide required copies of affirmative action plans within ten (10) working days after such tender.
- D. The check or draft submitted by the successful bidder will be returned after the receipt of an acceptable performance and payment bond and execution of the formal contract. Checks or drafts of all other bidders will be returned within a reasonable time after it is determined that the bid represented by same will receive no further consideration by the State of Missouri. Bid bonds will only be returned upon request.

## **6.0 - SIGNING OF BIDS**

- A. A bid from an individual shall be signed as noted on the Bid Form.
- B. A bid from a partnership or joint venture shall require only one signature of a partner, an officer of the joint venture authorized to bind the venture or an attorney-in-fact. If the bid is signed by an officer of a joint venture or an attorney-in-fact, a document evidencing the individual's authority to execute contracts should be included with the bid form.
- C. A bid from a limited liability company (LLC) shall be signed by a manager or a managing member of the LLC.
- D. A bid from a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation manually written. Title of office held by the person signing for the corporation shall appear, along with typed name of said individual. Corporate license number shall be provided and, if a corporation organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached. In addition, for corporate proposals, the President or Vice-President should sign as the bidder. If the signator is other than the corporate president or vice president, the bidder must provide satisfactory evidence that the signator has the legal authority to bind the corporation.

- E. A bid should contain the full and correct legal name of the Bidder. If the Bidder is an entity registered with the Missouri Secretary of State, the Bidder's name on the bid form should appear as shown in the Secretary of State's records.
- F. The Bidder should include its corporate license number on the Bid Form and, if the corporation is organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached to the bid form.

#### **7.0 - RECEIVING BID SUBMITTALS**

- A. It is the bidder's sole responsibility to assure receipt by Owner of bid submittals by the date and time specified in the Invitation for Bid. Bids received after the date and time specified shall not be considered by the Owner.
- B. Bids must be submitted through the MissouriBUYS statewide eProcurement system (<https://www.missouribuys.mo.gov/>) in accordance with the instructions for that system. The Owner shall only accept bids submitted through MissouriBUYS. Bids received by the Owner through any other means, including hard copies, shall not be considered and will be discarded by the Owner unopened.
- C. To respond to an Invitation for Bid, the Bidder must first register with MissouriBUYS by going through the MissouriBUYS Home Page (<https://www.missouribuys.mo.gov/>), clicking the "Register" button at the top of the page, and completing the Vendor Registration. Once registered, the Bidder accesses its account by clicking the "Login" button at the top of the MissouriBUYS Home Page. Enter your USERID and PASSWORD, which the Bidder will select. Under Solicitations, select "View Current Solicitations." A new screen will open. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8." Under "Filter by Opp. No." type in the State Project Number. Select "Submit." Above the dark blue bar, select "Other Active Opportunities." To see the Solicitation Summary, single click the Opp. No. (Project Number) and the summary will open. Single quick click each blue bar to open detailed information. The Bidder must read and accept the Original Solicitation Documents and complete all identified requirements. The Bidder should download and save all of the Original Solicitation Documents on its computer so that the Bidder can prepare its response to these documents. The Bidder should upload its completed response to the downloaded documents as an attachment to the electronic solicitation response.
- D. Step-by-step instructions for how a registered vendor responds to a solicitation electronically are provided in Section 001116 – Invitation For Bid.
- E. The Bidder shall submit its bid on the forms provided by the Owner on MissouriBUYS with each space fully and properly completed, including all amounts required for alternate bids, unit prices, cost accounting data, etc. The Owner may reject bids that are not on the Owner's forms or that do not contain all requested information.
- F. No Contractor shall stipulate in his bid any conditions not contained in the specifications or standard bid form contained in the contract documents. To do so may subject the Contractor's bid to rejection.
- G. The completed forms shall be without interlineations, alterations or erasures.

#### **8.0 - MODIFICATION AND WITHDRAWAL OF BIDS**

- A. Bidder may withdraw his bid at any time prior to scheduled closing time for receipt of bids, but no bidder may withdraw his bid for a period of twenty (20) working days after the scheduled closing time for receipt of bids.
- B. The Bidder shall modify his or her original bid by submitting a revised bid on MissouriBUYS.

#### **9.0 - AWARD OF CONTRACT**

- A. The Owner reserves the right to reject any and/or all bids and further to waive all informalities in bidding when deemed in the best interest of the State of Missouri.
- B. The Owner reserves the right to let other contracts in connection with the work, including but not by way of limitation, contracts for the furnishing and installation of furniture, equipment, machines, appliances and other apparatus.

- C. The Owner shall award a contract to the lowest, responsive, responsible Bidder in accordance with Section 8.250, RSMo. No contract will be awarded to any Bidder who has had a contract with the Owner terminated within the preceding twelve months for material breach of contract or who has been suspended or debarred by the Owner.
- D. Award of alternates, if any, will be made in numerical order unless all bids received are such that the order of acceptance of alternates does not affect the determination of the lowest, responsive, responsible bidder.
- E. No bid shall be considered binding upon the Owner until the written contract has been properly executed, a satisfactory bond has been furnished, evidence of required insurance coverage, submittal of executed Section 004541, Affidavit of Work Authorization form, documentation evidencing enrollment and participation in a federal work authorization program has been received and an affirmative action plan submitted. Failure to execute and return the contract and associated documents within the prescribed period of time shall be treated, at the option of the Owner, as a breach of bidder's obligation and the Owner shall be under no further obligation to bidder.
- F. If the successful bidder is doing business in the State of Missouri under a fictitious name, he shall furnish to Owner, attached to the Bid Form, a properly certified copy of the certificate of Registration of Fictitious Name from the State of Missouri, and such certificate shall remain on file with the Owner.
- G. Any successful bidder which is a corporation organized in a state other than Missouri shall furnish to the Owner, attached to the Bid Form, a properly certified copy of its current Certificate of Authority to do business in the State of Missouri, such certificate to remain on file with the Owner. No contract will be awarded by the Owner unless such certificate is furnished by the bidder.
- H. Any successful bidder which is a corporation organized in the State of Missouri shall furnish at its own cost to the Owner, if requested, a Certificate of Good Standing issued by the Secretary of State, such certificate to remain on file with the Owner.
- I. Transient employers subject to Sections 285.230 and 285.234, RSMo, (out-of-state employers who temporarily transact any business in the State of Missouri) may be required to file a bond with the Missouri Department of Revenue. No contract will be awarded by the Owner unless the successful bidder certifies that he has complied with all applicable provisions of Section 285.230-234.
- J. Sections 285.525 and 285.530, RSMo, require business entities to enroll and participate in a federal work authorization program in order to be eligible to receive award of any state contract in excess of \$5,000. Bidders should submit with their bid an Affidavit of Work Authorization (Section 004541) along with appropriate documentation evidencing such enrollment and participation. Section-004541, Affidavit of Work Authorization is located on the MissouriBUYS solicitation for this project. Bidders must also submit an E-Verify Memorandum before the Owner may award a contract to the Bidder. Information regarding an E-Verify is located at <https://www.uscis.gov/e-verify/>. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.

#### **10.0 - CONTRACT SECURITY**

- A. The successful bidder shall furnish a performance/payment bond as set forth in General Conditions Article 6.1 on a condition prior to the State executing the contract and issuing a notice to proceed.

#### **11.0 - LIST OF SUBCONTRACTORS**

- A. If required by "Section 004113 – Bid Form," each bidder must submit as part of their bid a list of subcontractors to be used in performing the work (Section 004336). The list must specify the name of the single designated subcontractor, for each category of work listed in "Section 004336 - Proposed Subcontractors Form." If work within a category will be performed by more than one subcontractor, the bidder must provide the name of each subcontractor and specify the exact portion of the work to be done by each. Failure to list the Bidder's firm, or a subcontractor for each category of work identified on the Bid Form or the listing of more than one subcontractor for any category without designating the portion of work to be performed by each shall be cause for rejection of the bid. If the bidder intends to perform any of the designated subcontract work with the use of his own employees, the bidder shall make that fact clear, by listing his own firm for the subject category. **If any category of work is left vacant, the bid shall be rejected.**

## **12.0 - WORKING DAYS**

- A. Contract duration time is stated in working days and will use the following definition in determining the actual calendar date for contract completion:
  - 1. Working days are defined as all calendar days except Saturdays, Sundays and the following State of Missouri observed holidays: New Year’s Day, Martin Luther King, Jr. Day, Lincoln Day, Washington’s Birthday, Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day and Christmas Day.

## **13.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS**

- A. By signing the bid form and submitting a bid on this project, the Bidder certifies that it will use American and Missouri products as set forth in Article 1.7 of the General Conditions. Bidders are advised to review those requirements carefully prior to bidding.
- B. A preference shall be given to Missouri firms, corporations or individuals, or firms, corporations or individuals that maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less.
- C. Pursuant to Section 34.076, RSMo, a contractor or Bidder domiciled outside the boundaries of the State of Missouri shall be required, in order to be successful, to submit a bid the same percent less than the lowest bid submitted by a responsible contractor or Bidder domiciled in Missouri as would be required for such a Missouri domiciled contractor or Bidder to succeed over the bidding contractor or Bidder domiciled outside Missouri on a like contract or bid being let in the person's domiciliary state and, further, the contractor or Bidder domiciled outside the boundaries of Missouri shall be required to submit an audited financial statement as would be required of a Missouri domiciled contractor or Bidder on a like contract or bid being let in the domiciliary state of that contractor or Bidder.

## **14.0 – ANTI-DISCRIMINATION AGAINST ISRAEL ACT CERTIFICATION:**

- A. Pursuant to section 34.600, RSMo, if the Bidder meets the section 34.600, RSMo, definition of a “company” and the Bidder has ten or more employees, the Bidder must certify in writing that the Bidder is not currently engaged in a boycott of goods or services from the State of Israel as defined in section 34.600, RSMo, and shall not engage in a boycott of goods or services from the State of Israel, if awarded a contract, for the duration of the contract. The Bidder is requested to complete and submit the applicable portion of Section 004545 - Anti-Discrimination Against Israel Act Certification with their Bid Form. The applicable portion of the exhibit must be submitted prior to execution of a contract by the Owner and issuance of Notice to Proceed. If the exhibit is not submitted, the Owner shall rescind its Intent to Award and move to the next lowest, responsive, responsible bidder.

## **15.0 - MBE/WBE/SDVE INSTRUCTIONS**

- A. Definitions:
  - 1. “**MBE**” means a Minority Business Enterprise.
  - 2. “**MINORITY**” has the same meaning as set forth in 1 C.S.R. 10-17.010.
  - 3. “**MINORITY BUSINESS ENTERPRISE**” has the same meaning as set forth in section 37.020, RSMo.
  - 4. “**WBE**” means a Women’s Business Enterprise.
  - 5. “**WOMEN’S BUSINESS ENTERPRISE**” has the same meaning as set forth in section 37.020, RSMo.
  - 6. “**SDVE**” means a Service-Disabled Veterans Enterprise.
  - 7. “**SERVICE-DISABLED VETERAN**” has the same meaning as set forth in section 34.074, RSMo.
  - 8. “**SERVICE-DISABLED VETERAN ENTERPRISE**” has the same meaning as “Service-Disabled Veteran Business” set forth in section 34.074, RSMo.

B. MBE/WBE/SDVE General Requirements:

1. For all bids greater than \$100,000, the Bidder shall obtain MBE, WBE and SDVE participation in an amount equal to or greater than the percentage goals set forth in the Invitation for Bid and the Bid Form, unless the Bidder is granted a Good Faith Effort waiver by the Director of the Division, as set forth below. If the Bidder does not meet the MBE, WBE and SDVE goals, or make a good faith effort to do so, the Bidder shall be non-responsive, and its bid shall be rejected.
2. The Bidder should submit with its bid all of the information requested in the MBE/WBE/SDVE Compliance Evaluation Form for every MBE, WBE, or SDVE subcontractor or material supplier the Bidder intends to use for the contract work. The Bidder is required to submit all appropriate MBE/WBE/SDVE documentation before the stated time and date set forth in the Invitation for Bid. If the Bidder fails to provide such information by the specified date and time, the Owner shall reject the bid.
3. The Director reserves the right to request additional information from a Bidder to clarify the Bidder's proposed MBE, WBE, and/or SDVE participation. The Bidder shall submit the clarifying information requested by the Owner within two (2) Working Days of receiving the request for clarification.
4. Pursuant to section 34.074, RSMo, a Bidder that is a SDVE doing business as Missouri firm, corporation, or individual, or that maintains a Missouri office or place of business, shall receive a three-point bonus preference in the contract award evaluation process. The bonus preference will be calculated and applied by reducing the bid amount of the eligible SDVE by three percent of the apparent low responsive bidder's bid. Based on this calculation, if the eligible SDVE's evaluation is less than the apparent low responsive bidder's bid, the eligible SDVE's bid becomes the apparent low responsive bid. This reduction is for evaluation purposes only, and will have no impact on the actual amount(s) of the bid or the amount(s) of any contract awarded. In order to be eligible for the SDVE preference, the Bidder must complete and submit with its bid the Missouri Service Disabled Veteran Business Form, and any information required by the form. The form is available on the MissouriBUYS solicitation for this project.

C. Computation of MBE/WBE/SDVE Goal Participation:

1. A Bidder who is a MBE, WBE, or SDVE may count 100% of the contract towards the MBE, WBE or SDVE goal, less any amounts awarded to another MBE, WBE or SDVE. (NOTE: A MBE firm that bids as general contractor must obtain WBE and SDVE participation; a WBE firm that bids as a general contractor must obtain MBE and SDVE participation; and a SDVE firm that bids as general contractor must obtain MBE and WBE participation.) In order for the remaining contract amount to be counted towards the MBE, WBE or SDVE goal, the Bidder must complete the MBE/WBE/SDVE Compliance Evaluation Form (Section 004337) identifying itself as an MBE, WBE or SDVE.
2. The total dollar value of the work granted to a certified MBE, WBE or SDVE by the Bidder shall be counted towards the applicable goal.
3. Expenditures for materials and supplies obtained from a certified MBE, WBE, or SDVE supplier or manufacturer may be counted towards the MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE assumes the actual and contractual responsibility for the provision of the materials and supplies.
4. The total dollar value of the work granted to a second or subsequent tier subcontractor or a supplier may be counted towards a Bidder's MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE properly assumes the actual and contractual responsibility for the work.
5. The total dollar value of work granted to a certified joint venture equal to the percentage of the ownership and control of the MBE, WBE, or SDVE partner in the joint venture may be counted towards the MBE/WBE/SDVE goals.
6. Only expenditures to a MBE, WBE, or SDVE that performs a commercially useful function in the work may be counted towards the MBE, WBE and SDVE goals. A MBE, WBE, or SDVE performs a commercially useful function when it is responsible for executing a distinct element of the work and carrying out its responsibilities by actually performing, managing and supervising the work or providing supplies or manufactured materials.

D. Certification of MBE/WBE/SDVE Subcontractors:

1. In order to be counted towards the goals, an MBE or WBE must be certified by the State of Missouri Office of Equal Opportunity and an SDVE must be certified by the State of Missouri, Office of Administration, Division of Purchasing and Material Management or by the Department of Veterans Affairs.
2. The Bidder may determine the certification status of a proposed MBE or WBE subcontractor or supplier by referring to the Office of Equal Opportunity (OEO)'s online MBE/WBE directory (<https://apps1.mo.gov/MWBCertifiedFirms/>). The Bidder may determine the eligibility of a SDVE subcontractor or supplier by referring to the Division of Purchasing and Materials Management's online SDVE directory (<https://oa.mo.gov/sites/default/files/sdvelisting.pdf>) or the Department of Veterans Affairs' directory (<https://vetbiz.va.gov/basic-search/>).
3. Additional information, clarifications, etc., regarding the listings in the directories may be obtained by calling the Division at (573)751-3339 and asking to speak to the Contract Specialist of record as shown in the Supplementary Conditions (Section 007300).

E. Waiver of MBE/WBE/SDVE Participation:

1. If a Bidder has made a good faith effort to secure the required MBE, WBE and/or SDVE participation and has failed, the Bidder shall submit with its bid the information requested in MBE/WBE/SDVE Good Faith Effort (GFE) Determination form. The GFE forms are located on the MissouriBUYS solicitation for this project. The Director will determine if the Bidder made a good faith effort to meet the applicable goals. If the Director determines that the Bidder did not make a good faith effort, the bid shall be rejected as being nonresponsive to the bid requirements. Bidders who demonstrate that they have made a good faith effort to include MBE, WBE, and/or SDVE participation will be determined to be responsive to the applicable participation goals, regardless of the percent of actual participation obtained, if the bid is otherwise acceptable.
2. In determining whether a Bidder has made a good faith effort to obtain MBE, WBE and/or SDVE participation, the Director may evaluate the factors set forth in 1 CSR 30-5.010(6)(C) and the following:
  - a. The amount of actual participation obtained;
  - b. How and when the Bidder contacted potential MBE, WBE, and SDVE subcontractors and suppliers;
  - c. The documentation provided by the Bidder to support its contacts, including whether the Bidder provided the names, addresses, phone numbers, and dates of contact for MBE/WBE/SDVE firms contacted for specific categories of work;
  - d. If project information, including plans and specifications, were provided to MBE/WBE/SDVE subcontractors;
  - e. Whether the Bidder made any attempts to follow-up with MBE, WBE or SDVE firms prior to bid;
  - f. Amount of bids received from any of the subcontractors and/or suppliers that the Bidder contacted;
  - g. The Bidder's stated reasons for rejecting any bids;
3. If no bidder has obtained any participation in a particular category (MBE/WBE/SDVE) or made a good faith effort to do so, the Director may waive that goal rather than rebid.

F. Contractor MBE/WBE/SDVE Obligations

1. If awarded a contract, the Bidder will be contractually required to subcontract with or obtain materials from the MBE, WBE, and SDVE firms listed in its bid, in amounts equal to or greater than the dollar amount bid, unless the amount is modified in writing by the Owner.
2. If the Contractor fails to meet or maintain the participation requirements contained in the Contractor's bid, the Contractor must satisfactorily explain to the Director why it cannot comply with the requirement and why failing meeting the requirement was beyond the Contractor's control. If the Director finds the Contractor's explanation unsatisfactory, the Director may take any appropriate action including, but not limited to:
  - a. Declaring the Contractor ineligible to participate in any contracts with the Division for up to twelve (12) months (suspension); and/or
  - b. Declaring the Contractor be non-responsive to the Invitation for Bid, or in breach of contract and rejecting the bid or terminating the contract.
3. If the Contractor replaces an MBE, WBE, or SDVE during the course of this contract, the Contractor shall replace it with another MBE, WBE, or SDVE or make a good faith effort to do so. All MBE, WBE and SDVE substitutions must be approved by the Director.
4. The Contractor shall provide the Owner with regular reports on its progress in meeting its MBE/WBE/SDVE obligations. At a minimum, the Contractor shall report the dollar-value of work completed by each MBE, WBE, or SDVE during the preceding month and the cumulative total of work completed by each MBE, WBE or SDVE to date with each monthly application for payment. The Contractor shall also make a final report, which shall include the total dollar-value of work completed by each MBE, WBE, and SDVE during the entire contract.

**STATE OF MISSOURI  
DIVISION OF FACILITIES MANAGEMENT,  
DESIGN AND CONSTRUCTION  
*MBE/WBE/SDVE DIRECTORIES***

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The MBE/WBE Directory for goods and services is maintained by the Office of Equal Opportunity (OEO) and is located at the following web address:

<https://apps1.mo.gov/MWBCertifiedFirms/>

The SERVICE DISABLED VETERAN ENTERPRISE (SDVE) Directories may be accessed at the following web addresses:

<https://purch.oa.mo.gov/media/pdf/listing-certified-missouri-service-disabled-veteran-business-enterprises-sdves>

<https://veterans.certify.sba.gov/#search>





# State of Missouri Construction Contract

**THIS AGREEMENT** is made (DATE) by and between:

## *Contractor Name and Address*

hereinafter called the "Contractor,"

and the **State of Missouri**, hereinafter called the "**Owner**", represented by the Office of Administration, Division of Facilities Management, Design and Construction, on behalf of the Department of Natural Resources, Division of State Parks.

WITNESSETH, that the Contractor and the Owner, for the consideration stated herein agree as follows:

## **ARTICLE 1. STATEMENT OF WORK**

The Contractor shall furnish all labor and materials and perform all work required for furnishing and installing all labor, materials, equipment and transportation and everything necessarily inferred from the general nature and tendency of the plans and specifications for the proper execution of the work for:

**Project Name:**                    **Construct Six New Cabins  
Echo Bluff State Park  
Eminence, Missouri**

**Project Number:**            **X2208-01**

in strict accordance with the Contract Documents as enumerated in Article 7, all of which are made a part hereof.

## **ARTICLE 2. TIME OF COMPLETION**

The contract performance time is **250 working days** from the transmittal date of this agreement. The contract completion date is **MONTH, DAY, YEAR**. This time includes ten (10) working days for the Contractor to receive, sign and return the contract form along with required bonding and insurance certificates. Failure of the Contractor to provide correct bonding and insurance within the ten (10) working days shall not be grounds for a time extension. Receipt of proper bonding and insurance is a condition precedent to the formation of the contract and if not timely received, may result in forfeiture of the Contractor's bid security. Work may not commence until the Owner issues a written Notice to Proceed and must commence within seven (7) working days thereafter.

## **ARTICLE 3. LIQUIDATED DAMAGES**

Whenever time is mentioned in this contract, time shall be and is of the essence of this contract. The Owner would suffer a loss should the Contractor fail to have the work embraced in this contract fully completed on or before the time above specified. THEREFORE, the parties hereto realize in order to adjust satisfactorily the damages on account of such failure that it might be impossible to compute accurately or estimate the amount of such loss or damages which the Owner would sustain by reason of failure to complete fully said work within the time required by this contract. The Contractor hereby covenants and agrees to pay the Owner, as and for **liquidated damages, the sum of \$1,000** per day for each and every day, Sunday and legal holidays excepted, during which the work remains incomplete and unfinished. Any sum which may be due the Owner for such damages shall be deducted and retained by the Owner from any balance which may be due the Contractor when said work shall have been finished and accepted. But such provisions shall not release the Bond of the Contractor from liability according to its terms. In case of failure to complete, the Owner will be under no obligation to show or prove any actual or specific loss or damage.

**ARTICLE 4. CONTRACT SUM**

The Owner shall pay the Contractor for the prompt, faithful and efficient performance of the conditions and undertakings of this contract, subject to additions, and deductions as provided herein, in current funds the sum of:

Base Bid:	\$
Alternate No. 1:	\$
<b>TOTAL CONTRACT AMOUNT:</b>	<b>(\$CONTRACT AMOUNT)</b>

**ARTICLE 5. PREVAILING WAGE RATE**

**MISSOURI PREVAILING WAGE LAW (Sections 290.210 to 290.340, RSMo):** The Contractor shall pay not less than the specified hourly rate of wages, as set out in the wage order attached to and made part of the specifications for work under this contract, to all workers performing work under the contract, in accordance with sections 290.210 to 290.340, RSMo. The Contractor shall forfeit a penalty to the Owner of one hundred dollars per day (or portion of a day) for each worker that is paid less than the specified rates for any work done under the contract by the Contractor or by any subcontractor, in accordance with section 290.250, RSMo.

**DAVIS-BACON ACT:** If this Project is financed in whole or in part from Federal funds (as indicated in the Instructions to Bidders or other bid or contract documents for this Project), then this contract shall be subject to all applicable federal labor statutes, rules and regulations, including provisions of the Davis-Bacon Act, 40 U.S.C. §3141 et seq., and the “Federal Labor Standards Provisions,” as further set forth in Section 007333 – Supplementary General Conditions for Federally Funded/Assisted Construction Projects, which is incorporated into the contract by reference. Where the Missouri Prevailing Wage Law and the Davis-Bacon Act require payment of different wages for work performed under this contract, the Contractor and all Subcontractors shall pay the greater of the wages required under either law, on a classification by classification basis.

**ARTICLE 6. MINORITY/WOMEN/SERVICE DISABLED VETERAN BUSINESS ENTERPRISE PARTICIPATION**

The Contractor has been granted a waiver of the 10% MBE and 10% WBE and 3% SDVE participation goals. The Contractor agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows: (OR)

The Contractor has met the MBE/WBE/SDVE participation goals and agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows:

MBE/WBE/SDVE Firm:	Subcontract Amt:\$	
MBE/WBE/SDVE Firm:	Subcontract Amt:\$	
MBE/WBE/SDVE Firm:	Subcontract Amt:\$	
		Total \$

MBE/WBE/SDVE assignments identified above shall not be changed without a contract change signed by the Owner.

The Director of the Division of Facilities Management, Design and Construction or his Designee shall be the final authority to resolve disputes and disagreements between the Contractor and the MBE/WBE/SDVE firms listed above when such disputes impact the subcontract amounts shown above.

**ARTICLE 7. CONTRACT DOCUMENTS**

The following documents are hereby incorporated into this contract by reference (all division/section numbers and titles are as utilized in the Project Manual published by the Owner for this Project):

1. Division 0 – Procurement and Contracting Information, including, but not limited to:
  - a. Invitation for Bid (Section 001116)
  - b. Instructions to Bidders (Section 002113)
  - c. Supplementary Instructions to Bidders (if applicable) (Section 002213)
  - d. The following documents as completed and executed by the Contractor and accepted by the Owner, if applicable:

- i. Bid Form (Section 004113)
- ii. Unit Prices (Section 004322)
- iii. Proposed Contractors Form (Section 004336)
- iv. MBE, WBE, SDVE Compliance Evaluation Form(s) (Section 004337)
- v. MBE, WBE, SDVE Eligibility Determination Form for Joint Ventures (Section 004338)
- vi. MBE, WBE, SDVE Good Faith Effort (GFE) Determination Form (Section 004339)
- vii. Missouri Service Disabled Veteran Business Form (Section 004340)
- viii. Affidavit of Work Authorization (Section 004541)
- ix. Affidavit for Affirmative Action (Section 005414)
- e. Performance and Payment Bond, completed and executed by the Contractor and surety (Section 006113)
- f. General Conditions (Section 007213)
- g. Supplementary Conditions (Section 007300)
- h. Supplementary General Conditions for Federally Funded/Assisted Construction Projects (Section 007333)
- i. Wage Rate(s) (Section 007346)
- 2. Division 1 – General Requirements
- 3. All Drawings identified in the Project Manual
- 4. All Technical Specifications included in the Project Manual
- 5. Addenda, if applicable

**ARTICLE 8 – CERTIFICATION**

By signing this contract, the Contractor hereby re-certifies compliance with all legal requirements set forth in Section 6.0, Bidder’s Certifications of the Bid Form.

Further, if the Contractor provides any “personal information” as defined in §105.1500, RSMo concerning an entity exempt from federal income tax under Section 501(c) of the Internal Revenue Code of 1986, as amended, the Contractor understands and agrees that it is voluntarily choosing to enter into a state contract and providing such information for that purpose. The state will treat such personal information in accord with §105.1500, RSMo.

By signature below, the parties hereby execute this contract document.

**APPROVED:**

\_\_\_\_\_  
 Brian Yansen, Director  
 Division of Facilities Management,  
 Design and Construction

\_\_\_\_\_  
 Contractor’s Authorized Signature

I, Corporate Secretary, certify that I am Secretary of the corporation named above and that (CONTRACTOR NAME), who signed said contract on behalf of the corporation, was then (TITLE) of said corporation and that said contract was duly signed for and in behalf of the corporation by authority of its governing body, and is within the scope of its corporate powers.

\_\_\_\_\_  
 Corporate Secretary



STATE OF MISSOURI  
 OFFICE OF ADMINISTRATION  
 DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION  
**AFFIDAVIT FOR AFFIRMATIVE ACTION**

PROJECT NUMBER
----------------

NAME
------

First being duly sworn on oath states: that

he/she is the  sole proprietor  partner  officer or  manager or managing member of

NAME
------

a  sole proprietorship  partnership  
 limited liability company (LLC)

or  corporation, and as such, said proprietor, partner, or officer is duly authorized to make this

affidavit on behalf of said sole proprietorship, partnership, or corporation; that under the contract known as

PROJECT TITLE
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Less than 50 persons in the aggregate will be employed and therefore, the applicable Affirmative Action requirements as set forth in Article 1.4 of the General Conditions of the State of Missouri have been met.

PRINT NAME & SIGNATURE
------------------------

DATE
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**NOTARY INFORMATION**

NOTARY PUBLIC EMBOSSER SEAL	STATE OF	COUNTY (OR CITY OF ST. LOUIS)	USE RUBBER STAMP IN CLEAR AREA BELOW
	SUBSCRIBED AND SWORN BEFORE ME, THIS		
	DAY OF	YEAR	
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES	
NOTARY PUBLIC NAME (TYPED OR PRINTED)			

**SECTION 006113 - PERFORMANCE AND PAYMENT BOND FORM**

KNOW ALL MEN BY THESE PRESENTS, THAT we \_\_\_\_\_

as principal, and \_\_\_\_\_

\_\_\_\_\_ as Surety, are held and firmly bound unto the

STATE OF MISSOURI. in the sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_ )

for payment whereof the Principal and Surety bind themselves, their heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

WHEREAS, the Principal has, by means of a written agreement dated the \_\_\_\_\_

day of \_\_\_\_\_, 20\_\_\_\_\_, enter into a contract with the State of Missouri for

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(Insert Project Title and Number)

NOW, THEREFORE, if the Principal shall faithfully perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the State of Missouri, with or without notice to the Surety and during the life of any guaranty required under the contract; and shall also faithfully perform and fulfill all undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made with or without notice to the Surety; and shall also promptly make payment for materials incorporated, consumed or used in connection with the work set forth in the contract referred to above, and all insurance premiums, both compensation and all other kinds of insurance, on said work, and for all labor performed on such work, whether by subcontractor or otherwise, at not less than the prevailing hourly rate of wages for work of a similar character (exclusive of maintenance work) in the locality in which the work is performed and not less than the prevailing hourly rate of wages for legal holiday and overtime work (exclusive of maintenance work) in the locality in which the work is performed both as determined by the Department of Labor and Industrial Relations or determined by the Court of Appeal, as provided for in said contract and in any and all duly authorized modifications of said contract that may be hereafter made, with or without notice to the Surety, then, this obligation shall be void and of no effect, but it is expressly understood that if the Principal should make default in or should fail to strictly, faithfully and efficiently do, perform and comply with any or more of the covenants, agreements, stipulations, conditions, requirements or undertakings, as specified in or by the terms of said contract, and with the time therein named, then this obligation shall be valid and binding upon each of the parties hereto and this bond shall remain in full force and effect; and the same may be sued on at the instance of any material man, laborer, mechanic, subcontractor, individual, or otherwise to whom such payment is due, in the name of the State of Missouri, to the use of any such person.

AND, IT IS FURTHER specifically provided that any modifications which may hereinafter be made in the terms of the contract or in the work to be done under it or the giving by the Owner of any extension of the time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal to the other, shall not in any way release the Principal and the Surety, or either or any of them, their heirs, executors, administrators and successors, from their liability hereunder, notice to the Surety of any such extension, modifications or forbearance being hereby waived.

IN WITNESS WHEREOF, the above bounden parties have executed the within instrument this \_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_.

**AS APPLICABLE:**

**AN INDIVIDUAL**

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

**A PARTNERSHIP**

Name of Partner: \_\_\_\_\_

Signature of Partner: \_\_\_\_\_

Name of Partner: \_\_\_\_\_

Signature of Partner: \_\_\_\_\_

**CORPORATION**

Firm Name: \_\_\_\_\_

Signature of President: \_\_\_\_\_

**SURETY**

Surety Name: \_\_\_\_\_

Attorney-in-Fact: \_\_\_\_\_

Address of Attorney-in-Fact: \_\_\_\_\_

Telephone Number of Attorney-in-Fact: \_\_\_\_\_

Signature Attorney-in-Fact: \_\_\_\_\_

**NOTE:** Surety shall attach Power of Attorney



STATE OF MISSOURI  
 OFFICE OF ADMINISTRATION  
 DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION  
**PRODUCT SUBSTITUTION REQUEST**

PROJECT NUMBER

PROJECT TITLE AND LOCATION

CHECK APPROPRIATE BOX

- SUBSTITUTION PRIOR TO BID OPENING**  
 (Minimum of (5) working days prior to receipt of Bids as per Article 4 – Instructions to Bidders)
- SUBSTITUTION FOLLOWING AWARD**  
 (Maximum of (20) working days from Notice to Proceed as per Article 3 – General Conditions)

FROM: BIDDER/CONTRACTOR (PRINT COMPANY NAME)

TO: ARCHITECT/ENGINEER (PRINT COMPANY NAME)

Bidder/Contractor hereby requests acceptance of the following product or systems as a substitution in accordance with provisions of Division One of the Bidding Documents:

SPECIFIED PRODUCT OR SYSTEM

SPECIFICATION SECTION NO.

SUPPORTING DATA

- Product data for proposed substitution is attached (include description of product, standards, performance, and test data)
- Sample  Sample will be sent, if requested

**QUALITY COMPARISON**

	SPECIFIED PRODUCT	SUBSTITUTION REQUEST
NAME, BRAND		
CATALOG NO.		
MANUFACTURER		
VENDOR		

**PREVIOUS INSTALLATIONS**

PROJECT	ARCHITECT/ENGINEER	DATE INSTALLED
LOCATION		

**SIGNIFICANT VARIATIONS FROM SPECIFIED PRODUCT**

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**REASON FOR SUBSTITUTION**

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**DOES PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK?**

YES       NO

IF YES, EXPLAIN \_\_\_\_\_

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**SUBSTITUTION REQUIRES DIMENSIONAL REVISION OR REDESIGN OF STRUCTURE OR A/E WORK**

YES       NO

**BIDDER'S/CONTRACTOR'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT:**

We have investigated the proposed substitution. We believe that it is equal or superior in all respects to specified product, except as stated above; that it will provide the same Warranty as specified product; that we have included complete implications of the substitution; that we will pay redesign and other costs caused by the substitution which subsequently become apparent; and that we will pay costs to modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning as a result of the substitution.

BIDDER/CONTRACTOR	DATE
-------------------	------

**REVIEW AND ACTION**

Resubmit Substitution Request with the following additional information:

---

Substitution is accepted.

Substitution is accepted with the following comments:

---

Substitution is not accepted.

ARCHITECT/ENGINEER	DATE
--------------------	------





PROJECT NUMBER
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KNOW ALL MEN BY THESE PRESENT THAT:                    hereinafter called "Subcontractor" who heretofore entered into an agreement with                    hereinafter called "Contractor", for the performance of work and/or furnishing of material for the construction of the project entitled

(PROJECT TITLE, PROJECT LOCATION, AND PROJECT NUMBER)

at  
 \_\_\_\_\_  
 (ADDRESS OF PROJECT)

for the State of Missouri (Owner) which said subcontract is by this reference incorporated herein, in consideration of such final payment by Contractor.

DOES HEREBY:

1. ACKNOWLEDGE that they have been **PAID IN FULL** all sums due for work and materials contracted or done by their Subcontractors, Material Vendors, Equipment and Fixture Suppliers, Agents and Employees, or otherwise in the performance of the Work called for by the aforesaid Contract and all modifications or extras or additions thereto, for the construction of said project or otherwise.
2. RELEASE and fully, finally, and forever discharge the Owner from any and all suits, actions, claims, and demands for payment for work performed or materials supplied by Subcontractor in accordance with the requirements of the above referenced Contract.
1. REPRESENT that all of their Employees, Subcontractors, Material Vendors, Equipment and Fixture Suppliers, and everyone else has been **paid in full** all sums due them, or any of them, in connection with performance of said Work, or anything done or omitted by them, or any of them in connection with the construction of said improvements, or otherwise.

DATED this            day of            , 20    .

NAME OF SUBCONTRACTOR

BY (TYPED OR PRINTED NAME)

SIGNATURE

TITLE

ORIGINAL: FILE/Closeout Documents



STATE OF MISSOURI  
 OFFICE OF ADMINISTRATION  
 DIVISION OF FACILITIES MANAGEMENT,  
 DESIGN AND CONSTRUCTION

**MBE/WBE/SDVE PROGRESS REPORT**

Remit with ALL Progress and Final Payments

(Please check appropriate box) CONSULTANT CONSTRUCTION

PAY APP NO.	PROJECT NUMBER
CHECK IF FINAL <input type="checkbox"/> <b>FINAL</b>	DATE

PROJECT TITLE

PROJECT LOCATION

FIRM

ORIGINAL CONTRACT SUM (Same as Line Item 1. on Form A of Application for Payment) \$	TOTAL CONTRACT SUM TO DATE (Same as Line Item 3. on Form A of Application for Payment) \$
---	--

THE TOTAL MBE/WBE/SDVE PARTICIPATION DOLLAR AMOUNT OF THIS PROJECT AS INDICATED IN THE ORIGINAL CONTRACT: \$

SELECT MBE, WBE, SDVE	TOTAL AMOUNT OF SUBCONTRACT	\$ AMOUNT PAID-TO-DATE	CONSULTANT/SUBCONSULTANT OR CONTRACTOR/SUBCONTRACTOR/SUPPLIER COMPANY NAME
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	
<input type="checkbox"/> MBE <input type="checkbox"/> WBE <input type="checkbox"/> SDVE	\$	\$	

Revised 05/21



STATE OF MISSOURI  
 OFFICE OF ADMINISTRATION  
 DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION  
**AFFIDAVIT – COMPLIANCE WITH PREVAILING WAGE LAW**

PROJECT NUMBER

Before me, the undersigned Notary Public, in and for the County of \_\_\_\_\_

State of \_\_\_\_\_ personally came and appeared \_\_\_\_\_

(NAME)

of the \_\_\_\_\_

(POSITION)

(NAME OF THE COMPANY)

(a corporation) (a partnership) (a proprietorship) and after being duly sworn did depose and say that all provisions and requirements set out in Chapter 290, Sections 290.210 through and including 290.340, Missouri Revised Statutes, pertaining to the payment of wages to workmen employed on public works project have been fully satisfied and there has been no exception to the full and completed compliance with said provisions and requirements

and with Wage Determination No: \_\_\_\_\_ issued by the

Department of Labor and Industrial Relations, State of Missouri on the \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_

in carrying out the contract and working in connection with \_\_\_\_\_

(NAME OF PROJECT)

Located at \_\_\_\_\_ in \_\_\_\_\_ County

(NAME OF THE INSTITUTION)

Missouri, and completed on the \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_

SIGNATURE

**NOTARY INFORMATION**

NOTARY PUBLIC EMBOSSEY OR BLACK INK RUBBER STAMP SEAL

STATE

COUNTY (OR CITY OF ST. LOUIS)

SUBSCRIBED AND SWORN BEFORE ME, THIS

DAY OF

YEAR

**USE RUBBER STAMP IN CLEAR AREA BELOW**

NOTARY PUBLIC SIGNATURE

MY COMMISSION EXPIRES

NOTARY PUBLIC NAME (TYPED OR PRINTED)

# GENERAL CONDITIONS

## INDEX

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#### 6.1. Bond

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## SECTION 007213 - GENERAL CONDITIONS

- A. These General Conditions apply to each section of these specifications. The Contractor is subject to the provisions contained herein.
- B. The General Conditions are intended to define the relationship of the Owner, the Designer and the Contractor thereby establishing certain rules and provisions governing the operation and performance of the work so that the work may be performed in a safe, orderly, expeditious and workmanlike manner.

## ARTICLE 1 – GENERAL PROVISIONS

### ARTICLE 1.1 - DEFINITIONS

As used in these contract documents, the following terms shall have the meanings and refer to the parties designated in these definitions.

- 1. **"COMMISSIONER"**: The Commissioner of the Office of Administration.
- 2. **"CONSTRUCTION DOCUMENTS"**: The "Construction Documents" shall consist of the Project Manual, Drawings and Addenda.
- 3. **"CONSTRUCTION REPRESENTATIVE:"** Whenever the term "Construction Representative" is used, it shall mean the Owner's Representative at the work site.
- 4. **"CONTRACTOR"**: Party or parties who have entered into a contract with the Owner to furnish work under these specifications and drawings.
- 5. **"DESIGNER"**: When the term "Designer" is used herein, it shall refer to the Architect, Engineer, or Consultant of Record specified and defined in Paragraph 2.0 of the Supplemental Conditions, or his duly authorized representative. The Designer may be either a consultant or state employee.
- 6. **"DIRECTOR"**: Whenever the term "Director" is used, it shall mean the Director of the Division of Facilities Management, Design and Construction or his Designee, representing the Office of Administration, State of Missouri. The Director is the agent of the Owner.
- 7. **"DIVISION"**: Shall mean the Division of Facilities Management, Design and Construction, State of Missouri.

- 8. **"INCIDENTAL JOB BURDENS"**: Shall mean those expenses relating to the cost of work, incurred either in the home office or on the job-site, which are necessary in the course of doing business but are incidental to the job. Such costs include office supplies and equipment, postage, courier services, telephone expenses including long distance, water and ice and other similar expenses.
- 9. **"JOINT VENTURE"**: An association of two (2) or more businesses to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge.
- 10. **"OWNER"**: Whenever the term "Owner" is used, it shall mean the State of Missouri.
- 11. **"PROJECT"**: Wherever the term "Project" is used, it shall mean the work required to be completed by the construction contract.
- 12. **"PROJECT MANUAL"**: The "Project Manual" shall consist of Introductory Information, Invitation for Bid, Instructions to Bidders, Bid Documents, Additional Information, Standard Forms, General Conditions, Supplemental General Conditions, General Requirements and Technical Specifications.
- 13. **"SUBCONTRACTOR"**: Party or parties who contract under, or for the performance of part or this entire Contract between the Owner and Contractor. The subcontract may or may not be direct with the Contractor.
- 14. **"WORK"**: Labor, material, supplies, plant and equipment required to perform and complete the service agreed to by the Contractor in a safe, expeditious, orderly and workmanlike manner so that the project shall be complete and finished in the best manner known to each respective trade.
- 15. **"WORKING DAYS"**: are all calendar days except Saturdays, Sundays and the following holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday (observed), Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day (observed), Thanksgiving Day, Christmas Day.

### ARTICLE 1.2 DRAWINGS AND SPECIFICATIONS

- A. In case of discrepancy between drawings and specifications, specifications shall govern. Should discrepancies in architectural drawings, structural drawings and mechanical drawings occur,

architectural drawings shall govern and, in case of conflict between structural and mechanical drawings, structural drawings shall govern.

- B. Specifications are separated into titled divisions for convenience of reference only and to facilitate letting of contracts and subcontracts. The Contractor is responsible for establishing the scope of work for subcontractors, which may cross titled divisions. Neither the Owner nor Designer will establish limits and jurisdiction of subcontracts.
- C. Figured dimensions take precedence over scaled measurements and details over smaller scale general drawings. In the event of conflict between any of the documents contained within the contract, the documents shall take precedence and be controlling in the following sequence: addenda, supplementary general conditions, general conditions, division 1 specifications, technical division specifications, drawings, bid form and instructions to bidders.
- D. Anything shown on drawings and not mentioned in these specifications or vice versa, as well as any incidental work which is obviously necessary to complete the project within the limits established by the drawings and specifications, although not shown on or described therein, shall be performed by the Contractor at no additional cost as a part of his contract.
- E. Upon encountering conditions differing materially from those indicated in the contract documents, the Contractor shall promptly notify the Designer and Construction Representative in writing before such conditions are disturbed. The Designer shall promptly investigate said conditions and report to the Owner, with a recommended course of action. If conditions do materially differ and cause an increase or decrease in contract cost or time required for completion of any portion of the work, a contract change will be initiated as outlined in Article 4 of these General Conditions.
- E. Only work included in the contract documents is authorized, and the Contractor shall do no work other than that described therein or in accordance with appropriately authorized and approved contract changes.

#### **ARTICLE 1.3 - COMPLIANCE WITH LAWS, PERMITS, REGULATIONS AND INSPECTIONS**

- A. Since the Owner is the State of Missouri, municipal or political subdivisions, zoning ordinances, construction codes (other than licensing of trades), and other like ordinances are not applicable to construction on Owner's property, and Contractor will not be required to submit drawings and specifications to any municipal or political subdivision, authority, obtain

construction permits or any other licenses (other than licensing of trades) or permits from or submit to inspections by any municipality or political subdivision relating to the construction for this project. All permits or licenses required by municipality or political subdivision for operation on property not belonging to Owner shall be obtained by and paid for by Contractor. Each Contractor shall comply with all applicable laws, ordinances, rules and regulations that pertain to the work of this contract.

- B. Contractors, subcontractors and their employees engaged in the businesses of electrical, mechanical, plumbing, carpentry, sprinkler system work, and other construction related trades shall be licensed to perform such work by the municipal or political subdivision where the project is located, if such licensure is required by local code. Local codes shall dictate the level (master, journeyman, and apprentice) and the number, type and ratio of licensed tradesmen required for this project within the jurisdiction of such municipal or political subdivision.
- C. Equipment and controls manufacturers and their authorized service and installation technicians that do not maintain an office within the jurisdiction of the municipal or political subdivision but are a listed or specified contractor or subcontractor on this project are exempt from Paragraph 1.3 B above.
- D. The Contractor shall post a copy of the wage determination issued for the project and included as a part of the contract documents, in a prominent and easily accessible location at the site of construction for the duration of the project.
- E. Any contractor or subcontractor to such contractor at any tier signing a contract to work on this project shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction safety program for their on-site employees which includes a course in construction safety and health approved by OSHA or a similar program approved by the Department of Labor and Industrial Relations which is at least as stringent as an approved OSHA program. The contractor shall forfeit as a penalty to the public body on whose behalf the contract is made or awarded, two thousand five hundred dollars plus one hundred dollars for each employee employed by the contractor or subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training.

#### **ARTICLE 1.4 - NONDISCRIMINATION IN EMPLOYMENT**

- A. The Contractor and his subcontractors will not discriminate against individuals based on race,

color, religion, national origin, sex, disability, or age, but may use restrictions which relate to bona fide occupational qualifications. Specifically, the Contractor and his subcontractors shall not discriminate:

1. Against recipients of service on the basis of race, color, religion, national origin, sex, disability or age.
2. Against any employee or applicant, for employment on the basis of race, color, religion, national origin, sex or otherwise qualified disability status.
3. Against any applicant for employment or employee on the basis of age, where such applicant or employee is between ages 40 and 70 and where such Contractor employs at least 20 persons.
4. Against any applicant for employment or employee on the basis of that person's status as a disabled or Vietnam-era veteran.

The Contractor and his Subcontractors will take affirmative action to insure applicants for employment and employees are treated equally without regard to race, color, religion, national origin, sex, disability, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion and transfer; recruitment or recruitment advertising; and selection for training, including apprenticeship. The Contractor and his Subcontractors will give written notice of their commitments under this clause to any labor union with which they have bargaining or other agreements.

- B. The Contractor and his subcontractors shall develop, implement, maintain and submit in writing to the Owner an affirmative action program if at least fifty (50) persons in the aggregate are employed under this contract. If less than fifty (50) persons in the aggregate are to be employed under this contract, the Contractor shall submit, in lieu of the written affirmative action program, a properly executed Affidavit for Affirmative Action in the form included in the contract specifications. For the purpose of this section, an "affirmative action program" means positive action to influence all employment practices (including, but not limited to, recruiting, hiring, promoting and training) in providing equal employment opportunity regardless of race, color, sex, national origin, religion, age (where the person affected is between age 40 and 70), disabled and Vietnam-era veteran status, and disability. Such "affirmative action program" shall include:

1. A written policy statement committing the total organization to affirmative action and

assigning management responsibilities and procedures for evaluation and dissemination;

2. The identification of a person designated to handle affirmative action;
3. The establishment of non-discriminatory selection standards, objective measures to analyze recruitment, an upward mobility system, a wage and salary structure, and standards applicable to lay-off, recall, discharge, demotion and discipline;
4. The exclusion of discrimination from all collective bargaining agreements; and
5. Performance of an internal audit of the reporting system to monitor execution and to provide for future planning.

In the enforcement of this non-discrimination clause, the Owner may use any reasonable procedures available, including, but not limited to: requests, reports, site visits and inspection of relevant documents of contractors and subcontractors.

- C. In the event of the Contractor's or his subcontractor's noncompliance with any provisions of this Article of the Contract, the Owner may cancel this contract in whole or in part or require the Contractor to terminate his contract with the subcontractor.

#### **ARTICLE 1.5 - ANTI-KICKBACK**

No employee of the division, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract or in any part hereof. No officer, employee, designer, attorney, or administrator of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

#### **ARTICLE 1.6 - PATENTS AND ROYALTIES**

- A. The Contractor shall hold and save the Owner and its officers, agents, servants and employees harmless from liabilities of any nature or kind, including cost and expenses, for, or on account of, any patented or unpatented invention, process, article or appliance manufactured or used in the performance of this contract, including its use by the Owner, unless otherwise specifically stipulated in the contract documents.
- B. If the Contractor uses any design, device or materials covered by letters, patent or copyright,

the Contractor shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, without exception, that the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract and shall indemnify the Owner for any cost, expense or damage it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

#### **ARTICLE 1.7 - PREFERENCE FOR AMERICAN AND MISSOURI PRODUCTS AND SERVICES**

- A. By virtue of statutory authority a preference will be given to Missouri labor and to products of mines, forests and quarries of the state of Missouri when they are found in marketable quantities in the state, and all such materials shall be of the best quality and suitable character that can be obtained at reasonable market prices, all as provided for in Section 8.280, Missouri Revised Statutes and Cumulative Supplements.
- B. Furthermore, pursuant to Section 34.076 Missouri Revised Statutes and Cumulative Supplements, a preference shall be given to those persons doing business as Missouri firms, corporations, or individuals, or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less. In addition, in order for a non-domiciliary bidder to be successful, his bid must be that same percentage lower than a domiciliary Missouri bidder's bid, as would be required for a Missouri bidder to successfully bid in the non-domiciliary state.
- C. In accordance with the Missouri Domestic Products Procurement Act Section 34.350 RSMo and Cumulative Supplements any manufactured goods or commodities used or supplied in the performance of this contract or any subcontract thereto shall be manufactured, assembled or produced in the United States, unless the specified products are not manufactured, assembled or produced in the United States in sufficient quantities to meet the agency's requirements or cannot be manufactured, assembled or produced in the United States within the necessary time in sufficient quantities to meet the contract requirements, or if obtaining the specified products manufactured, assembled or produced in the

United States would increase the cost of this contract for purchase of the product by more than ten percent.

#### **ARTICLE 1.8 - COMMUNICATIONS**

- A. All notices, requests, instructions, approvals and claims must be in writing and shall be delivered to the Designer and copied to the Construction Representative for the project except as required by Article 1.12 Disputes and Disagreements, or as otherwise specified by the Owner in writing as stated in Section 012600. Any such notice shall be deemed to have been given as of the time of actual receipt.
- B. The Contractor shall attend on-site progress and coordination meetings, as scheduled by the Construction Representative, no less than once a month.
- C. The Contractor shall ensure that major subcontractors and suppliers shall attend monthly progress meetings as necessary to coordinate the work, and as specifically requested by the Construction Representative.

#### **ARTICLE 1.9 - SEPARATE CONTRACTS AND COOPERATION**

- A. The Owner reserves the right to let other contracts in connection with this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs.
- B. The Contractor shall consult the drawings for all other contractors in connection with this work. Any work conflicting with the above shall be brought to the attention of the Owner's Representative before the work is performed. If the Contractor fails to do this, and constructs any work which interferes with the work of another contractor, the Contractor shall remove any part so conflicting and rebuild same, as directed by the Owner's Representative at no additional cost to the Owner.
- C. Each contractor shall be required to coordinate his work with other contractors so as to afford others reasonable opportunity for execution of their work. No contractor shall delay any other contractor by neglecting to perform contract work at the proper time. If any contractor causes delay to another, they shall be liable directly to that contractor for such delay in addition to any liquidated damages which might be due the Owner.
- D. Should the Contractor or project associated subcontractors refuse to cooperate with the instructions and reasonable requests of other Contractors or other subcontractors in the overall



coordinating of the work, the Owner may take such appropriate action and issue directions, as required, to avoid unnecessary and unwarranted delays.

- E. Each Contractor shall be responsible for damage done to Owner's or other Contractor's property by him/her or workers in his employ through their fault or negligence.
- F. Should a Contractor sustain any damage through any act or omission of any other Contractor having a contract with the Owner, the Contractor so damaged shall have no claim or cause of action against the Owner for such damage, but shall have a claim or cause of action against the other Contractor to recover any and all damages sustained by reason of the acts or omissions of such Contractor. The phrase "acts or omissions" as used in this section shall be defined to include, but not be limited to, any unreasonable delay on the part of any such contractors.

#### **ARTICLE 1.10 - ASSIGNMENT OF CONTRACT**

- A. No assignment by Contractor of any amount or any part of this contract or of the funds to be received there under will be recognized unless such assignment has had the written approval of the Director and the surety has been given due notice of such assignment and has furnished written consent thereto. In addition to the usual recitals in assignment contracts, the following language must be set forth: "It is agreed that the funds to be paid to the assignee under this assignment are subject to performance by the Contractor of this contract and to claims or liens for services rendered or materials supplied for the performance of the work called for in said contract in favor of all persons, firms or corporations rendering such services or supplying such materials."

#### **ARTICLE 1.11 - INDEMNIFICATION**

- A. Contractor agrees to indemnify and save harmless Owner and its respective commissioners, officers, officials, agents, consultants and employees and Designer, their agents, servants and employees, from and against any and all liability for damage arising from injuries to persons or damage to property occasioned by any acts or omissions of Contractor, any subcontractors, agents, servants or employees, including any and all expense, legal or otherwise, which may be incurred by Owner or Designer, its agents, servants or employees, in defense of any claim, action or suit.
- B. The obligations of the Contractor under this paragraph shall not extend to the liability of the Designer, his agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, contract changes, design or specifications, or (2) giving of or the failure to

give directions or instructions by the Designer, his agents or employees as required by this contract documents provided such giving or failure to give is the primary cause of the injury or damage.

#### **ARTICLE 1.12 - DISPUTES AND DISAGREEMENTS**

It is hereby expressly agreed and understood that in case any controversy or difference of opinion arises during construction, best efforts will be given to resolution at the field level. Should those efforts be unsuccessful, the Contractor has the right to appeal in writing, the decision of the Director's Designee to the Director at Room 730 Truman Building, P.O. Box 809, Jefferson City, Missouri 65102. The decision of the Director shall be final and binding on all parties.

#### **ARTICLE 2 -- OWNER/DESIGNER RESPONSIBILITIES**

- A. The Owner shall give all orders and directions contemplated under this contract relative to the execution of the work. During progress of work the Owner will be represented at the project site by the Construction Representative and/or Designer, whose responsibilities are to see that this contract is properly fulfilled.
- B. The Owner shall at all times have access to the work whenever it is in preparation or progress. The Contractors shall provide proper facilities for such access and for inspection and supervision.
- C. All materials and workmanship used in the work shall be subject to the inspection of the Designer and Construction Representative, and any work which is deemed defective shall be removed, rebuilt or made good immediately upon notice. The cost of such correction shall be borne by the Contractor. Contractor shall not be entitled to an extension of the contract completion date in order to remedy defective work. All rejected materials shall be immediately removed from the site of the work.
- D. If the Contractor fails to proceed at once with the correction of rejected defective materials or workmanship, the Owner may, by separate contract or otherwise, have the defects remedied or rejected. Materials removed from the site and charge the cost of the same against any monies which may be due the Contractor, without prejudice to any other rights or remedies of the Owner.
- E. Failure or neglect on the part of Owner to observe faulty work, or work done which is not in accordance with the drawings and specifications shall not relieve the Contractor from responsibility

for correcting such work without additional compensation.

- F. The Owner shall have the right to direct the Contractor to uncover any completed work.
  - 1. If the Contractor fails to adequately notify the Construction Representative and/or Designer of an inspection as required by the Contract Documents, the Contractor shall, upon written request, uncover the work. The Contractor shall bear all costs associated with uncovering and again covering the work exposed.
  - 2. If the Contractor is directed to uncover work, which was not otherwise required by the Contract Documents to be inspected, and the work is found to be defective in any respect, no compensation shall be allowed for this work. If, however, such work is found to meet the requirements of this contract, the actual cost of labor and material necessarily involved in the examination and replacement plus 10% shall be allowed the Contractor.
- G. The Designer shall give all orders and directions contemplated under this contract relative to the scope of the work and shall give the initial interpretation of the contract documents.
- H. The Owner may file a written notice to the Contractor to dismiss immediately any subcontractors, project managers, superintendents, foremen, workers, watchmen or other employees whom the Owner may deem incompetent, careless or a hindrance to proper or timely execution of the work. The Contractor shall comply with such notice as promptly as practicable without detriment to the work or its progress.
- I. If in the Owner's judgment it becomes necessary at any time to accelerate work, when ordered by the Owner in writing, the Contractor shall redirect resources to such work items and execute such portions of the work as may be required to complete the work within the current approved contract schedule.

### **ARTICLE 3 -- CONTRACTOR RESPONSIBILITIES**

The Contractor shall register and utilize the Owner's eBuilder digital project management system for submission of documents described in the following sections. This includes but is not limited to submittals as required by designer, payment applications, Request for Information (RFI), construction change orders, Request for Proposals (RFP), Designer Supplemental Instructions (DSI), etc.

### **ARTICLE 3.1 -- ACCEPTABLE SUBSTITUTIONS**

- A. The Contractor may request use of any article, device, product, material, fixture, form or type of construction which in the judgment of the Owner and Designer is equal in all respects to that named. Standard products of manufacturers other than those specified will be accepted when, prior to the ordering or use thereof, it is proven to the satisfaction of the Owner and Designer that they are equal in design, strength, durability, usefulness and convenience for the purpose intended.
- B. Any changes required in the details and dimensions indicated on the drawings for the substitution of products other than those specified shall be properly made at the expense of the Contractor requesting the substitution or change.
- C. The Contractor shall submit a request for such substitutions in writing to the Owner and Designer within twenty (20) working days after the date of the "Notice to Proceed." Thereafter no consideration will be given to alternate forms of accomplishing the work. This Article does not preclude the Owner from exercising the provisions of Article 4 hereof.
- D. Any request for substitution by the Contractor shall be submitted in accordance with SECTION 002113 - INSTRUCTIONS TO BIDDERS.
- E. When a material has been approved, no change in brand or make will be permitted unless:
  - 1. Written verification is received from the manufacturer stating they cannot make delivery on the date previously agreed, or
  - 2. Material delivered fails to comply with contract requirements.

### **ARTICLE 3.2 -- SUBMITTALS**

- A. The Contractor's submittals must be submitted with such promptness as to allow for review and approval so as not to cause delay in the work. The Contractor shall coordinate preparation and processing of submittals with performance of construction activities.

Coordinate each submittal with fabrication, = purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

Submit four (4) copies to the Designer and additional copies as required for the subcontractors and material suppliers. Also provide copies to meet the requirements for maintenance manuals.

- B. All subcontractors' shop drawings and schedules shall be submitted by the Contractor and shall bear evidence that Contractor has received, reviewed, and approved them. Any shop drawings and

schedules submitted without this evidence will be returned to the Contractor for resubmission.

- C. The Contractor shall include with the shop drawing, a letter indicating any and all deviations from the drawings and/or specifications. Failure to notify the Designer of such deviations will be grounds for subsequent rejection of the related work or materials. If, in the opinion of the Designer, the deviations are not acceptable, the Contractor will be required to furnish the item as specified and indicated on the drawings.
- D. The Designer shall check shop drawings and schedules with reasonable promptness and approve them only if they conform to the design concept of the project and comply with the information given in the contract documents. The approval shall not relieve the Contractor from the responsibility to comply with the drawings and specifications, unless the Contractor has called the Designer's attention to the deviation, in writing, at the time of submission and the Designer has knowingly approved thereof. An approval of any such modification will be given only under the following conditions:
  - 1. It is in the best interest of the Owner
  - 2. It does not increase the contract sum and/or completion time
  - 3. It does not deviate from the design intent
  - 4. It is without prejudice to any and all rights under the surety bond.
- E. No extension of time will be granted because of the Contractor's failure to submit shop drawings and schedules in ample time to allow for review, possible resubmission, and approval. Fabrication of work shall not commence until the Contractor has received approval. The Contractor shall furnish prints of approved shop drawings and schedules to all subcontractors whose work is in any way related to the work under this contract. Only prints bearing this approval will be allowed on the site of construction
- F. The Contractor shall maintain a complete file on-site of approved shop drawings available for use by the Construction Representative.

#### **ARTICLE 3.3 – AS-BUILT DRAWINGS**

- A. The Contractor shall update a complete set of the construction drawings, shop drawings and schedules of all work monthly by marking changes, and at the completion of their work (prior to submission of request for final payment) note all changes and turn the set over to the Construction Representative. The updates shall show all addenda, all field changes that were made to adapt to field conditions, changes resulting from contract

changes or supplemental instructions, and all locations of structures, buried installations of piping, conduit, and utility services. All buried and concealed items both inside and outside shall be accurately located as to depth and referenced to permanent features such as interior or exterior wall faces and dimensions shall be given in a neat and legible manner in a contrasting colored pencil or ink. If approved by the Designer, an electronic file format may be provided.

#### **ARTICLE 3.4 – GUARANTY AND WARRANTIES**

##### **A. General Guaranty**

- 1. Neither the final certificate of payment nor any provision in the contract documents nor partial use or occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with contract requirements.
- 2. The Contractor or surety shall remedy any defects in the work and pay for any damage to property resulting there from which shall appear within a period of one (1) year from the date of substantial completion unless a longer period is otherwise specified or a differing guaranty period has been established in the substantial completion certificate. The Owner will give notice of observed defects with reasonable promptness.
- 3. In case of default on the part of the Contractor in fulfilling this part of this contract, the Owner may correct the work or repair the damage and the cost and expense incurred in such event shall be paid by or recoverable from the Contractor or surety.
- 4. The work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment

##### **B. Extended Warranty**

Manufacturer's certificates of warranty shall be obtained for all major equipment. Warranty shall be obtained for at least one year. Where a longer

period is offered at no additional cost or called for in the specific equipment specifications, the longer period shall govern.

### **ARTICLE 3.5 -- OPERATION AND MAINTENANCE MANUALS**

A. Immediately after equipment submittals are approved and no later than ten (10) working days prior to the substantial completion inspection, the Contractor shall provide to the Designer three (3) copies of operating instructions and service manuals, containing the following:

1. Start-up and Shut-down Procedures: Provide a step-by-step write up of all major equipment. When manufacturer's printed start-up, trouble shooting and shut-down procedures are available; they may be incorporated into the operating manual for reference.
2. Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.
3. Equipment List: List of all major equipment as installed shall be prepared to include model number, capacities, flow rate, name place data, shop drawings and air and water balance reports.
4. Service Instructions: Provide the following information for all pieces of equipment.
  - a. Recommended spare parts including catalog number and name of local supplier or factory representative.
  - b. Belt sizes, types, and lengths.
  - c. Wiring diagrams.
5. Manufacturer's Certificate of Warranty as described in Article 3.4.
6. Prior to the final payment, furnish to the Designer three (4) copies of parts catalogs for each piece of equipment furnished by him/her on the project with the components identified by number for replacement ordering.

B. Submission of operating instructions shall be done in the following manner.

1. Manuals shall be in quadruplicate, and all materials shall be bound into volumes of standard 8½" x 11" hard binders. Large drawings too bulky to be folded into 8½" x 11" shall be separately bound or folded and in envelopes, cross referenced and indexed with the manuals.
2. The manuals shall identify project name, project number, and include the name and

address of the Contractor, subcontractors and manufacturers who were involved with the activity described in that particular manual.

3. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titles clearly printed under reinforced laminated plastic tabs.
4. Contents: Prepare a Table of Contents for each volume, with each product or system description identified.

### **ARTICLE 3.6 – OTHER CONTRACTOR RESPONSIBILITIES**

- A. The Contractor shall keep on site, during progress of the work, a competent superintendent satisfactory to the Construction Representative. The superintendent shall represent the Contractor and all agreements made by the superintendent shall be binding. The superintendent shall carefully study and compare all drawings, specifications and other instructions and shall promptly notify the Construction Representative and Designer, in writing, any error, inconsistency or omission which may be discovered. The superintendent shall coordinate all work on the project. Any change of the superintendent shall be approved by the Construction Representative.
- B. Contractor shall, at all times, enforce strict discipline and good order among his employees, and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him/her.
- C. The Contractor shall supply sufficient labor, material, plant and equipment and pay when due any laborer, subcontractor or supplier for supplies furnished and otherwise prosecute the work with diligence to prevent work stoppage and insure completion thereof within the time specified.
- D. The Contractor and each of his subcontractors shall submit to the Construction Representative, through the Designer such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.
- E. The Contractor, subcontractors, and material suppliers shall upon written request, give the Owner access to all time cards, material invoices, payrolls, estimates, profit and loss statements, and all other direct or indirect costs related to this work.
- F. The Contractor shall be responsible for laying out all contract work such as layout of architectural, structural, mechanical and electrical work, which shall be coordinated with layouts of subcontractors

for general construction work. The Contractor is also responsible for unloading, uncrating and handling of all materials and equipment to be erected or placed by him/her, whether furnished by Contractor or others. No extra charges or compensation will be allowed as a result of failure to verify dimensions before ordering materials or fabricating items.

- G. The Contractor must notify the Construction Representative at least one working day before placing concrete or burying underground utilities, pipelines, etc.
- H. Contractors shall prearrange time with the Construction Representative for the interruption of any facility operation. Unless otherwise specified in these documents, all connections, alterations or relocations as well as all other portions of the work will be performed during normal working hours.
- I. The Contractor shall coordinate all work so there will not be prolonged interruptions of existing equipment operation. Any existing plumbing, heating, ventilating, air conditioning or electrical disconnections necessary for the project, which affect portions of this construction or building or any other building must be scheduled with the Construction Representative to minimize or avoid any disruption of facility operations. In no case, unless previously approved in writing by the Construction Representative, shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities either intentionally or accidentally shall not relieve the Contractor responsible for the interruption from the responsibility to repair and restore the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.
- J. Contractors shall limit operations and storage of materials to the area within the project, except as necessary to connect to existing utilities, and shall not encroach on neighboring property. The Contractor shall be responsible for repair of their damage to property on or off the project site occurring during construction of project. All such repairs shall be made to the satisfaction of the property owner.
- K. Unless otherwise permitted, all materials shall be new and both workmanship and materials shall be of the best quality.
- L. Unless otherwise provided and stipulated within these specifications, the Contractor shall furnish, construct, and/or install and pay for materials, devices, mechanisms, equipment, all necessary personnel, utilities including, but not limited to water, heat, light and electric power, transportation

services, applicable taxes of every nature, and all other facilities necessary for the proper execution and completion of the work.

- M. Contractor shall carefully examine the plans and drawings and shall be responsible for the proper fitting of his material, equipment and apparatus into the building.
- N. The Contractor or subcontractors shall not overload, or permit others to overload, any part of any structure during the performance of this contract.
- O. All temporary shoring, bracing, etc., required for the removal of existing work and/or for the installation of new work shall be included in this contract. The Contractor shall make good, at no cost to the Owner, any damage caused by improper support or failure of shoring in any respect. Each Contractor shall be responsible for shoring required to protect his work or adjacent property and improvements of Owner and shall be responsible for shoring or for giving written notice to adjacent property owners. Shoring shall be removed only after completion of permanent supports.
- P. The Contractor shall provide at the proper time such material as is required for support of the work. If openings are required, whether shown on drawings or not, the Contractor shall see that they are properly constructed.
- Q. During the performance of work the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences and other devices appropriately located on site which will give proper and understandable warning to all persons of danger of entry onto land, structure or equipment.
- R. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials.
- S. The Contractor shall be responsible for care of the finished work and shall protect same from damage or defacement until substantial completion by the Owner. If the work is damaged by any cause, the Contractor shall immediately begin to make repairs in accordance with the drawings and specifications. Contractor shall be liable for all damage or loss unless attributable to the acts or omissions of the Owner or Designer. Any claim for reimbursement shall be submitted in accordance with Article 4. After substantial completion the Contractor will only be responsible for damage resulting from acts or omissions of the Contractor or subcontractors through final warranty.
- T. In the event the Contractor encounters an unforeseen hazardous material, the Contractor

shall immediately stop work in the area affected and report the condition to the Owner and Designer in writing. The Contractor shall not be required, pursuant to Article 4, to perform, any work relating to hazardous materials.

- U. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 4.
- V. Before commencing work, Contractors shall confer with the Construction Representative and facility representative and review any facility rules and regulations which may affect the conduct of the work.
- W. Project signs will only be erected on major projects and only as described in the specifications. If no sign is specified, none shall be erected.

#### **ARTICLE 3.7 -- SUBCONTRACTS**

- A. Subcontractor assignments as identified in the bid form shall not be changed without written approval of the Owner. The Owner will not approve changes of a listed subcontractor unless the Contractor documents, to the satisfaction of the Owner that the subcontractor cannot or will not perform the work as specified.
- B. The Contractor is fully responsible to the Owner for the acts and omissions of all subcontractors and of persons either directly or indirectly employed by them.
- C. Every subcontractor shall be bound by the applicable terms and provisions of these contract documents, but no contractual relationship shall exist between any subcontractor and the Owner unless the right of the Contractor to proceed with the work is suspended or this contract is terminated as herein provided, and the Owner in writing elects to assume the subcontract.
- D. The Contractor shall upon receipt of "Notice to Proceed" and prior to submission of the first payment request, notify the Designer and Construction Representative in writing of the names of any subcontractors to be used in addition to those identified in the bid form and all major material suppliers proposed for all parts of the work.

#### **ARTICLE 4 -- CHANGES IN THE WORK**

##### **4.1 CHANGES IN THE WORK**

- A. The Construction Representative, without giving notice to the surety and without invalidating this contract, may order extra work or make changes by

altering, adding to or deducting from the work, this contract sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract. A claim for extension of time caused by any change must be adjusted at the time of ordering such change. No future request for time will be considered.

- B. Each Contract Change shall include all costs required to perform the work including all labor, material, equipment, overheads and profit, delay, disruptions, or other miscellaneous expenses. No subsequent requests for additional compensation including claims for delay, disruption, or reduced efficiency as a result of each change will be considered. Values from the Schedule of Values will not be binding as a basis for additions to or deductions from the contract price.
- C. The amount of any adjustment in this contract price for authorized changes shall be agreed upon before such changes become effective and shall be determined, through submission of a request for proposal, as follows:
  - 1. By an acceptable fixed price proposal from the Contractor. Breakdowns shall include all takeoff sheets of each Contractor and subcontractor. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
  - 2. By a cost-plus-fixed-fee (time and material) basis with maximum price, total cost not to exceed said maximum. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
  - 3. By unit prices contained in Contractor's original bid form and incorporated in the construction contract.
- D. Overhead and Profit on Contract Changes shall be applied as follows:

- 1. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: incidental job burdens, small truck (under 1 ton) expense, mileage, small hand tools,

warranty costs, company benefits and general office overhead. Project supervision including field supervision and job site office expense shall be considered a part of overhead and profit unless a compensable time extension is granted.

2. The percentages for overhead and profit charged on Contract Changes shall be negotiated, and may vary according to the nature, extent, and complexity of the work involved. However, the overhead and profit for the Contractor or subcontractor actually performing the work shall not exceed 14%. When one or more tiers of subcontractors are used, in no event shall any Contractor or subcontractor receive as overhead and profit more than 3% of the cost of the work performed by any of his subcontractors. In no case shall the total overhead and profit paid by the Owner on any Contract Changes exceed twenty percent (20%) of the cost of materials, labor and equipment (exclusive of Contractor or any Subcontractor overhead and profit) necessary to put the contract change work in place.
  3. The Contractor will be allowed to add the cost of bonding and insurance to their cost of work. This bonding and insurance cost shall not exceed 2% and shall be allowed on the total cost of the added work, including overhead and profit.
  4. On proposals covering both increases and decreases in the amount of this contract, the application of overhead and profit shall be on the net change in the cost of the work.
  5. The percentage for overhead and profit to be credited to the Owner on Contract Changes that are solely decreases in the quantity of work or materials shall be negotiated, and may vary according to the nature, extent and complexity of the work involved, but in no case shall be less than ten percent (10%). If the percentage for overhead and profit charged for work added by Contract Changes for this contract has been negotiated to less than 10%, the negotiated rate shall then apply to credits as well.
- E. No claim for an addition to this contract sum shall be valid unless authorized as aforesaid in writing by the Owner. In the event that none of the foregoing methods are agreed upon, the Owner may order the Contractor to perform work on a time and material basis. The cost of such work shall be determined by the Contractor's actual labor and material cost to perform the work plus overhead and profit as outlined herein. The

Designer and Construction Representative shall approve the Contractor's daily time and material invoices for the work involved.

- F. If the Contractor claims that any instructions involve extra cost under this contract, the Contractor shall give the Owner's Representative written notice thereof within a reasonable time after the receipt of such instructions, and in any event before proceeding to execute the work. No such claim shall be valid unless so made and authorized by the Owner, in writing.
- G. In an emergency affecting the safety of life or of the structure or of adjoining property, the Contractor, without special instruction or authorization from the Construction Representative, is hereby permitted to act at their discretion to prevent such threatened loss or injury. The Contractor shall submit a claim for compensation for such emergency work in writing to the Owner's Representative.

#### **ARTICLE 4.2 – CHANGES IN COMPLETION TIME**

- A. Extension of the number of work days stipulated in the Contract for completion of the work with compensation may be made when:
  1. The contractor documents that proposed Changes in the work, as provided in Article 4.1, extends construction activities critical to contract completion date, OR
  2. The Owner suspends all work for convenience of the Owner as provided in Article 7.3, OR
  3. An Owner caused delay extends construction activities critical to contract completion (except as provided elsewhere in these General Conditions). The Contractor is to review the work activities yet to begin and evaluate the possibility of rescheduling the work to minimize the overall project delay.
- B. Extension of the number of work days stipulated in the Contract for completion of the work without compensation may be made when:
  1. Weather-related delays occur, subject to provisions for the inclusion of a specified number of "bad weather" days when provided for in Section 012100-Allowances, OR
  2. Labor strikes or acts of God occur, OR
  3. The work of the Contractor is delayed on account of conditions which were beyond the control of the Contractor, subcontractors or suppliers, and were not the result of their fault or negligence.
- C. No time extension or compensation will be provided for delays caused by or within the control

of the Contractor, subcontractors or suppliers and for concurrent delays caused by the Owner.

- D. The Contractor shall notify the Owner promptly of any occurrence or conditions which in the Contractor's opinion results in a need for an extension of time. The notice shall be in writing and shall include all necessary supporting materials with details of any resultant costs and be submitted in time to permit full investigation and evaluation of the Contractor's claim. The Owner shall promptly acknowledge the Contractor's notice and, after recommendation from the Owner's Representative and/or Designer, shall provide a decision to the Contractor. Failure on the part of the Contractor to provide such notice and to detail the costs shall constitute a waiver by the Contractor of any claim. Requests for extensions of time shall be for working days only.

## **ARTICLE 5 - CONSTRUCTION AND COMPLETION**

### **ARTICLE 5.1 – CONSTRUCTION COMMENCEMENT**

- A. Upon receipt of the "Intent to Award" letter, the Contractor must submit the following properly executed instruments to the Owner:
1. Contract;
  2. Performance/payment bond as described in Article 6.1;
  3. Certificates of Insurance, or the actual policies themselves, showing that the Contractor has obtained the insurance coverage required by Article 6.2.
  4. Written Affirmative Action Plans as required in Article 1.4.

Above referenced items must be received by the Owner within ten (10) working days after the effective date of the contract. If not received, the Owner may treat the failure to timely submit them as a refusal by the Contractor to accept a contract for this work and may retain as liquidated damages the Contractor's bid bond, cashier's check or certified check as provided in the Instructions to Bidders. Upon receipt the Owner will issue a "Notice to Proceed" with the work to the Contractor.

- B. Within the time frame noted in Section 013200 - Schedules, following receipt of the "Notice to Proceed", the Contractor shall submit to the Owner a progress schedule and schedule of values, showing activities through the end of the contract period. Should the Contractor not receive written notification from the Owner of the disapproval of the schedule of values within fifteen (15) working

days, the Contractor may consider it approved for purpose of determining when the first monthly Application and Certification for Payment may be submitted.

- C. The Contractor may commence work upon receipt of the Division of Facilities Management, Design and Construction's "Notice to Proceed" letter. Contractor shall prosecute the work with faithfulness and energy, and shall complete the entire work on or before the completion time stated in the contract documents or pay to the Owner the damages resulting from the failure to timely complete the work as set out within Article 5.4.

### **ARTICLE 5.2 -- PROJECT CONSTRUCTION**

- A. Each Contractor shall submit for the Owner's approval, in reproducible form, a progress schedule showing the rate of progress and the order of the work proposed to carry on various phases of the project. The schedule shall be in conformance with the requirements outlined in Section 013200 – Schedules.
- B. Contractor shall employ and supply a sufficient force of workers, material, and equipment and shall pay when due, any worker, subcontractor or supplier and otherwise prosecute the work with such diligence so as to maintain the rate of progress indicated on the progress schedule, prevent work stoppage, and insure completion of the project within the time specified.

### **ARTICLE 5.3 -- PROJECT COMPLETION**

- A. Substantial Completion. A Project is substantially complete when construction is essentially complete and work items remaining to be completed can be done without interfering with the Owner's ability to use the Project for its intended purpose.
1. Once the Contractor has reached what they believe is Substantial Completion, the Contractor shall notify the Designer and the Construction Representative of the following:
    - a. That work is essentially complete with the exception of certain listed work items. The list shall be referred to as the "Contractor's Punch."
    - b. That all Operation and Maintenance Manuals have been assembled and submitted in accordance with Article 3.5A.
    - c. That the Work is ready for inspection by the Designer and Construction Representative. The Owner shall be entitled to a minimum of ten working



days notice before the inspection shall be performed.

2. If the work is acceptable, the Owner shall issue a Certificate of Substantial Completion, which shall set forth the responsibilities of the Owner and the Contractor for utilities, security, maintenance, damage to the work and risk of loss. The Certificate shall also identify those remaining items of work to be performed by the Contractor. All such work items shall be complete within 30 working days of the date of the Certificate, unless the Certificate specifies a different time. If the Contractor shall be required to perform tests that must be delayed due to climatic conditions, it is understood that such tests and affected equipment will be identified on the Certificate and shall be accomplished by the Contractor at the earliest possible date. Performance of the tests may not be required before Substantial Completion can be issued. The date of the issuance of the Certificate of Substantial Completion shall determine whether or not the work was completed within the contract time and whether or not Liquidated Damages are due.
  3. If the work is not acceptable, and the Owner does not issue a Certificate of Substantial Completion, the Owner shall be entitled to charge the Contractor with the Designer's and Owner's costs of re-inspection, including time and travel.
- B. Partial Occupancy. Contractor agrees that the Owner shall be permitted to occupy and use any completed or partially completed portions of the Project, when such occupancy and use is in the Owner's best interest. Owner shall notify Contractor of its desire and intention to take Partial Occupancy as soon as possible but at least ten (10) working days before the Owner intends to occupy. If the Contractor believes that the portion of the work the Owner intends to occupy is not ready for occupancy, the Contractor shall notify the Owner immediately. The Designer shall inspect the work in accordance with the procedures above. If the Contractor claims increased cost of the project or delay in completion as a result of the occupancy, he shall notify the Owner immediately but in all cases before occupancy occurs.
- C. Final Completion. The Project is finally complete when the Certificate of Substantial Completion has been issued and all work items identified therein as incomplete have been completed, and when all administrative items required by the contract have been completed. Final Completion entitles the Contractor to payment of the outstanding balance of the contract amount including all change orders

and retainage. Within five (5) working days of the date of the Certificate of Substantial Completion, the Contractor shall identify the cost to complete any outstanding items of work. The Designer shall review the Contractor's estimate and either approve it or provide an independent estimate for all such items. If the Contractor fails to complete the remaining items within the time specified in the Certificate, the Owner may terminate the contract and go to the surety for project completion in accordance with Article 7.2 or release the contract balance to the Contractor less 150% of the approved estimate to complete the outstanding items. Upon completion of the outstanding items, when a final cost has been established, any monies remaining shall be paid to the Contractor. Failure to complete items of work does not relieve the Contractor from the obligation to complete the administrative requirements of the contract, such as the provisions of Article 5.3 FAILURE TO COMPLETE ALL ITEMS OF WORK UNDER THE CONTRACT SHALL BE CONSIDERED A DEFAULT AND BE GROUNDS FOR CONTRACT TERMINATION AND DEBARMENT.

- D. Liquidated Damages. Contractor agrees that the Owner may deduct from the contract price and retain as liquidated damages, and not as penalty or forfeiture, the sum stipulated in this contract for each work day after the Contract Completion Day on which work is not Substantially Complete. Assessment of Liquidated Damages shall not relieve the Contractor or the surety of any responsibility or obligation under the Contract. In addition, the Owner may, without prejudice to any other rights, claims, or remedies the Owner may have including the right to Liquidated Damages, charge the Contractor for all additional expenses incurred by the Owner and/or Designer as the result of the extended contract period through Final Completion. Additional Expenses shall include but not be limited to the costs of additional inspections.
- E. Early Completion. The Contractor has the right to finish the work before the contract completion date; however, the Owner assumes no liability for any hindrances to the Contractor unless Owner caused delays result in a time extension to the contract completion date. The Contractor shall not be entitled to any claims for lost efficiencies or for delay if a Certificate of Substantial Completion is given on or before the Contract Completion Date.

#### **ARTICLE 5.4 -- PAYMENT TO CONTRACTOR**

- A. Payments on account of this contract will be made monthly in proportion to the work which has been completed. Request for payment must be submitted on the Owner's forms. No other pay request will

be processed. Supporting breakdowns must be in the same format as Owner's forms and must provide the same level of detail. The Designer will, within 5 working days from receipt of the contractor's request for payment either issue a Certificate for Payment to the Owner, for such amount as the Designer determines is properly due, or notify the Contractor in writing of reasons for withholding a Certificate. The Owner shall make payment within 30 calendar days after the "Application and Certification for Payment" has been received and certified by the Designer. The following items are to be attached to the contractor's pay request:

1. Updated construction schedule
  2. Certified payrolls consisting of name, occupation and craft, number of hours worked and actual wages paid for each individual employee, of the Contractor and all subcontractors working on the project
- B. The Owner shall retain 5 percent of the amount of each such payment application, except as allowed by Article 5.4, until final completion and acceptance of all work covered by this contract.
- C. Each payment made to Contractor shall be on account of the total amount payable to Contractor and all material and work covered by paid partial payment shall thereupon become the sole property of Owner. This provision shall not be construed as relieving Contractor from sole responsibility for care and protection of materials and work upon which payments have been made or restoration of any damaged work or as a waiver of the right of Owner to require fulfillment of all terms of this contract.
- D. Materials delivered to the work site and not incorporated in the work will be allowed in the Application and Certification for Payment on the basis of one hundred (100%) percent of value, subject to the 5% retainage providing that they are suitably stored on the site or in an approved warehouse in accordance with the following requirements:
1. Material has previously been approved through submittal and acceptance of shop drawings conforming to requirements of Article 3.2 of General Conditions.
  2. Delivery is made in accordance with the time frame on the approved schedule.
  3. Materials, equipment, etc., are properly stored and protected from damage and deterioration and remain so - if not, previously approved amounts will be deleted from subsequent pay applications.

4. The payment request is accompanied by a breakdown identifying the material equipment, etc. in sufficient detail to establish quantity and value.
- E. The Contractor shall be allowed to include in the Application and Certification for Payment, one hundred (100%) of the value, subject to retainage, of major equipment and material stored off the site if all of the following conditions are met:
1. The request for consideration of payment for materials stored off site is made at least 15 working days prior to submittal of the Application for Payment including such material. Only materials inspected will be considered for inclusion on Application for Payment requests.
  2. Materials stored in one location off site are valued in excess of \$25,000.
  3. That a Certificate of Insurance is provided indicating adequate protection from loss, theft conversion or damage for materials stored off site. This Certificate shall show the State of Missouri as an additional insured for this loss.
  4. The materials are stored in a facility approved and inspected, by the Construction Representative.
  5. Contractor shall be responsible for, Owner costs to inspect out of state facilities, and any delays in the completion of the work caused by damage to the material or for any other failure of the Contractor to have access to this material for the execution of the work.
- F. The Owner shall determine the amount, quality and acceptability of the work and materials which are to be paid for under this contract. In the event any questions shall arise between the parties, relative to this contract or specifications, determination or decision of the Owner or the Construction Representative and the Designer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.
- G. Payments Withheld: The Owner may withhold or nullify in whole or part any certificate to such extent as may be necessary to protect the Owner from loss on account of:
1. Defective work not remedied. When a notice of noncompliance is issued on an item or items, corrective action shall be undertaken immediately. Until corrective action is completed, no monies will be paid and no additional time will be allowed for the item or

items. The cost of corrective action(s) shall be borne by the Contractor.

2. A reasonable doubt that this contract can be completed for the unpaid balance.
3. Failure of the Contractor to update as-built drawings monthly for review by the Construction Representative.
4. Failure of the Contractor to update the construction schedule.

When the Construction Representative is satisfied the Contractor has remedied above deficiencies, payment shall be released.

H. Final Payment: Upon receipt of written notice from the Contractor to the Designer and Project Representative that the work is ready for final inspection and acceptance, the Designer and Project Representative, with the Contractor, shall promptly make such inspection. If the work is acceptable and the contract fully performed, the Construction Representative shall complete a final acceptance report and the Contractor will be directed to submit a final Application and Certification for Payment. If the Owner approves the same, the entire balance shall be due and payable, with the exception of deductions as provided for under Article 5.4.

1. Where the specifications provide for the performance by the Contractor of (certain tests for the purpose of balancing and checking the air conditioning and heating equipment and the Contractor shall have furnished and installed all such equipment in accordance with the specifications, but said test cannot then be made because of climatic conditions, such test shall may be considered as required under the provisions of the specifications, Section 013300 and this contract may be substantial Full payment will not be made until the tests have been made and the equipment and system is finally accepted. If the tests are not completed when scheduled, the Owner may deduct 150% of the value of the tests from the final payment.
2. The final payment shall not become due until the Contractor delivers to the Construction Representative:
  - a) A complete file of releases, on the standard form included in the contract documents as "Final Receipt of Payment and Release Form", from subcontractors and material suppliers evidencing payment in full for services, equipment and materials, as the case may require, if the Owner approves, or a consent from

the Surety to final payment accepting liability for any unpaid amounts.

- b) An Affidavit of Compliance with Prevailing Wage Law, in the form as included in this contract specifications, properly executed by each subcontractor, and the Contractor
  - c) Certified copies of all payrolls
  - d) As-built drawings
3. If any claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a claim including all costs and a reasonable attorney's fee.
  4. Missouri statute requires prompt payment from the Owner to the Contractor within thirty calendar days and from the Contractor to his subcontractors within fifteen calendar days. Failure to make payments within the required time frame entitles the receiving party to charge interest at the rate of one and one half percent per month calculated from the expiration of the statutory time period until paid.
  5. The value of all unused unit price allowances and/or 150% of the value of the outstanding work items, and/or liquidated damages may be deducted from the final pay request without executing a Contract Change. Any unit price items which exceed the number of units in the contract may be added by Contract Change.

## ARTICLE 6 -- INSURANCE AND BONDS

### ARTICLE 6.1 -- BOND

- A. Contractor shall furnish a performance/payment bond in an amount equal to 100% of the contract price to guarantee faithful performance of the contract and 100% of the contract price to guarantee the payment of all persons performing labor on the project and furnishing materials in connection therewith under this contract as set forth in the standard form of performance and payment bond included in the contract documents. The surety on such bond shall be issued by a surety company authorized by the Missouri Department of Insurance to do business in the state of Missouri.
- B. All Performance/Payment Bonds furnished in response to this provision shall be provided by a bonding company with a rating of B+ or higher as established by A.M. Best Company, Inc. in their most recent publication.

**ARTICLE 6.2 – INSURANCE**

- A. The successful Contractor shall procure and maintain for the duration of the contract issued a policy or policies of insurance for the protection of both the Contractor and the Owner and their respective officers, officials, agents, consultants and employees. The Owner requires certification of insurance coverage from the Contractor prior to commencing work.
- B. Minimum Scope and Extent of Coverage
  - 1. General Liability  
Commercial General Liability, ISO coverage form number or equivalent CG 00 01 ("occurrence" basis), or I-SO coverage form number CG 00 02, or ISO equivalent.  
  
If ISO equivalent or manuscript general liability coverage forms are used, minimum coverage will be as follows: Premises/Operations; Independent Contractors; Products/Completed Operations; personal Injury; Broad Form Property Damage including Completed Operations; Broad Form Contractual Liability Coverage to include Contractor's obligations under Article 1.11 Indemnification and any other Special Hazards required by the work of the contract.
  - 2. Automobile Liability  
Business Automobile Liability Insurance, ISO Coverage form number or equivalent CA 00 01 covering automobile liability, code 1 "ANY AUTO".
  - 3. Workers' Compensation and Employer's Liability  
Statutory Workers' Compensation Insurance for Missouri and standard Employer's Liability Insurance, or the authorization to self-insure for such liability from the Missouri Division of Workers' Compensation.
  - 4. Builder's Risk or Installation Floater Insurance  
Insurance upon the work and all materials, equipment, supplies, temporary structures and similar items which may be incident to the performance of the work and located at or adjacent to the site, against loss or damage from fire and such other casualties as are included in extended coverage in broad "All Risk" form, including coverage for Flood and Earthquake, in an amount not less than the replacement cost of the work or this contract price, whichever is greater, with loss payable to Contractor and Owner as their respective interests may appear.

Contractor shall maintain sufficient insurance to cover the full value of the work and materials as the work progresses, and shall furnish Owner copies of all endorsements. If Builder's Risk Reporting- Form of Endorsement is used, Contractor shall make all reports as required therein so as to keep in force an amount of insurance which will equal the replacement cost of the work, materials, equipment, supplies, temporary structures, and other property covered thereby; and if, as a result of Contractor's failure to make any such report, the amount of insurance so recoverable shall be less than such replacement cost, Contractor's interest in the proceeds of such insurance, if any, shall be subordinated to Owner's interest to the end that Owner may receive full reimbursement for its loss.

- C. Minimum Limits of Insurance
  - 1. General Liability  
Contractor  
\$2,000,000 combined single limit per occurrence for bodily injury, personal injury, and property damage  
\$2,000,000 annual aggregate
  - 2. Automobile Liability  
\$2,000,000 combined single limit per occurrence for bodily injury and property damage
  - 3. Workers' Compensation and Employers Liability  
Workers' Compensation limits as required by applicable State Statutes (generally unlimited) and minimum of \$1,000,000 limit per accident for Employer's Liability.  
  
General Liability and Automobile Liability insurance may be arranged under individual policies for the full limits required or by a combination of underlying policies with the balance provided by a form-following Excess or Umbrella Liability policy.
- D. Deductibles and Self-Insured Retentions  
All deductibles, co-payment clauses, and self-insured retentions must be declared to and approved by the Owner. The Owner reserves the right to request the reduction or elimination of unacceptable deductibles or self-insured retentions, as they would apply to the Owner, and their respective officers, officials, agents, consultants and employees. Alternatively, the Owner may request Contractor to procure a bond guaranteeing

payment of losses and related investigations, claims administration, and defense expenses.

E. Other Insurance Provisions and Requirements

The respective insurance policies and coverage, as specified below, must contain, or be endorsed to contain the following conditions or provisions:

1. General Liability

The Owner, and its respective commissioners, officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 Additional Insured - Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance of self-insurance programs maintained by the designated additional -insured's shall be excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's general liability insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner, or for any of their officers, officials, agents, consultants or employees.

2. Automobile Insurance

The Owner, and their respective officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 - Additional Insured Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance or self-insurance

programs maintained by the designated additional insured's shall be in excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's automobile insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner or for any of its officers, officials, agents, consultants or employees.

3. Workers' Compensation/Employer's Liability

Contractor's workers' compensation insurance shall be endorsed with NCCI form WC 00 03 01 A - Alternative Employer Endorsement. The Alternative Employer Endorsement shall designate the Owner as "alternate employers."

4. All Coverages

Each insurance policy required by this section of the Contract shall contain a stipulation, endorsed if necessary, that the Owner will receive a minimum of a thirty (30) calendar day advance notice of any policy cancellation. Ten (10) calendar days advance notice is required for policy cancellation due to non-payment of premium.

F. Insurer Qualifications and Acceptability

Insurance required hereunder shall be issued by an A.M. Best, "B+" rated, Class IX insurance company approved to conduct insurance business in the state of Missouri.

G. Verification of Insurance Coverage

Prior to Owner issuing a Notice to Proceed, the Contractor shall furnish the Owner with Certificate(s) of Insurance and with any applicable original endorsements evidencing the required insurance coverage. The insurance certificates and endorsements are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates and endorsements received by the Owner are subject to review and approval by the Owner. The Owner reserves the right to require certified copies of all required policies at any time. If the scope of this contract will exceed one (1) year - or, if any of Contractor's applicable insurance coverage expires prior to completion of the work or services required under this contract -

the Contractor will provide a renewal or replacement certificate before continuing work or services hereunder. If the Contractor fails to provide documentation of required insurance coverage, the Owner may issue a stop work order and no additional contract completion time and/or compensation shall be granted as a result thereof.

## **ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT**

### **ARTICLE 7.1 - FOR SITE CONDITIONS**

When conditions at the site of the proposed work are considered by the Owner to be unsatisfactory for prosecution of the work, the Contractor may be ordered in writing to suspend the work or any part thereof until reasonable conditions exist. When such suspension is not due to fault or negligence of the Contractor, time allowed for completion of such suspended work will be extended by a period of time equal to that lost due to delay occasioned by ordered suspension. This will be a no cost time extension.

### **ARTICLE 7.2 - FOR CAUSE**

#### **A. Termination or Suspension for Cause:**

1. If the Contractor shall file for bankruptcy, or should make a general assignment for the benefit of the creditors, or if a receiver should be appointed on account of insolvency, or if the contractor should persistently or repeatedly refuse or fail to supply enough properly skilled workers or proper materials, or if the contractor should fail to make prompt payment to subcontractors or for material or labor, or persistently disregard laws, ordinances or the instructions of the Owner, or otherwise be guilty of a substantial violation of any provision of this contract, then the Owner may serve notice on the Contractor and the surety setting forth the violations and demanding compliance with this contract. Unless within ten (10) consecutive calendar days after serving such notice, such violations shall cease and satisfactory arrangements for correction be made, the Owner may suspend the Contractor's right to proceed with the work or terminate this contract.
2. In the event the Owner suspends Contractor's right to proceed with the work or terminates the contract, the Owner may demand that the Contractor's surety take over and complete the work on this contract, after the surety submits a written proposal to the Owner and receives written approval and upon the surety's failure or refusal to do so within ten (10) consecutive

calendar days after demand therefore, the Owner may take over the work and prosecute the same to completion by bid or negotiated contract, or the Owner may elect to take possession of and utilize in completing the work such materials, supplies, appliances and plant as may be on the site of the work, and all subcontractors, if the Owner elects, shall be bound to perform their contracts.

- B. The Contractor and its surety shall be and remain liable to the Owner for any excess cost or damages occasioned to the Owner as a result of the actions above set forth.
- C. The Contractor in the event of such suspension or termination shall not be entitled to receive any further payments under this contract until the work is wholly finished. Then if the unpaid balance under this contract shall exceed all expenses of the Owner as certified by the Director, such excess shall be paid to the Contractor; but, if such expenses shall exceed the unpaid balance as certified by the Director, the Contractor and their surety shall be liable for and shall pay the difference and any damages to the Owner.
- D. In exercising Owner's right to secure completion of the work under any of the provisions hereof, the Director shall have the right to exercise Owner's sole discretion as to the manner, methods and reasonableness of costs of completing the work.
- E. The rights of the Owner to suspend or terminate as herein provided shall be cumulative and not exclusive and shall be in addition to any other remedy provided by law.
- F. The Contractor in the event of such suspension or termination may be declared ineligible for Owner contracts for a minimal period of twelve (12) months. Further, no contract will be awarded to any Contractor who lists in their bid form any subcontractor whose prior performance has contributed, as determined by the Owner, to a breach of a contract. In order to be considered for state-awarded contracts after this period, the Contractor/subcontractor will be required to forward acceptance reports to the Owner regarding successful completion of non-state projects during the intervening twelve (12) months from the date of default. No contracts will be awarded to a subcontractor/Contractor until the ability to perform responsibly in the private sector has been proven to the Owner.

### **ARTICLE 7.3 -- FOR CONVENIENCE**

- A. The Owner may terminate or suspend the Contract or any portion of the Work without cause at any time, and at the Owner's convenience. Notification of a termination or suspension shall be in writing

and shall be given to the Contractor and their surety. If the Contract is suspended, the notice will contain the anticipated duration of the suspension or the conditions under which work will be permitted to resume. If appropriate, the Contractor will be requested to demobilize and re-mobilize and will be reimbursed time and costs associated with the suspension.

B. Upon receipt of notification, the Contractor shall:

1. Cease operations when directed.
2. Take actions to protect the work and any stored materials.
3. Place no further subcontracts or orders for material, supplies, services or facilities except as may be necessary to complete the portion of the Contract that has not been terminated. No claim for payment of materials or supplies ordered after the termination date shall be considered.
4. Terminate all existing subcontracts, rentals, material, and equipment orders.

5. Settle all outstanding liabilities arising from termination with subcontractors and suppliers.

6. Transfer title and deliver to the Owner, work in progress, completed work, supplies and other material produced or acquire for the work terminated, and completed or partially completed plans, drawings information and other property that, if the Contract had been completed, would be required to be furnished to the Owner.

C. For termination without cause and at the Owner's convenience, in addition to payment for work completed prior to date of termination, the Contractor may be entitled to payment of other documented costs directly associated with the early termination of the contract. Payment for anticipated profit and unapplied overhead will not be allowed.

## **SECTION 007300 - SUPPLEMENTARY CONDITIONS**

### **1.0 GENERAL:**

A. These Supplementary General Conditions clarify, add, delete, or otherwise modify standard terms and conditions of DIVISION 0, BIDDING AND CONTRACTING REQUIREMENTS.

### **2.0 CONTACTS:**

Designer:

Nick Bruner  
Farnsworth Group  
20 Allen Avenue, Suite 200  
St. Louis, MO 63119  
Telephone: (309) 429-6689  
Email: [nbruner@F-W.com](mailto:nbruner@F-W.com)

Construction Representative:

Kevin Hultberg  
Division of Facilities Management, Design and Construction  
10325 Business 21 North  
Hillsboro, MO 63050  
Telephone: (636) 524-8528  
Email: [Kevin.Hultberg@oa.mo.gov](mailto:Kevin.Hultberg@oa.mo.gov)

Project Manager:

Ryan Abbott  
Division of Facilities Management, Design and Construction  
301 West High Street, Room 730  
Jefferson City, Missouri 65101  
Telephone: (573) 298-1967  
Email: [Ryan.Abbott@oa.mo.gov](mailto:Ryan.Abbott@oa.mo.gov)

Contract Specialist:

Paul Girouard  
Division of Facilities Management, Design and Construction  
301 West High Street, Room 730  
Jefferson City, Missouri 65102  
Telephone: 573-751-4797  
Email: [Paul.Girouard@oa.mo.gov](mailto:Paul.Girouard@oa.mo.gov)

### **3.0 NOTICE: ALL BID MATERIALS ARE DUE AT THE TIME OF BID SUBMITTAL. THERE IS NO SECOND SUBMITTAL FOR THIS PROJECT.**

### **4.0 FURNISHING CONSTRUCTION DOCUMENTS:**

- A. The Owner will furnish the Contractor with approximately 6 complete sets of drawings and specifications at no charge.
- B. The Owner will furnish the Contractor with approximately 6 sets of explanatory or change drawings at no charge.
- C. The Contractor may make copies of the documents as needed with no additional cost to the Owner.

### **5.0 SAFETY REQUIREMENTS**

Contractor and subcontractors at any tier shall comply with RSMo 292.675 and Article 1.3, E, of Section 007213, General Conditions.



# Missouri

## Division of Labor Standards

### WAGE AND HOUR SECTION



MICHAEL L. PARSON, Governor

# Annual Wage Order No. 29

Section 105  
**SHANNON COUNTY**

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by \_\_\_\_\_

Todd Smith, Director  
Division of Labor Standards

Filed With Secretary of State: \_\_\_\_\_ **March 10, 2022**

Last Date Objections May Be Filed: **April 11, 2022**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$17.84*
Boilermaker	\$17.84*
Bricklayer	\$17.84*
Carpenter	\$17.84*
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$17.84*
Plasterer	
Communications Technician	\$17.84*
Electrician (Inside Wireman)	\$17.84*
Electrician Outside Lineman	\$17.84*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$17.84*
Glazier	\$17.84*
Ironworker	\$17.84*
Laborer	\$17.84*
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$17.84*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$17.84*
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$17.84*
Plumber	\$17.84*
Pipe Fitter	
Roofer	\$17.84*
Sheet Metal Worker	\$17.84*
Sprinkler Fitter	\$17.84*
Truck Driver	\$17.84*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

\*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

\*\*The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in Section 290.210 RSMo.

Heavy Construction Rates for  
SHANNON County

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$17.84*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$17.84*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$17.84*
General Laborer	
Skilled Laborer	
Operating Engineer	\$59.01
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$17.84*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

\*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

\*\*The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in Section 290.210 RSMo.

# OVERTIME and HOLIDAYS

## OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, "**overtime work**" shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

## HOLIDAYS

January first;  
The last Monday in May;  
July fourth;  
The first Monday in September;  
November eleventh;  
The fourth Thursday in November; and  
December twenty-fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

## **SECTION 011000 – SUMMARY OF WORK**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 WORK COVERED BY CONTRACT DOCUMENTS**

- A. The Project consists of Interior renovations and various exterior building improvements.
  - 1. Project Location: Echo Bluff State Park  
Eminence, Missouri
  - 2. Owner: State of Missouri, Office of Administration, Division of Facilities Management, Design and Construction, Harry S Truman State Office Building, Post Office Box 809, 301 West High Street, Jefferson City, Missouri 65102.
- B. Contract Documents dated 03-02-2023 were prepared for the Project by Farnsworth Group.
- C. The Work consists of construction of six new cabins (*two four-bedroom cabins and four two-bedroom cabins*) at Echo Bluff State Park and modify the original site plan for the day use area to accommodate the cabins. *The cabins should be similar in layout and style to the existing cabins and will be located in vacant green space near the historic lodge. The design shall include accompanying parking and sidewalk connections necessary to comply with current code and ADA requirements and to accommodate park needs. The scope shall also include the existing water and waste water services in comparison to the water requirements and loadings for the added cabins and evaluate the electrical supply system needs.*
  - 1. The Work includes but not limited to earthwork, site improvements, utilities, concrete foundations, rough carpentry, finish carpentry, standing seam roof, fiber cement siding, sheet metal flashing, joint sealants, stile and rail doors, door hardware, , gypsum board assemblies, ceramic tile flooring, painting, signage toilet accessories, fire extinguisher, plumbing HVAC and electrical systems.
- D. The Work will be constructed under a single prime contract.

#### **1.3 FUTURE WORK**

- A. Future Contract: The Owner has additional work to be performed at the site following Substantial Completion. Completion of that work depends on successful completion of preparatory work under this Contract.

#### **1.4 CONTRACTOR USE OF PREMISES**

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.

- B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
1. Owner Occupancy: Allow for Owner occupancy.
  2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

## **1.5 OCCUPANCY REQUIREMENTS**

- A. Full Owner Occupancy: The Owner will occupy the site during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate owner usage. Perform the Work so as not to interfere with the Owner's operations.

## **1.6 OWNER-FURNISHED PRODUCTS**

- A. The Owner will furnish miscellaneous kitchen equipment as identified on the drawings. The Work includes providing support systems to receive Owner's equipment, and mechanical and electrical connections.
1. The Owner will arrange for and deliver necessary shop drawings, product data, and samples to the Contractor.
  2. The Owner will arrange and pay for delivery of Owner-furnished items according to the contractor's Construction Schedule.
  3. The Contractor is responsible for receiving, unloading and handling Owner furnished items at the site.
  4. Following delivery, the Contractor will inspect items delivered for damage. The Contractor shall not accept damaged items and shall notify the Owner of rejection of damaged items.
  5. If Owner-furnished items are damaged, defective, or missing, the Owner will arrange for replacement.
  6. The Owner will arrange for manufacturer's field services and for the delivery of manufacturer's warranties to the appropriate Contractor.
  7. The Contractor shall designate delivery dates of Owner-furnished items in the Contractor's Construction Schedule.
  8. The Contractor shall review shop drawings, product data and samples and return them to the Designer noting discrepancies or problems anticipated in use of the project.
  9. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to the elements. The Contractor shall repair or replace items damaged as a result of his operations.

**1.7 MISCELLANEOUS PROVISIONS**

**PART 2 - PRODUCTS (Not Applicable)**

**PART 3 - EXECUTION**

**3.1 SCHEDULE OF PRODUCTS ORDERED IN ADVANCE**

**END OF SECTION 011000**

## **SECTION 012300 - ALTERNATES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements governing Alternates.

#### **1.3 DEFINITIONS**

- A. Definition: An alternate is an amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to the Base Bid amount if the Owner decides to accept a corresponding change in either 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 for each alternate is the net addition to the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

- B. No additional time will be allowed for alternate work unless the number of work days is so stated on the bid form.

#### **1.4 PROCEDURES**

- A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate the Alternate Work into the 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 mentioned as part of the Alternate.

- B. Notification: The award of the Contract will indicate whether alternates have been accepted or rejected.

- C. Execute accepted alternates under the same conditions as other Work of this Contract.

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



**PART 2 - PRODUCTS (Not Applicable)**

**PART 3 - EXECUTION**

**3.1 SCHEDULE OF ALTERNATES**

- A. Alternate No. 1: All Landscaping as defined on drawing sheets L-101 and L-501

**END OF SECTION 012300**

## **SECTION 012600 – CONTRACT MODIFICATION PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section specifies administrative and procedural requirements for handling and processing Contract Modifications.
- B. Related Sections include the following:
  - 1. Division 1, Section 013115 “Project Management Communications” for administrative requirements for communications.
  - 2. Division 0, Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
  - 3. Division 0, Section 007213, Article 4.0 "Changes in the Work" for Change Order requirements.

#### **1.3 REQUESTS FOR INFORMATION**

- A. In the event that the Contractor or Subcontractor, at any tier, determines that some portion of the Drawings, Specifications, or other Contract Documents requires clarification or interpretation, the Contractor shall submit a “Request for Information” (RFI) in writing to the Designer. A RFI may only be submitted by the Contractor and shall only be submitted on the RFI forms provided by the Owner. The Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed. In the RFI, the Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.
- B. Responses to RFI shall be issued within ten (10) working days of receipt of the Request from the Contractor unless the Designer determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Designer, the Designer will, within five (5) working days of receipt of the request, notify the Contractor of the anticipated response time. If the Contractor submits a RFI on a time sensitive activity on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Designer to respond to the request provided that the Designer responds within the ten (10) working days set forth above.
- C. Responses from the Designer will not change any requirement of the Contract Documents. In the event the Contractor believes that a response to a RFI will cause a change to the requirements of the Contract Document, the Contractor shall give written notice to the Designer requesting a Change Order for the work. Failure to give such

written notice within ten (10) working days, shall waive the Contractor's right to seek additional time or cost under Article 4, "Changes in the Work" of the General Conditions.

#### **1.4 MINOR CHANGES IN THE WORK**

- A. Designer will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Amount or the Contract Time, on "Designer's Supplemental Instructions" (DSI).

#### **1.5 PROPOSAL REQUESTS**

- A. The Designer or Owner Representative will issue a detailed description of proposed Changes in the Work that may require adjustment to the Contract Amount or the Contract Time. The proposed Change Description will be issued using the "Request for Proposal" (RFP) form. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests issued by the Designer or Owner Representative are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  - 2. Within ten (10) working days after receipt of Proposal Request, submit a proposal for the cost adjustments to the Contract Amount and the Contract Time necessary to execute the Change. The Contractor shall submit his proposal on the appropriate Change Order Detailed Breakdown form. Subcontractors may use the appropriate Change Order Detailed Breakdown form or submit their proposal on their letterhead provided the same level of detail is included. All proposals shall include:
    - a. A detailed breakdown of costs per Article 4.1 of the General Conditions.
    - b. If requesting additional time per Article 4.2 of the General Conditions, include an updated Contractor's Construction Schedule that indicates the effect of the Change including, but not limited to, changes in activity duration, start and finish times, and activity relationship.

#### **1.6 CHANGE ORDER PROCEDURES**

- A. On Owner's approval of a Proposal Request, the Designer or Owner Representative will issue a Change Order for signatures of Owner and Contractor on the "Change Order" form.

#### **PART 2 - PRODUCTS (Not Used)**

#### **PART 3 - EXECUTION (Not Used)**

**END OF SECTION 012600**

## **SECTION 013100 – COORDINATION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes administrative provisions for coordinating construction operations on Projects including, but not limited to, the following:
  - 1. Coordination Drawings.
  - 2. Administrative and supervisory personnel.
  - 3. Project meetings.
- B. Each Contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific Contractor.
- C. Related Sections include the following:
  - 1. Division 1, Section 013200 "Schedules" for preparing and submitting Contractor's Construction Schedule.
  - 2. Articles 1.8.B and 1.8.C of Section 007213 "General Conditions" for coordinating meetings onsite.
  - 3. Article 5.4.H of Section 007213 "General Conditions" for coordinating Closeout of the Contract.

#### **1.3 COORDINATION**

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections, which depend on each other for proper installation, connection, and operation.
- B. Coordination: Each Contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components with other Contractors to ensure maximum accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components including mechanical and electrical.
- C. Prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate Contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other Contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
  2. Preparation of the Schedule of Values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Startup and adjustment of systems.
  8. Project Closeout activities.
- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

#### 1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
- B. Key Personnel Names: Within fifteen (15) work days of starting construction operations, submit a list of key personnel assignments including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

## 1.5 PROJECT MEETINGS

- A. The Owner's Construction Representative will schedule a Pre-Construction Meeting prior to beginning of construction. The date, time, and exact place of this meeting will be determined after Contract Award and notification of all interested parties. The Contractor shall arrange to have the Job Superintendent and all prime Subcontractors present at the meeting. During the Pre-Construction Meeting, the construction procedures and information necessary for submitting payment requests will be discussed and materials distributed along with any other pertinent information.
1. Minutes: Designer will record and distribute meeting minutes.
- B. Progress Meetings: The Owner's Construction Representative will conduct Monthly Progress Meetings as stated in Articles 1.8.B and 1.8.C of Section 007213 "General Conditions".
1. Minutes: Designer will record and distribute to Contractor the meeting minutes.
- C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of Manufacturers and Fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Designer and Construction Representative of scheduled meeting dates.
  2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration including requirements for the following:
    - a. Contract Documents
    - b. Options
    - c. Related RFIs
    - d. Related Change Orders
    - e. Purchases
    - f. Deliveries
    - g. Submittals
    - h. Review of mockups
    - i. Possible conflicts
    - j. Compatibility problems
    - k. Time schedules
    - l. Weather limitations
    - m. Manufacturer's written recommendations
    - n. Warranty requirements
    - o. Compatibility of materials

- p. Acceptability of substrates
  - q. Temporary facilities and controls
  - r. Space and access limitations
  - s. Regulations of authorities having jurisdiction
  - t. Testing and inspecting requirements
  - u. Installation procedures
  - v. Coordination with other Work
  - w. Required performance results
  - x. Protection of adjacent Work
  - y. Protection of construction and personnel
3. Contractor shall record significant conference discussions, agreements, and disagreements including required corrective measures and actions.
  4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
  5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
  6. Revise paragraph below if Project requires holding progress meetings at different intervals. Insert special intervals such as "every third Tuesday" to suit special circumstances.
  7. Project name
  8. Name and address of Contractor
  9. Name and address of Designer
  10. RFI number including RFIs that were dropped and not submitted
  11. RFI description
  12. Date the RFI was submitted
  13. Date Designer's response was received
  14. Identification of related DSI or Proposal Request, as appropriate

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION (Not Used)**

**END OF SECTION 013100**

## SECTION 013115 - PROJECT MANAGEMENT COMMUNICATIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.
- B. Division 1, Section 013300 - Submittals
- C. Division 1, Section 012600 – Contract Modification Procedures

#### 1.2 SUMMARY

- A. Project Management Communications: The Contractor shall use the Internet web based project management communications tool, E-Builder<sup>®</sup> ASP software, and protocols included in that software during this project. The use of project management communications as herein described does not replace or change any contractual responsibilities of the participants.
  - 1. Project management communications is available through E-Builder<sup>®</sup> as provided by "e-Builder<sup>®</sup>" in the form and manner required by the Owner.
  - 2. The project communications database is on-line and fully functional. User registration, electronic and computer equipment, and Internet connections are the responsibility of each project participant. The sharing of user accounts is prohibited
- B. Support: E-Builder<sup>®</sup> will provide on-going support through on-line help files.
- C. Copyrights and Ownership: Nothing in this specification or the subsequent communications supersedes the parties' obligations and rights for copyright or document ownership as established by the Contract Documents. The use of CAD files, processes or design information distributed in this system is intended only for the project specified herein.
- D. Purpose: The intent of using E-Builder<sup>®</sup> is to improve project work efforts by promoting timely initial communications and responses. Secondly, to reduce the number of paper documents while providing improved record keeping by creation of electronic document files
- E. Authorized Users: Access to the web site will be by individuals who are authorized users.
  - 1. Individuals shall complete the E-Builder New Company/User Request Form located at the following web site: <https://oa.mo.gov/facilities/vendor-links/contractor-forms>.



- Completed forms shall be emailed to the following email address: [OA.FMDCE-BuilderSupport@oa.mo.gov](mailto:OA.FMDCE-BuilderSupport@oa.mo.gov).
2. Authorized users will be contacted directly and assigned a temporary user password.
  3. Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.
- F. Administrative Users: Administrative users have access and control of user licenses and all posted items. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE! Improper or abusive language toward any party or repeated posting of items intended to deceive or disrupt the work of the project will not be tolerated and will result in deletion of the offensive items and revocation of user license at the sole discretion of the Administrative User(s).
- G. Communications: The use of fax, email and courier communication for this project is discouraged in favor of using E-Builder® to send messages. Communication functions are as follows:
1. Document Integrity and Revisions:
    - a. Documents, comments, drawings and other records posted to the system shall remain for the project record. The authorship time and date shall be recorded for each document submitted to the system. Submitting a new document or record with a unique ID, authorship, and time stamp shall be the method used to make modifications or corrections.
    - b. The system shall make it easy to identify revised or superseded documents and their predecessors.
    - c. Server or Client side software enhancements during the life of the project shall not alter or restrict the content of data published by the system. System upgrades shall not affect access to older documents or software.
  2. Document Security:
    - a. The system shall provide a method for communication of documents. Documents shall allow security group assignment to respect the contractual parties communication except for Administrative Users. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE!
  3. Document Integration:
    - a. Documents of various types shall be logically related to one another and discoverable. For example, requests for information, daily field reports, supplemental sketches and photographs shall be capable of reference as related records.
  4. Reporting:
    - a. The system shall be capable of generating reports for work in progress, and logs for each document type. Summary reports generated by the system shall be available for team members.
  5. Notifications and Distribution:
    - a. Document distribution to project members shall be accomplished both within the extranet system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be

- accomplished by secure email of outgoing documents and attachments, readable by a standard email client.
6. Required Document Types:
    - a. RFI, Request for Information.
    - b. Submittals, including record numbering by drawing and specification section.
    - c. Transmittals, including record of documents and materials delivered in hard copy.
    - d. Meeting Minutes.
    - e. Application for Payments (Draft or Pencil).
    - f. Review Comments.
    - g. Field Reports.
    - h. Construction Photographs.
    - i. Drawings.
    - j. Supplemental Sketches.
    - k. Schedules.
    - l. Specifications.
    - m. Request for Proposals
    - n. Designer's Supplemental Instructions
    - o. Punch Lists
  
  - H. Record Keeping: Except for paper documents, which require original signatures and large format documents (greater than 8½ x 11 inches), all other 8½ x 11 inches documents shall be submitted by transmission in electronic form to the E-Builder® web site by licensed users.
    - a. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier shall respond to documents received in electronic form on the web site, and consider them as if received in paper document form.
    - b. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall reply or respond by transmissions in electronic form on the web site to documents actually received in paper document form.
    - c. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall copy any paper document into electronic form and make same available on the web site.
  
  - I. Minimum Equipment and Internet Connection: In addition to other requirements specified in this Section, the Owner and his representatives, the Construction Manager and his representatives, the Architect and his consultants, and the Contractor and his sub-contractors and suppliers at every tier required to have a user license(s) shall be responsible for the following:

1. Providing suitable computer systems for each licensed user at the users normal work location<sup>1</sup> with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.
2. Each of the above referenced computer systems shall have the following minimum system<sup>2</sup> and software requirements:
  - a. Desktop configuration (Laptop configurations are similar and should be equal to or exceed desktop system.)
    - 1) Operating System: Windows XP or newer
    - 2) Internet Browser: Internet Explorer 6.01SP2+ (Recommend IE7.0+)
    - 3) Minimum Recommend Connection Speed: 256K or above
    - 4) Processor Speed: 1 Gigahertz and above
    - 5) RAM: 512 mb
    - 6) Operating system and software shall be properly licensed.
    - 7) Internet Explorer version 7 (current version is a free distribution for download). This specification is not intended to restrict the host server or client computers provided that industry standard HTTP clients may access the published content.
    - 8) Adobe Acrobat Reader (current version is a free distribution for download).
    - 9) Users should have the standard Microsoft Office Suite (current version must be purchased) or the equivalent.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable.)

END OF SECTION 013115

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<sup>1</sup> The normal work location is the place where the user is assigned for more than one-half of his time working on this project.

<sup>2</sup> The minimum system herein will not be sufficient for many tasks and may not be able to process all documents and files stored in the E-Builder® Documents area.

## **SECTION 013200.10 – SCHEDULES – CRITICAL PATH METHOD (CPM)**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 CONSTRUCTION PROGRESS SCHEDULE – CRITICAL PATH METHOD (CPM)**

- A. This Section includes administrative and procedural requirements for the Critical Path Method (CPM) of scheduling and reporting progress of the Work.
  - 1. Refer to the General Conditions and the Agreement for definitions and specified dates of Contract Time.
  - 2. Due to the scheduling sensitivity of this Project and the need for the Owner to closely monitor all levels of activity, the following personnel and reporting requirements are mandatory.
- B. CPM Definitions
  - 1. Critical Path Method (CPM): A method of planning and scheduling a construction project where activities are arranged based on activity relationships and network calculations determine when activities can be performed and the critical path of the Project.
  - 2. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall project duration.
  - 3. Network Diagram: A graphic diagram of a network schedule, showing the activities and activity relationships.
  - 4. Activity: A discrete part of a project than can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
    - a. Critical activities are activities on the critical path.
    - b. Predecessor activity is an activity that must be completed before a given activity can be started.
  - 5. Event: An event is the starting or ending point of an activity.
  - 6. Milestone: A key or critical point in time for reference or measurement.
  - 7. Float or Slack Time: The measure of leeway in activity performance. Accumulative float time is not for the exclusive use or benefit of the Owner or Contractor, but is a project resource available to both parties as needed to meet contract milestones and the completion date.
    - a. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.

- b. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned project completion date.
  8. Inclement Weather: Adverse weather conditions affecting the critical path.
- C. CPM Quality Assurance
  1. The Owner's Consultant shall assist in planning, evaluating, and reporting by CPM Scheduling.
  2. The Contractor is responsible for developing its own schedule logic and activities with appropriate duration, restraints and relationships. All information must be acceptable and compatible with the Owner's needs. All target, completion, and milestone dates generated must be acceptable to the Owner and meet the requirements of the Contract Documents including the Statement of Work in the Agreement.
  3. The Owner reserves the right to reject any schedule or report that fails to reflect timely completion of the Project, or any intermediate milestone, or otherwise indicates unrealistic performance. Failure of the Contractor to deliver satisfactory schedules or reports to the Owner may result in temporary suspension of progress payments at the Owner's sole discretion.

### **1.3 PROJECT INSPECTION**

- A. The Owner will designate the time for a regular monthly update inspection at which time representatives of the Owner, Designer, and Contractor will inspect the Project and agree on progress of all activities. The information so obtained may be the basis for the Contractor's monthly schedule update.

### **1.4 REPORTS**

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
  1. List of subcontractors at Project site
  2. List of separate contractors at Project site
  3. Approximate count of personnel at Project site
  4. Equipment at Project site
  5. Material deliveries
  6. High and low temperatures and general weather conditions
  7. Accidents
  8. Meetings and significant decisions
  9. Unusual events (refer to special reports)
  10. Stoppages, delays, shortages, and losses
  11. Meter readings and similar recordings
  12. Emergency procedures

13. Orders and requests of authorities having jurisdiction
14. Change Orders received and implemented
15. Services connected and disconnected
16. Equipment or system tests and startups
17. Partial Completions and Occupancies
18. Substantial Completions authorized

## **PART 2 - PRODUCTS**

### **2.1 HARDWARE – Reserved**

### **2.2 CPM SCHEDULING SOFTWARE**

- A. The Contractor will use Primavera Project Planner (P6) or other approved scheduling software.

### **2.3 CPM SCHEDULING PERSONNEL**

- A. The Contractor is to designate a person who will have all scheduling responsibilities for this Work. That individual must have had previous scheduling responsibilities on similar construction projects. The Contractor shall submit the resume of the designated person for approval by Owner prior to the Notice to Proceed.
- B. The Owner will designate the time and location for regular Monthly Progress Meetings. The Contractor is required to attend these Meetings. Current schedule, job progress, delays, projections, problem issues, alternatives, and applications for payment will be among the priority items addressed in detail at these meetings.

## **PART 3 - EXECUTION**

### **3.1 CONSTRUCTION PROGRESS SCHEDULE – CRITICAL PATH METHOD (CPM)**

- A. Preliminary Schedule:
  1. The Contractor's Preliminary CPM Schedule including Schedule of Values shall be submitted before the first pay application is approved. The preliminary network diagram shall outline activities for the first (60) days of construction. Include a skeleton diagram for the remainder of the Work with the preliminary diagram. This schedule will be the basis for pay applications for the first (60) days.
    - a. Include each significant construction activity. Coordinate each activity in the network with other activities. Schedule each construction activity in proper sequence.
    - b. Include an activity showing the contract weather allowance time – if any.
    - c. Indicate completion of the Work on the date established for Substantial Completion.

- d. A tabular activity list.
  - e. In addition to submitting paper copies of schedule reports, updates, and plots, the Contractor shall submit all diskettes containing all required schedule information.
2. Cash Requirement Prediction: With submittal of the preliminary network diagram, include a preliminary cash requirement prediction based on indicated activities.
  3. Distribution: Distribute the preliminary network diagram to parties involved in construction activities that are scheduled early, including the Designer and the Owner.
- B. Schedule Submittals:
1. In preparing the CPM Schedule, the Contractor shall include procurement, submittal, approval, fabrication, and delivery activities for review and approval by the Owner.
  2. Submittal and Distribution: Submit (3) copies of the initial issue of the tabulations and network for acceptance. When authorized, distribute copies to the Designer, Owner's CPM Consultant, and the Owner, separate Contractors, subcontractors, and suppliers or fabricators, and others identified by the Contractor with a need-to-know schedule responsibility.
    - a. Post copies in the Project meeting rooms and temporary field offices.
    - b. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in the performance of construction activities.
    - c. Submit copies of each computer-produced report to the Designer.
  3. Schedule Updating: Revise the Schedule within five (5) working days after each meeting or other activity, where revisions have been recognized or made. Issue the updated Schedule concurrently with the report of each project meeting.
    - a. Weekly: On a weekly basis, the current detailed construction schedule (Three Week Look Ahead Schedule) shall be provided by the Contractor, at the request of the Owner. This information shall include a brief written report describing activities begun or finished, during the preceding week and a projection of all activities to be started or finished in the next three weeks.
    - b. Monthly: Each month, the Contractor shall provide current, detailed construction schedule information consisting of certified tabular data and summaries, which show all changes to the schedule which have occurred since the previous submission of schedule information and indicates progress of each activity and shown completion dates. The submittal shall include major changes in scope, logic changes, activities modified since previous update, identification of any slippage, revised projections due to changes, out-of-sequence progress, and other identifiable changes.

4. In the event a revised detailed schedule is not acceptable to the Owner, the Schedule shall be revised within five (5) working days by the Contractor until it is found acceptable by the Owner.
5. The Contractor shall submit an updated schedule to CPM Consultant a minimum of five (5) working days prior to the scheduled Monthly Progress Meeting.
6. In the event that the Contractor fails to provide the required Schedules, reports, or updates noted above, in a timely manner, the Owner shall have the right to withhold all progress payments until such time as acceptable scheduling documentation is received.
7. Following each update, the Contractor shall distribute copies of the updated schedule to subcontractors, designer, and Owner.

C. Schedule Requirements:

1. Within (30) days after approval of the proposed preliminary network diagram, the Contractor shall submit draft of proposed complete network diagram for review. Upon request, include written certification that major subcontractors have reviewed and accepted the proposed schedule.
2. Within (15) days after joint review of proposed complete network diagram, submit final complete network diagram. The Owner anticipates a final base line schedule acceptable to the CPM Consultant within (90) days from Contractor's Notice to Proceed.
3. All relevant data is to be acquired and processed and reports prepared and submitted by the person designated to be responsible for the Project Schedule.
4. The scheduled logic for the Work shall be developed by the Contractor and approved by the Owner, along with established duration for each activity. Activity numbers shall be based on a reasonable, rational system for identification purposes. As a minimum, along with the activity numbers, include the building/area and type of work by trade and subcontractor company activity codes.
5. Participate in joint review and evaluation of network diagrams and analysis with Owner, Owner's CPM Consultant, and Designer at each submittal above.
  - a. Following joint review of the final completion network diagram, distribute copies of the schedule to subcontractors, suppliers, designer, and Owner.
6. The detailed construction schedule submitted by the Contractor shall reflect complete sequence of construction by activity including:
  - a. Procurement and delivery dates for long lead items
  - b. Contractual milestone dates
  - c. Dates for beginning and completion of each element of construction
  - d. Disruptions and shutdowns due to other operations, facilities, functions, or testing agencies' activities
  - e. Planned periods of inactivity on the project



- f. Anticipated periods of overtime or shift work
  - g. Dates for installation and testing of all equipment
  - h. Cleanup
  - i. Contract startup and closeout
7. Identify work for separate buildings or areas and other logically grouped activities.
8. The schedule is to show projected percentage of completion for each item of work as of the last day of each month. Each item of work shall be cost loaded.
9. Provide special schedules to define critical portions of the entire schedule as requested by Owner.
10. Incorporate the procurement submittal schedule.
  - a. Discrete activities shall be separated by trade or other category as requested by the Owner and separate activities shall be assigned activity numbers for use and monitoring.
  - b. Separate activities shall be reflected in a level of detail such that no activity shall be of greater duration than (15) days. Specific exceptions must be requested in writing.
11. Provide recovery plan to complete the project within the contract completion time as requested by Owner.
12. The schedule activities shall be cost loaded per the schedule of values and will be used as the basis for the Contractor's monthly pay applications including:
  - a. Milestone and zero duration activities shall not be dollar loaded.
  - b. The dollar value for each activity will be the cost including labor, materials, equipment, and pro rata contribution to overhead and profit. The Contractor shall make the sum of all activity costs equal to the total Contract sum.
  - c. The Contractor shall provide a "General Conditions" activity which shall include all Contractor jobsite costs. This activity cost shall be distributed evenly for the entire duration of the Contract. The Contractor shall furnish a detailed listing to the Owner of the items and their associated costs included in this activity.
  - d. Separate activities should be shown for mobilization and demobilization. These should be equal cost amounts.
  - e. "Front-end" dollar loading of construction activities will not be allowed.
13. Change Orders that extend the Contract Completion Date shall be shown as a new activity. This schedule impact shall be submitted with the Change Order proposal showing float used and/or impact on the critical path.
14. If a Change Order results in a compensable time extension, the daily General Condition rate defined above will be used. It will be added to the Change Order and will be excluded from overhead and profit markup as allowed by the General Conditions.

- a. Any additional General Condition monies associated with the approved additional time will be added on a daily basis to the end of the project. The additional time granted per the change order shall also be added to the end of the latest approved contract completion date. These additional General Condition monies shall be held by the Owner and not paid to the Contractor until the project's original contract time has been exceeded.
- b. If the Owner grants the Contractor Substantial Completion prior to the most current Contract Completion date, then for any and all contract days remaining beyond the date of Substantial Completion, the Contractor and Owner shall share on a 50% - 50% basis, all previously approved extended daily General Conditions costs.
- c. If the change warrants a reduction in contract time, for any reason, then the Owner shall deduct as part of the change 50% of the applicable pro rata share of the General Conditions monies as shown in the Schedule of Values.

D. Reporting:

1. Contractor reports shall include monthly updates, and as requested by Owner, revised network logic diagrams, and activity lists. The monthly updates may be accompanied by certificates that all data submitted is complete and current (See sample at end of this Section).
2. Contractor network diagrams shall legibly show the order and interdependence of activities, and the sequence in which the work is to be accomplished as planned by the Contractor. Networks shall be drawn on 24" by 36" or 11" by 17" sized sheets, as directed by Owner, with title, match data, and date of latest version on each sheet.
3. Tabular Activity Lists shall be provided and shall show one activity per line along with appropriate data for the purpose intended including various combinations of the following:
  - a. Activity ID number
  - b. Activity description
  - c. Preceding and succeeding activities and descriptions
  - d. Original duration (in working days)
  - e. Remaining duration (in working days)
  - f. Percent complete
  - g. Earliest start date (by calendar date)
  - h. Earliest finish date (by calendar date)
  - i. Latest start date (by calendar date)
  - j. Latest finish date (by calendar date)
4. Narrative: A written narrative shall be required by Owner under the following circumstances:
  - a. Added, deleted, or changed activities including logic and budget changes

- b. To explain out-of-sequence progress
- c. To detail procurement/delivery problems
- d. To describe recovery plans, if the Contractor fails to maintain its schedule
- e. To explain any schedule item which requires clarification as directed by the Owner

### **3.2 SCHEDULE OF SUBMITTALS**

- A. Tabulation of Submittals: With submittal of the preliminary network diagram, include a tabulation by date of submittals required during the first (90) days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead-time for manufacture or fabrication.
- B. Upon acceptance of the CPM Construction Progress Schedule, prepare, and submit a complete schedule of submittals. Coordinate the submittal schedule with Section 013300 SUBMITTALS, the approved Construction Progress Schedule, list of subcontracts, Schedule of Values and the list of products.
- C. Prepare the schedule in chronological order. Provide the following information:
  - 1. Scheduled date for the first submittal
  - 2. Related Section number
  - 3. Submittal category
  - 4. Name of the subcontractor
  - 5. Description of the part of the Work covered
  - 6. Scheduled date for resubmittal
  - 7. Scheduled date for the Designer's final release or approval
- D. Distribution: Following the Designer's response to the initial submittal schedule, print, and distribute copies to the Designer, Owner, Subcontractors, and other parties required to comply with submittal dates indicated.
  - 1. Post copies in the Project meeting room and temporary field office.
  - 2. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned part of the Work and are no longer involved in construction activities.
- E. Schedule Updating: Revise the schedule after each meeting or other activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

### **3.3 SCHEDULE OF INSPECTIONS AND TESTS**

- A. Upon acceptance of the CPM Construction Progress Schedule, prepare and submit within (15) working days a complete schedule of inspections, tests, and similar services required by the Contract Documents.

- B. Form: The schedule shall be in tabular form and shall include, but not be limited to, the following:
1. Specification Section number
  2. Description of the test
  3. Identification of applicable standards
  4. Identification of test methods
  5. Number of tests required
  6. Time schedule or time span for tests
  7. Entity responsible for performing tests
  8. Requirements for taking samples
  9. Unique characteristics of each service
- C. Distribution: Distribute the schedule to the Owner, Designer, and each party involved in performance of portions of the Work where inspections and tests are required.

**END OF SECTION 013200.10**

## **SECTION 013300 – SUBMITTALS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.
- B. Division 1, Section 013115 “Project Management Communications” for administrative requirements for communications.

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for submittals required for performance of the Work including the following:
  - 1. Shop Drawings
  - 2. Product Data
  - 3. Samples
  - 4. Quality Assurance Submittals
  - 5. Construction Photographs
  - 6. Operating and Maintenance Manuals
  - 7. Warranties
- B. Administrative Submittals: Refer to General and Supplementary Conditions other applicable Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
  - 1. Construction Progress Schedule including Schedule of Values
  - 2. Performance and Payment Bonds
  - 3. Insurance Certificates
  - 4. Applications for Payment
  - 5. Certified Payroll Reports
  - 6. Partial and Final Receipt of Payment and Release Forms
  - 7. Affidavit – Compliance with Prevailing Wage Law
  - 8. Record Drawings
  - 9. Notifications, Permits, etc.
- C. The Contractor is obliged and responsible to check all shop drawings and schedules to assure compliance with contract plans and specifications. The Contractor is responsible for the content of the shop drawings and coordination with other contract work. Shop drawings and schedules shall indicate, in detail, all parts of an Item or Work including erection and setting instructions and integration with the Work of other trades.

- D. The Contractor shall at all times make a copy, of all approved submittals, available on site to the Construction Representative.

### **1.3 SUBMITTAL PROCEDURES**

- A. The Contractor shall comply with the General and Supplementary Conditions and other applicable sections of the Contract Documents. The Contractor shall submit, with such promptness as to cause no delay in his work or in that of any other contractors, all required submittals indicated in Part 3.1 of this section and elsewhere in the Contract Documents. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
    - a. The Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
- B. Each drawing and/or series of drawings submitted must be accompanied by a letter of transmittal giving a list of the titles and numbers of the drawings. Each series shall be numbered consecutively for ready reference and each drawing shall be marked with the following information:
  - 1. Date of Submission
  - 2. Name of Project
  - 3. Location
  - 4. Section Number of Specification
  - 5. State Project Number
  - 6. Name of Submitting Contractor
  - 7. Name of Subcontractor
  - 8. Indicate if Item is submitted as specified or as a substitution

### **1.4 SHOP DRAWINGS**

- A. Comply with the General Conditions, Article 3.2.
- B. The Contractor shall 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 basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- C. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings including the following information:

1. Dimensions
2. Identification of products and materials included by sheet and detail number
3. Compliance with specified standards
4. Notation of coordination requirements
5. Notation of dimensions established by field measurement
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8½"x11" but no larger than 36"x48".

## 1.5 PRODUCT DATA

- A. The Contractor shall comply with the General Conditions, Article 3.2.
- B. The Contractor shall collect Product Data 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 including the following information:
    - a. Manufacturer's printed recommendations
    - b. Compliance with Trade Association standards
    - c. Compliance with recognized Testing Agency standards
    - d. Application of Testing Agency labels and seals
    - e. Notation of dimensions verified by field measurement
    - f. Notation of coordination requirements
  2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

## 1.6 SAMPLES

- A. The Contractor shall comply with the General Conditions, Article 3.2.
- B. The Contractor shall 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. The Contractor shall mount or display samples in the manner to facilitate review of qualities indicated. Prepare samples to match the Designer's sample including the following:
    - a. Specification Section number and reference
    - b. Generic description of the Sample
    - c. Sample source
    - d. Product name or name of the Manufacturer

- e. Compliance with recognized standards
  - f. Availability and delivery time
2. The Contractor shall 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, or other characteristic is inherent in the material or product represented, submit at least three (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.
    - c. Refer to other Sections for samples to be returned to the Contractor for incorporation in the Work. Such samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of sample submittals.
    - d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
  3. Field samples are full-size examples erected onsite to illustrate finishes, coatings, or finish materials and to establish the Project standard.
    - a. The Contractor shall comply with submittal requirements to the fullest extent possible. The Contractor shall process transmittal forms to provide a record of activity.

## **1.7 QUALITY ASSURANCE DOCUMENTS**

- A. The Contractor shall comply with the General Conditions, Article 3.2
- B. The Contractor shall submit quality control submittals including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
- C. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the Manufacturer certifying compliance with specified requirements.
  1. Signature: Certification shall be signed by an officer of the Manufacturer or other individual authorized to contractually bind the Company.
- D. Inspection and Test Reports: The Contractor shall submit the required inspection and test reports from independent testing agencies as specified in this Section and in other Sections of the Contract Documents.
- E. Construction Photographs: The Contractor shall submit record construction photographs as specified in this Section and in other Sections of the Contract Documents.



1. The Contractor shall submit digital photographs. The Construction Administrator shall determine the quantity and naming convention at the preconstruction meeting.
2. The Contractor shall identify each photograph with project name, location, number, date, time, and orientation.
3. The Contractor shall submit progress photographs monthly unless specified otherwise. Photographs shall be taken one (1) week prior to submitting.
4. The Contractor shall take four (4) site photographs from differing directions and a minimum of five (5) interior photographs indicating the relative progress of the Work.

### 1.8 OPERATING AND MAINTENANCE MANUALS AND WARRANTIES

- A. The Contractor shall submit all required manufacturer’s operating instructions, maintenance/service manuals, and warranties in accordance with the General Conditions, Article 3.5, and Supplementary Conditions along with this and other Sections of the Contract Documents.

### PART 2 - PRODUCTS (Not Applicable)

### PART 3 - EXECUTION

#### 3.1 REQUIRED SUBMITTALS

- A. Contractor shall submit the following information for materials and equipment to be provided under this contract.

<b>SPEC SECTION</b>	<b>TITLE</b>	<b>CATEGORY</b>
30516	<b>Under Slab Vapor Barrier</b>	Product Data
30516	<b>Under Slab Vapor Barrier</b>	Sample
30516	<b>Under Slab Vapor Barrier</b>	Manufacturer Instructions
32000	<b>Concrete Reinforcing</b>	Shop Drawings
32000	<b>Concrete Reinforcing</b>	Certification
33000	<b>Cast-in-place concrete</b>	Product Data
33000	<b>Cast-in-place concrete</b>	Certification
33000	<b>Cast-in-place concrete</b>	Test Report
44343.13	<b>Anchored Stone Masonry Veneer</b>	Shop Drawings
44343.13	<b>Anchored Stone Masonry Veneer</b>	Product Data
44343.13	<b>Anchored Stone Masonry Veneer</b>	Sample
51200	<b>Structural Steel Framing</b>	Shop Drawings
51200	<b>Structural Steel Framing</b>	Product Data
51200	<b>Structural Steel Framing</b>	Certification
51200	<b>Structural Steel Framing</b>	Test Report
61000	<b>Rough Carpentry</b>	Product Data
61323	<b>Heavy Timber Trusses</b>	Shop Drawings

61323	<b>Heavy Timber Trusses</b>	Product Data
61323	<b>Heavy Timber Trusses</b>	Certification
61753	<b>Shop Fabricated Wood Trusses</b>	Shop Drawings
61753	<b>Shop Fabricated Wood Trusses</b>	Product Data
61753	<b>Shop Fabricated Wood Trusses</b>	Certification
61800	<b>Glue Laminated Construction</b>	Shop Drawings
61800	<b>Glue Laminated Construction</b>	Product Data
61800	<b>Glue Laminated Construction</b>	Certification
62000	<b>Finish Carpentry</b>	Product Data
62000	<b>Finish Carpentry</b>	Sample
62013	<b>Exterior Finish Carpentry</b>	Product Data
62013	<b>Exterior Finish Carpentry</b>	Sample
62013	<b>Exterior Finish Carpentry</b>	Manufacturer Instructions
64100	<b>Architectural Wood Casework</b>	Shop Drawings
64100	<b>Architectural Wood Casework</b>	Product Data
64100	<b>Architectural Wood Casework</b>	Sample
67300	<b>Composite Decking</b>	Product Data
67300	<b>Composite Decking</b>	Sample
67300	<b>Composite Decking</b>	Manufacturer Instructions
67300	<b>Composite Decking</b>	Maintenance Data
67300	<b>Composite Decking</b>	Warranty
71113	<b>Bituminous Dampproofing</b>	Product Data
71113	<b>Bituminous Dampproofing</b>	Manufacturer Instructions
72100	<b>Thermal Insulation</b>	Product Data
72100	<b>Thermal Insulation</b>	Certification
72100	<b>Thermal Insulation</b>	Manufacturer Instructions
72119	<b>Foamed-In-Place Insulation</b>	Product Data
72119	<b>Foamed-In-Place Insulation</b>	Certification
72119	<b>Foamed-In-Place Insulation</b>	Manufacturer Instructions
72119	<b>Foamed-In-Place Insulation</b>	Warranty
72500	<b>Weather Barriers</b>	Shop Drawings
72500	<b>Weather Barriers</b>	Product Data
72500	<b>Weather Barriers</b>	Certification
72500	<b>Weather Barriers</b>	Manufacturer Instructions
72500	<b>Weather Barriers</b>	Warranty
74112	<b>Standing-Seam Metal Roof Panels</b>	Shop Drawings
74112	<b>Standing-Seam Metal Roof Panels</b>	Product Data
74112	<b>Standing-Seam Metal Roof Panels</b>	Sample
74112	<b>Standing-Seam Metal Roof Panels</b>	Manufacturer Instructions
74112	<b>Standing-Seam Metal Roof Panels</b>	Warranty
74646	<b>Fiber-Cement Siding</b>	Product Data
74646	<b>Fiber-Cement Siding</b>	Sample

74646	<b>Fiber-Cement Siding</b>	Warranty
78400	<b>Firestopping</b>	Product Data
78400	<b>Firestopping</b>	Certification
79200	<b>Joint Sealants</b>	Product Data
79200	<b>Joint Sealants</b>	Sample
79200	<b>Joint Sealants</b>	Warranty
81113	<b>Hollow Metal Doors and Frames</b>	Shop Drawings
81113	<b>Hollow Metal Doors and Frames</b>	Product Data
81113	<b>Hollow Metal Doors and Frames</b>	Certification
81113	<b>Hollow Metal Doors and Frames</b>	Manufacturer Instructions
81113	<b>Hollow Metal Doors and Frames</b>	Warranty
81433	<b>Stile and Rail Wood Doors</b>	Shop Drawings
81433	<b>Stile and Rail Wood Doors</b>	Product Data
81433	<b>Stile and Rail Wood Doors</b>	Sample
81433	<b>Stile and Rail Wood Doors</b>	Manufacturer Instructions
81433	<b>Stile and Rail Wood Doors</b>	Warranty
83100	<b>Access Doors and Panels</b>	Product Data
83100	<b>Access Doors and Panels</b>	Manufacturer Instructions
85200	<b>Aluminum Clad Wood Windows and Doors</b>	Shop Drawings
85200	<b>Aluminum Clad Wood Windows and Doors</b>	Product Data
85200	<b>Aluminum Clad Wood Windows and Doors</b>	Sample
85200	<b>Aluminum Clad Wood Windows and Doors</b>	Manufacturer Instructions
85200	<b>Aluminum Clad Wood Windows and Doors</b>	Warranty
87100	<b>Door Hardware</b>	Shop Drawings
87100	<b>Door Hardware</b>	Product Data
87100	<b>Door Hardware</b>	Manufacturer Instructions
87100	<b>Door Hardware</b>	Operation / Maintenance Manual
87100	<b>Door Hardware</b>	Warranty
92116	<b>Gypsum Board Assemblies</b>	Product Data
93000	<b>Tiling</b>	Product Data
93000	<b>Tiling</b>	Sample
93000	<b>Tiling</b>	Warranty
96813	<b>Tile Carpeting</b>	Product Data
96813	<b>Tile Carpeting</b>	Sample
96813	<b>Tile Carpeting</b>	Manufacturer Instructions
99113	<b>Exterior Painting</b>	Product Data
99113	<b>Exterior Painting</b>	Sample
99123	<b>Interior Painting</b>	Product Data
99123	<b>Interior Painting</b>	Sample
99300	<b>Staining and Transparent Finishing</b>	Product Data
99300	<b>Staining and Transparent Finishing</b>	Sample

101416	<b>Plaques</b>	Shop Drawings
101416	<b>Plaques</b>	Product Data
101419	<b>Dimensional Letter Signage</b>	Product Data
102800	<b>Toilet, Bath and Laundry Accessories</b>	Product Data
102800	<b>Toilet, Bath and Laundry Accessories</b>	Sample
102800	<b>Toilet, Bath and Laundry Accessories</b>	Manufacturer Instructions
102800	<b>Toilet, Bath and Laundry Accessories</b>	Warranty
103107	<b>Manufactured Fireplaces</b>	Shop Drawings
103107	<b>Manufactured Fireplaces</b>	Product Data
103107	<b>Manufactured Fireplaces</b>	Certification
103107	<b>Manufactured Fireplaces</b>	Manufacturer Instructions
103107	<b>Manufactured Fireplaces</b>	Maintenance Data
103107	<b>Manufactured Fireplaces</b>	Operation / Maintenance Manual
103107	<b>Manufactured Fireplaces</b>	Warranty
104400	<b>Protection Specialties</b>	Product Data
104400	<b>Protection Specialties</b>	Sample
123600	<b>Countertops</b>	Shop Drawings
123600	<b>Countertops</b>	Product Data
123600	<b>Countertops</b>	Sample
123600	<b>Countertops</b>	Manufacturer Instructions
123600	<b>Countertops</b>	Maintenance Data
123600	<b>Countertops</b>	Warranty
210500	<b>Common Work Result for Fire Suppression</b>	Product Data
210500	<b>Common Work Result for Fire Suppression</b>	Maintenance Data
210500	<b>Common Work Result for Fire Suppression</b>	Operation / Maintenance Manual
210523	<b>General-Duty Valves for Water Based Fire Suppression Piping</b>	Product Data
210523	<b>General-Duty Valves for Water Based Fire Suppression Piping</b>	Maintenance Data
210523	<b>General-Duty Valves for Water Based Fire Suppression Piping</b>	Operation / Maintenance Manual
210553	<b>Identification for Fire-Suppression Piping and Equipment</b>	Product Data
211300	<b>Fire Suppression Sprinkler Systems</b>	Shop Drawings
211300	<b>Fire Suppression Sprinkler Systems</b>	Product Data
211300	<b>Fire Suppression Sprinkler Systems</b>	Maintenance Data
211300	<b>Fire Suppression Sprinkler Systems</b>	Operation / Maintenance Manual
220517	<b>Sleeves and Sleeve Seals for Plumbing Piping</b>	Product Data
220519	<b>Meters and Gages for Plumbing Piping</b>	Product Data
220523	<b>General Duty Valves for Plumbing Piping</b>	Product Data

220529	<b>Hangers and Supports for Plumbing Piping and Equipment</b>	Product Data
220533	<b>Heat Tracing for Plumbing Piping</b>	Product Data
220533	<b>Heat Tracing for Plumbing Piping</b>	Manufacturer Instructions
220533	<b>Heat Tracing for Plumbing Piping</b>	Maintenance Data
220533	<b>Heat Tracing for Plumbing Piping</b>	Operation / Maintenance Manual
220548	<b>Vibration and Seismic Controls for Plumbing Piping and Equipment</b>	Product Data
220553	<b>Identification for Plumbing Piping and Equipment</b>	Product Data
220716	<b>Plumbing Equipment Insulation</b>	Product Data
220716	<b>Plumbing Equipment Insulation</b>	Manufacturer Instructions
220719	<b>Plumbing Piping Insulation</b>	Product Data
220719.11	<b>Under Lavatory Pipe and Supply Covers</b>	Product Data
221005	<b>Plumbing Piping</b>	Product Data
221006	<b>Plumbing Piping Specialties</b>	Product Data
221006	<b>Plumbing Piping Specialties</b>	Manufacturer Instructions
221006	<b>Plumbing Piping Specialties</b>	Operation / Maintenance Manual
223000	<b>Plumbing Equipment</b>	Product Data
223000	<b>Plumbing Equipment</b>	Manufacturer Instructions
223000	<b>Plumbing Equipment</b>	Maintenance Data
223000	<b>Plumbing Equipment</b>	Operation / Maintenance Manual
223000	<b>Plumbing Equipment</b>	Warranty
224000	<b>Plumbing Fixtures</b>	Product Data
224000	<b>Plumbing Fixtures</b>	Manufacturer Instructions
224000	<b>Plumbing Fixtures</b>	Maintenance Data
224000	<b>Plumbing Fixtures</b>	Operation / Maintenance Manual
230529	<b>Hangers and Supports for HVAC</b>	Product Data
230529	<b>Hangers and Supports for HVAC</b>	Manufacturer Instructions
230548	<b>Vibration and Seismic Controls for HVAC Piping and Equipment</b>	Product Data
230548	<b>Vibration and Seismic Controls for HVAC Piping and Equipment</b>	Manufacturer Instructions
230553	<b>Identification for HVAC Piping and Equipment</b>	Product Data
230553	<b>Identification for HVAC Piping and Equipment</b>	Manufacturer Instructions
230593	<b>Testing, Adjusting, and Balancing for HVAC</b>	Test Report
230713	<b>Duct Insulation</b>	Product Data
233113	<b>Metal Ducts</b>	Product Data
233300	<b>Air Duct Accessories</b>	Product Data
233300	<b>Air Duct Accessories</b>	Manufacturer Instructions
233423	<b>HVAC Power Ventilators</b>	Shop Drawings

233423	<b>HVAC Power Ventilators</b>	Product Data
233423	<b>HVAC Power Ventilators</b>	Manufacturer Instructions
233423	<b>HVAC Power Ventilators</b>	Wiring Diagrams
233423	<b>HVAC Power Ventilators</b>	Maintenance Data
233423	<b>HVAC Power Ventilators</b>	Operation / Maintenance Manual
233713	<b>Diffusers, Registers and Grilles</b>	Product Data
233713	<b>Diffusers, Registers and Grilles</b>	Manufacturer Instructions
235416.13	<b>Gas Fired Furnaces</b>	Shop Drawings
235416.13	<b>Gas Fired Furnaces</b>	Product Data
235416.13	<b>Gas Fired Furnaces</b>	Manufacturer Instructions
235416.13	<b>Gas Fired Furnaces</b>	Wiring Diagrams
235416.13	<b>Gas Fired Furnaces</b>	Maintenance Data
235416.13	<b>Gas Fired Furnaces</b>	Operation / Maintenance Manual
238239.19	<b>Wall and Ceiling Unit Heaters</b>	Shop Drawings
238239.19	<b>Wall and Ceiling Unit Heaters</b>	Product Data
238239.19	<b>Wall and Ceiling Unit Heaters</b>	Manufacturer Instructions
238239.19	<b>Wall and Ceiling Unit Heaters</b>	Maintenance Data
238239.19	<b>Wall and Ceiling Unit Heaters</b>	Wiring Diagrams
238239.19	<b>Wall and Ceiling Unit Heaters</b>	Operation / Maintenance Manual
260519	<b>Low-Voltage Electrical Power Conductors and Cables</b>	Product Data
260526	<b>Grounding and Bonding for Electrical Systems</b>	Product Data
260529	<b>Hangers and Supports for Electrical Systems</b>	Product Data
260533.13	<b>Conduit For Electrical Systems</b>	Product Data
260533.16	<b>Boxes</b>	Product Data
260540	<b>Directional Boring for Electrical Systems</b>	Construction Schedule
260540	<b>Directional Boring for Electrical Systems</b>	Product Data
260553	<b>Identification for Electrical Systems</b>	Product Data
260573	<b>Power System Studies</b>	Shop Drawings
260573	<b>Power System Studies</b>	Test Report
262416	<b>Panel Boards</b>	Shop Drawings
262416	<b>Panel Boards</b>	Product Data
262416	<b>Panel Boards</b>	Manufacturer Instructions
262416	<b>Panel Boards</b>	Wiring Diagrams
262416	<b>Panel Boards</b>	Maintenance Data
262416	<b>Panel Boards</b>	Operation / Maintenance Manual
262726	<b>Wiring Devices</b>	Product Data
262813	<b>Fuses</b>	Product Data
262816.13	<b>Enclosed Circuit Breakers</b>	Shop Drawings
262816.13	<b>Enclosed Circuit Breakers</b>	Product Data

262816.13	<b>Enclosed Circuit Breakers</b>	Manufacturer Instructions
262816.13	<b>Enclosed Circuit Breakers</b>	Wiring Diagrams
262816.13	<b>Enclosed Circuit Breakers</b>	Maintenance Data
262816.13	<b>Enclosed Circuit Breakers</b>	Operation / Maintenance Manual
262816.16	<b>Enclosed Switches</b>	Shop Drawings
262816.16	<b>Enclosed Switches</b>	Product Data
262816.16	<b>Enclosed Switches</b>	Manufacturer Instructions
262913	<b>Enclosed Controllers</b>	Product Data
262913	<b>Enclosed Controllers</b>	Shop Drawings
262913	<b>Enclosed Controllers</b>	Operation / Maintenance Manual
262913	<b>Enclosed Controllers</b>	Test Report
265100	<b>Interior Lighting</b>	Shop Drawings
265100	<b>Interior Lighting</b>	Product Data
265100	<b>Interior Lighting</b>	Manufacturer Instructions
265100	<b>Interior Lighting</b>	Wiring Diagrams
265100	<b>Interior Lighting</b>	Maintenance Data
265100	<b>Interior Lighting</b>	Operation / Maintenance Manual
265100	<b>Interior Lighting</b>	Warranty
265600	<b>Exterior Lighting</b>	Shop Drawings
265600	<b>Exterior Lighting</b>	Product Data
265600	<b>Exterior Lighting</b>	Manufacturer Instructions
265600	<b>Exterior Lighting</b>	Wiring Diagrams
265600	<b>Exterior Lighting</b>	Maintenance Data
265600	<b>Exterior Lighting</b>	Operation / Maintenance Manual
265600	<b>Exterior Lighting</b>	Warranty
284600	<b>Fire Detection and Alarm</b>	Shop Drawings
284600	<b>Fire Detection and Alarm</b>	Product Data
284600	<b>Fire Detection and Alarm</b>	Manufacturer Instructions
284600	<b>Fire Detection and Alarm</b>	Wiring Diagrams
284600	<b>Fire Detection and Alarm</b>	Maintenance Data
284600	<b>Fire Detection and Alarm</b>	Operation / Maintenance Manual

312000	<b>Earth Moving</b>	Product Data
312000	<b>Earth Moving</b>	Sample
312000	<b>Earth Moving</b>	Certification
312000	<b>Earth Moving</b>	Test Report
315000	<b>Excavation Support and Protection</b>	Product Data
315000	<b>Excavation Support and Protection</b>	Shop Drawings
315000	<b>Excavation Support and Protection</b>	Certification

315000	<b>Excavation Support and Protection</b>	As-Builts
321313	<b>Concrete Paving</b>	Product Data
321313	<b>Concrete Paving</b>	Test Report
321373	<b>Concrete Paving Joint Sealants</b>	Product Data
321713	<b>Parking Bumpers</b>	Product Data
321723	<b>Pavement Markings</b>	Product Data
329113	<b>Soil Preparation</b>	Product Data
329113	<b>Soil Preparation</b>	Sample
329113	<b>Soil Preparation</b>	Test Report
329200	<b>Turf and Grasses</b>	Product Data
329200	<b>Turf and Grasses</b>	Certification
329300	<b>Plant Material and Accessories</b>	Product Data
329300	<b>Plant Material and Accessories</b>	Certification
329300	<b>Plant Material and Accessories</b>	Warranty
331113	<b>Water Utility Distribution Piping</b>	Product Data
331313	<b>Sanitary Sewer Piping and Accessories</b>	Product Data
333600	<b>Septic Tanks</b>	Product Data
333600	<b>Septic Tanks</b>	Manufacturer Instructions
333616	<b>Septic Tank Effluent Pumping</b>	Product Data
333616	<b>Septic Tank Effluent Pumping</b>	Manufacturer Instructions
333616	<b>Septic Tank Effluent Pumping</b>	Wiring Diagrams
333616	<b>Septic Tank Effluent Pumping</b>	Operation / Maintenance Manual
333616	<b>Septic Tank Effluent Pumping</b>	Warranty
334100	<b>Storm Utility Drainage Piping</b>	Product Data

**END OF SECTION 013300**



## **SECTION 013513 – SITE SECURITY AND HEALTH REQUIREMENTS (DNR)**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUBMITTALS**

- A. List of required submittals:
  - 1. Materials Safety Data Sheets for all hazardous materials to be brought onsite.
  - 2. Schedule of proposed shutdowns, if applicable.
  - 3. A list of the names of all employees who will submit fingerprints for a background check, and the signed privacy documents identified below for each employee.

### **PART 2 - PRODUCTS (Not Applicable)**

### **PART 3 - EXECUTION**

#### **3.1 ACCESS TO THE SITE**

- A. The Contractor shall arrange with Facility Representatives to establish procedures for the controlled entry of workers and materials into the work areas at the Facility.
- B. The Contractor shall establish regular working hours with Facility Representatives. The Contractor must report changes in working hours or overtime to Facility Representatives and obtain approval twenty-four (24) hours ahead of time. The Contractor shall report emergency overtime to Facility Representatives as soon as it is evident that overtime is needed. The Contractor must obtain approval from Facility Representatives for all work performed after dark.
- C. The Contractor shall provide the name and phone number of the Contractor's employee or agent who is in charge onsite; this individual must be able to be contacted in case of emergency. The Contractor must be able to furnish names and address of all employees upon request.
- D. All construction personnel shall visibly display issued identification cards.

#### **3.2 FIRE PROTECTION, SAFETY, AND HEALTH CONTROLS**

- A. The Contractor shall take all necessary precautions to guard against and eliminate possible fire hazards.
  - 1. Onsite burning is prohibited.
  - 2. The Contractor shall store all flammable or hazardous materials in proper containers located outside the buildings or offsite, if possible.

3. The Contractor shall provide and maintain, in good order, during construction fire extinguishers as required by the National Fire Protection Association. In areas of flammable liquids, asphalt, or electrical hazards, 15-pound carbon dioxide or 20-pound dry chemical extinguishers shall be provided.
- B. The Contractor shall not obstruct streets or walks without permission from the Owner's Construction Representative and Facility Representatives.
- C. The Contractor's personnel shall not exceed the speed limit of 15 mph while at the Facility unless otherwise posted.
- D. The Contractor shall take all necessary, reasonable measures to reduce air and water pollution by any material or equipment used during construction. The Contractor shall keep volatile wastes in covered containers, and shall not dispose of volatile wastes or oils in storm or sanitary drains.
- E. The Contractor shall keep the project site neat, orderly, and in a safe condition at all times. The Contractor shall immediately remove all hazardous waste, and shall not allow rubbish to accumulate. The Contractor shall provide onsite containers for collection of rubbish and shall dispose of it at frequent intervals during the progress of the Work.
- F. Fire exits, alarm systems, and sprinkler systems shall remain fully operational at all times, unless written approval is received from the Owner's Construction Representative and the appropriate Facility Representative at least twenty-four (24) hours in advance. The Contractor shall submit a written time schedule for any proposed shutdowns.
- G. For all hazardous materials brought onsite, Material Safety Data Sheets shall be on site and readily available upon request at least a day before delivery.
- H. Alcoholic beverages or illegal substances shall not be brought upon the Facility premises. The Contractor's workers shall not be under the influence of any intoxicating substances while on the Facility premises.

### **3.3 DISRUPTION OF UTILITIES**

- A. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and the Facility Representative before disconnecting electric, gas, water, fire protection, or sewer service to any building.
- B. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and Facility Representative before closing any access drives, and shall make temporary access available, if possible. The Contractor shall not obstruct streets, walks, or parking.

**END OF SECTION 013513.31**

## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. Testing and inspection agencies and services.
- D. Contractor's design-related professional design services.
- E. Control of installation.
- F. Mock-ups.

#### 1.2 RELATED REQUIREMENTS

- A. Document 007213 - General Conditions: Inspections and approvals required.
- B. Section 013300 - Submittals.

#### 1.3 REFERENCE STANDARDS

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants 2008 (Reapproved 2019).
- B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2022.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2019.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2021.
- G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components 2016.

#### 1.4 DEFINITIONS

- A. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
  - 1. Design Services Types Required:

- B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

#### 1.5 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
  - 1. Concrete Mix Design: As described in Section 033000 - Cast-in-Place Concrete. No specific designer qualifications are required.
  - 2. Structural Design of Heavy Timber Framing: As described in Section 061323 - Heavy Timber Framing.
  - 3. Structural Design of Wood Trusses: As described in Section 061753 - Shop-Fabricated Wood Trusses
  - 4. Electrical Calculations: For array and associated equipment, as described in Section 260573- Power System Studies.

#### 1.6 SUBMITTALS

- A. See Section 013300 - Submittals for submittal procedures
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
  - 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
    - a. Full name.
    - b. Professional licensure information.
    - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
  - 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
  - 2. Include required product data and shop drawings.
  - 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.

4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of inspector.
    - d. Date and time of sampling or inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.
    - g. Type of test/inspection.
    - h. Date of test/inspection.
    - i. Results of test/inspection.
    - j. Compliance with Contract Documents.
    - k. When requested by Architect, provide interpretation of results.
  2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.7 Quality Assurance

A. Testing Agency Qualifications:

1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.8 Testing and Inspection Agencies and Services

A. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

C. Contractor Employed Agency:

1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
2. Laboratory: Authorized to operate in the State in which the Project is located.
3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.

PART 3 EXECUTION

2.1 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

## 2.2 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- D. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- E. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- F. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
  - 1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
  - 2. Make corrections as necessary until Architect's approval is issued.
- G. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- H. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

## 2.3 TESTING AND INSPECTION

- A. Testing Agency Duties:
  - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
  - 2. Perform specified sampling and testing of products in accordance with specified standards.
  - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
  - 5. Perform additional tests and inspections required by Architect.
  - 6. Submit reports of all tests/inspections specified.
- B. Limits on Testing/Inspection Agency Authority:
  - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
  - a. To provide access to Work to be tested/inspected.
  - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
  - c. To facilitate tests/inspections.
  - d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

2.4 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION



## **SECTION 015000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes requirements for construction facilities and temporary controls including temporary utilities, support facilities, security, and protection.
- B. Temporary utilities include, but are not limited to, the following:
  - 1. Water service and distribution
  - 2. Temporary electric power and light
  - 3. Temporary heat
  - 4. Ventilation
  - 5. Telephone service
  - 6. Sanitary facilities, including drinking water
  - 7. Storm and sanitary sewer
- C. Support facilities include, but are not limited to, the following:
  - 1. Field offices and storage sheds
  - 2. Temporary roads and paving
  - 3. Temporary enclosures
  - 4. Temporary project identification signs and bulletin boards
  - 5. Waste disposal services
  - 6. Rodent and pest control
  - 7. Construction aids and miscellaneous services and facilities
- D. Security and protection facilities include, but are not limited to, to following:
  - 1. Temporary fire protection
  - 2. Barricades, warning signs, and lights
  - 3. Sidewalk bridge or enclosure fence for the site
  - 4. Environmental protection

#### **1.3 SUBMITTALS**

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

- B. Implementation and Termination Schedule: Within (15) days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.

#### **1.4 QUALITY ASSURANCE**

- A. Regulations: Comply with industry standards and applicable laws and regulations 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. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

#### **1.5 PROJECT CONDITIONS**

- A. 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.
- B. 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 onsite.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. General: Provide new materials. If acceptable to the Designer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Lumber and Plywood: Comply with requirements in Division 6 Section “Rough Carpentry”.

1. For job-built temporary office, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
  2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.
  3. For fences and vision barriers, provide minimum 3/9" (9.5mm) thick exterior plywood.
  4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8" (16mm) thick exterior plywood.
- C. Water: Provide potable water approved by local health authorities.
- D. Open-Mesh Fencing: Provide 0.120" (3mm) thick, galvanized 2" (50mm) chainlink fabric fencing 6' (2m) high with galvanized steel pipe posts, 1½" (38mm) ID for line posts and 2½" (64mm) ID for corner posts.

## 2.2 EQUIPMENT

- A. General: Provide new equipment. If acceptable to the Designer, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Water Hoses: Provide ¾" (19mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100' (30m) 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 120V 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 rating.
- 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 fixture where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.
- H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated re-circulation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

- I. 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.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. 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.
- B. Provide each Facility ready for use when 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.

### **3.2 TEMPORARY UTILITY INSTALLATION**

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
  1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
  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 site where the Owner's easements cannot be used for that purpose.
  4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Change Order.
- B. Temporary Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
  1. Sterilization: Sterilize temporary water piping prior to use.
- C. Temporary Water Service: The Owner will provide water for construction purposes from the existing building system. All required temporary extensions shall be provided and removed by the Contractor. Connection points and methods of connection shall be designated and approved by the Construction Representative.
- D. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.

1. Install electric power service underground, except where overhead service must be used.
  2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125V, AC 20ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.
- E. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- F. Temporary Heating: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
1. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP gas or fuel-oil heaters with individual space thermostatic control.
  2. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.
- G. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities.
1. Telephone Lines: Provide telephone lines for the following:
    - a. Where an office has more than two (2) occupants, install a telephone for each additional occupant or pair of occupants.
    - b. Provide a dedicated telephone for a fax machine in the field office.
    - c. Provide a separate line for the Owner's use.
  2. At each telephone, post a list of important telephone numbers.
- H. Drinking-Water Facilities: Provide drinking-water fountains where indicated, including paper cup supply.
- I. 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.

### **3.3 SUPPORT FACILITIES INSTALLATION**

- A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.

1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip office as follows:
1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase.
  2. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.
- C. Storage facilities: Install storage 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. Specific locations for storage and craning operations will be discussed at the Pre-Bid Meeting and the Pre-Construction Meeting.
- D. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Designer.
1. Paving: Comply with Division 2 Section "Hot-Mixed Asphalt Paving" for construction and maintenance of temporary paving.
  2. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
  3. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
  4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
  5. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.
- E. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.
- F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
1. 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 materials drying or curing requirements to avoid dangerous conditions and effects.
2. Install tarpaulins securely with incombustible wood framing and other materials. Close openings of 25SqFt (2.3SqM) or less with plywood or similar materials.
  3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
  4. Where temporary wood or plywood enclosure exceeds 100SqFt (9.2SqM) in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.
- G. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.
- H. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.
1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
  2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- I. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.
- J. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above 80°F (27°C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.
- K. Rodent Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures are regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- L. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

### **3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION**

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Designer.

- B. 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 reasonable 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 (1) extinguisher on each floor at or near each usable stairwell.
  - 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.
  - 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
  
- C. 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.
  
- D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting including flashing red or amber lights.
  
- E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.
  - 1. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.
  
- F. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
  - 1. 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 material to minimize the opportunity for theft and vandalism.
  
- G. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near the site.



### 3.5 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage 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. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Designer requests that it be maintained longer, remove each temporary facility when the need has ended, when 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 the 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 Contractor's property. The Owner reserves the right to take possession of project identification signs.
  - 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances as required by the governing authority.
  - 3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
    - a. Replace air filters and clean inside of ductwork and housing.
    - b. Replace significantly worn parts and parts subject to unusual operating conditions.
    - c. Replace lamps burned out or noticeably dimmed by hours of use.

**END OF SECTION 015000**

## **SECTION 017000 - EXECUTION AND CLOSEOUT REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition.
- C. Pre-installation meetings.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- I. General requirements for maintenance service.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 015000 - Temporary Facilities and Controls: Temporary exterior enclosures.

#### **1.3 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
  - 1. On request, submit documentation verifying accuracy of survey work.
  - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
  - 3. Submit surveys and survey logs for the project record.

#### **1.4 QUALIFICATIONS**

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

#### **1.5 PROJECT CONDITIONS**

- A. Use of explosives is not permitted.

- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
  - 1. Minimize amount of bare soil exposed at one time.
  - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
  - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
  - 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

#### 1.6 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

## PART 2 PRODUCTS

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### 3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### 3.3 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
  - 1. Review conditions of examination, preparation and installation procedures.
  - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### 3.4 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.

- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Control datum for survey is that indicated on drawings.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- H. Utilize recognized engineering survey practices.
- I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
  - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
  - 2. Grid or axis for structures.
  - 3. Building foundation, column locations, ground floor elevations.
  - 4. Controlling lines and levels required for mechanical and electrical trades.
- J. Periodically verify layouts by same means.
- K. Maintain a complete and accurate log of control and survey work as it progresses.

### 3.5 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

### 3.6 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  - 1. Verify that construction and utility arrangements are as indicated.

2. Report discrepancies to Architect before disturbing existing installation.
  3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
  2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
  3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    - b. Provide temporary connections as required to maintain existing systems in service.
  4. Verify that abandoned services serve only abandoned facilities.
  5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- C. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- D. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
  2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- E. Clean existing systems and equipment.
- F. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- G. Do not begin new construction in alterations areas before demolition is complete.
- H. Comply with all other applicable requirements of this section.
- 3.7 PROGRESS CLEANING
- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

### 3.8 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- H. Prohibit traffic from landscaped areas.
- I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### 3.9 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.

### 3.10 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

- C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

### 3.11 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

### 3.12 FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, and downspouts.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### 3.13 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.



3.14 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

## **SECTION 017400 – CLEANING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for cleaning during the Project.
- B. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.
  - 1. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
  - 2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator for 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 PROGRESS CLEANING**

- A. General
  - 1. Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
  - 2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
  - 3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the jobsite.
  - 4. Provide adequate storage for all items awaiting removal from the jobsite, observing all requirements for fire protection and protection of the ecology.
- B. Site
  - 1. Daily, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.

2. Weekly, inspect all arrangements of materials stored onsite. Re-stack, tidy, or otherwise service all material arrangements.
3. Maintain the site in a neat and orderly condition at all times.

C. Structures

1. Daily, inspect the structures and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
2. Weekly, sweep all interior spaces clean. "Clean" for the purposes of this paragraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom.
3. In preparation for installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.
4. Following the installation of finish floor materials, clean the finish floor daily while work is being performed in the space in which finish materials have been installed. "Clean" for the purposes of this subparagraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Construction Representative, may be injurious to the finish of the finish floor material.

### 3.2 FINAL CLEANING

- A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
- B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or a portion of the Project.
  1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities including landscape development areas, of rubbish, waste material, litter, and foreign substances.
  2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  3. Remove petrochemical spills, stains, and other foreign deposits.
  4. Remove tools, construction equipment, machinery, and surplus material from the site.
  5. Remove snow and ice to provide safe access to the building.
  6. 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.
  7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  8. Broom clean concrete floors in unoccupied spaces.
  9. Vacuum clean carpet and similar soft surfaces removing debris and excess nap. Shampoo, if required.

10. Clean transparent material, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  11. Remove labels that are not permanent labels.
  12. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - a. Do not paint over “UL” and similar labels, including mechanical and electrical nameplates.
  13. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  14. Clean plumbing fixtures to a sanitary condition free of stains, including stains resulting from water exposure.
  15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  16. Clean ducts, blowers, and coils if units were operated without filters during construction
  17. Clean food-service equipment to a sanitary condition, ready and acceptable for its intended use.
  18. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.
  19. Leave the Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities.
- D. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.
- E. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.
1. Where extra materials of value remain after Final Acceptance by the Owner, they become the Owner’s property.

**END OF SECTION 017400**

## **SECTION 017800 - CLOSEOUT SUBMITTALS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 007213 - General Conditions and 007300 Supplementary Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

#### **1.3 SUBMITTALS**

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
  - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 3. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders and other modifications to the Contract.
  - 5. Reviewed shop drawings, product data, and samples.
  - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
  - 1. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
  - 1. Measured depths of foundations in relation to finish first floor datum.
  - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  - 4. Field changes of dimension and detail.
  - 5. Details not on original Contract drawings.

3.2 OPERATION AND MAINTENANCE DATA

- A. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- B. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

- C. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### 3.3 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
  - 1. Product data, with catalog number, size, composition, and color and texture designations.
  - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

### 3.4 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
  - 2. Identify function, normal operating characteristics, and limiting conditions.
  - 3. Include performance curves, with engineering data and tests.
  - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Provide servicing and lubrication schedule, and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.

- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

### 3.5 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
  - 1. Project Directory.
  - 2. Table of Contents, of all volumes, and of this volume.
  - 3. Operation and Maintenance Data: Arranged by system, then by product category.
    - a. Source data.
    - b. Operation and maintenance data.
    - c. Field quality control data.
    - d. Photocopies of warranties and bonds.



3.6 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

## **SECTION 017900 - DEMONSTRATION AND TRAINING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
  - 3. Demonstration and training video recordings.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.
- C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
  - 1. Identification: On each copy, provide an applied label with the following information:
    - a. Name of Project.
    - b. Name and address of videographer.
    - c. Name of Architect.
    - d. Name of Construction Manager.
    - e. Name of Contractor.
    - f. 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 on compact disc.

## **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 experienced in operation and maintenance procedures and training.
- C. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Coordination". Review methods and procedures related to demonstration and training including, but not limited to, the following:
  1. Inspect and discuss locations and other facilities required for instruction.
  2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  3. Review required content of instruction.
  4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

## **1.6 COORDINATION**

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

## **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 Contractor is delegated design responsibility.
  - c. Operating standards.
  - d. Regulatory requirements.
  - e. Equipment function.
  - f. Operating characteristics.
  - g. Limiting conditions.
  - h. Performance curves.
2. Documentation: Review the following items in detail:
- a. Emergency manuals.
  - b. Operations manuals.
  - c. Maintenance manuals.
  - d. Project record documents.
  - e. Identification systems.
  - f. Warranties and bonds.
  - g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
- a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

### **PART 3 - EXECUTION**

#### **3.1 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 Section 007213 "General Conditions".
- B. Set up instructional equipment at instruction location.

#### **3.2 INSTRUCTION**

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
  2. Owner will furnish an instructor to describe Owner's operational philosophy.
  3. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  1. Schedule training with Owner with at least seven days' advance notice.

- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

### **3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS**

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. 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. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
  - 1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
  - 2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
  - 3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
  - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
    - a. Name of Contractor/Installer.
    - b. Business address.
    - c. Business phone number.
    - d. Point of contact.
    - e. E-mail address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
  - 1. Film training session(s) in segments not to exceed 15 minutes.
    - a. Produce segments to present a single significant piece of equipment per segment.
    - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

**END OF SECTION 017900**

## **SECTION 024100 - DEMOLITION**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Selective demolition of built site elements.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 01 5000 - Construction Facilities and Temporary Controls.
- D. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- E. Section 311000 - Site Clearing: Vegetation and existing debris removal.

#### **1.3 REFERENCE STANDARDS**

- A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

#### **1.4 SUBMITTALS**

- A. See Section 013300 - Submittal Procedures, for submittal procedures.
- B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

### **PART 2 PRODUCTS -- NOT USED**

### **PART 3 EXECUTION**

#### **3.1 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Use of explosives is not permitted.
  - 3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 4. Provide, erect, and maintain temporary barriers and security devices.



5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
  6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  7. Do not close or obstruct roadways or sidewalks without permit.
  8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
  9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Protect existing structures and other elements that are not to be removed.
1. Provide bracing and shoring.
  2. Prevent movement or settlement of adjacent structures.
  3. Stop work immediately if adjacent structures appear to be in danger.
- E. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- F. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

### 3.2 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.3 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

## **SECTION 030516 - UNDERSLAB VAPOR BARRIER**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Sheet vapor barrier on earth in crawl space.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 031000 - Concrete Forming and Accessories: Forms and accessories for formwork.
- B. Section 032000 - Concrete Reinforcing.
- C. Section 033000 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

#### **1.3 REFERENCE STANDARDS**

- A. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2018a.
- B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs 2017.

#### **1.4 SUBMITTALS**

- A. See Section 01 3300 - Submittal Procedures, for administrative and procedural requirements.
- B. Product Data: Submit manufacturers' data on manufactured products.
- C. Samples: Submit samples of underslab vapor barrier to be used.
- D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

### **PART 2 PRODUCTS**

#### **2.1 MATERIALS**

- A. Underslab Vapor Barrier:
  - 1. Water Vapor Permeance: Not more than 0.010 perms (0.6 ng/(s m<sup>2</sup> Pa)), maximum.
  - 2. Complying with ASTM E1745 Class A.
  - 3. Thickness: 15 mils (0.4 mm).
  - 4. Basis of Design:
    - a. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil): [www.stegoindustries.com/#sle](http://www.stegoindustries.com/#sle).
  - 5. Other Acceptable Manufactures subject to compliance with Basis of Design Product and accessories.

- a. Trex-Trude Xtreme Vapor Barrier / Retarder (15 mil. Class A).
  - b. ISI Building Products Viper II (15 mil. Class A).
- B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.
1. Basis of Design: Vapor Barrier Accessories:
    - a. Sealing Seams: High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4 inches. Stego Tape.
    - b. Sealing Penetrations:Stego Mastic or Stego Tape
    - c. Sealing Perimeter of Vapor barrier: StegoTack Tape (double-sided sealant tape) or Stego Crete Claw.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

#### 3.2 INSTALLATION

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.
- B. Install vapor barrier in crawl space; lap sheet over footings and seal to foundation walls.
- C. Lap joints minimum 6 inches (150 mm).
- D. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
- E. Extend vapor barrier to the perimeter of the crawl space. At the point of termination, seal vapor barrier to the foundation wall and the concrete piers.
  1. Seal vapor barrier to the entire slab perimeter using Stego Crete Claw, per manufacturer's instructions.
  2. Option to install above; Seal vapor barrier to the entire perimeter wall or footing/grade beam with double sided StegoTack Tape, or both Stego Term Bar and StegoTack Tape, per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.
- F. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
- G. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.
- H. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

## **SECTION 031000 - CONCRETE FORMING AND ACCESSORIES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 032000 - Concrete Reinforcing.
- B. Section 033000 - Cast-in-Place Concrete.
- C. Section 051200 - STRUCTURAL STEEL FRAMING: Placement of embedded steel anchors and plates in cast-in-place concrete.

#### **1.3 REFERENCE STANDARDS**

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).
- B. ACI 301 - Specifications for Concrete Construction 2020.
- C. ACI 318 - Building Code Requirements for Structural Concrete 2019, with Errata (2021).
- D. ACI 347R - Guide to Formwork for Concrete 2014 (Reapproved 2021).
- E. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2016.

#### **1.4 SUBMITTALS**

- A. See Section 013300 - Submittals, for administrative and procedural requirements.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.
- B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

### **PART 2 PRODUCTS**

#### **2.1 FORMWORK - GENERAL**

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

- B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.
- C. Chamfer outside corners of exposed walls and pedestals.
- D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
- E. Comply with relevant portions of ACI 301, ACI 318, and ACI 347R.

## 2.2 WOOD FORM MATERIALS

- A. Plywood: Douglas Fir species; solid one side grade; sound undamaged sheets with clean, true edges.

## 2.3 REMOVABLE PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gauge, 0.0598 inch (1.52 mm) thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Preformed Plastic Forms: Thermoplastic polystyrene form liner, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.
- D. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches (50 mm) thick.

## 2.4 FORMWORK ACCESSORIES

- A. Form Ties: Factory-fabricated, removeable, or snap-off type, fiber reinforced plastic or metal form, fixed length, free of defects that could leave holes larger than 1 inch (25 mm) in concrete surface.
  - 1. Ties shall be designed to resist lateral pressure of fresh concrete on forms.
  - 2. Furnish ties that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
- B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- C. Filler Strips for Chamfered Corners: Metal, wood, PVC, or rubber strips type; 3/4 by 3/4 inch (\_\_\_\_ by \_\_\_\_ mm) size; maximum possible lengths.
- D. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 051200.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

#### 3.2 EARTH FORMS

- A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.
  - 1. Earth forms are not permitted for below grade concrete wall stems.

#### 3.3 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
  - 2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Align joints and make watertight. Keep form joints to a minimum.
- G. 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.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. Form openings, chases, offsets, linkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

- K. Obtain approval before framing openings in structural members that are not indicated on drawings.
- L. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- M. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- N. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- O. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- P. Coordinate this section with other sections of work that require attachment of components to formwork.

#### 3.4 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

#### 3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303 .
- E. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

#### 3.6 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
  - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.



2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

### 3.7 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.
- B. Construct permanent insulated foam panel formwork to maintain tolerances required by ACI 301.

### 3.8 FORM REMOVAL AND REUSE

- A. Do not remove forms or bracing until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  1. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
  2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.
- D. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- E. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

END OF SECTION

## **SECTION 032000 - CONCRETE REINFORCING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 031000 - Concrete Forming and Accessories.
- B. Section 033000 - Cast-in-Place Concrete.

#### **1.3 REFERENCE STANDARDS**

- A. ACI 301 - Specifications for Concrete Construction 2020.
- B. ACI 318 - Building Code Requirements for Structural Concrete 2019, with Errata (2021).
- C. ACI SP-66 - ACI Detailing Manual 2004.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.
- E. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement 2022.
- F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.
- G. CRSI (DA4) - Manual of Standard Practice 2009.

#### **1.4 SUBMITTALS**

- A. See Section 013300 - Submittals, for administrative and procedural requirements.
- B. Shop Drawings: Comply with requirements of ACI SP-66. Include placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

#### **1.5 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 301.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

## PART 2 PRODUCTS

### 2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
  - 1. Deformed billet-steel bars.
- B. Stirrup Steel: ASTM A1064/A1064M steel wire, unfinished.
- C. Reinforcement Accessories:
  - 1. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa), plain-steel bars, cut true to length with ends square and free of burrs.
  - 2. 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 (DA4) Manual of Standard Practice, of greater compressive strength than concrete and as follows:
    - a. 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.

### 2.2 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is not permitted.
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress.
  - 1. Provide standard Class B lap splices unless otherwise indicated.
  - 2. Review locations of splices with Architect.

## PART 3 EXECUTION

### 3.1 PLACEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  - 1. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- D. Do not displace or damage vapor barrier.
- E. Accommodate placement of formed openings.

- F. Maintain concrete cover around reinforcing according to Construction Drawings.
- G. Comply with applicable code for concrete cover over reinforcement.

END OF SECTION

## **SECTION 033000 - CAST-IN-PLACE CONCRETE**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Concrete foundation walls and retaining walls, pad footings, strip footings, and pedestals.
- B. Non-Shrink Cementitious or Epoxy Grout.
- C. Joint devices associated with concrete work.
- D. Miscellaneous concrete elements, including equipment pads.
- E. Concrete curing.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 031000 - Concrete Forming and Accessories: Forms and accessories for formwork
- B. Section 032000 - Concrete Reinforcing.
- C. Section 079200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

#### **1.3 REFERENCE STANDARDS**

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete 1991 (Reapproved 2009).
- C. ACI 301 - Specifications for Concrete Construction 2020.
- D. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).
- F. ACI 305R - Guide to Hot Weather Concreting 2020.
- G. ACI 306R - Guide to Cold Weather Concreting 2016.
- H. ACI 308R - Guide to External Curing of Concrete 2016.
- I. ACI 318 - Building Code Requirements for Structural Concrete 2019, with Errata (2021).
- J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.
- K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2022a.
- L. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.

- M. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.
- N. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- O. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete 2020.
- P. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete 2017.
- Q. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method 2016.
- R. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).
- S. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete 2019.
- T. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019, with Editorial Revision (2022).
- U. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2022.
- V. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures 2016.
- W. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2020a.
- X. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete 2021.
- Y. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.
- Z. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2020.
- AA. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete 2019.
- BB. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.
- CC. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2018a.
- DD. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs 2017.
- EE. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- FF. NSF 372 - Drinking Water System Components - Lead Content 2022.

#### 1.4 ACTION SUBMITTALS

- A. See Section 013300 - Submittals, for administrative and procedural requirements.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit proposed concrete mix design.
  - 1. For each concrete mixture, indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
  - 2. For each concrete mixture, indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
  - 3. Indicate proposed mix design complies with admixture manufacturer's written recommendations.
  - 4. Indicate amounts of mixing water to be withheld for later addition at the Project site.
- D. Test Reports: Submit report for each test or series of tests specified.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, and testing agency.
- B. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Curing compounds.
  - 4. Bonding agents.
  - 5. Adhesives.
  - 6. Repair materials.
- C. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- D. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.

- D. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- E. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
  - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

#### 1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

#### 1.8 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and as follows:
  - 1. 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. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### PART 2 PRODUCTS

#### 2.1 FORMWORK

- A. Comply with requirements of Section 031000 - Concrete Forming and Accessories.



2.2 REINFORCEMENT MATERIALS

- A. Comply with requirements of Section 032000 - Concrete Reinforcing

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I/II Portland type, gray.

- 1. Acquire cement for entire project from same source.

- B. Normal-Weight Fine and Coarse Aggregates: ASTM C 33 or better, graded.

- 1. Acquire all aggregates for entire project from same source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

- 2. Maximum Coarse-Aggregate Size: 1-1/2 inches unless noted otherwise per design mix.

- 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

- C. Fly Ash: ASTM C618, Class C.

- D. Water: ASTM C94/C94M and potable.

2.4 ADMIXTURES

- A. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

- B. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

- C. Air Entrainment Admixture: ASTM C260/C260M.

- D. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

- E. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

- F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

- G. Retarding Admixture: ASTM C494/C494M Type B.

- H. Water Reducing Admixture: ASTM C494/C494M Type A.

2.5 ACCESSORY MATERIALS

- A. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

- 1. Grout: Comply with ASTM C1107/C1107M.

- 2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:

- a. Maximum: Plus 4 percent.
- b. Minimum: Plus 1 percent.
3. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2,000 pounds per square inch (13.7 MPa).
4. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch (48 MPa).

## 2.6 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Epoxy Bonding System:
  1. Complying with ASTM C881/C881M and of Type required for specific application.
  2. Two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
    - a. Types I and II, nonload bearing and Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.7 CURING MATERIALS

- A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
- B. Curing and Sealing Compound, Moisture Emission-Reducing, Membrane-Forming: Clear, liquid sealer for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
  1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.
  2. Comply with ASTM C309 and ASTM C1315 Type I Class A.
  3. VOC Content: Less than 100 g/L.
- C. Moisture-Retaining Sheet: ASTM C171.
  1. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch (0.102 mm).
  2. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard (1.71 kg/sq m).
- D. Water: Potable, not detrimental to concrete.

## 2.8 REPAIR MATERIALS

- A. 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 C150/C150M, portland cement or hydraulic or blended hydraulic cement.
  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 C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement.
  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 C109/C109M.

## 2.9 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
1. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
    - a. Fly Ash: 25 percent.
  2. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, or both, as specified in ACI 301 .
1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete for Isolated Footings and Continuous Footings:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch (27.6 MPa).
  2. Water-Cement Ratio: Maximum 0.5 for  $f'_c = 4,000$  psi.
  3. Total Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size
  4. Maximum Slump: 5 inches for concrete without a water-reducing or plasticizing admixture. 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch
  5. Maximum Aggregate Size: [1-1/2] inch ([ ] mm).
- E. Normal Weight Concrete for Foundation Walls, Retaining Walls, and pedestals:
1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch (27.6 MPa).
  2. Water-Cement Ratio: Maximum 0.5 for  $f'_c = 4,000$  psi.
  3. Total Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2 inch nominal maximum aggregate size.
  4. Maximum Slump: 4 inches for concrete without high-range water-reducing or plasticizing admixture; or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
  5. Maximum Aggregate Size: [1-1/2] inch ([ ] mm).

## 2.10 MIXING

- A. Transit Mixers: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

### 3.2 JOINTS

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

- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  - 3. Locate vertical joints in walls beside piers integral with walls, near corners, and in concealed locations where possible.
  - 4. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

### 3.3 PREPARATION

- A. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
  - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
  - 2. Use latex bonding agent only for non-load-bearing applications.
- B. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

### 3.4 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Notify Architect not less than 24 hours prior to commencement of placement operations.
- C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- D. Ensure reinforcement, inserts, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 .
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete

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

### 3.5 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
  - 1. Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch (6 mm) or more in height. Provide finish as follows:
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.6 MISCELLANEOUS CONCRETE ITEM INSTALLATION

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

### 3.7 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R . Immediately after placement, protect concrete from premature drying, excessively hot (ACI 301 ) or cold temperatures (ACI 306R ), and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
  - 1. Normal concrete: Not less than seven days.
- C. 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.
- D. Formed Surfaces: Cure by moist curing. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

### 3.8 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000. The contractor shall be responsible for scheduling all required tests.

- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Contractor shall notify the owner's representative a minimum of 48 hours prior to all placement of concrete.
- D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- E. Inspections:
  - 1. Verification of use of required design mixture.
  - 2. Concrete placement, including conveying and depositing.
  - 3. Curing procedures and maintenance of curing temperature.
- F. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
  - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
    - a. When frequency of testing provides 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 C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  - 3. Air Content: ASTM C 231/C 231M, pressure method, 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.
  - 4. Compressive Strength Tests: ASTM C39/C39M . Test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
    - b. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
  - 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
  - 6. 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.

- G. 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.
- H. 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. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
- I. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- J. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

### 3.9 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. 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 matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to



reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.
  3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  4. Correct other low areas scheduled to 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.
  5. 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 (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  6. 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.
  7. 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 Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

END OF SECTION

## **SECTION 044313.13 - ANCHORED STONE MASONRY VENEER**

### **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. Stone masonry for Buildings, including exterior walls and selected interior decorative walls, stone accents and hearthstones.
  - 2. Stone masonry anchored to wood framing and sheathing.
  - 3. Stone masonry (thin cut stone veneer) anchored to woodl framing and sheathing.
- B. Related Requirements:
  - 1. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.

#### **1.3 PREINSTALLATION MEETING**

- A. Preinstallation Conference: Conduct conference at Project site.

#### **1.4 ACTION SUBMITTALS**

- A. See Section 01 3300 - Submittal Procedures, for administrative and procedural requirements.
- B. Product Data: For each variety of stone, stone accessory, and manufactured product.
- C. Samples for Verification:
  - 1. For each stone type indicated. Include at least five Samples in each set and show the full range of color and other visual characteristics in completed Work.
  - 2. For each color of mortar required. Label Samples to indicate types and amounts of pigments used.
  - 3. The Contractor shall provide the Construction Representative with stone and mortar samples for review and approval prior to construction. The approved stone sample shall be kept on site for reference until the stone masonry work is complete.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer and Supplier.
- B. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, supply sources, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.

1. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents contained in mockups unless Construction Representative approves such deviations in writing.

C. Material Test Reports:

1. Stone Test Reports: For each stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within previous five years.

D. Shop Drawings:

1. The Contractor shall submit shop drawings indicating all stones, stone anchor types and dimensions, stone details, anchorages, layouts, construction and setting details to the Construction Representative for approval.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters. Personnel installing anchored masonry stone veneer shall have a minimum of seven (7) years of documented experience working on at least 5 projects with installed patterns, joint spacings and aesthetic affects similar to those required for this project.
- B. Supplier Qualifications: A qualified supplier shall have a minimum of seven (7) years experience specializing in supplying the required specified types of stone.
- C. Stone shall conform to the following:
  1. National Building Quarries Association, Inc. (NBQA)
  2. American Society for Testing and Materials (ASTM)-ASTM C99
- D. The minimum unit weight (material density) of the stone shall be 150 lb/ft<sup>3</sup> (2,400 kg/m<sup>3</sup>).
- E. Anchors shall conform to the following American Society of Testing Materials (ASTM) standards:
  1. ASTM A167 – Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  2. ASTM A240 – Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
  3. ASTM A82 – Steel Wire, Plain, for Concrete Reinforcement
  4. ASTM A580 – Stainless Steel Wire
- F. Anchors shall be a combination of , flexible ties, rigid bars, and split anchors. All anchors shall be type 304 stainless steel. Anchors shall be attached with self-tapping screw fasteners.
- G. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for each type of stone masonry in sizes approximately 60 inches long by 60 inches high, or as otherwise required to accommodate window mock up, by full thickness, including face and backup wall construction and accessories.
  - a. Include representative color and size range for stone.
  - b. Mock up shall present the pattern basis of design and shown on the drawings including varying size transition and shapes of stone pieces.
  - c. Include presentation of exterior corner conditions, use additional mockup if required.
  - d. The approved mock ups shall be kept on site for reference until the stone veneer installation is complete.
2. Protect accepted mockups from the elements with weather-resistant membrane.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Construction Representative specifically approves such deviations in writing.

#### 1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Sealant Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Section 079200 "Joint Sealants," Samples of materials that will contact or affect joint sealants.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.
- E. Store stones in a manner to ensure against cracking, staining and discoloration.

#### 1.9 FIELD CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.
  1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.

1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the 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 end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.
- C. 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 stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

#### 1.10 COORDINATION

- A. Advise installers of other work about specific requirements for placement of reinforcement, veneer anchors, flashing, and similar items to be built into stone masonry.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations for Stone: Obtain each variety of stone, from single quarry, with resources to provide materials of consistent quality in appearance and physical properties.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.
- C. Basis of Design Manufacturer: Semco Stone Products; Perryville, MO.
- D. Alternative Manufacturers, subject to compliance with project requirements, provide comparable products by one of the following manufacturers:
1. Earthworks Inc.; Perryville, MO.
  2. Buechel Stone; Chilton, WI.
  3. Halquist Stone; Sussex, WI.

#### 2.2 STONE VENEER

- A. Typical "Random Height Rockport Blend" pattern, provide Basis of Design product or Construction Representative approved equivalent.

1. The Basis of Design for stone masonry veneer is Random Height Rockport Blend as produced by Semco Stone Products: Perryville, MO.
2. Provide full thickness veneer, and thin cut veneer as shown on the drawings.
3. Match samples for color, finish, and other stone characteristics relating to aesthetic effects.
4. Full Veneer:
  - a. 100 % weathered edge.
  - b. Thickness: approximately 4" thick, range from 3 inch to 5 inch thick.
  - c. Heights: 3 inches to 7 inches.
  - d. Lengths: 5 inches to 15 inches; random.
  - e. Color: Gray and BEarthtones.
5. Thincut Veneer:
  - a. 100 % weathered edge.
  - b. Thickness: approximately 1-inch thick, range from ¾-inch to 1 ¾-inch thick.
  - c. Heights: 3 inches to 7 inches.
  - d. Lengths: 5 inches to 15 inches; random.
  - e. Color: to match full thickness veneer
6. Design Intent for full veneer and thin cut veneer is to achieve weathered surface appearance at areas exposed to view. It is permissible to utilize center cut stone with weathered face at exposed conditions and cut face at non-exposed condition.

### 2.3 Hearthstones

- A. The Basis of Design for stone hearthstones is S-127HEARTH "Rustic Cedar Hearthstone"; as produced by Semco Stone Products: Perryville, MO.
- B. Provide honed finish.

### 2.4 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.
  1. Low-Alkali Cement: Not more than 0.60 percent total alkali 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 and hydrated lime containing no other ingredients.

- D. Colored Portland Cement-Lime Mix: Packaged blend of portland cement, hydrated lime, and mortar pigments. Mix shall produce color indicated or, if not indicated, as selected from manufacturer's standard colors. Pigments shall not exceed 10 percent of portland cement by weight.
- E. Aggregate: ASTM C 144 and as follows:
  - 1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
- F. Water: Potable.

## 2.5 VENEER ANCHORS

- A. Materials:
  - 1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
  - 2. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
- B. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.
- C. Wire Veneer Anchors: Wire ties formed from W1.7 or 0.148-inch-diameter, stainless-steel wire.
  - 1. Ties are bent in the form of loops with legs not less than 15 inches in length and with last 2 inches bent at 90 degrees.
  - 2. Ties are bent in the form of rectangular loops with ends bent downward for inserting into eyes projecting from masonry joint reinforcement specified in Section 042000 "Unit Masonry."
  - 3. Ties are bent in the form of triangular loops designed to be attached to masonry joint reinforcement specified in Section 042000 "Unit Masonry" with vertical wires passing through ties and through eyes projecting from masonry joint reinforcement.
- D. Polymer-Coated, Steel Tapping Screws for Concrete Masonry: Self-tapping screws with specially designed threads for tapping and wedging into masonry, with hex washer head and neoprene washer, 3/16-inch diameter by 1-1/2-inch length, and with organic polymer coating with more than 800-hour, salt-spray resistance to red rust per ASTM B 117.

## 2.6 STONE TRIM ANCHORS

- A. Stone Trim Anchors: Units fabricated with tabs or dowels designed to engage kerfs or holes in stone trim units and holes for fasteners or postinstalled anchor bolts for fastening to substrates or framing as indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Canaren Inc.
    - b. Heckmann Building Products Inc.
    - c. Hohmann & Barnard, Inc.

d. Meadow Burke.

- B. Materials: Fabricate anchors from stainless steel, ASTM A 240/A 240M or ASTM A 666, Type 304. Fabricate dowels from stainless steel, ASTM A 276, Type 304.
- C. Fasteners for Stone Trim Anchors: Annealed stainless-steel bolts, nuts, and washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Postinstalled Anchor Bolts for Fastening Stone Trim Anchors: Chemical anchors, torque-controlled expansion anchors or undercut anchors made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or Type 316, for anchors.

2.7 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual and as follows:
  - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
  - 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
  - 3. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) Cheney Flashing Company; Cheney Flashing (Dovetail).
      - 2) Approved equivalent product by other manufacturers.
  - 4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
  - 5. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
  - 6. Fabricate metal drip edges for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
  - 7. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
- B. Application: Unless otherwise indicated, use the following:
  - 1. Where flashing is indicated to receive counterflashing, use metal flashing.
  - 2. Where flashing is indicated to be turned down at or beyond wall face, use metal flashing.



3. Where flashing is partly exposed and is indicated to terminate at wall face, use metal flashing with a drip edge.

4. Where flashing is fully concealed, use metal flashing.

C. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Cementitious Dampproofing: Cementitious formulation recommended by ILI and nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.

B. Asphalt Dampproofing: Cut-back asphalt complying with ASTM D 4479, Type I.

C. Weep/Vent Products: Use the following unless otherwise indicated:

1. Mesh Weep Holes/Vents: Free-draining mesh; made from polyethylene strands, full width of head joint and 2 inches high by thickness of stone masonry; in color selected from manufacturer's standard.

a. Basis of Design Product: Provide Mortar Net USA, Ltd.; Mortar Net Weep Vents or Construction Representative approved equal product.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Provide one of the following configurations:

a. Sheets or strips not less than 1/2 inch thick and installed to full height of cavity with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from being clogged with mortar.

E. Reinforcing: ASTM C 847, 2.5lb/yd<sup>2</sup> (1.4kg/m<sup>2</sup>) galvanized expanded metal lath complying with code agency requirements for the type of substrate over which stone veneer is installed.

2.9 FABRICATION

A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.

B. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Stone Masonry" Article.

C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.

D. Cut and drill sinkages and holes in stone for anchors and supports.

E. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.

1. Clean sawed backs of stone to remove rust stains and iron particles.
- F. Thickness of Stone: Provide thickness indicated, but not less than the following:
1. Full Thickness: 4 inches average thickness with range from 3 to 5 inches.
  2. Thin veneer: 1 inch average thickness with range from  $\frac{3}{4}$  to  $1\frac{1}{2}$  inches.
  3. Heavy Veneer for Pedestrian Bridge and Boardwalk: 7 inches average thickness with range from 6 to 8 inches.
- G. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples and mockups.

## 2.10 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride.
  2. Use portland cement-lime mortar unless otherwise indicated.
  3. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches required consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Stone Masonry: Comply with ASTM C 270, Proportion Specification.
1. Mortar for Setting Stone: Type S.
    - a. The mortar shall be type S and shall meet the requirements of ASTM C270
    - b. Compressive Strength: 1,800 psi (12 MPa)
    - c. Water Retention Maximum: 75%
    - d. Air Content Maximum: 18%
  2. Mortar for Pointing Stone: Type N.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.
- B. Examine substrate to verify that dovetail slots, inserts, reinforcement, veneer anchors, flashing, and other items installed in substrates and required for or extending into stone masonry are correctly installed.
- C. Examine wall framing, sheathing, and weather-resistant sheathing paper to verify that stud locations are suitable for spacing of veneer anchors and that installation will result in a weatherproof covering.
- D. Examine stones to verify they are free of chips, voids, stains and other defects.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Accurately mark stud centerlines on face of weather-resistant sheathing paper before beginning stone installation.
- B. Coat concrete and unit masonry backup with asphalt dampproofing.
- C. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

### 3.3 SETTING STONE MASONRY

- A. Perform necessary field cutting and trimming as stone is set.
  - 1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
  - 2. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
  - 3. Pitch face at field-split edges as needed to match stones that are not field split.
- B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- C. Arrange stones in random-range pattern as indicated with joint widths within tolerances indicated. Insert small stones into spaces between larger stones as needed to produce joints as uniform in width as practical.
- D. Maintain uniform joint widths except for variations due to artistic effect of “random height” layout with different stone sizes and where minor variations are required to maintain bond alignment if any.
  - 1. At typical “random height” installations, lay walls with joints not less than 1/4 inch at narrowest points or more than 1 inch at widest points.

2. At caps or trim conditions, lay walls with joints not less than 1/4 inch at narrowest points or more than 1/2 inch at widest points.
- E. Provide sealant joints of widths and at locations indicated.
1. Keep sealant joints free of mortar and other rigid materials.
  2. Sealing joints is specified in Section 079200 "Joint Sealants."
- F. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
1. At stud-framed walls, extend flashing through stone masonry, up sheathing face at least 8 inches, and behind weather barrier.
  2. At concrete backing, extend flashing through stone masonry, turned up a minimum of 8 inches, and insert in reglet.
  3. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches into masonry at each end. Align with edge of stone headers where provided.
  4. At sills, extend flashing not less than 4 inches at ends.
  5. At ends of head and sill flashing, turn up not less than 2 inches to form end dams.
  6. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
  7. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
  8. Extend sheet metal flashing 1/2 inch beyond masonry face at exterior, and turn flashing down to form a drip.
  9. Install metal drip edges beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch back from exterior wall face and adhere flexible flashing to top of metal drip edge.
- G. Coat stone with cementitious dampproofing as follows:
1. Stone at Grade: Beds, joints, and back surfaces to at least 12 inches above finish-grade elevations.
  2. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.
  3. Allow cementitious dampproofing formulations to cure before setting dampproofed stone. Do not damage or remove dampproofing in the course of handling and setting stone.
- H. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.
1. Use mesh weep holes/vents to form weep holes.

2. Space weep holes 24 inches o.c.
  3. Place pea gravel in cavities as soon as practical to a height of not less than 2 inches above top of flashing, to maintain drainage.
  4. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- I. Install vents in head joints at top of each continuous cavity at spacing indicated. Use mesh weep holes/vents to form vents.
    1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

### 3.4 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.
- D. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each stone face from level, plumb, or dimensioned plane.
- E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.
- F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

### 3.5 INSTALLATION OF ANCHORED STONE MASONRY

- A. Anchor stone masonry to unit masonry with adjustable, screw-attached veneer anchors unless otherwise indicated. Fasten anchors to unit masonry with two screws.
- B. Anchor stone masonry to stud framing with screw-attached veneer anchors unless otherwise indicated.
- C. Anchor stone masonry to wood-stud framing with wire anchors unless otherwise indicated. Fasten anchors through sheathing to wood studs with corrosion-resistant roofing nails.
- D. Anchor stone masonry to metal-stud framing with wire anchors unless otherwise indicated. Tie anchors to studs.
- E. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.
- F. Space anchors not more than 18 inches o.c. vertically and 32 inches o.c. horizontally, with not less than one anchor per 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.

- G. Anchor stone trim with stone trim anchors where indicated. Install anchors by fastening to substrate and inserting tabs and dowels into kerfs and holes in stone units. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.
- H. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.
- I. Provide 2-inch cavity between stone masonry and backup construction unless otherwise indicated. Keep cavity free of mortar droppings and debris.
  - 1. Slope beds toward cavity to minimize mortar protrusions into cavity.
  - 2. Do not attempt to trowel or remove mortar fins protruding into cavity.
- J. Rake out joints for pointing with mortar to depth of not less than 1/2 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

### 3.6 POINTING

- A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.
- B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch deep. Compact each layer thoroughly and allow to it become thumbprint hard before applying next layer.
- C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
  - 1. Joint Profile: Smooth, flat face recessed 1/4 inch below edges of stone (raked joint).

### 3.7 ADJUSTING AND CLEANING

- A. Remove and replace stone masonry of the following description:
  - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Construction Representative.
  - 2. Defective joints.
  - 3. Stone masonry not matching approved samples and mockups.
  - 4. Stone masonry not complying with other requirements indicated.
- B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Construction Representative's approval of sample cleaning before cleaning stone masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.
6. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.

### 3.8 EXCESS MATERIALS AND WASTE

- A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.
- B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
  1. Crush masonry waste to less than 4 inches in greatest dimension.
  2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
  3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION

## **SECTION 051200 - STRUCTURAL STEEL FRAMING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Structural steel framing members, support members.
- B. Surface preparation for priming and touch-up primer.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Non-shrink grout under base plates and bearing plates.
- B. Section 099113 - Exterior Painting: Priming requirements for exterior and galvanized steel.

#### **1.3 REFERENCE STANDARDS**

- A. AISC (MAN) - Steel Construction Manual 2017.
- B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2016.
- C. AISC 341 - Seismic Provisions for Structural Steel Buildings 2016 (Revised 2020).
- D. AISC 360 - Specification for Structural Steel Buildings 2016 (Revised 2021).
- E. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling 2021.
- F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- I. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- K. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality 2019.
- L. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric) 2021a.
- M. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2021a.
- N. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2021a.
- O. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.



- P. ASTM A992/A992M - Standard Specification for Structural Steel Shapes 2022.
  - Q. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2020.
  - R. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments 2019.
  - S. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry 2018.
  - T. ASTM E709 - Standard Guide for Magnetic Particle Testing 2021.
  - U. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions 2019.
  - V. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength 2020.
  - W. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2022.
  - X. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
  - Y. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.
  - Z. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
  - AA. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections 2020.
  - BB. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals 2016.
  - CC. SSPC-SP 2 - Hand Tool Cleaning 2018.
  - DD. SSPC-SP 3 - Power Tool Cleaning 2018.
- 1.4 COORDINATION
- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
  - B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.
- 1.5 SUBMITTALS
- A. See Section 013300 - Submittals, for administrative and procedural requirements.
  - B. Shop Drawings:
    - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.

2. Connections, Connections not detailed, Splices, and Holes.
    - a. Indicate type, size, and length of bolts. Distinguish between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
    - b. Indicate welded connections with AWS A2.4 welding symbols. Distinguish between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  - C. Mill Test Reports for structural steel: Indicate structural strength, and chemical and physical properties.
  - D. Materials Test Reports: Submit independent test results or engineered performance analysis of structural thermal-break pad performance in bearing or slip-critical connections where shear and moment loads are applied.
  - E. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
  - F. Product Data: For each type of product. Include Test Reports for the following:
    1. Tension-control, high-strength, bolt-nut-washer assemblies.
  - G. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
  - H. Field quality-control and special inspection reports.
- 1.6 QUALITY ASSURANCE
- A. Fabricate structural steel members in accordance with AISC (MAN).
  - B. Fabricate steel fasteners in accordance with RCSC (HSBOLT).
  - C. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
    1. 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 F 1852 fasteners and for retesting fasteners after lubrication.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Steel W Shapes and Tees: ASTM A992/A992M.
- B. Headed Anchor Rods: As per Documents (ASTM F1554, Grade 36 minimum), plain. Provide Hot-dip zinc coating, ASTM A153/A153M, Class C at exterior conditions. Provide matching ASTM A563/A563M heavy-hex carbon-steel nuts and ASTM F436/F436M Type 1 hardened carbon-steel washers.

### 2.2 TOUCH-UP PRIMER

- A. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
- B. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

### 2.3 FABRICATION

- A. Shop fabricate to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 341 and AISC 360.
  1. Identify high-strength structural steel according to ASTM A6/A6M and maintain markings until structural steel has been erected.
  2. Mark and match-mark materials for field assembly.
  3. Complete structural-steel assemblies, including welding of units, before starting shop- priming operations.
- B. 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/D1.1M and AWS D1.8/D1.8M Structural Welding Code - Seismic Supplement.

### 2.4 FINISH

- A. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- B. Prepare structural component surfaces in accordance with SSPC-SP 2 Hand-Tool Cleaning. Remove loose rust and mill scale and spatter, slag or flux deposits.
- C. Shop prime structural steel members. Do not prime surfaces that will be galvanized, fireproofed, field welded, high strength bolted, or embedded in concrete or mortar.
- D. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.
3. Galvanize all exterior steel members and connectors.

## 2.5 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.
  1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

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

### 3.3 ERECTION

- A. Erect structural steel in compliance with AISC 303 "Code of Standard Practice for Steel Buildings and Bridges" and AISC 341 and AISC 360, accurately in locations and to elevations indicated.
- B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  1. Set plates for structural members on wedges, shims, or setting nuts as required.
  2. Snug-tighten anchor rods after supported members have been positioned and plumbed unless indicated to be pretensioned. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  3. Promptly pack grout solidly between bearing surfaces and 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. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Do not use thermal cutting during erection unless approved by Pre-Bid Location. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- F. Do not field cut or alter structural members without approval of Architect.
- G. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

### 3.4 TOLERANCES

- A. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

### 3.5 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the 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.

END OF SECTION

## **SECTION 061000 - ROUGH CARPENTRY**

### **PART 1 GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

##### **A. Section Includes:**

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Shear wall panels.
4. Wood blocking, cants, and nailers.
5. Wood furring and grounds.
6. Plywood backing panels.

##### **B. Related Requirements:**

1. Section 061063 "Exterior Rough Carpentry" for elevated decks and other exterior construction made of wood.
2. Section 061323 "Heavy Timber Framing."
3. Section 067300 "Composite Decking" for deck and railing systems.
4. Section 061600 "Sheathing."

#### **1.3 DEFINITIONS**

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.
- C. Timber: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.
- D. Lumber grading agencies, and the abbreviations used to reference them, include the following:
  1. NeLMA: Northeastern Lumber Manufacturers' Association.
  2. NLGA: National Lumber Grades Authority.
  3. SPIB: The Southern Pine Inspection Bureau.
  4. WCLIB: West Coast Lumber Inspection Bureau.

5. WWPA: Western Wood Products Association.

#### 1.4 ACTION SUBMITTALS

- A. See Section 013300 - Submittals, for administrative and procedural requirements.
- B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
  3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- C. Fastener Patterns: Full-size templates for fasteners in exposed framing.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

#### 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

### PART 2 PRODUCTS

#### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.

3. 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.
  4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.
- C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

## 2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
  2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.



5. Wood floor plates that are installed over concrete slabs-on-grade.

### 2.3 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
  1. Application: Interior partitions not indicated as load-bearing.
  2. Species:
    - a. Spruce Pine Fir; WCLIB or WWPA.
- B. Load-Bearing Partitions: No. 2 grade.
  1. Application: interior load-bearing partitions.
  2. Species:
    - a. Douglas fir-larch; WCLIB or WWPA.
- C. Joists, Rafters, and Other Framing Not Listed Above: No. 2 grade.
  1. Species:
    - a. Douglas fir-larch; WCLIB or WWPA.
- D. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
  1. Application: Exposed exterior and interior framing indicated to receive a stained or natural finish.
  2. Species and Grade: As indicated above for load-bearing construction of same type.

### 2.4 SHEAR WALL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Shear Transfer Systems.
  2. Simpson Strong-Tie Co., Inc.
  3. Weyerhaeuser Company.
- B. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood or OSB sheathing.
- C. Steel-Framed Shear Wall Panels: Prefabricated assembly consisting of cold-formed galvanized steel panel, steel top and bottom plates, and wood studs.

### 2.5 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
  2. Nailers.
  3. Cants.
  4. Furring.
  5. Grounds.
  6. Utility shelving.
- B. For items of dimension lumber size, provide Construction or No. 2 and the following species:
1. Spruce Pine Fir; WCLIB or WWPA.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
1. Spruce Pine Fir; 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.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
- 2.6 PLYWOOD BACKING PANELS
- A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.
- 2.7 FASTENERS
- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

## 2.8 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cleveland Steel Specialty Co.

2. KC Metals Products, Inc.

3. Phoenix Metal Products, Inc.

4. Simpson Strong-Tie Co., Inc.

5. USP Structural Connectors.

- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

- C. Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges at least 85 percent of joist depth.

1. Thickness: [0.050 inch (1.3 mm)] [0.062 inch (1.6 mm)].

- D. Bridging: Rigid, V-section, nailless type, 0.050 inch (1.3 mm) thick, length to suit joist size and spacing.

- E. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch (25 mm) above base and with 2-inch- (50-mm-) minimum side cover, socket 0.062 inch (1.6 mm) thick, and standoff and adjustment plates 0.108 inch (2.8 mm) thick.

- F. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

1. Width: 1-1/4 inches (32 mm).

2. Thickness: 0.062 inch (1.6 mm).

3. Length: as indicated.

- G. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches (57 mm) wide by 0.062 inch (1.6 mm) thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

- H. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches (32 mm) wide by 0.050 inch (1.3 mm) thick by 36 inches (914 mm) long.

- I. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.
  - 1. Bolt Diameter: 3/4 inch (19 mm).
  - 2. Width: 3-3/16 inches (81 mm).
  - 3. Body Thickness: 0.138 inch (3.5 mm).
  - 4. Base Reinforcement Thickness: 0.239 inch (6.1 mm).
- J. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches (29 mm) wide by 9/16 inch (14 mm) deep by 0.034 inch (0.85 mm) thick with hemmed edges.
- K. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch (24 by 24 by 1 mm) thick with hemmed edges.

## 2.9 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).
- C. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

## PART 3 EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, [grounds, ]and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Shear Wall Panels: Install shear wall panels to comply with manufacturer's written instructions.
- E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

- G. Do not splice structural members between supports unless otherwise indicated.
- H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- I. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
  - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.
  - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
  - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.
- J. 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.
- K. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- L. Securely attach rough 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.
  - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings at Building 7b Caretaker' Residence.
- M. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

- N. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
  - 1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
  - 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

### 3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

### 3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring horizontally and vertically at 24 inches (610 mm) o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) o.c.

### 3.4 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal (38-mm actual) thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.
  - 1. For exterior walls, provide 2-by-6-inch nominal- (38-by-140-mm actual-) size wood studs spaced 16 inches (406 mm) o.c. unless otherwise indicated.
  - 2. For interior partitions and walls, provide 2-by-4-inch nominal- (38-by-89-mm actual-) [2-by-3-inch nominal- (38-by-64-mm actual-)] size wood studs spaced 16 inches (406 mm) o.c. unless otherwise indicated.
  - 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches (2438 mm) high, using members of 2-inch nominal (38-mm actual) thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs..

- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
  - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal (89-mm actual) depth for openings 48 inches (1200 mm) and less in width, 6-inch nominal (140-mm actual) depth for openings 48 to 72 inches (1200 to 1800 mm) in width, 8-inch nominal (184-mm actual) depth for openings 72 to 120 inches (1800 to 3000 mm) in width, and not less than 10-inch nominal (235-mm actual) depth for openings 10 to 12 feet (3 to 3.6 m) in width.
  - 2. For load-bearing walls, provide double-jamb studs for openings 60 inches (1500 mm) and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.
- D. Provide diagonal bracing in exterior walls, at both walls of each external corner, at 45-degree angle, full-story height unless otherwise indicated. Use 1-by-4-inch nominal- (19-by-89-mm actual-) size boards, let-in flush with faces of studs.

### 3.5 FLOOR JOIST FRAMING INSTALLATION

- A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches (38 mm) of bearing on wood or metal, or 3 inches (76 mm) on masonry. Attach floor joists as follows:
  - 1. Where supported on wood members, by toe nailing or by using metal framing anchors.
  - 2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.
- B. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches (76 mm) and do not embed more than 4 inches (102 mm).
- C. Frame openings with headers and trimmers supported by (2)2x jack studs.
- D. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches (50 mm) from top or bottom.
- E. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist at ends of joists unless nailed to header or band.
- F. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches (102 mm) or securely tie opposing members together. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist over supports.
- G. Anchor members paralleling masonry with 1/4-by-1-1/4-inch (6.4-by-32-mm) metal strap anchors spaced not more than 96 inches (2438 mm) o.c., extending over and fastening to three joists. Embed anchors at least 4 inches (102 mm) into grouted masonry with ends bent at right angles and extending 4 inches (102 mm) beyond bend.
- H. Provide solid blocking between joists under jamb studs for openings.
- I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.

1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.
- J. Provide bridging of type indicated below, at intervals of 96 inches (2438 mm) o.c., between joists.
1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal- (19-by-64-mm actual-) size lumber, double-crossed and nailed at both ends to joists.
  2. Steel bridging installed to comply with bridging manufacturer's written instructions.

### 3.6 CEILING JOIST AND RAFTER FRAMING INSTALLATION

- A. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against valley rafters.
  2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- B. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal- (19-by-140-mm actual-) size boards between every third pair of rafters, but not more than 48 inches (1219 mm) o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- C. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

### 3.7 STAIR FRAMING INSTALLATION

- A. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:
1. Size: 2-by-12-inch nominal- (38-by-286-mm actual-) size, minimum.
  2. Material: Laminated-veneer lumber, parallel-strand lumber or solid lumber.
  3. Notching: Notch rough carriages to receive treads, risers, and supports; leave at least 3-1/2 inches (89 mm) of effective depth.
  4. Spacing: At least three framing members for each 36-inch (914-mm) clear width of stair.
- B. Provide stair framing with no more than 3/16-inch (4.7-mm) variation between adjacent treads and risers and no more than 3/8-inch (9.5-mm) variation between largest and smallest treads and risers within each flight.



3.8 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

## **SECTION 061323 - HEAVY TIMBER FRAMING**

### **PART 1 GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section includes design, fabrication, and installation of framing systems using timbers and trusses.
- B. Related Requirements:
  - 1. Section 061000 "Rough Carpentry" for dimension lumber items associated with heavy timber framing.

#### **1.3 DEFINITIONS**

- A. Timbers: Lumber of 5 inches nominal or greater in least dimension.
- B. Poles: Round wood members, called either "poles" or "posts" in the referenced standards.
- C. Inspection 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: Southern Pine Inspection Bureau (The).
  - 5. WCLIB: West Coast Lumber Inspection Bureau.
  - 6. WWPA: Western Wood Products Association.

#### **1.4 ACTION SUBMITTALS**

- A. See Section 013300 - Submittals, for administrative and procedural requirements.
- B. Product Data: For timber connectors.
  - 1. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
  - 2. For timber connectors. Include installation instructions.
- C. Shop Drawings: For heavy timber framing. Show layout, dimensions of each member, and details of connections.
- D. Delegated-Design Submittal: For timber framing systems and connections.

- E. Samples: Not less than 9 inches wide by 24 inches long, showing the range of variation to be expected in appearance, including surface texture, of wood products.
- F. The contractor shall provide the construction representative with time entry frame material samples for review and approval prior to construction. The approved timber entry frame material samples shall be kept on site for reference.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates:
  - 1. For timbers specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.
  - 2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- B. Certificates of Inspection: Issued by lumber-grading agency for exposed timber not marked with grade stamp.

#### 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that specializes in performing work of this section on projects of similar size and complexity with a minimum of 5 years documented experience.
- B. Installer Qualifications: A qualified installer that specializes in performing work of this section on projects of similar size and complexity with a minimum of 5 years documented experience.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Schedule delivery of materials to avoid extended on-site storage and to avoid delaying the Work.
- B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.

### PART 2 PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer licensed in the State of Missouri to design timber systems and connections.
- B. Structural Performance: Timber system and connections shall withstand the effects of gravity and lateral structural design criteria as shown on the Drawings and comply with ASCE 7, AF&PA NDS, TFEC1, and TCM

#### 2.2 TIMBER

- A. Comply with DOC PS 20 and with grading rules of lumber-grading agencies certified by ALSC's Board of Review as applicable.

1. Factory mark each item of timber with grade stamp of grading agency.
2. For exposed timber indicated to receive a stained or natural finish, apply grade stamps to surfaces that are not exposed to view, or omit grade stamps and provide certificates of grade compliance issued by grading agency.

- B. Timber Species and Grade: Port Orford Cedar; Select Structural, WCLIB.
- C. Moisture Content: Provide timber with 19 percent maximum moisture content at time of dressing.
- D. Dressing: Provide dressed timber (S4S) unless otherwise indicated.

### 2.3 TIMBER CONNECTORS

- A. Fabricate beam seats from steel with dimensions as required for structural performance.
- B. Fabricate beam hangers from steel with dimensions as required for structural performance.
- C. Fabricate strap ties from steel with dimensions as required for structural performance.
- D. Fabricate tie rods from round steel bars with upset threads connected with forged-steel turnbuckles complying with ASTM A 668/A 668M.
- E. Provide bolts, 3/4 inch minimum or larger as required for structural performance, complying with ASTM A 307, Grade A; provide nuts complying with ASTM A 563; and, where required for structural performance, provide flat washers.
- F. Provide stainless-steel bolts, 3/4 inch minimum or larger as required for structural performance, complying with ASTM F 593, Alloy Group 1 or 2 ; provide nuts complying with ASTM F 594, Alloy Group 1 or 2; and, where indicated, provide flat washers.
- G. Provide shear plates, with dimensions as require for structural performance, complying with ASTM D 5933.
- H. Materials: Unless otherwise indicated, fabricate from the following materials:
  1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.
  2. Round steel bars complying with ASTM A 575, Grade M 1020.
  3. Hot-rolled steel sheet complying with ASTM A 1011/A 1011M, Structural Steel, Type SS, Grade 33.
  4. Stainless-steel plate and flat bars complying with ASTM A 666, Type 316.
  5. Stainless-steel bars and shapes complying with ASTM A 276, Type 316.
  6. Stainless-steel sheet complying with ASTM A 666, Type 316.
  7. Structural-steel plates for timber entry frames on the pedestrian bridge and bluff walk shall be weathering steel (Corten) ASTM A588 grade 50.

- I. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A 123/A 123M or ASTM A 153/A 153M.

#### 2.4 MISCELLANEOUS MATERIALS

- A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

#### 2.5 FABRICATION

- A. Camber: Fabricate horizontal members and inclined members with a slope of less than 1:1, with natural convex bow (crown) up, to provide camber.
- B. Shop fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
- C. Predrill for fasteners and assembly of units.
- D. Coat crosscuts with end sealer.
- E. Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent.

### PART 3 EXECUTION

#### 3.1 JOINERY

- A. Joinery shall be in the best of the early English and early American traditions, where feasible, and shall be designed for strength, shrinkage, checking, and twisting.
- B. Final connection and joinery aesthetics shall be coordinated with the Construction Representative.

#### 3.2 INSTALLATION

- A. General: Erect heavy timber framing true and plumb. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
  1. Install horizontal and sloping members with crown edge up, and provide not less than 4 inches of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports with metal strap ties if not continuous.
  2. Handle and temporarily support heavy timber framing to prevent surface damage, compression, and other effects that might interfere with indicated finish.
- B. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
- C. Fitting: Fit members by cutting and restoring exposed surfaces to match specified surfacing.

1. Predrill for fasteners using timber connectors as templates.
  2. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
  3. Coat crosscuts with end sealer.
- D. Install timber connectors as indicated by delegated design engineer.
1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
  2. Install bolts with orientation as indicated or, if not indicated, as directed by Construction Representative.
- 3.3 ADJUSTING
- A. Repair damaged surfaces and finishes after completing erection. Replace damaged heavy timber framing if repairs are not approved by Construction Representative.

END OF SECTION

## **SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Shop-fabricated wood trusses and girder trusses.
- B. Truss bridging.
- C. Truss accessories

#### **1.2 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Material requirements for blocking, bridging, plates, and miscellaneous framing.

#### **1.3 DEFINITIONS**

- A. Shop Fabricated Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

#### **1.4 REFERENCE STANDARDS**

- A. ANSI/TPI 1 - National Design Standard for Metal-Plate-Connected Wood Truss Construction 2014.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. SBCA (BCSI) - Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses 2018 (Updated 2020).

#### **1.5 SUBMITTALS**

- A. See Section 013300 - Submittals, for administrative and procedural requirements.
- B. Product Data: Manufacturer's data sheets on plate connectors, bearing plates, and metal bracing components.
- C. Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.
  - 1. Include identification of engineering software used for design.
  - 2. Provide shop drawings stamped or sealed by design engineer.
  - 3. Delegated-Design Submittal: For metal-plate-connected wood trusses and bracing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer licensed in the State of Missouri responsible for their preparation.
  - 4. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
  - 5. Indicate sizes, stress grades, and species of lumber.

6. Indicate locations, sizes, and materials for temporary and permanent bracing required to prevent buckling of individual truss members due to design loads.
7. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
8. Show splice details and bearing details.

D. Designer's Qualification Statement.

E. Fabricator's Qualification Statement.

1. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Construction Representative and authorities having jurisdiction.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.
- B. Evaluation Reports: For the following, from ICC-ES:
  1. Metal-plate connectors.
  2. Metal truss accessories.

#### 1.7 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design by or under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Fabricator Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Handle trusses in accordance with SBCA (BCSI).
- B. Store trusses in vertical position resting on bearing ends. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
  1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
  2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
  3. Provide for air circulation around stacks and under coverings.



- C. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective

## PART 2 PRODUCTS

### 2.1 TRUSSES

- A. Wood Trusses: Design and fabricate trusses in accordance with ANSI/TPI 1 and to achieve specified design requirements indicated.
- B. Delegated Design: Engage a qualified professional engineer licensed in the State of Missouri to design metal-plate-connected wood trusses, truss to truss connections, truss framing around roof openings, overbuild framing, temporary bracing, and permanent bracing.
- C. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
- D. Design Loads: As indicated on structural drawings.
- E. Maximum Deflection under Design Loads:
  - 1. Roof Trusses: Vertical deflection of 1/240 of span.
- F. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- G. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

### 2.2 MATERIALS

- A. Lumber:
  - 1. Moisture Content: Between 7 and 9 percent.
  - 2. Lumber fabricated from old growth timber is not permitted.
  - 3. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (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.
    - a. Factory mark each piece of lumber with grade stamp of grading agency.
    - b. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
    - c. Provide dressed lumber, S4S.
    - d. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Steel Connectors: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) Grade 33/230, with G90/Z275 coating; die stamped with integral teeth; thickness as indicated.

- C. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

### 2.3 ACCESSORIES

- A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: As specified in Section 061000.

### 2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
- C. Nails, Brads, and Staples: ASTM F 1667.

### 2.5 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Allowable design loads, as published by manufacturer, shall comply with or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
  - 1. Use for interior locations unless otherwise indicated.
- C. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below with minimum capacity as indicated. Install per manufacturer's recommendations to achieve required load capacity.
- D. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches (32 mm) wide by 0.050 inch (1.3 mm) thick. Clip is fastened to truss through slotted holes to allow for truss deflection.
- E. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches (38 mm) wide by 1 inch (25 mm) deep by 0.040 inch (1.0 mm) thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.
- F. Drag Strut Connectors: Angle clip with one leg extended for fastening to the side of girder truss.
- G. Angle clip is 3 by 3 by 0.239 by 10-1/2 inches (76 by 76 by 6.07 by 267 mm) with extended leg 10-1/2 inches (267 mm) long. Connector has painted finish.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that supports and openings are ready to receive trusses.

3.2 PREPARATION

- A. Coordinate placement of bearing items.

3.3 ERECTION

- A. Install trusses in accordance with manufacturer's instructions, SBCA (BCSI); maintain a copy of applicable documents on site until installation is complete.
- B. Install wood trusses only after supporting construction is in place and is braced and secured.
- C. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- D. Set members level and plumb, in correct position. Install wood trusses within installation tolerances in TPI 1.
- E. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.
- F. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- G. Do not field-cut or alter structural members without approval of Architect.
- H. Install permanent bridging and bracing.
- I. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- J. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- K. Securely connect each truss ply required for forming built-up girder trusses.
- L. Replace wood trusses that are damaged or do not comply with requirements.
  - 1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Construction Representative.
- M. Install headers and supports to frame openings required.

3.4 TOLERANCES

- A. Framing Members: 1/2 inch (12 mm) maximum, from true position.

END OF SECTION

## **SECTION 061800 - GLUED-LAMINATED CONSTRUCTION**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Glue laminated wood beams and purlins.
- B. Preservative treatment of wood.
- C. Steel hardware and attachment brackets.

#### **1.2 REFERENCE STANDARDS**

- A. AITC A190.1 - American National Standard for Wood Products - Structural Glued Laminated Timber 2007.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- E. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2021a.
- F. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2021a.
- G. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions 2012a (Reapproved 2018).
- H. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2022.
- I. AWPA U1 - Use Category System: User Specification for Treated Wood 2022.
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- K. WWPA G-5 - Western Lumber Grading Rules 2021.

#### **1.3 SUBMITTALS**

- A. See Section 013300 – Submittals, for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials, application technique and resultant performance information.
- C. Shop Drawings: Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing, framed openings .
  - 1. Submit design calculations signed and sealed by design engineer.

#### 1.4 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural members under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of glue laminated structural units with three years of documented experience and certified by AITC in accordance with AITC A190.1.
- C. Erector Qualifications: Company specializing in erection of products of the type specified with 5 years documented experience and approved by manufacturer.
- D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect members to AITC requirements for individually wrapped.
- B. Leave individual wrapping in place until finishing occurs.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Glued-Laminated Structural Units:
  - 1. Substitutions: See Section 016000 - Product Requirements.

#### 2.2 GLUED-LAMINATED UNITS

- A. Glued-Laminated Units: Fabricate in accordance with AITC 117 Industrial grade.
  - 1. Verify dimensions and site conditions prior to fabrication.
  - 2. Cut and fit members accurately to length to achieve tight joint fit.
  - 3. Fabricate member with camber built in.
  - 4. Do not splice or join members in locations other than those indicated without permission.
  - 5. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.
  - 6. Welding: Perform welding in accordance with AWS D1.1/D1.1M.
  - 7. After end trimming, seal with penetrating sealer in accordance with AITC requirements.
- B. Performance Criteria:
  - 1. Comply with applicable code for loads, seismic zoning, and other load criteria.

## 2.3 MATERIALS

- A. Lumber: Port Orford Cedar lumber complying with WWPA G-5 grading rules with 12 percent maximum moisture content before fabrication.
- B. Steel Connections and Brackets: ASTM A36/A36M weldable quality, galvanize per ASTM A123/A123M.
- C. Anchor Bolts: ASTM F3125/F3125M, Type 1 heavy hex high strength bolts and ASTM A563 (ASTM A563M) nuts; hot-dip galvanized to meet requirements of ASTM A153/A153M, matching washers.
- D. Laminating Adhesive: Tested for wet/exterior service in accordance with ASTM D2559.
- E. Bearing Plate Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

## 2.4 WOOD TREATMENT

- A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.
- B. Preservative Pressure Treatment:
  - 1. Preservative Pressure Treatment of Glued-Laminated Structural Units: AWPA U1, Use Category UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention (to 4.0 kg/cu m retention).
    - a. Kiln dry lumber after treatment and before lamination to maximum moisture content of 19 percent.

## 2.5 FABRICATION

- A. Fabricate glue laminated structural members in accordance with AITC Premium grade.
- B. Welding: Perform welding in accordance with AWS D1.1/D1.1M.
- C. Verify dimensions and site conditions prior to fabrication.
- D. Cut and fit members accurately to length to achieve tight joint fit.
- E. Do not splice or join members in locations other than those indicated without permission.
- F. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.
- G. After end trimming, seal with penetrating sealer in accordance with AITC requirements.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that supports are ready to receive units.

3.2 PREPARATION

- A. Coordinate placement of bearing items.

3.3 ERECTION

- A. Lift members using protective straps to prevent visible damage.
- B. Set structural members level and plumb, in correct positions or sloped where indicated.
- C. Provide temporary bracing and anchorage to hold members in place until permanently secured.
- D. Fit members together accurately without trimming, cutting, splicing, or other unauthorized modification.
- E. Swab and seal the interior wood surfaces of field drilled holes in members with primer.

3.4 TOLERANCES

END OF SECTION

## **SECTION 062000 - FINISH CARPENTRY**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Finish carpentry items.
- B. Wood door frames.
- C. Wood casings and moldings.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 064100 - Architectural Wood Casework: Shop fabricated custom cabinet work.
- C. Section 081433 - Stile and Rail Wood Doors.
- D. Section 099300 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.
- E. Section 123600 - Countertops: Solid Surface window sills.

#### **1.3 REFERENCE STANDARDS**

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.
- C. BHMA A156.9 - Cabinet Hardware 2020.
- D. NHLA G-101 - Rules for the Measurement and Inspection of Hardwood and Cypress 2019.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

#### **1.5 SUBMITTALS**

- A. See Section 013300 - Submittals, for administrative and procedural requirements.
- B. Product Data:
  - 1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
  - 2. Provide instructions for attachment hardware and finish hardware.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.



1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

D. Samples: Submit two samples of wood trim 6 inch long, illustrating finish, construction, species and custom stain color.

#### 1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Single Source Responsibility: Provide and install this work from single fabricator.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.

B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

C. Protect from moisture damage.

D. Handle materials and products to prevent damage to edges, ends, or surfaces.

### PART 2 PRODUCTS

#### 2.1 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Interior Woodwork Items:

1. Moldings, Bases, Casings, and Miscellaneous Trim: Red oak; prepare for custom stained finish.

2. Swing Door and Bi-Pass Door Frames: Red oak; prepare for custom stained finish.

3. Loose Shelving: Red oak; prepare for custom stained finish.

#### 2.2 LUMBER MATERIALS

A. Hardwood Lumber: Red oak species, <math>\diamond</math> sawn, maximum moisture content of 6 percent ; with vertical grain , of quality suitable for transparent finish.

1. Grading: In accordance with NHLA G-101 Grading Rules; [www.nhla.org](http://www.nhla.org).

#### 2.3 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Adhesive for factory-fabricated units: Manufacturer's recommended adhesive for application.

- C. Fasteners for Exterior Applications: Stainless steel; length required to penetrate wood substrate 1-1/2 inch (38 mm) minimum.
- D. Concealed Joint Fasteners: Threaded steel.

#### 2.4 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Lumber for Shimming and Blocking: Softwood lumber of pine species.
- C. Wood Filler: Solvent base, tinted to match surface finish color.

#### 2.5 HARDWARE

- A. Hardware: Comply with BHMA A156.9.
- B. Countertop Support Brackets: Fixed, L-shaped, face-of-stud mounting.
  - 1. Material: Steel; T-shape cross-section.
    - a. Finish: Manufacturer's standard, factory-applied, textured powder coat.
    - b. Color: Black.
    - c. Height: 9 inches (230 mm).
    - d. Support Length: 9 inches (230 mm).
    - e. Width: 1 inch (25 mm).
  - 2. Products:
    - a. A&M Hardware, Inc; Hybrid Brackets: [www.aandmhardware.com/#sle](http://www.aandmhardware.com/#sle).
- C. Vanity Brackets: Fixed, ADA-Compliant, face-of-stud mounting.
  - 1. Material: Steel; formed compound shapes.
    - a. Finish: Manufacturer's standard, factory-applied, textured powder coat.
    - b. Color: Black.
  - 2. Height: 18 inches (460 mm).
  - 3. Support Length: 21-1/2 inches (546 mm).
  - 4. Products:
    - a. A&M Hardware, Inc; ADA Vanity Brackets: [www.aandmhardware.com/#sle](http://www.aandmhardware.com/#sle).

2.6 WOOD TREATMENT

- A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.
- B. Redry wood after pressure treatment to maximum 9 percent moisture content.

2.7 SITE FINISHING MATERIALS

- A. Field Finishing: See Section 099123.

2.8 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.9 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.
- D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:
    - a. System - 4, Latex Acrylic, Water-based.
    - b. Stain: Custom, to match sample as selected by Architect.
    - c. Sheen: Satin.
- E. Stain, seal, and varnish exposed to view surfaces. Brush apply only.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 INSTALLATION

- A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

### 3.3 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

### 3.4 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch (1.6 mm).
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

## **SECTION 062013 - EXTERIOR FINISH CARPENTRY**

### **PART 1 GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

##### **A. Section Includes:**

1. Miscellaneous exterior trim.
2. Exterior wood wrapped column covers.

##### **B. Related Requirements:**

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view and for framing exposed to view.
2. Section 061533 "Wood Patio Decking" for elevated decks including stairs and railings.
3. Section 074646 "Fiber-Cement Siding" for typical exterior siding and trim.

#### **1.3 ACTION SUBMITTALS**

- A. See Section 013300 - Submittals, for administrative and procedural requirements.
- B. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
  1. Include data for wood-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. Include chemical-treatment manufacturer's written instructions for finishing treated material.
  2. Include copies of warranties from chemical-treatment manufacturers for each type of treatment.
- C. Shop Drawings: For each wood wrapped column condition indicated, provide plan, elevation and detail drawings.
  1. Include delineation of surrounding conditions and coordination with support structure. Provide detailed information on proposed attachment systems.
- D. Samples for Verification:
  1. For each species and cut of lumber and panel products, with 1/2 of exposed surface finished; 50 sq. in. for lumber and 8 by 10 inches for panels.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Compliance Certificates:

1. For lumber that is not marked with grade stamp.
  2. For preservative-treated wood that is not marked with treatment-quality mark.
- B. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated wood.
- C. Sample Warranties: For manufacturer's warranties.
- 1.5 QUALITY ASSURANCE
- A. Testing Agency Qualifications: For testing agency providing classification marking for wood preservative-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- 1.7 FIELD CONDITIONS
- A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
- 1.8 WARRANTY
- A. Manufacturer's Warranty for Columns: Manufacturer agrees to repair or replace columns that fail in materials or workmanship within specified warranty period.
1. Warranty Period for Columns: Five years from date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and the following grading rules:
1. NeLMA: Northeastern Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."

2. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
3. RIS: Redwood Inspection Service, "Standard Specifications for Grades of California Redwood Lumber."
4. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
5. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."

B. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

## 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC3b.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
4. Do not use material that is warped or does not comply with requirements for untreated material.
5. Mark lumber with treatment-quality mark of an inspection agency approved by the American Lumber Standard Committee's Board of Review.
  - a. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.
6. Application: All exterior lumber and plywood.

## 2.3 EXTERIOR TRIM NOT IDENTIFIED AS FIBER CEMENT

A. Lumber Trim for Semitransparent-Stained Finish:

1. Species and Grade: Western red cedar, Clear Heart VG (Vertical Grain); NLGA, WCLIB, or WWPA.
2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
3. Finger Jointing: Not allowed.
4. Face Surface: Saw textured.

- B. Moldings for Semitransparent-Stained Finish: WMMPA WM 4, N-grade wood moldings, without finger jointing. Made from kiln-dried stock to patterns included in WMMPA WM 12.
  - 1. Species: Western red cedar.
- C. Refer to Section 07 4646 - Fiber Cement Siding for information on exterior window and door trim and corner boards associated with siding installation.

#### 2.4 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.
  - 1. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
  - 2. For pressure-preservative-treated wood, provide stainless-steel fasteners.
  - 3. For applications not otherwise indicated, provide stainless-steel fasteners.
- B. Sealants: Latex, complying with ASTM C 834 Type OP, Grade NF and with applicable requirements in Section 079200 "Joint Sealants," recommended by sealant manufacturer and manufacturer of substrates for intended application.

#### 2.5 FABRICATION

- A. Back out or kerf backs of standing and running trim wider than 5 inches , except members with ends exposed in finished work.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed. Cut to required lengths and prime ends. Comply with requirements in Section 099113 "Exterior Painting."



### 3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
- B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
  - 1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  - 2. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
  - 3. Coordinate exterior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

### 3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install flat-grain lumber with bark side exposed to weather.
- B. Install trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long except where necessary.
  - 1. Use scarf joints for end-to-end joints.
  - 2. Stagger end joints in adjacent and related members.
- C. Fit exterior joints to exclude water. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- D. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

### 3.5 ORNAMENTAL COLUMN INSTALLATION

- A. Lay out column locations on soffits and beams and plumb down to locate column locations at supports.
- B. Set plinths in location, shim as required to temporarily level, and scribe and trim as required so that top of plinths will sit level without use of shims. Fasten plinths in place to support using pins or fasteners as recommended by manufacturer.
- C. Scribe and trim tops of columns to fit to soffits and beams. Maintain ventilation passages to interior of columns.
- D. Seal ends of columns with two coats of wood sealer or primer.
- E. Install column caps and flashing on columns and fasten to columns. Install caps and flashing so that loads are not imposed on caps and so that ventilation of column interior is not blocked.
- F. Secure columns in place at top and bottom with fasteners recommended by manufacturer.

3.6 ADJUSTING

- A. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.7 CLEANING

- A. Clean exterior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.8 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

## **SECTION 064100 - ARCHITECTURAL WOOD CASEWORK**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Hardware.
- C. Preparation for installing utilities.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 099300 - Staining and Transparent Finishing: Field finishing of cabinet exterior.
- C. Section 123600 - Countertops.

#### **1.3 REFERENCE STANDARDS**

- A. AWI/AWMA/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- B. AWMA/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.
- C. BHMA A156.9 - Cabinet Hardware 2020.
- D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

#### **1.5 SUBMITTALS**

- A. See Section 013300 - Submittals, for administrative and procedural requirements.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  - 1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
  - 2. Provide information as required by AWI/AWMA/WI (AWS) or AWMA/WI (NAAWS).
  - 3. Include certification program label.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual samples of architectural cabinet construction, minimum 8 inches (200 mm) square, illustrating proposed cabinet and shelf unit substrate and finish.

- E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, locksets, and surface materials, demonstrating hardware design, quality, and finish.

#### 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
  - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
  - 2. Single Source Responsibility: Provide and install this work from single fabricator.

#### 1.7 MOCK-UPS

- A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.
- B. Locate where directed.
- C. Mock-up may remain as part of the work.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

#### 1.9 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

### PART 2 PRODUCTS

#### 2.1 WOOD CABINETS FOR TRANSPARENT FINISH

- A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Type of Construction: Frameless
- C. Cabinet and Door and Drawer Front Interface Style: Reveal overlay.
- D. Reveal Dimension: 1/2 inch (13 mm).
- E. Wood Veneer Faced Cabinet:
  - 1. Species: Red Oak.
  - 2. Cut: Plain sliced/plain sawn.
  - 3. Grain Direction: Vertically for doors and fixed panels, horizontally for drawer fronts.
  - 4. Matching of Veneer Leaves: Book match.

5. Veneer Matching within Panel Face: Running match.
  6. Veneer Matching within Room: Provide cabinet veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.
  7. Comply with veneer and other matching requirements indicated for blueprint-matched paneling.
- F. Semiexposed Surfaces: Provide surface materials indicated below:
1. Surfaces Other Than Drawer Bodies: Compatible species to that indicated for exposed surfaces, stained to match.
  2. Drawer Subfronts, Backs, and Sides: Solid-hardwood lumber, stained to match species indicated for exposed surfaces.
  3. Drawer Bottoms: Hardwood plywood.
- G. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- 2.2 WOOD-BASED COMPONENTS
- A. Wood fabricated from old growth timber is not permitted.
- B. Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Wood moisture content: 5 to 10 percent.
- C. 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. Particleboard: ANSI A208.1, Grade M-2.
  2. Softwood Plywood: DOC PS 1, medium-density overlay.
  3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
  4. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGJL, for test methods 3.3, 3.4, 3.6, 3.8 and 3.10.
  5. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
  6. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.

7. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

## 2.3 COUNTERTOPS

- A. Countertops: See Section 123600.

## 2.4 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Fasteners: Size and type to suit application.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- D. Concealed Joint Fasteners: Threaded steel.

## 2.5 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, satin chrome finish, for nominal 1 inch (25 mm) spacing adjustments.
- C. Fixed Specialty Shelf Supports:
  1. Material: Steel.
  2. Manufacturer's standard, factory-applied, textured powder coat.
  3. Products:
    - a. Basis of design: Walnut Wood Works; <https://walnutwoodworks.com/>; 2" Heavy Duty Floating Shelf Bracket.
- D. Fixed Specialty Workstation and Countertop Brackets:
  1. Material: Steel.
  2. Finish: Manufacturer's standard, factory-applied powder coat.
  3. Color: Black.
  4. Manufacturers:
    - a. A&M Hardware, Inc; Heavy-Duty Hybrid Brackets: [www.aandmhardware.com/#sle](http://www.aandmhardware.com/#sle).
    - b. Rakks/Rangine Corporation; Inside Wall Flush Mount Brackets: [www.rakks.com/#sle](http://www.rakks.com/#sle)
    - c. Basis of Design: Hafele, Front Mounting Bracket, Centerline Countertop Support #287.75.330; 6" x 6".

- E. Fixed Standard Shelf, Countertop, and Workstation Brackets:
  - 1. Material: Steel.
  - 2. Color: White.
  - 3. Products:
    - a. A&M Hardware, Inc; Standard Brackets: [www.aandmhardware.com/#sle](http://www.aandmhardware.com/#sle).
- F. Drawer and Door Pulls:
  - 1. Back-Mounted Pulls: BHMA A156.9, B02011. Basis of Design product Craftsman Hardware. Antique Copper Finish, Peened 5" Handle CH-2034AC; 5-1/4" x 3/4" with boring holes at 3-3/4". Contact: 509-766-4322 or [info@craftsmanhardware.com](mailto:info@craftsmanhardware.com). Or comparable product by Richelieu or Fusion Hardware.
- G. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, bronze with satin finish.
- H. Cabinet Catches:
  - 1. Type: Magnetic catch. BHMA A156.9, B03141.
- I. Door Locks: BHMA A156.11, E07121.
- J. Drawer Locks: BHMA A156.11, E07041.
- K. Door and Drawer Silencers: BHMA A156.16, L03011.
- L. Drawer Slides BHMA A156.9.:
  - 1. Type: Full extension.
  - 2. Static Load Capacity: Heavy Duty grade.
  - 3. Mounting: Bottom mounted.
  - 4. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated steel with polymer rollers.
  - 5. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
  - 6. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
  - 7. For drawers more than 3 inches (75 mm) high but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
  - 8. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-200.
  - 9. Features: Provide self closing/stay closed type.

M. Hinges: Concealed (fully mortised) self-closing type, bronze with satin finish.

1. Semi concealed Hinges for Overlay Doors: BHMA A156.9, B01521.

## 2.6 HARDWARE FINISH

A. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Dark, Oxidized, Satin Bronze, Oil Rubbed: BHMA 613 for bronze base; BHMA 640 for steel base; match project representative's sample.

B. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

## 2.7 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets: 1/16 inch (1.5 mm) unless otherwise indicated.

C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

E. 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.

F. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

G. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

H. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Seal cut edges.

## 2.8 SHOP FINISHING

A. General: Finish architectural wood cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.



- B. General: Shop finish transparent-finished architectural wood cabinets at fabrication shop as specified in this Section.
- C. General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to Section 099300 "Staining and Transparent Finishing" for field finishing architectural woodwork not indicated to be shop finished.
- D. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural wood cabinets, as applicable to each unit of work.
- E. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.
- F. Sand work smooth and set exposed nails and screws.
- G. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.
- H. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:
    - a. System - 4, Latex Acrylic, Water-based.
    - b. Stain: As selected by Architect.
    - c. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.
    - d. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to cabinets made from closed-grain wood before staining and finishing.
    - e. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
    - f. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

#### 3.2 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.

- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages.
- G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

### 3.3 ADJUSTING

- A. Test installed work for rigidity and ability to support loads.
- B. Adjust moving or operating parts to function smoothly and correctly.
- C. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

### 3.4 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

## SECTION 067300 - COMPOSITE DECKING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Composite decking for elevated decks and stairs.
- B. Aluminum railing balusters for elevated decks and stairs.

#### 1.2 RELATED REQUIREMENTS

- A. Section 06 1000 Rough Carpentry for wood framing, furring, blocking, and other carpentry work not exposed to view from deck.

#### 1.3 DEFINITIONS

- A. Composite Materials: Materials made from two or more constituent materials with significantly different physical or chemical properties that, when combined, produce materials with characteristics different from the individual components.
- B. Plastic Composites, or Wood-Plastic Composites: Composite materials made primarily from wood- or cellulose-based materials and plastics.

#### 1.4 REFERENCE STANDARDS

- A. ANSI A326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials 2021.
- B. ANSI/ACMA/PIC (CSP) - Code of Standard Practice, Industry Guidelines for Fabrication and Installation of Pultruded FRP Structures 2011 (Reapproved 2012).
- C. ASTM D7032 - Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite and Plastic Lumber Deck Boards, Stair Treads, Guards, and Handrails 2021.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- E. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct preinstallation meeting one week prior to start of work of this section; require attendance by affected installers.

#### 1.6 SUBMITTALS

- A. See Section 013300 - Submittals, for administrative and procedural requirements.
- B. Product Data: Manufacturer's published product literature:
  - 1. Include sizes and profiles; structural design data, uniform load deflection tables, concentrated load deflection tables, and allowable span tables.

- C. Shop Drawings - Plastic Composite Decking: For each system; indicate:
  - 1. Composite decking and balluster manufactures installation instruction.
- D. Samples: Submit two samples, 12 inches by 12 inches (300 mm by 300 mm) in size, indicating specified texture and finish.

#### 1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications:
  - 1. Fabricator Qualifications: Company specializing in fabricating products specified in this section, with at least five years of documented experience.
  - 2. ACMA Member: Member of American Composites Manufacturer's Association (AMCA).
  - 3. Internal Quality Control Plan: Comply with requirements of ANSI/ACMA/PIC (CSP).
- B. Installer Qualifications: Company specializing in installing work of type specified in this section, and with at least three years of documented experience and approved by manufacturer.
- C. Documents at Project Site: Maintain at project site one copy of manufacturer's installation instructions, installation drawings, and reference standard documents.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in original, unbroken packages, or bundles bearing label of manufacturer and component identification markings.
- B. Store materials under cover and elevated above grade.
- C. Protect decking units from damage including cracking or chipping.

#### 1.9 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within five year period after Date of Substantial Completion.
- C. Provide manufacturer's standard limited warranty for products.
- D. Provide manufacturer's standard 25-year warranty against splintering, splitting, rot, and decay.

### PART 2 PRODUCTS

#### 2.1 COMPOSITE DECKING

- A. Manufacturers:
  - 1. Deckorators, Inc; Voyage Composite Decking: [www.deckorators.com/#sle](http://www.deckorators.com/#sle).
  - 2. TimberTech Pro; Reserve Collection.
  - 3. Trex Company, Inc; Transcend: [www.trex.com/#sle](http://www.trex.com/#sle).

4. Wolf Home Products; Wolf Perspective Decking: [www.wolfhomeproducts.com.com/#sle](http://www.wolfhomeproducts.com.com/#sle).
- B. Composite Decking: Extruded thermoplastic composite decking boards; for exterior applications where ICC (IBC) permits combustible construction; complying with ASTM D7032.
1. Shell: Fully enclosed.
  2. Filler: Inorganic
  3. Deck Board Size: 7/8 inch (22 mm) by 5-1/2 inches (140 mm).
  4. Board Edges: Radiused.
  5. Board Side Profile: Slotted.
  6. Deck Board Slip Resistance - Dynamic Coefficient of Friction (DCOF) (Wet): Minimum of 0.42, when tested in accordance with ANSI A326.3.
  7. Finish: Manufacturer's standard finish; in compliance with specified slip resistance requirements.
  8. Color: To be selected by Architect from manufacturer's full range.
  9. Flame Spread Index: 200 or less when tested in accordance with ASTM E84.
- C. Fabrication:
1. Shop fabricate to greatest extent possible.
  2. Provide labeling on deck boards or packaging indicating compliance with ASTM D7032; include labeling data indicating deck board span rating.
- D. Accessories:
1. Manufacturer's standard fasteners and anchorage devices.
    - a. Concealed Decking Clips: Black-oxide-coated, stainless steel clips designed to secure decking material and provide uniform spacing of decking material.
    - b. Fasteners: Stainless steel screws, minimum #7 size, in sufficient length to penetrate not less than 1-1/4 inches (31 mm) into wood framing substrate.
- 2.2 ALUMINUM RAILING BALLUSTERS
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Deckorators Classic Baluster
  2. Decks Direct
  3. Vista Railing Systems Inc. [www.vistarailings.com](http://www.vistarailings.com) Or (800) 667-8247.
- B. Round aluminum ballusters for wood deck railing applications:
- C. Material Type: 18 gauge aluminum.

- D. Mount Type: Between the top and bottom 2x wood railing assembly. Provide manufacture's connectors top and bottom.
- E. Width: 3/4-inch diameter.
- F. Length: Varies as required for 42-inch high guardrail assemblies.
- G. Powder Coat Colors: Black.
- H. Provide manufacture standard Rail Hanger Bracket to complete railing system.

### PART 3 EXECUTION

#### 3.1 EXAMINATION - GENERAL

- A. Verify dimensions, tolerances, and interfaces with related work; verify location of supporting assemblies.
- B. Examine field conditions to confirm that building lines, grades, and elevations will allow proper installation of decking.
- C. Verify substrates to determine that conditions are acceptable for installation of decking in accordance with manufacturer's written instructions.

#### 3.2 INSTALLATION - PLASTIC COMPOSITE DECKING

- A. Install decking in accordance with manufacturer's published instructions, subject to conditions of its evaluation report.

#### 3.3 INSTALLATION - BALUSTER SYSTEM

- A. Install metal baluster system and rail brackets in accordance with manufacture's published instructions.
- B. Install balluster connectors in wood rails set in sealant to minimize water infiltration into wood railings. The sealnt should be on outside of connector where inside of baluster makes contact with connector
- C. Apply silicon sealant to top of connector to prevent baluster from turning or rattling.

#### 3.4 TOLERANCES

- A. Install decking complying with installation tolerances indicated in ANSI/ACMA/PIC (CSP).

#### 3.5 PROTECTION

- A. Protect installed decking from subsequent construction operations.

END OF SECTION

## SECTION 071113 - BITUMINOUS DAMPPROOFING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Bituminous dampproofing. Cold-applied, cut-back-asphalt dampproofing.

#### 1.2 RELATED REQUIREMENTS

- A. Section 033000 "Cast-in-Place Concrete" for bituminous vapor retarders.

#### 1.3 REFERENCE STANDARDS

- A. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free 2007 (Reapproved 2018).

#### 1.4 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures, for administrative and procedural requirements.
- B. Product Data: Provide properties of primer, bitumen, and mastics.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

#### 2.2 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied, spray-grade; asphalt base, volatile petroleum solvents, and other content, suitable for application by spray, brush, roller, or squeegee; asbestos-free; suitable for application on vertical and horizontal surfaces.
  - 1. Composition: ASTM D4479/D4479M Type I, asbestos free.
  - 2. VOC Content: Not more than permitted by local, State, and federal regulations.
  - 3. Applied Thickness: 1/16 inch (1.5 mm), minimum, wet film.
  - 4. Products:
    - a. W. R. Meadows, Inc; Sealmastic Spray-Mastic: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - b. BASF Construction Chemicals - Building Systems; Sonneborn Brand Products.
    - c. Euclid Chemical Company (The); an RPM company.
    - d. Henry Company.

### 2.3 ACCESSORIES

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Cut-Back-Asphalt Primer: ASTM D 41.
- C. Patching Compound: Epoxy or latex-modified repair mortar of type recommended in writing by dampproofing manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

### 3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing. Field verify finish grade elevation to ensure dampproofing is not applied above finish grade elevation.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

### 3.3 APPLICATION

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
  - 1. Apply dampproofing to provide continuous plane of protection.
  - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
  - 1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
- C. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.



3.4 COLD-APPLIED ASPHALT DAMPPROOFING

- A. Unexposed Concrete Foundations: Apply two brush or spray coats at not less than 1.25 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat or one trowel coat at not less than 4 gal./100 sq. ft. .

END OF SECTION

## SECTION 072100 - THERMAL INSULATION

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Batt insulation and vapor retarder in exterior wall, ceiling, and attic construction.

#### 1.2 RELATED REQUIREMENTS

- A. Section 07 2119 - Foamed in place insulation: Crawl space joist framing insulation system.
- B. Section 072500 - Weather Barriers: Separate air barrier and vapor retarder materials.

#### 1.3 REFERENCE STANDARDS

- A. ASTM C240 - Standard Test Methods for Testing Cellular Glass Insulation Block 2021.
- B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2022.
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.

#### 1.4 SUBMITTALS

- A. See Section 013300 - Submittals, for administrative and procedural requirements.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

#### 1.5 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
  - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

## PART 2 PRODUCTS

### 2.1 APPLICATIONS

- A. Insulation in Wood Framed Walls: Batt insulation with no vapor retarder.
- B. Insulation in Wood Framed Ceiling Attic Structure: Batt insulation with no vapor retarder.

### 2.2 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
  1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
  2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
  4. Formaldehyde Content: Zero.
  5. Attic Thermal Resistance: R-value (RSI-value) of 38 .
  6. Wall Stud Cavity Resistance: R-Value of 20 minimum.
  7. Products:
    - a. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
    - c. Knauf Ecobatt R-21 HD.
    - d. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: Next Gen [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).

### 2.3 ACCESSORIES

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of irregularities.

3.2 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.3 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

## **SECTION 072119 - FOAMED-IN-PLACE INSULATION**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Foamed-in-place insulation.
  - 1. In underside of floor decks in crawl space.
- B. Protective intumescent coating.

#### **1.2 REFERENCE STANDARDS**

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics 2019.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.
- E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.

#### **1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

#### **1.4 SUBMITTALS**

- A. See Section 01 3300 - Submittal Procedures, for administrative and procedural requirements.
- B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
- C. Certificates: Certify that products of this section meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.
- C. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP);  
[www.airbarrier.org/#sle](http://www.airbarrier.org/#sle):

1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

#### 1.6 MOCK-UPS

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Provide underside of sub floor and joist framing mock-up, 4 feet (1.25 m) long by 4 feet (1.25 m) wide; include insulation overcoat in mock-up.

#### 1.7 FIELD CONDITIONS

- A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- B. Do not apply foam when temperature is within 5 degrees F (2.78 degrees C) of dew point.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
  1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and overcoat limitations.
  2. Thermal Resistance: R-value (RSI-value) of 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature when tested in accordance with ASTM C518.
  3. Water Vapor Permeance: Vapor retarder; 1 perms (57.5 ng/(Pa s sq m)), maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
  4. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
  5. Air Permeance: 0.04 cfm per square foot (0.2 L/(s/sq m)), maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf (75 Pa).
  6. Closed Cell Content: At least 90 percent.
  7. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
  8. Basis of Design:
    - a. Carlisle Spray Foam Insulation; SealTite PRO HFO: [www.carlislefi.com/#sle](http://www.carlislefi.com/#sle).
    - b. Icynene-Lapolla; Icynene ProSeal LE: [www.icynene.com/#sle](http://www.icynene.com/#sle).

9. Other Acceptable Manufacturers:
  - a. BASF Corporation: [www.spf.basf.com/#sle](http://www.spf.basf.com/#sle).
  - b. Henry Company: [www.henry.com/#sle](http://www.henry.com/#sle).
  - c. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).

## 2.2 ACCESSORIES

- A. Primer: As required by insulation manufacturer.
- B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.
  1. Coating Type: Single component, water based.
  2. Protected Insulation Type: Spray polyurethane foam (SPF).
  3. Application: Apply using brush, roller, or airless sprayer.
  4. Fire Test: Flame spread index (FSI) of 0 (Zero) and smoke developed index (SDI) of 10 (Ten), when tested in accordance with ASTM E84.
  5. Color: Gray.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify work within construction spaces or crevices is complete prior to insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

### 3.2 PREPARATION

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

### 3.3 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by spray method, to a uniform monolithic density without voids.
- C. Patch damaged areas.
- D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.
- E. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.4 PROTECTION

- A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION



## SECTION 072500 - WEATHER BARRIERS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Weather Barrier Assemblies: Exterior Vapor Retarder / Air Barrier / Water-Resistive Barrier: Materials to make exterior walls and joints around frames of openings in exterior walls water vapor and moisture resistant and air tight.

#### 1.2 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Water-resistive barrier under exterior cladding.
- B. Section 072100 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.
- C. Section 076200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

#### 1.3 DEFINITIONS

- A. Weather Barriers: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.
- C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.

- 1. Water Vapor Permeance: For purposes of conversion,  $57.2 \text{ ng}/(\text{Pa s sq m}) = 1 \text{ perm}$ .

#### 1.4 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a.
- D. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing 2015.

#### 1.5 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures, for administrative and procedural requirements.
- B. Product Data: Provide data on material characteristics and performance criteria.

1. Submit manufacturer's product data, installation instructions, and manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.
  2. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
  3. Include statement that materials are compatible with adjacent materials proposed for use.
  4. Submit reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.
- C. **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 each of the adjacent materials proposed for use.
- D. **Shop Drawings:** Provide drawings of special joint conditions. Shop drawings showing locations and extent of air and vapor barrier assemblies and details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated, how materials that cover the air and vapor barrier are secured with air-tight condition maintained, and how miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed.
- E. **Manufacturer's Installation Instructions:** Indicate preparation, installation methods, and storage and handling criteria.
- F. **ABAA Manufacturer Qualification:** Submit documentation of current evaluation of proposed manufacturer and materials.
- 1.6 **QUALITY ASSURANCE**
- A. **Manufacturer:** Obtain primary materials, accessory transition membranes and termination sealants from a single manufacturer regularly engaged in manufacturing air and vapor barrier membranes and accessories.
  - B. **VOC Regulations:** Provide products which comply with applicable regulations controlling the use of volatile organic compounds.
  - C. **Preconstruction Meeting:** Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, construction and testing of mock-up and sequence of construction. Provisions for compatible connection to adjacent construction, substrate preparation, identification of materials approved for use, coordination with installation of adjacent and covering materials, and details of construction shall be discussed. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.
- 1.7 **MOCK-UPS**
- A. Locate where directed.
  - B. Mock-up may remain as part of work.

## 1.8 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.
- B. Temperature: Install air and vapor barrier within range of ambient and substrate temperatures recommended by air and vapor barrier manufacturer.
- C. Do not install air and vapor barrier in snow, rain, fog, or mist without temporary protection and supplemental heat as required. Do not install air and vapor barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer. Apply membrane to a surface dry substrate, or in accordance with manufacturer's recommendations.

## 1.9 WARRANTY

- A. Manufacturer's Special Warranty: Weather barrier and accessories are free of defects at time of delivery and are manufactured to meet manufacturer's published physical properties and material specifications.
- B. Warranty Period: Five years from date of substantial completion.
- C. Installation Warranty: Provide installer's 2 year warranty from date of Substantial Completion, including all components of the air and vapor barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

## PART 2 PRODUCTS

### 2.1 WEATHER BARRIER ASSEMBLIES

- A. Exterior Vapor Retarder / Air Barrier /Water-Resistive Barrier: Provide on exterior walls under exterior cladding.
  - 1. Fluid-Applied Membrane Air Barrier-Vapor-Retarding: Fluid-applied proprietary materials as specified. Use regular or low-temperature formulation depending on site conditions, within temperature ranges specified by manufacturer. Provide related accessories including primer, seam tape, mastic, fluid and sealant provided by manufacturer.

### 2.2 [AVB] VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

- A. Water resistive Air and Vapor Retarder Coating: Liquid applied, resilient, UV-resistant coating and associated joint treatment.
  - 1. LowTemperature Crack Bridging: ASTM C1305, no cracking after 10 cycles at -15°F (-26°C)
  - 2. Elongation: ASTM D412, primary air barrier and vapor barrier material, > 500%.
  - 3. Tensile Strength: ASTM D412, > 200 psi (1378 kPa).
  - 4. Dry Film Thickness: 40 mils (0.040 inch) (1.016 mm), minimum.
  - 5. Water Vapor Permeance: 0.1 perm (5.72 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M.
  - 6. Air Leakage: Less than 0.2 L/m2s @ 75 Pa

7. VOC Content: Less than 100 g per L when tested in accordance with 40 CFR 59, Subpart D (EPA Method 24).
8. Resistance to Fungal Growth: No growth when tested according to ASTM D5590.
9. Code Acceptance: Comply with applicable requirements of ICC-ES AC212.
  - a. Product must meet requirements for NFPA 285 Compliant Enclosure Wall Assemblies.
10. Suitable for use on concrete, masonry, plywood and glass mat gypsum sheathing.
11. Joint Preparation Treatment: Coating manufacturer's recommended method, either tape or reinforcing mesh saturated with coating material.
12. Manufacturers:
  - a. Basis of Design: Sto Corp; Sto VaporSeal (40 mil application): [www.stocorp.com/#sle](http://www.stocorp.com/#sle)
    - 1) Rough Opening Treatments: StoGuard VaporSeal with StoGuard Fabric and StoGuard Redicorner™: flexible waterproof air barrier membrane material with non-woven integrally reinforced cloth reinforcements
    - 2) Transition Membrane:
      - a) StoGuard Transition Membrane: flexible air barrier membrane for continuity at transitions: sheathing to foundation, dissimilar materials (CMU to frame wall), flashing shingle lap transitions, floor line deflection joints, masonry control joints, and through wall joints in masonry or frame construction.
      - b) StoGuard RapidFill: one component gun-applied air and moisture barrier membrane material for continuity at static transitions such as through wall penetrations such as pipes, electrical boxes, and scupper penetrations.
  - b. Other approved manufacturers (dependant on meeting basis of design and specification criteria):
    - 1) MasterSeal - BASF Corporation; AWB 660.
    - 2) Carlisle Coatings and Waterproofing, Inc.; Fire Resist Barritech VP
    - 3) GCP Applied Technologies; Perm-A-Barrier
    - 4) Henry Company; Air-Bloc 17MR
  - c. Substitutions: See Section 016000 - Product Requirements.
13. Joint Filler: As recommended by coating manufacturer and suitable to the substrate.

### 2.3 ACCESSORIES

- A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with water-resistive barrier manufacturer's installation instructions.

- B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and weather barrier materials.
  - 1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch (0.76 to 1.02 mm) nominal thickness.
  - 2. Color: Manufacture standard.
- C. Primer, joint reinforcing strip, substrate-patching membrane, adhesive, and tape as recommended by material manufacturer.
- D. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
  - 1. Width: 6 inches (152 mm).
  - 2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 30 days of weather exposure.
- E. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.
  - 1. Width: 5-1/2 inches (140 mm).
  - 2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 30 days of weather exposure.
  - 3. Products:
    - a. Protecto Wrap Company; Triple Guard Energy Sill Sealer: [www.protectowrap.com/#sle](http://www.protectowrap.com/#sle).
- F. Thinners and Cleaners: As recommended by water-resistive barrier manufacturer.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that surfaces and conditions comply with requirements of this section.

#### 3.2 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive air/vapor barrier material in accordance with manufacturer's instructions.

#### 3.3 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Coatings:
  - 1. Prepare substrate in accordance with coating manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
  - 2. Where exterior masonry veneer is being applied, install masonry anchors prior to placement of water-resistive barrier over masonry substrate; seal airtight around anchors.
  - 3. Apply bead or trowel coat of mastic sealant with minimum thickness of 1/4 inch (6 mm) along coating seams, rough cuts, and as recommended by manufacturer.
  - 4. Apply flashing to seal with adjacent construction and to bridge joints in coating substrate.
- E. Openings and Penetrations in Exterior Water-Resistive Barriers:
  - 1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches (127 mm) onto water-resistive barrier and at least 6 inches (152 mm) up jambs; mechanically fasten stretched edges.
  - 2. At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.
  - 3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches (230 mm) wide, and covering entire depth of framing.
  - 4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches (50 mm) beyond face of jambs; seal water-resistive barrier to flashing.
  - 5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
  - 6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.
  - 7. Install two coats of Water-Resistive barriers ad thin stone applications at fireplace chimney. Tie barrier into top leg of weep screed at base of thin stone installation.

### 3.4 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Owner's Inspection and Testing: Cooperate with Owner's testing agency.
  - 1. Allow access to work areas and staging.
  - 2. Notify Owner's testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
  - 3. Do not cover work of this section until testing and inspection is accepted.

- C. Do not cover installed water-resistive barriers until required inspections have been completed.
- D. Take digital photographs of each portion of installation prior to covering up weather barriers.

### 3.5 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.
- B. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- C. Do not leave paper- or felt-based barriers exposed to weather for longer than one week.

END OF SECTION

## SECTION 074112 - STANDING-SEAM METAL ROOF PANELS

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes flat standing-seam metal roof panels, gutters, downspouts, drip edge, sheet metal flashings and trim.
- B. Roofing Terminology: Refer to ASTM D 1079 for definitions of terms related to roofing work not otherwise defined in this Section.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide manufactured roof panel assemblies complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water into the building interior.
- B. Water Penetration: Provide manufactured roof panel assemblies with no water penetration as defined in the test method when tested according to ASTM E 1646 at a minimum differential pressure of 20 percent of inward acting, wind-load design pressure of not less than 6.24 lb/sq. ft. (300 Pa) and not more than 12.0 lb/sq. ft. (575 Pa).
- C. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
- D. Wind-Uplift Resistance: Provide roof panel assemblies that meet requirements of UL 580 for Class 90 wind-uplift resistance and the design criteria indicated on Structural Drawings.
- E. Loading Requirements: Provide all panels, supports, trims, and accessories to meet the following: International Building Code, 2012
  - 1. 20 lbs. No tributary load reductions allowed.
  - 2. 120 MPH - Exposure Factor C - Importance Factor 1
  - 3. Seismic: Seismic Design Category C - Importance Factor 1.25
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

#### 1.4 ACTION SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures, for administrative and procedural requirements.



- B. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- C. Shop Drawings:
  - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
  - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
  - 1. Include similar Samples of trim and accessories involving color selection.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Product Test Reports: Indicate compliance of manufactured roof panel assemblies and materials with performance and other requirements based on comprehensive testing of current products.
- C. Sample Warranties: For special warranties.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed metal roof panel projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

E. PROJECT CONDITIONS

- F. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- G. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Weathertight System Warranty: Submit a written warranty, signed by roofing system manufacturer agreeing to promptly repair leaks in the complete system including roof membrane and flashings, penetrations, curbs, accessories, etc., resulting from defects in materials or workmanship for the warranty period listed below. The manufacturer's liability shall not exceed the original installed cost of the roofing system. Indicate by letter that "All roofing components contained in the system proposed are approved and compatible with the warranty requirements of the roof system as specified, and that the warranty specified will be issued at completion of the project if system is installed as designed.
1. Warranty Period: 20 years.
- D. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering roofing, insulation, fasteners, flashings, penetrations, curbs, accessories, etc., if any, for the following warranty period:

1. Warranty Period: 5 years.
- E. The State of Missouri is prohibited by law from entering into binding arbitration. No warranty shall be submitted with any arbitration clause.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design: Berridge Manufacturing Company – Zee-loc Panel.
- B. Other available Manufacturers: Subject to compliance with requirements, manufacturers offering metal roof systems that are considered acceptable and may be incorporated into the Work include, but are not limited to, the following:
1. American Buildings Roofing and Architectural Products. - Loc-Seam panel
  2. Butler Manufacturing Co. - VSR Roof System
  3. Metal Building Components, Inc. SuperLok System
  4. Steelox Roofing Systems, Inc - LRK (Steelox Panel)
  5. Centria - System SDP-200
  6. Peterson Aluminum Pac Clad Tite-Loc.
- C. Substitutions: Any proposed substitution to the list above must be approved a minimum of 10 days in advance of bid date by submitting the "SUBSTITUTION REQUEST" form enclosed with bidding documents.

### 2.2 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
- B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
1. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
    - a. Nominal Thickness: 0.028 inch.

- b. Exterior Finish: Two-coat fluoropolymer.
- c. Color: metallic color to match Berridge "Lead-Cote".
2. Clips: One-piece fixed to accommodate thermal movement.
  - a. Material: 0.064-inch- nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
3. Joint Type: As standard with manufacturer.
4. Panel Coverage: 16 inches.
5. Panel Height: 2.0 inches minimum.

### 2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
  1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
  2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
- B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

### 2.4 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
  1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
  2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same metallic color finish system as adjacent metal panels.
- C. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, of 5-inch size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters.

1. Provide continuous gutter guard system.
    - a. Basis of Design Springrock Gutter Guards, extruded aluminum frame and marine grade stainless steel micromesh materials.
    - b. Other Acceptable Products:
      - 1) Raptor Gutter Guard; stainless steel micro-mesh.
      - 2) Superior Gutter Guards / Raised stainless-steel screen technology.
  - D. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.
  - E. Panel Fasteners: Self-tapping screws designed to withstand design loads.
  - F. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
    1. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
  - G. Closure Strips: Closed-cell, self-extinguishing, expanded, cellular, rubber or cross-linked, polyolefin-foam flexible closure strips. Cut or premold to match configuration of panels. Provide closure strips where indicated or necessary to ensure weathertight construction.
  - H. Snow Guards: Prefabricated, noncorrosive units designed to use with roof panels and complete with attachment to seam mechanism.
- 2.5 FABRICATION
- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
  - B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
  - C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
  - D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
  - E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
  - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

## 2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
  1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    - a. Basis of Design: Berridge "Lead-Cote" metallic color.
  2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
  2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
    - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
  - B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
  - C. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 PREPARATION
- A. Coordinate metal panel roofing with rain drainage work; flashing; trim; and construction of decks, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
  - B. Promptly remove protective film, if any, from exposed surfaces of metal panels and accessories. Strip with care to avoid damage to finish.
- 3.3 UNDERLAYMENT INSTALLATION
- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
    1. Apply over the entire roof surface.
  - B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.
  - C. Flashings: Install flashings in accordance with roof system manufacture to cover underlayment to comply with requirements for roof system warranty.
- 3.4 METAL PANEL INSTALLATION
- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
    1. Shim or otherwise plumb substrates receiving metal panels.
    2. Field cutting exterior panels by torch is not permitted.
    3. Install panels to slopes as shown on the Drawings, over a minimum 1/2:12 slope.
    4. Accessories: Install components required for a complete roof panel assembly including trim, copings, fascia, ridge closures, clips, seam covers, battens, flashings, gutters, leaf guards, sealants,

gaskets, fillers, closure strips, and similar items. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.

5. Install screw fasteners in predrilled holes.
  6. Locate and space fastenings in uniform vertical and horizontal alignment.
  7. Install flashing and trim as metal panel work proceeds.
  8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  9. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  10. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Install weatherseal under ridge cap. Flash and seal panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
- F. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
1. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
  2. Install clips to supports with self-tapping fasteners.
  3. Install pressure plates at locations indicated in manufacturer's written installation instructions.
  4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
  5. Watertight Installation:
    - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
    - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.



- c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
      - d. Seal panel end laps with double beads of tape or sealant, full width of panel.
  - G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
    - 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
  - H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
    - 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
    - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
  - I. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
  - J. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
    - 1. Provide elbows at base of downspouts to direct water away from building.
    - 2. Connect downspouts to underground drainage system indicated.
  - K. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.
- 3.5 ERECTION TOLERANCES
- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.8 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS of  
*, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:*
  - 1. Owner:
  - 2. Address:
  - 3. Building Name/Type:
  - 4. Address:
  - 5. Area of Work:
  - 6. Acceptance Date:
  - 7. Warranty Period:
  - 8. Expiration Date:
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs

to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
  - a. lightning;
  - b. peak gust wind speed exceeding 72 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;
  - g. 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 has been paid by Owner or by another responsible party so designated.
3. The Roofing Installer is responsible for damage to work covered by this Warranty ,
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.
5. The 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.
6. This Warranty is recognized to be the installation 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 and to coordinate the Manufacturer's warranty, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this day of , 2023.

Construct Six New Cabins  
Echo Bluff State Park

X2208-01  
FGI Project Number: 0211626.00

1. Authorized Signature:
2. Name:
3. Title:

END OF SECTION

## **SECTION 074646 - FIBER-CEMENT SIDING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Fiber-cement siding.
- B. Wood-fiber cement vertical panel siding.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Siding substrate.
- B. Section 072500 - Weather Barriers: Water-resistive barrier under siding.
- C. Section 079200 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

#### **1.3 REFERENCE STANDARDS**

- A. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets 2022.

#### **1.4 SUBMITTALS**

- A. See Section 013300 Submittal Procedures for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
  - 1. Manufacturer's requirements for related materials to be installed by others.
  - 2. Preparation instructions and recommendations.
  - 3. Storage and handling requirements and recommendations.
  - 4. Installation methods, including nail patterns.
- C. Installer's Qualification Statement.
- D. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.
- E. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.

#### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum three years of experience.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Store products under waterproof cover and elevated above grade, on a flat surface.

## PART 2 PRODUCTS

### 2.1 MANUFACTURER

- A. Source Limitations: Obtain siding and components from single manufacturer.
- B. Basis of Design: James Hardie Building Products, Inc: [www.jameshardie.com](http://www.jameshardie.com)
- C. Other Acceptable Manufacturers (dependant on meeting Basis of Design and specification criteria):
  - 1. Allura, a division of Plycem USA, Inc: [www.allurausa.com](http://www.allurausa.com)
  - 2. Nichiha USA, Inc: [www.nichiha.com](http://www.nichiha.com).
  - 3. Substitutions: See Section 016000 - Product Requirements.

### 2.2 FIBER-CEMENT SIDING

- A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
  - 1. Style: Standard lap style.
  - 2. Texture: Simulated cedar grain.
  - 3. Length: 12 ft (3.7 m), nominal.
  - 4. Width (Height): 6 inches (152 mm).
  - 5. Thickness: 5/16 inch (8 mm), nominal.
  - 6. Finish: Factory applied topcoat.
  - 7. Color: As selected by Architect from manufacturers full range of available colors.
  - 8. Warranty: 50 year limited; transferable.
- B. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
  - 1. Texture: Simulated cedar grain, vertically grooved.
  - 2. Length (Height): 96 inches (2400 mm), nominal.
  - 3. Width: 48 inches (1220 mm).
  - 4. Thickness: 5/16 inch (8 mm), nominal.
  - 5. Finish: Factory applied topcoat.
  - 6. Color: As selected by Architect from manufacturers full range of available colors.

### 2.3 ACCESSORIES

- A. Furring Strips, Metal: Galvanized metal channels.
- B. Trim: Same material and texture as siding.
- C. Fasteners: Galvanized or corrosion resistant; length as required to penetrate, 1-1/4 inch (32 mm), minimum.
- D. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.
- E. Finish Paint: Latex house paint acceptable to siding manufacturer; primer recommended by paint manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Verify that water-resistant barrier has been installed over substrate completely and correctly; see Section 054000.
- C. Do not begin until unacceptable conditions have been corrected.
- D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Install Sheet Metal Flashing:
  - 1. Above door and window trim and casings.
  - 2. Above horizontal trim in field of siding.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
  - 1. Read warranty and comply with terms necessary to maintain warranty coverage.
  - 2. Use trim details indicated on drawings.
  - 3. Touch up field cut edges before installing.
  - 4. Pre-drill nail holes if necessary to prevent breakage.
- B. Over Wood and Wood-Composite Sheathing: Install z-furring of adequate thickness to accept full length of nails and spaced at 16 inches on center. Leave space at top and bottom open; top may be behind soffit; at bottom install insect screen over opening by wrapping a strip of screen over bottom ends of vertical furring strips..

- C. Over Masonry Walls: Install z-furring of adequate thickness to accept full length of nails and spaced at 16 inches (406 mm) on center. Leave space at top and bottom open; top may be behind soffit; at bottom install insect screen over opening by wrapping a strip of screen over bottom ends of vertical furring strips.
- D. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.
- E. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.
- F. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.
- G. Do not install siding less than 6 inches (150 mm) from surface of ground nor closer than 1 inch (25 mm) to roofs, patios, porches, and other surfaces where water may collect.
- H. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.
- I. Finish Painting: Within one week after installation, paint siding and trim with one coat primer and two coats finish paint.

#### 3.4 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION



## **SECTION 078400 - FIRESTOPPING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

#### **1.2 REFERENCE STANDARDS**

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- C. ITS (DIR) - Directory of Listed Products Current Edition.
- D. FM (AG) - FM Approval Guide current edition.
- E. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.
- F. UL (FRD) - Fire Resistance Directory Current Edition.

#### **1.3 SUBMITTALS**

- A. See Section 013300 Submittals for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.

#### **1.4 QUALITY ASSURANCE**

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
  - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
  - 1. Trained by manufacturer.

## 1.5 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Firestopping Manufacturers:
  - 1. 3M Fire Protection Products: [www.3m.com/firestop/#sle](http://www.3m.com/firestop/#sle).
  - 2. A/D Fire Protection Systems Inc: [www.adfire.com/#sle](http://www.adfire.com/#sle).
  - 3. Hilti, Inc: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
  - 4. Nelson FireStop Products: [www.nelsonfirestop.com/#sle](http://www.nelsonfirestop.com/#sle).
  - 5. Specified Technologies Inc: [www.stifirestop.com/#sle](http://www.stifirestop.com/#sle).
  - 6. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - 7. Substitutions: See Section 016000 - Product Requirements.

### 2.2 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

### 2.3 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
  - 1. Fire Ratings: Use any system that is listed by FM (AG) or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

### 3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

- B. Remove incompatible materials that could adversely affect bond.

### 3.3 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

### 3.4 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

### 3.5 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

## **SECTION 079200 - JOINT SEALANTS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 072500 - Weather Barriers: Sealants required in conjunction with water-resistive barriers.
- B. Section 088000 - Glazing: Glazing sealants and accessories.
- C. Section 092116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

#### **1.3 REFERENCE STANDARDS**

- A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants 2018 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants 2017.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- D. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems 2016.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2022.
- G. ASTM C1311 - Standard Specification for Solvent Release Sealants 2022.
- H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.

#### **1.4 SUBMITTALS**

- A. See Section 013300 Submittals for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes 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 use of primer is required.
  6. Substrates for which laboratory adhesion and/or compatibility testing is required.
  7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
  8. Sample product warranty.
  9. Certification by manufacturer indicating that product complies with specification requirements.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

#### 1.5 QUALITY ASSURANCE

- A. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
1. Deliver to manufacturer sufficient samples for testing.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

#### 1.6 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.
- D. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Verify available warranties and warranty periods with manufacturers listed in Part 2 articles.
  2. Warranty Period: Two years from date of Substantial Completion.
- E. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  2. Disintegration of joint substrates from natural causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
  1. Retain subparagraph below if sealants are indicated for Use I. Revise if a liquid other than water is used in testing.
  2. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

### 2.2 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
  1. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
  2. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  3. Dow Corning Corporation: [www.dowcorning.com/construction/#sle](http://www.dowcorning.com/construction/#sle).
  4. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  5. Sika Corporation: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
  6. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  7. Substitutions: See Section 016000 - Product Requirements.
- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
  1. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
  2. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  3. Dow Corning Corporation: [www.dowcorning.com/construction/#sle](http://www.dowcorning.com/construction/#sle).

4. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
5. Sika Corporation: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
6. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
7. Substitutions: See Section 016000 - Product Requirements.

## 2.3 JOINT SEALANT APPLICATIONS

### A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
  - a. Wall expansion and control joints.
  - b. Joints between door, window, and other frames and adjacent construction.
  - c. Joints between different exposed materials.
  - d. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
  - a. Joints between door, window, and other frames and adjacent construction.
  - b. Gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
    - 1) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
  - c. Other joints indicated below.
3. Do not seal the following types of joints.
  - a. Intentional weepholes in masonry.
  - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
  - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
  - d. Joints where installation of sealant is specified in another section.
  - e. Joints between suspended panel ceilings/grid and walls.

### B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.

1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.

2. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
  2. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
  3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
  4. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
- D. Interior Wet Areas: Bathrooms, restrooms, kitchens, and food service areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.
- E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

#### 2.4 JOINT SEALANTS - GENERAL

#### 2.5 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
  2. Non-Staining to Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
  3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
  4. Color: Match adjacent finished surfaces.
  5. Cure Type: Single-component, neutral moisture curing
  6. Service Temperature Range: Minus 20 to 180 degrees F (Minus 29 to 82 degrees C).
- B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
  2. Color: Match adjacent finished surfaces.
  3. Cure Type: Single-component, neutral moisture curing
  4. Service Temperature Range: Minus 65 to 180 degrees F (Minus 54 to 82 degrees C).
- C. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.



1. Color: Clear.
- D. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
  2. Color: Match adjacent finished surfaces.
  3. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
- E. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
1. Movement Capability: Plus and minus 35 percent, minimum.
  2. Color: Match adjacent finished surfaces.
  3. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
- F. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Color: Match adjacent finished surfaces.
  3. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
- G. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.
  2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
- H. Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, non-sag, non-skinning, non-hardening, non-bleeding.
1. Manufacturers:
    - a. Basis of Design: Tremco; TremPro JS-773.
    - b. Substitutions: See Section 016000 - Product Requirements.
- 2.6 SELF-LEVELING SEALANTS
- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
1. Movement Capability: Plus and minus 25 percent, minimum.

2. Color: To be selected by Architect from manufacturer's standard range.
3. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).

## 2.7 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
  1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
  2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
  3. Open Cell: 40 to 50 percent larger in diameter than joint width.
  4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Preformed Extruded Silicone Joint Seal: Pre-cured low-modulus silicone extrusion, in sizes to fit applications indicated on drawings, combined with a neutral-curing liquid silicone sealant for bonding joint seal to substrates.
  1. Size: 1 inch (25.4 mm) wide, in rolls 100 feet (30.5 m) long.
  2. Thickness: 0.78 inch (19.8 mm), with ridges along outside bottom edges for bonding area.
  3. Color: As selected by Architect..
- C. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- D. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- E. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- F. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

### 3.2 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.

- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

### 3.3 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

### 3.4 FIELD QUALITY CONTROL

- A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

### 3.5 POST-OCCUPANCY

- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

## **SECTION 081113 - HOLLOW METAL DOORS AND FRAMES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Thermally insulated hollow metal doors with frames.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 087100 - Door Hardware.

#### **1.3 ABBREVIATIONS AND ACRONYMS**

- A. ANSI: American National Standards Institute.
- B. ASCE: American Society of Civil Engineers.
- C. HMMA: Hollow Metal Manufacturers Association.
- D. NAAMM: National Association of Architectural Metal Manufacturers.
- E. NFPA: National Fire Protection Association.
- F. SDI: Steel Door Institute.
- G. UL: Underwriters Laboratories.

#### **1.4 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2018.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- H. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames 2016.

- I. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
  - J. ITS (DIR) - Directory of Listed Products Current Edition.
  - K. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
  - L. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.
  - M. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2017.
  - N. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.
  - O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
  - P. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.
  - Q. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2019.
  - R. UL (DIR) - Online Certifications Directory Current Edition.
  - S. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- 1.5 SUBMITTALS
- A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
  - B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
  - C. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
  - D. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- 1.6 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
  - B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

1.8 PROJECT CONDITIONS

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

1.9 COORDINATION

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
1. Curries, an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  2. Curries, an Assa Abloy Group company.
  3. Steelcraft, an Allegion brand: [www.allegion.com/#sle](http://www.allegion.com/#sle).

2.2 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
  2. Accessibility: Comply with ICC A117.1 and ADA Standards.
  3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
  4. Door Edge Profile: Manufacturers standard for application indicated.
  5. Typical Door Face Sheets: Flush.
  6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Flush.
  7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
  8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.

- a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
  - B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.
- 2.3 HOLLOW METAL DOORS
- A. Door Finish: Factory primed and field finished.
  - B. Exterior Doors: Thermally insulated.
    - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      - a. Level 2 - Heavy-duty.
      - b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
      - c. Model 2 - Seamless.
      - d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
    - 2. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
- 2.4 HOLLOW METAL FRAMES
- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
  - B. Frame Finish: Same as hollow metal door.
  - C. Exterior Door Frames: Full profile/continuously welded type.
    - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
    - 2. Frame Metal Thickness: 14 gage, 0.067 inch (1.7 mm), minimum.
    - 3. Weatherstripping: Separate, see Section 087100.
- 2.5 FINISHES
- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
  - B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch (0.4 mm) dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 ACCESSORIES

- A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.3 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Install door hardware as specified in Section 087100.
- F. Comply with glazing installation requirements of Section 088000.

3.4 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.5 ADJUSTING

- A. Adjust for smooth and balanced door movement.

END OF SECTION



## **SECTION 081433 - STILE AND RAIL WOOD DOORS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Wood doors, stile and rail design; non-fire rated.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 087100 - Door Hardware.

#### **1.3 REFERENCE STANDARDS**

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

#### **1.4 SUBMITTALS**

- A. See Section 013300 Submittal Procedures for submittal procedures.
- B. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- C. Manufacturer's qualification statement.
- D. Warranty, executed in Owner's name.

#### **1.5 QUALITY ASSURANCE**

- A. Maintain one copy of specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
  - 1. Accredited participant in specified certification program prior to commencement of fabrication and throughout duration of project.
- C. Quality Certification:
  - 1. Provide labels or certificates indicating that installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
  - 2. Provide designated labels on shop drawings as required by certification program.
  - 3. Provide designated labels on installed products as required by certification program.
  - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Package, deliver, and store doors in accordance with quality standard specified.

- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

#### 1.7 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials and telegraphing core construction

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Stile and Rail Wood Doors:
  - 1. Karona, Inc: [www.karonadoor.com/#sle](http://www.karonadoor.com/#sle).
  - 2. Masonite Architectural; Aspiro Authentic Stile & Rail Doors: [www.architectural.masonite.com/#sle](http://www.architectural.masonite.com/#sle).
  - 3. VT Industries, Inc: [www.vtindustries.com/#sle](http://www.vtindustries.com/#sle).
  - 4. Substitutions: See Section 016000 - Product Requirements.

#### 2.2 DOORS

- A. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.
- B. Interior Doors: 1-3/8 inches (34.93 mm) thick unless otherwise indicated; solid lumber construction; mortise and tenon joints. Transparent finish as indicated on drawings.
- C. Wood veneer facing with factory transparent finish as indicated on drawings.

#### 2.3 DOOR AND PANEL FACINGS

- A. Veneer Facing for Transparent Finish: Red Oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
- B. Adhesive: Type I - Waterproof.

#### 2.4 DOOR CONSTRUCTION

#### 2.5 FINISHES

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

3.2 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standards.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Machine cut for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.

END OF SECTION

## **SECTION 083100 - ACCESS DOORS AND PANELS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Wall mounted access units.
- B. Wall and ceiling mounted access units.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 03 1000 - Concrete Forming and Accessories: Openings in concrete.

#### **1.3 REFERENCE STANDARDS**

- A. UL (FRD) - Fire Resistance Directory Current Edition.

#### **1.4 SUBMITTALS**

- A. See Section 013300 Submittals, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Project Record Documents: Record actual locations of each access unit.

### **PART 2 PRODUCTS**

#### **2.1 ACCESS DOORS AND PANELS ASSEMBLIES**

- A. Wall-Mounted Units:
  - 1. Location: Concrete foundation into crawl space and specifications.
  - 2. Panel Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
  - 3. Size: 24 inch by 24 inch (610 mm by 610 mm), unless otherwise indicated.
  - 4. Exterior Access Panel: @-inch thick polyiso insulation .040 aluminum door panel / with continuous hinge
    - a. Basis of Design Activar/JL Industries XT.

#### **2.2 WALL MOUNTED EXTERIOR ACCESS UNITS**

- A. Manufacturers:
  - 1. Activar Construction Products Group, Inc. - JL Industries: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
    - a. Exterior Access Panel: Activar/JL Industries XTA.
  - 2. Babcock-Davis: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).

3. Cendrex, Inc: [www.cendrex.com/#sle](http://www.cendrex.com/#sle).
  - a. Insulated Aluminum Units: Cendrex PAL.
4. Milcor, Inc; EXT: [www.milcorinc.com/#sle](http://www.milcorinc.com/#sle).
- B. Wall-Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
  1. Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
  2. Style: Exposed frame with door surface flush with frame surface.
  3. Door Style: Double-skinned hollow panel.
  4. Frames: 16 gauge, 0.0598 inch (1.52 mm), minimum thickness.
  5. Steel Finish: Primed.
  6. Primed and Factory Finish: Polyester powder coat; color Gray.
  7. Hardware:
    - a. Hinges for Non-Fire-Rated Units: Continuous piano hinge.
    - b. Latch/Lock: Lockable compression panel Cylinder lock-operated cam latch, two keys for each unit.
    - c. Inside Latch Release: Mechanism that allows door/panel to be opened from inside.
    - d. Gasketing: Extruded neoprene, around perimeter of door panel.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### 3.2 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

## **SECTION 085200 - ALUMINUM-CLAD WOOD WINDOWS AND DOORS**

### **PART 1 GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section includes aluminum-clad wood windows and doors.

#### **1.3 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include manufacturer's installation instructions as part of initial submittal, for the specific model or series of window.
- B. Shop Drawings: For aluminum-clad wood windows. Include plans, elevations, sections, full-size details, and attachments to other work.
  - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
  - 2. Include full-size details of each vertical-to-horizontal intersection of aluminum-clad wood windows and doors, showing the following:
    - a. Joinery, including concealed welds.
    - b. Anchorage.
    - c. Expansion provisions.
    - d. Glazing.
    - e. Flashing and drainage.
  - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

- 1.5 Samples for Initial Selection: For units with factory-applied color finishes.

#### **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.

- B. Mockups: Install an initial aluminum-clad wood window in actual wall construction to serve as mockup to demonstrate aesthetic effects, accommodate testing and to set quality standards for materials and execution.
  - 1. Mockup shall include perimeter sealing and flashing conditions.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Construction Representative specifically approves such deviations in writing.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Aluminum-Clad Wood Windows:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Andersen Window & Door company E-Series; Auxiliary Series and Geometric Series or comparable product by one of the following:
    - a. Kolbe & Kolbe Millwork Co., Inc.
    - b. Marvin; Signature Ultimate Clad Wood Windows: [www.marvin.com/#sle](http://www.marvin.com/#sle).
    - c. Pella Corporation Architect Series Reserve.
- B. Aluminum-Clad Wood Doors:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Andersen Window & Door company; E Series Commercial Doors or comparable product by one of the following:
    - a. Kolbe & Kolbe Millwork Co., Inc.
    - b. Marvin; Signature Ultimate Clad Wood Windows: [www.marvin.com/#sle](http://www.marvin.com/#sle).
    - c. Pella Corporation Architect Series Reserve.
  - 2. Cabin front main entry door to be custom design to match existing. Provide full lite door unit with 6 1/2 inch stiles (to accommodate hotel lock) and simulated divided lite in a "branch" design.
- C. Source Limitations: Obtain Aluminum-Clad wood windows and doors from single source from single manufacturer.

### 2.2 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
  - 1. Window Certification: WDMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: CW.
- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.35 Btu/sq. ft. x h x deg F.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.36.
- E. Water-Spray Test: Test according to AAMA 502 as follows:
  1. Testing Agency shall test the first installation of aluminum-clad wood windows in each unique exterior wall system for moisture penetration per AAMA 502. Testing shall be conducted at each building within project scope that contains aluminum-clad window units.
  2. Minimum requirements of test include:
    - a. Random window shall be put under negative pressure from inside of room.
    - b. Selected window shall be sprayed on outside of wall with colored water. Look for leaks
    - c. Window shall be tested for 5 minute duration.
  3. Testing shall occur after window system is weather tight but prior to installation of interior finishes allowing for adequate viewing of potential leakage from both the interior and exterior of the building.
  4. Wherever water leakage has occurred as a result of the test, the test shall be deemed a failure and the Contractor shall make the sample watertight in a manner acceptable to the Owner. Once measures have been put into place and the appropriate curing time has passed a second test of the sample shall be conducted in the same manner as the first in accordance with the re-testing procedure of this section. Should leakage still be found, further remedial measures shall be implemented and testing shall be repeated until the sample has been deemed acceptable by the Owner.
  5. Re-testing is at the Contractor's expense.

### 2.3 DOOR PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
  1. Window Certification: WDMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
  1. Minimum Performance Class: CW.
- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.55 Btu/sq. ft. x h x deg F.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.36.

### 2.4 ALUMINUM-CLAD WOOD WINDOWS

- A. Operating Types: Provide the following operating types in locations indicated on Drawings:



1. Fixed.
  2. Casement.
  3. Double-hung
- B. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.
1. Exterior Finish: Aluminum-clad wood.
    - a. Aluminum Finish: High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    - b. Color: Custom color as shown on the Drawings.
  2. Interior Finish: Manufacturer's standard factory-prime coat.
- C. Insulating-Glass Units: ASTM E 2190, certified through IGCC as complying with requirements of IGCC.
1. Glass: ASTM C 1036, Type 1, Class 1, q3.
    - a. Tint: Gray.
    - b. Kind: Fully tempered where indicated on Drawings.
  2. Lites: Two.
  3. Filling: Fill space between glass lites with argon.
  4. Low-E Coating: Sputtered on second or third surface.
- D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
- E. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- F. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- 2.5 ALUMINUM CLAD WOOD DOORS
- A. Operating Types: Provide the following operating types in locations indicated on Drawings:
1. Outswing Commercial Doors.

- B. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.
1. Exterior Finish: Aluminum-clad wood.
    - a. Aluminum Finish: High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    - b. Color: custom color as shown on the Drawings.
  2. Interior Finish: Manufacturer's standard factory-prime coat.
  3. Bottom Rail: ADA compliant 12 inch.
  4. Top rail 6 1/2 inch.
- C. Insulating-Glass Units: ASTM E 2190, certified through IGCC as complying with requirements of IGCC.
1. Glass: ASTM C 1036, Type 1, Class 1, q3.
    - a. Tint: Gray.
    - b. Kind: Fully tempered.
  2. Lites: One.
  3. Filling: Fill space between glass lites with argon.
  4. Low-E Coating: Sputtered on second or third surface.
- D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
- E. Door Hardware: As specified in Section 087100 "Door Hardware."
1. Provide 6 1/2 inch stile at front door main entry to accommodate Saflok hotel lock specified in division 087100 - Door Hardware.
- F. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- G. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- H. Custom wood simulated divided lite grilles; "branch" design as shown on the drawings to match existing for front door main entry.

## 2.6 ALUMINUM-CLAD WOOD WINDOW FABRICATION

- A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.
- B. Glaze wood windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- E. Window Assemblies: Provide fixed units in configuration indicated. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
  - 1. Angled mullion posts with interior and exterior trim.
  - 2. Angled interior and exterior extension and trim.
  - 3. Clear pine head and seat boards.
  - 4. Exterior head and sill casings and trim.
- F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

## 2.7 ALUMINUM-CLAD WOOD DOOR FABRICATION

- A. Fabricate stile and rail wood doors in sizes indicated for field fitting.
- B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:
  - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/2 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide not more than 3/8 inch from bottom of door to top of threshold.
    - a. Comply with NFPA 80 for fire-rated doors.
  - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
  - 3. Bevel fire-rated doors 1/8 inch in 2 inches on lock edge; trim stiles and rails only to extent permitted by labeling agency.
- C. 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, BHMA-156.115-W, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- D. Glazed Openings: Factory install glazing in doors, complying with Section 088000 "Glazing." Install glass using manufacturer's standard elastomeric glazing sealant complying with ASTM C 920. Secure glass in place with removable wood moldings. Miter wood moldings at corner joints.
- E. Exterior Doors: Factory treat exterior doors after fabrication with water-repellent preservative to comply with WDMA I.S.4. Flash top of outswinging doors with manufacturer's standard metal flashing.
- F. Prehung Doors: Provide stile and rail doors complete with frames, weather stripping, and hardware.
  1. Provide hardware, including weather stripping, that complies with Section 087100 "Door Hardware."

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, doors, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows and doors level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

#### 3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
  1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

- D. Protect window and door surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform tests on aluminum-clad wood windows and doors as specified in Performance Requirements article of this section.
- C. Aluminum-clad wood windows and doors will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

## SECTION 08 7100 - DOOR HARDWARE

### 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. Mechanical and electrified door hardware for:
    - 1. Swinging doors.
- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:
  - 1. Windows
  - 2. Cabinets (casework), including locks in cabinets
- C. Related Sections:
  - 1. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
  - 2. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.
  - 3. Division 26 sections for connections to electrical power system and for low-voltage wiring.
  - 4. Division 28 sections for coordination with other components of electronic hotel access control system.

#### 1.3 REFERENCES

- A. UL - Underwriters Laboratories
  - 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. Key Systems and Nomenclature
- C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

#### 1.4 SUBMITTALS

##### A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.

##### B. Action Submittals:

1. Product Data: Product data including manufacturers' 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:
  1. 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 Construction Representative, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
  1. Samples will be returned to supplier in like-new condition. Units that are acceptable to Construction Representative may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
  1. Door Index; include door number, heading number, and Architects hardware set number.
  2. Opening Lock Function Spreadsheet: List locking device and function for each opening.
  3. Type, style, function, size, and finish of each hardware item.
  4. Name and manufacturer of each item.
  5. Fastenings and other pertinent information.
  6. Location of each hardware set cross-referenced to indications on Drawings.
  7. Explanation of all abbreviations, symbols, and codes contained in schedule.
  8. Mounting locations for hardware.
  9. Door and frame sizes and materials.
  10. Name and phone number for local manufacturer's representative for each product.
  11. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
    - 1) Submittal Sequence: Submit door hardware schedule 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 that is critical in Project construction schedule.

5. Key Schedule:

1. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
2. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
3. 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.
4. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
5. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
  - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
6. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product Certificates for electrified door hardware, signed by manufacturer:
  1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
3. Certificates of Compliance:
  1. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
  2. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.
  3. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
5. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:
  1. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
  2. Catalog pages for each product.



3. Name, address, and phone number of local representative for each manufacturer.
4. Parts list for each product.
5. Final approved hardware schedule, edited to reflect conditions as-installed.
6. Final keying schedule
7. Copies of floor plans with keying nomenclature
8. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
9. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

## 1.5 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
    1. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection as the established Basis of Design.
    2. Any requests for substitution must be accompanied by a detailed comparison of significant qualities of proposed substitution with those of the product specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the product specified.
  2. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
1. Warehousing Facilities: In Project's vicinity.
  2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
  3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
  4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
    1. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Architectural Hardware Consultant Qualifications: 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:

1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
  2. Can provide installation and technical data to Architect and other related subcontractors.
  3. Can inspect and verify components are in working order upon completion of installation.
  4. Capable of producing wiring diagrams.
  5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
  2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, 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.
- G. 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.
1. Air Leakage Rate: 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.
- H. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- I. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
- J. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
  2. Maximum opening-force requirements:
    1. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
    2. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
    3. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
  3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
  4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.
- K. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.
1. Attendees: Owner, Contractor, Architect, Installer and Supplier's Architectural Hardware Consultant.

2. 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.
  
  - L. Pre-installation Conference: Conduct conference at Project site or at place designated by Architect / Owner.
    1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    2. Inspect and discuss preparatory work performed by other trades.
    3. Inspect and discuss electrical roughing-in for electrified door hardware.
    4. Review sequence of operation for each type of electrified door hardware.
    5. Review required testing, inspecting, and certifying procedures.
  
  - M. Coordination Conferences:
    1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
      1. Attendees: Door hardware supplier, door hardware installer, Contractor.
      2. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.
  
    2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.
      1. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Architect and Contractor.
      2. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
  
  - 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.
    1. Deliver each article of hardware in manufacturer's original packaging.
  
  - C. Project Conditions:
    1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
    2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

F. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.7 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory 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.

E. Direct shipments not permitted, unless approved by Contractor.

1.8 WARRANTY

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

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

1. Closers:

- 1) Mechanical: 10 years.
- 2) Electrified: 2 years.

2. Exit Devices:

- 1) Mechanical: 3 years.
- 2) Electrified: 1 year.

3. Locksets:

- 1) Mechanical: 3 years.
- 2) Electrified: 1 year.

4. Continuous Hinges: 10 years.

5. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

## 1.9 MAINTENANCE

### A. Extra Materials:

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
2. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

## PRODUCTS

### 2.1 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and particular project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings 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 manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- 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. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- E. 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 Construction Representative's approval.

### 2.2 MATERIALS

#### A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) 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 for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Construction Representative if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

- 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.
- C. Provide five-knuckle, ball bearing hinges.
  - 1. Manufacturers and Products:
    - 1. Scheduled Manufacturer and Product: Ives 5BB series
    - 2. Acceptable Manufacturers and Products: Hager Hinge Co., Stanley. (addendum 2)
- D. Requirements:
  - 1. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
    - 1. As shown in hardware sets
  - 2. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
    - 1. As shown in hardware sets
  - 3. 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.
  - 4. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
  - 5. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
    - 1. Steel Hinges: Steel pins
    - 2. Non-Ferrous Hinges: Stainless steel pins
    - 3. Out-Swinging Exterior Doors: Non-removable pins
    - 4. Out-Swinging Interior Lockable Doors: Non-removable pins
    - 5. Interior Non-lockable Doors: Non-rising pins
  - 6. Provide mortar guard for each electrified hinge specified, unless specified in hollow metal frame specification.
  - 7. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

## 2.3 ELECTRIC POWER TRANSFER

- A. Manufacturers:
  - 1. Scheduled Manufacturer: Von Duprin
  - 2. Acceptable Manufacturers:
    - 1. Von Duprin (Basis of Design)
    - 2. Sargeant
    - 3. Falcon
- B. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.

- C. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

## 2.4 HOTEL LOCKS:

### A. Basis of Design Manufacturer:

- 1. Saflok; 31750 Sherman Ave., Madison Heights, MI 48071
- 2. Due to special requirements, no substitutions allowed.

### B. Requirements:

#### 1. System Features:

- 1. Internal clock and calendar.
- 2. Automatic inhibiting when new keys are added: The lock can be designed to activate automatic inhibiting between levels of guest keys so only the current guest key is valid (e.g., a new room key will inhibit an old guest's suite, fail safe or connector key.
- 3. Override dead bolt master and guest levels: All levels can be programmed to override the dead bolt if desired.
- 4. Hardware status indicators: The software is designed to allow diagnostic keys to be used to test and determine the status of various lock hardware such as dead bolt and handle switches, clocking, battery, etc.
- 5. Reporting features: User and Authorization, Transaction History, and Lock and Key Interrogation, all reports may be viewed onscreen, saved to a file or printed.
- 6. System shall include key expiration; staff keys that work only during specified shift hours and days of the week; guestroom, suite and connector keys; a wide variety of staff keys; and emergency keys, fail safe or backup keys, dual security keys and latching and unlatching keys. Fail safe keys can automatically be issued without programming them into a guest room lock as they are issued. These fail safe keys also cancel out the previous guest key.
- 7. Locks will log a use history on memory and smart cards any time they are used in a lock. The system interrogates these keys using an encoder, and produces reports that detail up to 1,000 of the most recent uses, including each lock the keycard attempted to open, why the keycard was not allowed to open certain doors and which locks require battery changes or had privacy activated.
- 8. If an employee loses a key or leaves service, his/her key can be canceled out of locks without affecting or canceling other staff keys currently issued.

#### 2. System Functions:

- 1. Lock function: Locks shall be operated only by a correctly encoded keycard with magnetic stripe, smart card or memory card technologies.
- 2. Keying levels: System shall be capable of providing up to 14 standard independent key levels.

#### 3. System Components:

##### 1. Lock Units

- 1) Saflok MT RFID – lever as selected by Architect
  - a) Locksets shall be mortise type, tamper resistant door units. Provide Grade 1, ANSI/BHMA 156.13, UL listed mortise lock equipped with adjustable armored front, 1" throw hardened steel insert deadbolt, 3/4" throw latch bolt, auxiliary deadlocking latch, 2-3/4" backset. Latch bolt and deadbolt operated simultaneously by rotating inside lever.
- 2) Lock Trim
  - a) Lever as selected by Architect

2. Keycards
  - 1) Activation of all units shall be by insertion of magnetic strip encoded keycards.
  - 2) Keycards shall resist tearing, bending and scratching and shall be water resistant.
  - 3) Keycards shall have no less than a 600-coersivity magnetic strip.
3. CS640203 includes:
  - 1) Basic System Items: Saflok System 6000 software, manuals, etc. keycards sold separately.
  - 2) Smart Card encoder encodes Smart/Memory/Mag Strip Cards.
  - 3) Lock Programming/Interrogator (LPI) handheld with base and AC.
  - 4) Lock Programming/Interrogator (LPI Interface Probe).
  - 5) Emergency Lock Power Supply (ELPS).
4. 7081602-PMS includes Saflok PMS interface software.
5. Additional check-in encoding stations CE4010 Motorized Encoders (quantity as determined by Owner) shall be connected to property's Windows-based Desk PMS workstation computers.
6. Host Computer: Saflok CD6 Desktop.
7. Messenger Software
  - 1) SW-MSNGR
8. Basic Windows System software package:
  - 1) One LPI probe.
  - 2) Emergency lock power supply (ELPS)
  - 3) One hand-held base with AC adapter and Smart Card encoder.
9. One 7081602-PMS Saflok PMS interface software.
10. One box of 5000 Saflok reusable mag strip keycards.
11. 250 Smart Card keys or memory keys (employee use).
12. Saflok software database/property configuration files.
13. Saflok Windows operating procedures manual.
14. Remote controller units (RCU)
15. Saflok MT RFID trim for Von Duprin 98 series exit devices.
16. Elevator Control Unit (ECU/Discriminating) at all elevator locations. Coordinate installation with Elevator Contractor.

## 2.5 MORTISE LOCKS

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Best 45H series
2. Acceptable Manufacturers and Products: Schlage
3. Sergeant.

### B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
2. 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.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.



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4. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide a request to exit (RX) switch that is actuated with rotation of inside lever.
5. 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.
  1. Lever Design: Best 15D
  2. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

## 2.6 CYLINDRICAL LOCKS – GRADE 1

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Best 9K series
2. Acceptable Manufacturers and Products:
  1. Best 9K series
  2. Schlage
  3. Sergeant

### B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1. Cylinders: Refer to “KEYING” article, herein.
2. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
3. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
4. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
5. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
6. Provide electrified options as scheduled in the hardware sets.
7. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.
  1. Lever Design: Best 15D.
  2. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

## 2.7 POWER SUPPLIES

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage or Von Duprin PS900 series
2. Acceptable Manufacturers and Products: Sergeant, Falcon.

### B. Requirements:

1. Provide power supplies, recommended, and approved by manufacturer of electrified locking component, for operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring power supply.
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 Construction Representative.

3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Options:
  1. Provide power supply, where specified, with internal capability of charging sealed backup batteries 24 VDC, in addition to operating DC load.
  2. Provide sealed batteries for battery back-up at each power supply where specified.
  3. Provide keyed power supply cabinet.
5. Provide power supply in an enclosure, complete, and requiring 120VAC to fused input.
6. Provide power supply with emergency release terminals, where specified, that allow release of all devices upon activation of fire alarm system complete with fire alarm input for initiating “no delay” exiting mode.

## 2.8 ROLLER LATCHES

### A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers:
  1. Ives
  2. Trimco
  3. Burns

### B. Requirements:

1. Provide roller latches with 4-7/8 inches (124 mm) strike at single doors to fit ANSI frame prep. If dummy levers are used in conjunction with roller latch mount roller latch at a height as to not interfere with proper mounting and height of dummy lever.
2. Provide roller latches 2-1/4 inches (57 mm) full lip strike at pair doors. Mount roller in top rail of each leaf per manufacturer’s template.

## 2.9 CYLINDERS

### A. Manufacturer and Product:

1. Scheduled Manufacturer and Product: Best Lock.
2. Approved Manufacturers and Products:
  1. Best Lock
  2. Schlage
  3. Sergeant.

### B. Requirements:

1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer’s series as indicated. Refer to “KEYING” article, herein.

## 2.10 DOOR TRIM

### A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers:
  1. Ives
  2. Trimco
  3. Burns

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

## 2.11 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers:
  1. Ives
  2. Trimco
  3. Burns

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
  1. Kick Plates: 8 inches (254 mm) high by 1 1/2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
  2. Mop Plates: 4 inches (102 mm) high by 1 1/2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
  3. Armor Plates: 34 inches (914 mm) high by 1 1/2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

## 2.12 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Manufacturers:
  1. Glynn-Johnson
  2. Sargent
  3. ABH

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

## 2.13 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers:
  1. Ives
  2. Trimco
  3. Burns

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

## 2.14 THRESHOLDS, SEALS, DOOR SWEEPS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: National Guard Products
2. Acceptable Manufacturers:
  1. National Guard Products
  2. Reese
  3. Zero International

B. Requirements:

1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
  1. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
  2. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
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.

## 2.15 SILENCERS

### A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers:
  1. Ives
  2. Trimco
  3. Burns

### 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.

### C. Provide appropriate door viewer for door type and rating with minimum of 180-degree view area.

## 2.16 BI-PASS DOOR HARDWARE

### A. Manufacturers:

1. Scheduled Manufacturer: Hager
2. Acceptable Manufacturers:
  1. Hager
  2. Johnson Hardware
  3. Stanley

### B. Requirements:

1. Provide complete sets of by-pass door hardware as recommended by manufacturer for door type and weight.
  1. Include track, hangers, fasteners, guides, cup pulls, and other hardware as required for complete installation.

## 2.17 BI-FOLD DOOR HARDWARE

### A. Manufacturer:

1. Scheduled Manufacturer: Hager
2. Acceptable Manufacturers:
  1. Hager
  2. Johnson Hardware
  3. Stanley

B. Requirements:

1. Provide complete sets of bi-fold door hardware as recommended by manufacturer for door type and weight.
  1. Include track, hangers, fasteners, guides, and other hardware as required for complete installation.

2.18 POCKET DOOR HARDWARE

A. Manufacturers:

1. Scheduled Manufacturer: Hager
2. Acceptable Manufacturers:
  1. Hager
  2. Johnson Hardware
  3. Stanley

B. Requirements:

1. Provide complete sets of pocket door hardware as recommended by manufacturer for door type and weight.
  1. Include track, hangers, fasteners, guides, and other hardware as required for complete installation.

2.19 FINSHES

A. Finish: BHMA 613/640 (US10B); except:

1. Continuous Hinges: US32D (BHMA 630).
2. Mortise Locks: ORB – Oil Rubbed Bronze.
3. Tubular Locks: ORB – Oil Rubbed Bronze.
4. Door Closers: Powder Coat to Match.
5. Latch Protectors: US32D (BHMA 630).
6. Weatherstripping: Dark Bronze Anodized Aluminum.
7. Thresholds: Extruded Architectural Bronze, Oil-Rubbed

## EXECUTION

### 3.1 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.
- B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Where on-site modification of doors and frames is required:
  - 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
  - 2. Field modify and prepare existing door and frame for new hardware being installed.
  - 3. When modifications are exposed to view, use concealed fasteners, when possible.
  - 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
    - 1. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    - 2. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    - 3. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

### 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  - 2. Custom Steel Doors and Frames: HMMA 831.
  - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

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- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Wiring: Coordinate with Division 26, ELECTRICAL 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 Construction Representative.
  - 5. Testing and labeling wires with Architect's opening number.
- I. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Construction Representative.
- J. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Construction Representative.
  - 1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- K. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- L. 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.
- M. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- N. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

### 3.4 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
  - 1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust



door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

### 3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary 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.

### 3.7 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

### 3.8 DOOR HARDWARE SCHEDULE

- A. Locksets, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Note: All necessary mounting plates, brackets, shims for closers & exit devices are to be included in the suppliers bid to provide when detailing project. These items will not be considered extra to contract.

#### Hardware Group No. ENT1

ALUMINUM LOCK STILES AND TOP RAIL STILES MUST BE WIDE ENOUGH TO ACCEPT HARDWARE

For use on mark/door #(s):

#### Front Entry Doors

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
1	EA SURFACE CLOSER	4040XP SCUSH	695	LCN
1	EA HINGE	5BB1 4.5 X 4.5	640	IVE
1	EA ELECTRONIC LOCK	MT SERIES	613	SAF
1	EA DRIP CAP	16A	CL	NGP
1	EA DOOR SWEEP	200NA	CL	NGP
1	EA SADDLE THRESHOLD	425	719	NGP
1	EA DOOR GUARD	482	626	IVE

Operational Description

Self-Closing. Templating allows Spring CUSH Arm to stop the door's swing between 85 and 110 degrees.

#### Hardware Group No. 2

For use on mark/door #(s):

#### Bathrooms and Bedroom Doors-Privacy

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
3	EA HINGE	5PB1 4.5 X 4.5	640	IVE
1	EA CYLINDRICAL LOCK PRIVACY	9K3-L-15D-STK	613	BES
1	EA WALL STOP	WS406/407CCV	613	IVE
3	EA SILENCER	SR65	GRY	IVE

#### Hardware Group No. 3

For use on mark/door #(s):

#### Mechanical room and Storage room Doors

Each To Have:

Qty	Description	Catalog Number	Finish	Mfr
3	EA HW HINGE	5BB1HW 4.5 X 4.5 NRP	613	IVE
1	EA MORTISE LOCK	45H-7-D-15D-S1	613	BES
1	EA SURFACE CLOSER	4040XP SCUSH	695	LCN
1	SET SEALS	700ES	DKB	NGP
1	EA DOOR SWEEP	200NA	CL	NGP
1	EA SADDLE THRESHOLD	425	719	NGP

Operational Description

Self-Closing. Templating allows Spring CUSH Arm to stop the door's swing between 85 and 110 degrees.

**Hardware Group No. 4**

For use on mark/door #(s):

**4'-0" wide Closet Doors BI-PASS**

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	BI-PASS TRACK SET	9673-96	CL	HAG
2	EA	5x5 ADA Compliant Flush Cup Pull	27N32D	613	HAG

## SECTION 092116 - GYPSUM BOARD ASSEMBLIES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Acoustic insulation.
- C. Cementitious backing board.
- D. Gypsum wallboard.
- E. Joint treatment and accessories.

#### 1.2 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Building framing and sheathing.

#### 1.3 REFERENCE STANDARDS

- A. ANSI A108.11> ANSI A108/A118/A136.1 - American National Standard for Interior of Cementitious Backer Units 2010 (Revised).
- B. ANSI A118.9>ANSI A108/A118/A136.1 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2010).
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).
- E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.
- F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- I. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2022.
- J. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2022.
- K. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.

- L. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.
- M. ASTM C1288 - Standard Specification for Fiber-Cement Interior Substrate Sheets 2017.
- N. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2022.
- O. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- P. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2019, with Editorial Revision (2020).
- Q. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- R. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- S. ASTM E413 - Classification for Rating Sound Insulation 2022.
- T. GA-216 - Application and Finishing of Gypsum Panel Products 2021.

#### 1.4 SUBMITTALS

- A. See Section 013300 Submittals, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on gypsum board, glass mat faced gypsum board, accessories, joint finishing system, and cementitious tile backer board.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

### PART 2 PRODUCTS

#### 2.1 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions: Provide completed assemblies with the following characteristics:
  - 1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire Rated Assemblies: Provide completed assemblies complying with applicable code.

#### 2.2 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
  - 1. American Gypsum Company.
  - 2. CertainTeed Corporation.

3. National Gypsum Company.
  4. USG Corporation.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
  3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
    - b. Mold resistant board is required at all locations.
  4. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  5. Thickness:
    - a. Vertical Surfaces: 5/8 inch (16 mm).
    - b. Ceilings: 5/8 inch (16 mm).
  6. Mold Resistant Paper Faced Products:
    - a. American Gypsum Company; M-Bloc.
    - b. American Gypsum Company; M-Bloc Type X.
    - c. Continental Building Products; Mold Defense.
    - d. Continental Building Products; Mold Defense Type X.
    - e. Georgia-Pacific Gypsum; ToughRock Mold-Guard.
    - f. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
    - g. National Gypsum Company; Gold Bond XP Gypsum Board .
- C. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas including tub and shower surrounds.
  2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A108/A118/A136.1 or ASTM C1325.
    - a. Thickness: 1/2 inch (12.7 mm).

- b. Products:
  - 1) Custom Building Products: [www.custombuildingproducts.com](http://www.custombuildingproducts.com).
  - 2) National Gypsum Company: [www.nationalgypsum.com](http://www.nationalgypsum.com).
  - 3) USG Corporation: [www.usg.com](http://www.usg.com).
- 3. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
  - a. Thickness: 1/2 inch (12.7 mm).
  - b. Products:
    - 1) James Hardie Building Products, Inc: [www.jameshardie.com](http://www.jameshardie.com).
- 4. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
  - a. Application: Surfaces behind tile in semi-wet areas including areas adjacent to kitchen and bathroom sinks.
  - b. Standard Type: Thickness [5/8] inch ([ ] mm).
  - c. Products:
    - 1) Georgia-Pacific Gypsum; DensShield Tile Backer.
    - 2) National Gypsum Company; Gold Bond eXP Tile Backer.
- D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
  - 1. Application: Vertical surfaces behind thinset tile, except in wet areas.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  - 4. Type: Regular and Type X, in locations indicated.
  - 5. Type X Thickness: 5/8 inch (16 mm).
  - 6. Regular Board Thickness: 5/8 inch (16 mm).
  - 7. Edges: Tapered.
  - 8. Products:
    - a. American Gypsum Company; M-Bloc.
    - b. American Gypsum Company; M-Bloc Type X.

- c. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board.
- d. Georgia-Pacific Gypsum; DensArmor Plus.
- e. National Gypsum Company; Gold Bond XP Gypsum Board.

### 2.3 ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: [3 1/2] inch ([ ] mm).
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
  - 1. Architectural Reveal Beads:
    - a. Reveal Depth: 1/4 inch (6 mm).
    - b. Reveal Width: 1/4 inch (6 mm).
    - c. Shapes: As shown on drawings.
- D. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
  - 1. Ready-mixed vinyl-based joint compound.
- E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

### 3.2 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
  - 1. Place one bead continuously on substrate before installation of perimeter framing members.
  - 2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.



### 3.3 BOARD INSTALLATION

- A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
  - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- F. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108/A118/A136.1 and manufacturer's instructions.
- G. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For non-rated assemblies, install as follows:
  - 1. Single-Layer Applications: Screw attachment.

### 3.4 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  - 1. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

END OF SECTION

## **SECTION 093000 - TILING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Non-ceramic trim.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 092116 - Gypsum Board Assemblies: Tile backer board.

#### **1.3 REFERENCE STANDARDS**

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- C. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2021.
- D. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2019.
- E. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2019.
- F. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 2019.
- G. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2014 (Reaffirmed 2019).
- H. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014 (Reaffirmed 2019).
- I. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2019.
- J. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2022.
- K. ANSI A137.3 - American National Standard Specifications for Gauged Porcelain Tile and Gauged Porcelain Tile Panels/Slabs 2021.
- L. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2018.

- M. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2022.

#### 1.4 SUBMITTALS

- A. See Section 013300 – Submittals for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.
- D. Installer's Qualification Statement:
  - 1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.
- E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Tile: 1 percent of each size, color, and surface finish combination, but not less than one full carton of each type.

#### 1.5 QUALITY ASSURANCE

- A. Maintain one copy of ANSI A108/A118/A136 and TCNA (HB) on site.
- B. Installer Qualifications:
  - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

#### 1.7 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

### PART 2 PRODUCTS

#### 2.1 TILE

- A. Manufacturers:
  - 1. Dal-Tile Corporation: [www.daltile.com/#sle](http://www.daltile.com/#sle).

2. Anatolia; [www.anatolia.com](http://www.anatolia.com).
  3. Atlas Concorde; [www.atlasconcordeusa.com](http://www.atlasconcordeusa.com).
  4. Milestone Tile; [www.milestonetiles.com](http://www.milestonetiles.com)
  5. Edimax Ceramiche; [www.virginiatile.com](http://www.virginiatile.com)
- B. Ceramic Mosaic Tile, Type T-1: ANSI A137.1 standard grade.
1. Shape: Random linear.
  2. Color(s): As indicated on drawings.
  3. Mounted Sheet Size: 12 by 12 inches (305 by 305 mm).
  4. Products:
    - a. Basis of design Anatolia Glass & Stone Blend Mosaic Random Linear.
- C. Pressed Floor Tile, Type T-2: ANSI A137.1 standard grade.
1. Moisture Absorption: 0.5 to 3.0 percent as tested in accordance with ASTM C373.
  2. Size: 12 by 24 inch (305 by 610 mm), nominal.
  3. Thickness: 3/8 inch (9.5 mm) [9mm], nominal.
  4. Color(s): As indicated on drawings.
  5. Products:
    - a. Basis of design: Atlas Concorde USA, Fray.
- D. Porcelain Tile, Type T-2: ANSI A137.1 standard grade.
1. Size: 12 by 24 inch, nominal.
  2. Thickness: .354 inch (9 mm).
  3. Products:
    - a. Basis of design: Atlas Concorde USA, Fray.
- E. Porcelain Tile, Type T-3: ANSI A137.1 standard grade.
1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
  2. Size: 4 by 12 inch, nominal.
  3. Thickness: 3/8 inch (9.5 mm).
  4. Edges: Cushioned.
  5. Color(s): As indicated on drawings.

6. Pattern: Deco.
7. Products:
  - a. Basis of design: Edimax Ceramiche, More Deco.

F. Porcelain Tile, Type T-4: ANSI A137.3 standard grade.

1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
2. Size: 6 inch (152 mm) by 36 inch (914 mm), nominal.
3. Thickness: .394 inches [10 mm].
4. Edges: Square.
5. Color(s): As indicated on drawings.
6. Products:
  - a. Basis of design: Milestone Tiles, Pier.

2.2 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Brushed stainless steel, style and dimensions as indicated on drawings, for setting using tile mortar or adhesive.

1. Applications:
  - a. Open edges of wall and wall base tile.
  - b. Transition between floor finishes of different heights.
2. Manufacturers:
  - a. Basis of design: Schluter-Systems: [www.schluter.com/#sle](http://www.schluter.com/#sle); Jolly (open edges of wall tile).
  - b. Basis of design: Schluter-Systems: [www.schluter.com/#sle](http://www.schluter.com/#sle); Reno-TK (between floor finishes of different heights).
  - c. Genesis APS International: [www.genesis-aps.com/#sle](http://www.genesis-aps.com/#sle).
  - d. Winsen

B. Non-ceramic shelf, style and dimension as indicated on drawings, for setting using tile mortar or adhesive.

1. Application:
  - a. Corner shelf.
2. Manufacturers:

- a. Basis of design: Schluter-Systems: [www.schluter.com/#sle](http://www.schluter.com/#sle); Shelf-E - WAVE, #SES2 D10 EB.

## 2.3 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
  1. Custom Building Products: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
  2. H.B. Fuller Construction Products, Inc; <>: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
  3. Mapei; [www.mapei.com](http://www.mapei.com).
- C. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
  1. Applications: Use this type of bond coat at glass mosaic tile locations.
  2. Products:
    - a. Custom Building Products; Glass Tile Premium Thin-set Mortar: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. H.B. Fuller Construction Products, Inc; Design FX Tile Grout: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
    - c. Basis of design: Mapei; [www.mapei.com](http://www.mapei.com), Mosaic & Glass Tile Mortar.
- D. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
  1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.
  2. Products:
    - a. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. H.B. Fuller Construction Products, Inc; TEC 3N1 Performance Mortar: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
    - c. Basis of Design: Mapei, Ultraflex LFT.

## 2.4 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
  1. Custom Building Products: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
  2. H.B. Fuller Construction Products, Inc: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
  3. Mapei; [www.mapei.com](http://www.mapei.com).

- C. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
1. Applications: Walls.
  2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
  3. Color(s): As selected by Architect from manufacturer's full line.
  4. Products:
    - a. Custom Building Products; Prism Color Consistent  
Grout: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. H.B. Fuller Construction Products, Inc; TEC AccuColor Plus  
Grout: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
    - c. Basis of Design: Mapei, Flexcolor CQ.
- D. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
1. Color(s): As selected by Architect from manufacturer's full line.
  2. Color(s): As selected by Architect from manufacturer's full range of colors.
  3. Products:
    - a. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy  
Grout: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
    - b. H.B. Fuller Construction Products, Inc; TEC AccuColor EFX Epoxy Special Effects  
Grout: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
    - c. Basis of Design: Mapei, Kerapoxy.

## 2.5 Maintenance Materials

- A. Tile Sealer: Stain protection for natural stone tile.
- B. Grout Release: Temporary, water-soluble pre-grout coating.

## 2.6 ACCESSORY MATERIALS

- A. Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
  1. Crack Resistance: No failure at 1/8 inch (3.2 mm) gap, minimum.
  2. Fluid or Trowel Applied Type:
    - a. Material: Synthetic rubber or Acrylic.
    - b. Thickness: 20 mils (0.5 mm), maximum.
    - c. Products:

- 1) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
  - 2) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
  - 3) Basis of Design: Mapei; [www.mapei.com](http://www.mapei.com): AquaDefense.
- B. Waterproofing Membrane at floors and tiled shower walls in bathrooms: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum; comply with ANSI A118.12.
  2. Fluid or Trowel Applied Type:
    - a. Material: Synthetic rubber or Acrylic.
    - b. Thickness: 25 mils (0.6 mm), minimum, dry film thickness.
    - c. Products:
      - 1) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
      - 2) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
      - 3) Basis of Design: Mapei; [www.mapei.com](http://www.mapei.com): AquaDefense.
- C. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 7/16 inch (11 mm) thick; 2 inch (51 mm) wide coated glass fiber tape for joints and corners.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

#### 3.2 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.



- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

### 3.3 INSTALLATION - GENERAL

- A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

### 3.4 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F144, for cementitious backer boards, with polymer modified grout.

### 3.5 INSTALLATION - SHOWERS AND BATHTUB WALLS

- A. At bathtub walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.
- B. Grout with polymer modified grout as specified above.

### 3.6 INSTALLATION - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at showers.
- B. Grout with polymer modified grout as specified above.

### 3.7 CLEANING

- A. Clean tile and grout surfaces.

3.8 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

## **SECTION 096813 - TILE CARPETING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Carpet tile, fully adhered.

#### **1.2 RELATED REQUIREMENTS**

#### **1.3 REFERENCE STANDARDS**

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- B. CRI 104 - Standard for Installation of Commercial Carpet 2015.
- C. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

#### **1.4 SUBMITTALS**

- A. See Section 013300 – Submittals, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: Indicate layout of joints.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

#### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience.

#### **1.6 FIELD CONDITIONS**

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

#### A. Tile Carpeting:

1. Interface, Inc: [www.interface.com/#sle](http://www.interface.com/#sle).
2. Tarkett: [www.tarkett.com](http://www.tarkett.com).
3. Patcraft: [www.patcraft.com](http://www.patcraft.com).

### 2.2 MATERIALS

#### A. Tile Carpeting, Type CPT-1: Tufted, manufactured in one color dye lot.

1. Tile Size: 18 by 36 inch (457 by 914 mm), nominal.
2. Thickness: [.215] inch (5.5 mm).
3. Color: As indicated on drawings.
4. Pattern: Basis of design: Tarkett, Tundra Flower #11663.
5. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
6. Dye Method: Solution Dyed.
7. Gauge: [5/64] inch (2 mm).
8. Stitches: 10 per inch (4 per cm).
9. Secondary Backing Material: Ethos Modular with Omnicoat Technology.
10. Installation Method: Vertical Ashlar.

### 2.3 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Edge Strips: Embossed aluminum, color as selected by Architect.
- C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

### 3.2 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.

### 3.3 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

### 3.4 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

## **SECTION 099113 - EXTERIOR PAINTING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Materials for backpriming woodwork.
- D. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
  - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
  - 2. Exposed surfaces of steel lintels and ledge angles.
  - 3. Mechanical and Electrical:
    - a. On the roof and outdoors, paint equipment exposed to weather or to view, including factory-finished materials.
- E. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
  - 6. Floors, unless specifically indicated.
  - 7. Glass.
  - 8. Concealed pipes, ducts, and conduits.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 055000 - Metal Fabrications: Shop-primed items.
- B. Section 055100 - Metal Stairs: Shop-primed items.
- C. Section 099123 - Interior Painting.

1.3 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.
- C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- E. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1 2016.
- F. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual Volume 2 2021.
- G. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- H. SSPC-SP 2 - Hand Tool Cleaning 2018.
- I. SSPC-SP 3 - Power Tool Cleaning 2018.
- J. SSPC-SP 6 - Commercial Blast Cleaning 2007.
- K. SSPC-SP 13 - Surface Preparation of Concrete 2018.

1.5 SUBMITTALS

- A. See Section 013300 – Submittals, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
  - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
  - 3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

- D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
  - 3. Label each container with color in addition to the manufacturer's label.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

#### 1.8 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Paints:



1. Basis of Design Manufacturer: Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com) or system matching performance and product information for the basis of design product identified below.
  - B. Primer Sealers: Same manufacturer as top coats.
  - C. Substitutions: See Section 016000 - Product Requirements.
- 2.2 PAINTS AND FINISHES - GENERAL
- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
    1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
    2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
    3. Supply each paint material in quantity required to complete entire project's work from a single production run.
    4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
  - B. Volatile Organic Compound (VOC) Content:
    1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      - b. Architectural coatings VOC limits of the State in which the Project is located.
    2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
  - C. Flammability: Comply with applicable code for surface burning characteristics.
  - D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
  - E. Colors: As indicated in Color Schedule.
    1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
    2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

## 2.3 PAINT SYSTEMS - EXTERIOR

### A. Concrete, Opaque, Latex, 3 Coat:

1. One coat of primer for smooth concrete/masonry; A24W8300 Loxon Concrete And Masonry Interior/Exterior Latex Primer.
2. Semi-gloss: Two coats of latex enamel; B66W651 Pro Industrial High Performance Acrylic Semi-Gloss.

### B. Ferrous Metals, Unprimed, Latex, 3 Coat:

1. One coat of alkyd primer.
2. Semi-gloss: Two coats of water-based alkyd urethane; B53W01251 Pro Industrial Water-Based Alkyd Urethane Low Sheen.

### C. Ferrous Metals, Primed, Latex, 2 Coat:

1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
2. Semi-gloss: Two coats of water-based alkyd urethane; B53W01251 Pro Industrial Water-Based Alkyd Urethane Low Sheen.

### D. Galvanized Metals, Latex, 3 Coat:

1. One coat galvanize primer.
2. Semi-gloss: Two coats of water-based alkyd urethane; B53W01251 Pro Industrial Water-Based Alkyd Urethane Low Sheen.

## 2.4 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

- E. Test shop-applied primer for compatibility with subsequent cover materials.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
  - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
  - 2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- H. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- I. Galvanized Surfaces:
  - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
  - 2. Prepare surface according to SSPC-SP 2.
- J. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  - 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- K. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

### 3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- F. Apply each coat to uniform appearance.
- G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### 3.4 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### 3.5 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

### 3.6 COLOR SCHEDULE

END OF SECTION

## SECTION 099123 - INTERIOR PAINTING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
  - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
  - 2. Mechanical and Electrical:
    - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
    - b. In finished areas, paint shop-primed items.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
  - 6. Floors, unless specifically indicated.
  - 7. Ceramic and other tiles.
  - 8. Glass.
  - 9. Concrete masonry units in utility, mechanical, and electrical spaces.
  - 10. Acoustical materials, unless specifically indicated.
  - 11. Concealed pipes, ducts, and conduits.

#### 1.2 RELATED REQUIREMENTS

- A. Section 055000 - Metal Fabrications: Shop-primed items.

- B. Section 055100 - Metal Stairs: Shop-primed items.
- C. Section 099113 - Exterior Painting.
- D. Section 099300 - Staining and Transparent Finishing: Wood substrates.
- E. Section 099600 - High-Performance Coatings.

### 1.3 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- D. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1 2016.
- E. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual Volume 2 2021.
- F. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- G. SSPC-SP 2 - Hand Tool Cleaning 2018.
- H. SSPC-SP 3 - Power Tool Cleaning 2018.
- I. SSPC-SP 6 - Commercial Blast Cleaning 2007.
- J. SSPC-SP 13 - Surface Preparation of Concrete 2018.

### 1.4 SUBMITTALS

- A. See Section 013300 Submittal Procedures, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
  - 2. MPI product number (e.g., MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit one paper "draw down" sample, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
  - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.

3. Allow 30 days for approval process, after receipt of complete samples by Architect.
  4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.
- E. Maintenance Data: Submit data including product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
  2. Extra Paint and Finish Materials: Furnish an additional 5 percent, but not less than 1 gallon (4 L) of each color; from the same product run, store where directed.
  3. Label each container with color in addition to the manufacturer's label.

#### 1.5 QUALITY ASSURANCE

- A. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

#### 1.7 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F (3 degrees C) above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
- B. Paints:
  - 1. Basis of Design Manufacturer: Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com) or system matching performance and product information for the basis of design product identified below.
    - a. Benjamin Moore & Co: [www.benjaminmoore.com](http://www.benjaminmoore.com).
    - b. Behr Process Corporation: [www.behr.com/#sle](http://www.behr.com/#sle).
    - c. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
- C. Primer Sealers: Same manufacturer as top coats.

### 2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
  - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at [www.paintinfo.com](http://www.paintinfo.com), for specified MPI categories, except as otherwise indicated.
  - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
  - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    - b. Architectural coatings VOC limits of the State in which the Project is located.



2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified on drawings; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- E. Colors: As indicated on drawings.
  1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
  2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.
  3. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

### 2.3 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
  1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
  2. Two top coats and one coat primer.
  3. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, or 141.
    - a. Products:
      - 1) Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel.
- B. Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board, plaster, concrete, concrete masonry units, uncoated steel, shop primed steel, galvanized steel, and aluminum.
  1. Two top coats and one coat primer.
  2. Top Coat(s): High Performance (bathrooms wet areas, mechanical and storage rooms) Architectural Interior Latex; MPI #138, 139, 140, or 141.
    - a. Products:
      - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
  3. Top Coat(s): Institutional (all areas Unless noted otherwise) Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
    - a. Products:

- 1) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Egg shell.
4. Top Coat Sheen:
    - a. Eggshell: MPI gloss level 3; use this sheen at all locations, unless noted otherwise.
    - b. Semi-Gloss: MPI gloss level 5; use this sheen at bathrooms, wet areas, storage and mechanical.
- C. Ferrous Metals, Unprimed, Alkyd, 3 Coat:
1. One coat of alkyd primer.
  2. Semi-gloss: Two coats of alkyd enamel; B53W01151 Pro Industrial Water-Based Alkyd Urethane Semi-Gloss.
- D. Ferrous Metals, Primed, Alkyd, 2 Coat:
1. Touch-up with alkyd primer.
  2. Semi-gloss: Two coats of alkyd enamel; B53W01151 Pro Industrial Water-Based Alkyd Urethane Semi-Gloss.
- E. Galvanized Metals, Alkyd, 3 Coat:
1. One coat galvanize primer.
  2. Semi-gloss: Two coats of alkyd enamel; B53W01151 Pro Industrial Water-Based Alkyd Urethane Semi-Gloss.
- F. Gypsum Board/Plaster, Latex, 3 Coat:
1. One coat of latex primer sealer; B28W2600 ProMar 200 Zero VOC Interior Latex Primer.
  2. Semi-gloss: Two coats of latex enamel; K46-150 Series Pro Industrial Pre-Catalyzed Waterbased Epoxy.
  3. Egg shell: Two Coats of latex enamel; Sherwin-Williams ProMar 200 Zero VOC Interior Latex.
- G. Fabrics/Insulation Jackets, Latex, 3 Coat:
1. One coat of latex primer; B28W2600 ProMar 200 Zero VOC Interior Latex Primer.
  2. Eggshell: Two coats of latex; K45-150 Series Pro Industrial Pre-Catalyzed Waterbased Epoxy.
- 2.4 PRIMERS
- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Interior Drywall Primer Sealer.
    - a. Products:

- 1) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer.
2. Anti-Corrosive Alkyd Primer for Metal; MPI #134.
  - a. Products:
    - 1) Sherwin-Williams Pro-Cryl Univeral Primer.
3. Interior Rust-Inhibitive Water Based Primer; MPI #107.
  - a. Products:
    - 1) Sherwin-Williams Pro-Cryl Univeral Primer.
4. Interior Water Based Primer for Galvanized Metal; MPI #134.
  - a. Products:
    - 1) Sherwin-Williams Pro-Cryl Univeral Primer.

## 2.5 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
  1. Gypsum Wallboard: 12 percent.
  2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.

- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- I. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- J. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- K. Galvanized Surfaces:
  - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- L. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  - 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- M. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.
- N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

### 3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### 3.4 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### 3.5 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

### 3.6 SCHEDULE - PAINT SYSTEMS

- A. Gypsum Board: Finish surfaces exposed to view.
  - 1. Interior Walls, Ceilings, and Soffits:
    - a. Prime Coat(s): Primer Sealer, Latex, MPI #50.
      - 1) Sherwin Williams, B28W02600 ProMar 200 Zero VOC Interior Latex Primer
    - b. Intermediate Coat: Latex, Interior matching topcoat.
    - c. Top Coat: Latex, Interior Eggshell, (Gloss Level 3)
      - 1) Sherwin Williams, B20W12651 ProMar 200 200 Zero VOC Interior Latex, Egg-Shell.
    - d. Locations: General use kitchen, living room bedrooms and hallways, U.N.O.
  - 2. Interior Walls, Ceilings and Soffits:
    - a. Prime Coat(s): Primer Sealer, Latex, MPI #50.
      - 1) Sherwin Williams, B28W02600 ProMar 200 Zero VOC Interior Latex Primer
    - b. Intermediate Coat: Latex, Interior matching topcoat.
    - c. Top Coat: Latex, Interior Semi-Gloss, (Gloss Level 5)
      - 1) Sherwin Williams, K46-150 Series ProIndustrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss.

- d. Locations: Areas with plumbing fixtures and high use areas including, but not limited to, , mechanical rooms, storage rooms and bathrooms.
- B. Steel Doors and Frames: Finish surfaces exposed to view.
- 1. Prime Coat:
    - a. Sherwin Williams, Pro Industrial Pro-Cryl Universal Metal Primer, B66-310 Series.
  - 2. Intermediate Coat: Latex interior, institutional low-odor/VOC, matching topcoat.
  - 3. Top Coat:
    - a. Sherwin Williams, B53W01151 Pro Industrial Water-Based Alkyd Urethane, Semi-Gloss.

END OF SECTION

## **SECTION 099300 - STAINING AND TRANSPARENT FINISHING**

### **PART 1 GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section includes surface preparation and application of wood finishes.

- 1. Exterior Substrates:

- a. Exposed dimension lumber (rough carpentry).
- b. Dressed lumber (finish carpentry).
- c. Exposed wood panel products.
- d. Wood decks and stairs.

- 2. Interior Substrates:

- a. Exposed glued-laminated beams and columns.
- b. Exposed dimension lumber (rough carpentry).
- c. Dressed lumber (finish carpentry).
- d. Exposed wood panel products.

- B. Related Requirements:

- 1. Section 099113 "Exterior Painting" for standard paint systems on exterior substrates.
- 2. Section 099123 "Interior Painting" for stains and transparent finishes on concrete floors.

#### **1.3 DEFINITIONS**

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- D. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.
- B. Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.
  - 1. Submit Samples on representative samples of actual wood substrates, 8 inches square or 8 inches long.
  - 2. Label each Sample for location and application area.
- C. Product List: For each product indicated, include the following:
  - 1. Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules.
  - 2. VOC content.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. of each material and color applied.

#### 1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Construction Representative will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
    - b. Other Items: Construction Representative will designate items or areas required.
  - 2. Final approval of stain color selections will be based on mockups.
    - a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Construction Representative at no added cost to Owner.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.



1.8 FIELD CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply finishes when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. DEFY (Basis of Design).
  - 2. Behr Process Corporation.
  - 3. Sherwin-Williams.
  - 4. Approved Equivalent.
- B. Basis of Design: DEFY Extreme Exterior Semi-Transparent Wood Stain; SaverSystems, Richmond, Indiana.
  - 1. Stain, Exterior, Water based, synthetic-resin, Semi-Transparent: DEFY, "Butternut".

2.2 MATERIALS, GENERAL

- 1. Provide materials to achieve a complete exterior finish system application including manufacturer's wood cleaning and wood brightening surface preparation products.
- 2. Provide materials for use within each finish 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
- 3. For each coat in the finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Materials: Owner reserves the right to invoke the following procedure:
  - 1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
  - 2. Testing agency will perform tests for compliance with product requirements.

3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Construction Representative, are aesthetically unacceptable.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with finish application only after unsatisfactory conditions have been corrected.
  1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

#### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
  1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
  1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
  2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
- D. Exterior Wood Substrates:
  1. Scrape and clean knots, and apply coat of knot sealer before applying primer.

2. Prime edges, ends, faces, undersides, and backsides of wood.
  - a. For solid hide stained wood, stain edges and ends after priming.
  - b. For varnish coated stained wood, stain edges and ends and prime with varnish. Prime undersides and backsides with varnish.

E. Interior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Apply wood filler paste to open-grain woods to produce smooth, glasslike finish.
3. Sand surfaces that will be exposed to view and dust off.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

### 3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
  1. Use applicators and techniques suited for finish and substrate indicated.
  2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
  3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

### 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Construction Representative, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

END OF SECTION

## SECTION 101416 - PLAQUES

### PART 1 GENERAL

- 1.1 Section Includes
  - A. Plaques.
- 1.2 Reference Standards
  - A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
  - B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
  - C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- 1.3 Submittals
  - A. See Section 013300 for Submittal Procedures for submittal procedures.
  - B. Product Data: Manufacturer's product literature for each type of plaque sign, indicating style, font, foreground and background colors, locations, and overall dimensions of each sign.
  - C. Shop Drawings: Indicate dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
  - D. Selection Samples: Where materials, colors, and finishes are not specified, submit two sets of color selection charts or chips.
- 1.4 Quality Assurance
  - A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- 1.5 Delivery, Storage, and Handling
  - A. Package plaque signs as required to prevent damage before installation.
  - B. Store under cover and elevated above grade.

### PART 2 PRODUCTS

- 2.1 Manufacturers
  - A. Plaques:
    - 1. FASTSIGNS International, Inc: [www.fastsigns.com/#sle](http://www.fastsigns.com/#sle).
    - 2. ASI Signage; [www.asisignage.com](http://www.asisignage.com).
    - 3. Ace Sign Company: [www.acesignco.com/](http://www.acesignco.com/).

2.2 Regulatory Requirements

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.3 Plaques (S-1)

A. Cabin Designation Metal Plaques:

1. Material: Aluminum casting.
2. Material Thickness: 1/8 inch (3 mm), minimum.
3. Size: 15 inches by 7 inches (381 mm by 178 mm).
4. Text and Typeface:
  - a. Character Font: Match existing cabins.
  - b. Character Case: Upper and lower case (title case).
  - c. Character Color: Contrast with background color.
5. Border Style: Single line.
6. Painted Background Color: Medium bronze. Match Existing
7. Protective Coating: Manufacturer's standard clear coating.
8. Mounting: Exposed fastener through the face .
9. Products:
  - a. Basis of design: ASI, SignEtch II.

B. Acrylic Plaques (S-3):

1. Material Thickness: 1/8 inch minimum.
2. Size: As indicated on drawings.
3. Text and Typeface:
  - a. Character Font: Helvetica, Arial, or other sans serif font.
  - b. Character Case: Upper and lower case (title case).
  - c. Character Color: Contrast with background color.
4. Border Style: As indicated on drawings.
5. Background Color: As indicated on drawings.
6. Mounting: Double stick adhesive tape.

7. Products:
  - a. Basis of design: ASI Signage, InTac.

C. Acrylic Plaques (S-4)

1. Material Thickness: 1/4 inch.
2. Size: As indicated on drawings.
3. Text and Typeface:
  - a. Character Font: Helvetica, Arial or other sans serif font.
  - b. Character Case: Upper and lower case (title case).
  - c. Character color: Contrast with background color.
4. Border Style: As indicated on drawings.
5. Background Color: As indicated on drawings.
6. Mounting: Mechanically fastened, concealed.
7. Products:
  - a. Basis of design: ASI Signage, InTac.

2.4 Accessories

- A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, or other.

PART 3 EXECUTION

3.1 Examination

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.2 Installation

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate plaque signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until substantial completion; repair or replace damaged items.

END OF SECTION

## SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

### PART 1 GENERAL

- 1.1 Section Includes
  - A. Cut vinyl letter signage.
- 1.2 Reference Standards
  - A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
  - B. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- 1.3 Submittals
  - A. See Section 013300 - Submittals for submittal procedures.
  - B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.
  - C. Shop Drawings:
    - 1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
  - D. Verification Samples: Submit samples showing colors and finishes specified.
  - E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- 1.4 Quality Assurance
  - A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- 1.5 Delivery, Storage, and Handling
  - A. Package dimensional letter signs as required to prevent damage before installation.
  - B. Store under cover and elevated above grade.
- 1.6 Field Conditions
  - A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
  - B. Maintain minimum ambient temperature during and after installation.

### PART 2 PRODUCTS

- 2.1 Manufacturers
  - A. Cut Vinyl Letter Signs:
    - 1. FASTSIGNS International, Inc: [www.fastsigns.com/#sle](http://www.fastsigns.com/#sle).

2. ASI Signage; [www.asisignage.com](http://www.asisignage.com).
3. Ace Sign Company; [www.acesignco.com](http://www.acesignco.com).

## 2.2 Cut Vinyl Letters

- A. Applications: Mechanical and storage areas.
  1. Use individual cut vinyl letters.
  2. Mounting Location: Exterior as indicated on drawings.
- B. Plastic Letters:
  1. Material: Vinyl sheet, flat cutout.
  2. Thickness: Manufacturer's standard for letter size.
  3. Letter Height: As indicated on drawings.
  4. Text and Typeface:
    - a. Character Font: Helvetica, Arial, or other sans serif font.
    - b. Character Case: Upper case only.
  5. Finish: Matte.
  6. Color: As selected by Architect from manufacturer's standard colors.
  7. Mounting: Self-adhered.
  8. Products:
    - a. Basis of design: ASI Signage, Exterior Cut Vinyl Letters.

## PART 3 EXECUTION

### 3.1 Examination

- A. Verify that substrate surfaces are ready to receive work.
- B. Coordinate schedule of installation with paint sub-contractor to ensure substrate finish has cured and is ready for application.
- C. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

### 3.2 Installation

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.



- C. Locate dimensional letter signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until substantial completion; repair or replace damaged items.

END OF SECTION

## **SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES**

### **PART 1 GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Accessibility accessories
  - 2. Standard Washroom and Bathroom accessories.
  - 3. Themed Washroom and Bathroom accessories.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include the following:
  - 1. Construction details and dimensions.
  - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Material and finish descriptions.
  - 4. Features that will be included for Project.
  - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
  - 1. Identify locations using room designations indicated.
  - 2. Identify products using designations indicated.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Warranty: Sample of special warranty.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

#### **1.6 QUALITY ASSURANCE**

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

- 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.

#### 1.7 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

#### 1.8 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 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, 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: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

#### 2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. A & J Washroom Accessories, Inc.

2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.

### 2.3 ACCESSIBILITY ACCESSORIES

#### A. Grab Bar T11:

1. Basis-of-Design Product: Bobrick; B5806.99 x 42.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
  - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: Straight, 42 inches long.

#### B. Grab Bar T10:

1. Basis-of-Design Product: Bobrick; B5806.99 x 36.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
  - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches .
5. Configuration and Length: Straight, 36 inches long.

#### C. Grab Bar T9:

1. Basis-of-Design Product: Bobrick; B-5806.99 x 24.
2. Mounting: Flanges with fasteners.
3. Material: Stainless steel, 0.05 inch thick.
  - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches .
5. Configuration and Length: Straight, 24 inches long.

#### D. Grab Bar T8:

1. Basis-of-Design Product: Bobrick; B-5806.99 x 18.
2. Mounting: Flanges with fasteners.

3. Material: Stainless steel, 0.05 inch thick.
  - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches .
5. Configuration and Length: Straight, 18 inches long.

E. Shower Seat T3:

1. Basis-of-Design Product: Bobrick; B5181.
2. Configuration: L-shaped seat, designed for wheelchair access.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).

2.4 THEMED TOILET AND BATH ACCESSORIES

A. Basis-of-Design Products for themed accessories are selected for a combination of aesthetic and functional properties to fit the character of this project's interior design. Subject to compliance with requirements, provide product indicated or approved comparable product.

1. Any requests for substitution must be accompanied by a detailed comparison of significant qualities of proposed substitution with those of the product specified. Significant qualities may include attributes such as performance and visual effect. Indicate deviations, if any, from the product specified.

B. Mirror Unit T2:

1. Basis-of-Design Product: Kohler Westmore, K-2504.
2. Frame: Wood with catalyzed polyurethane finish, F41 color.
3. Hangers: Manufacturer's standard hanger.
4. Size: 24" wide x 33" high x 1" deep.

C. Hotelier T4:

1. Basis-of-Design Product: Basis-of-Design Product: Kohler, Artifacts Hotelier K-72575-2BZ.
2. Size: 27 inch wide x 10 inch deep x 7-1/2 inch high.
3. Finish: Oil rubbed bronze.

D. Toilet Tissue (Roll) Holder T1:

1. Basis-of-Design Product: Estrend Wall Mounted Dual Roll Toilet Paper Holder with Shelf, B09W2QD63K ([www.amazon.com](http://www.amazon.com)).
2. Description: Double-roll holder.

3. Mounting: Wall mounted.
4. Size: 11.06 inches wide by 4.76 inches deep by 3.7 inches high.
5. Capacity: Designed for 4-1/2- or 5-inch-diameter tissue rolls.
6. Finish: Oil rubbed bronze.

E. Shower Curtain Rod T6:

1. Basis-of-Design Product: Kamanina US Curved Shower Curtain Rod, 54-90 inches, Heavy Duty Premium Aluminum, TW-080250199-US-F1 ([www.amazon.com](http://www.amazon.com)).
2. Description: Curved Shower Curtain Rod
3. Mounting: Surface mounted.
4. Width:
  - a. 60" wide for tub openings.
5. Finish: Oil rubbed bronze.

F. Towel Bar T-5:

1. Basis-of-Design Product: Kohler Artifacts, K-72567.
2. Size: 21" overall width x 3 1/2" deep x 3" high.
3. Finish: Oil rubbed bronze.

G. Double Robe Hook T-7:

1. Basis of Design Product: Kohler Artifacts, K-72572-2BZ.
2. Size: 4-7/8" wide.
3. Finish: Oil rubbed bronze.

## 2.5 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf , when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

## **SECTION 103100 - MANUFACTURED FIREPLACES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Manufactured steel box fireplace.
- B. Accessories, including firestop spacer, circulating fan, and exposed cladding.
- C. Insulated chimney flue and associated roof flashings.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 221105 - Plumbing Piping: For gas piping to fire box.
- B. Section 260583 - Wiring Connections.

#### **1.3 REFERENCE STANDARDS**

- A. UL (DIR) - Online Certifications Directory Current Edition.
- B. UL 127 - Standard for Factory-Built Fireplaces Current Edition, Including All Revisions.

#### **1.4 SUBMITTALS**

- A. See Section 013300 Submittal Procedures, for submittal procedures.
- B. Product Data: Provide fire box cabinet dimensions, clearances required from adjacent dissimilar construction, applicable regulatory agency approvals, electrical characteristics of fan.
- C. Shop Drawings: Indicate fire box rough opening dimensions, rough opening sizes for chimney flue, and fan size.
- D. Manufacturer's Certificate: Certify that fireplace components meet or exceed UL (DIR) requirements.
- E. Manufacturer's Instructions: Indicate installation procedures and component installation sequence, clearances and tolerances from adjacent construction.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Manufactured Fireplaces:
  - 1. Basis of Design Manufacturer for Single Sided Gas Fireplaces: Majestic Quartz Series.
    - a. Direct Vent, Single Sided Gas Fireplace : Basis of Design is Majestic Quartz 36 w/IFT.
  - 2. Alternative Manufacturers, subject to compliance with project requirements, provide comparable products by one of the following manufacturers:
  - 3. Heat & Glo: [www.heatnglo.com/#sle](http://www.heatnglo.com/#sle).



4. Heatilator.

## 2.2 REGULATORY REQUIREMENTS

- A. Comply with applicable code for clearances from adjacent materials, chimney height above roof line requirements, and unit UL approval.
- B. Listed by Underwriters Laboratories Inc. (UL) as complying with UL 127.
- C. Products Requiring Electrical Connection: Listed and labeled by UL (DIR) or testing firm acceptable to authorities having jurisdiction, as suitable for the purpose specified and indicated.

## 2.3 COMPONENTS

- A. Fire Box: Formed insulated steel cabinet, rectangular shaped interior, configured to include chimney outlet and cleanout, refractory brick lining.
  1. Hearth Opening: 32 inches (812 mm) wide by 22 1/2 inches (571 mm) high viewing area by 16 inches (406 mm) deep.
  2. Flue Diameter: 8 inches (203 mm).
  3. Combustion Air Source: Ducted outside air with screened grilles and ducts.
  4. Air Jacket: Steel enclosure surrounding fire box, air inlets and outlets, electrical fan.
  5. BTU Rating: 22,000 BTU LP gas input..
- B. Exposed Cladding: Prepainted steel.
- C. Front: Clear Tempered glass manufactures standard.
- D. "Tavern Brown" interior fire brick.
- E. Sealed unit with tempered glass.
- F. Circulating Fans: Manufacturer's standard variable speed circulating fan compatible with specified fireplace.
- G. Natural flame burner system with ceramic fire log and ember bed.
- H. Controls: Wall mounted fan on off switch and wall mounted wireless controls. Features on/off, battery strength indicator, cold climate mode. Install in accordance with manufactures
- I. Fire Box Closure: Clear, tempered glass doors in black steel frame, butt hinged, with friction catch.
- J. Flue Construction: Insulated stainless steel sandwich construction, modular sized sections with elbows and spacing collars to permit site assembly, air and fire stop collars, elbows, elbow offsets, tees, supports, roofing storm collar, roof flashing; nominal inside diameter of 8 inches (200 mm).
- K. Roof Terminations: Round terminal cap. Manufacture standard for venting and combustion air intake.
  1. Decorative termination cap to match existitng:

- a. Basis of Design: Octagon DTO134-CP/DTO146-CP by Hearth & Home or approved equivalent.

## 2.4 FACTORY FINISHING

- A. Exposed to View Surfaces: Baked enamel, Black color.

## 2.5 ACCESSORIES

- A. Firestop Spacer: Non-combustible device designed to fit between chimney riser and penetrated floor or roof construction framing.
- B. Roof Flashing: Pre-finished sheet metal, configured to fit tightly to chimney riser and seal to shingle roofing system.
- C. Circulating Fans: Motor and fan, UL approved, 120 volts with remote on/off switch, sheet steel enclosure, and face grille.
- D. Fasteners and Anchors: Galvanized steel type.

## PART 3 EXECUTION

### 3.1 VERIFICATION OF CONDITIONS

- A. Verify that prepared openings are ready to receive work and opening dimensions are as indicated on drawings.
- B. Verify that proper power supply and fuel source are available.

### 3.2 INSTALLATION

- A. Install unit assembly in accordance with manufacturer's instructions. Install in accordance with manufacturer's instructions, ANSI Z21.44 and the requirements of authorities having jurisdiction. Use manufacturer's guidelines for minimum clearances to combustibles, walls, and finishes. Anchor all components firmly in position for long life under hard use.
- B. Coordinate installation of controls, wiring, piping with construction of finished surrounds.
- C. Install chimney plumb through prepared openings using fire stop spacers.
- D. Secure chimney in opening framing with appropriate fasteners.
- E. Carefully cut holes for fan wall switch and grilles.
- F. Install roof flashings to ensure moisture is shed from chimney flue.

### 3.3 TOLERANCES AND QUALITY CONTROL

- A. Maximum Variation of Chimney From Plumb: 1/2 inch (12 mm).
- B. Upon completion of installation, visually inspect all exposed surfaces. Touch up scratches and abrasions with touch-up paint recommended by the manufacturer, make imperfections invisible to the unaided eye from a distance of 5 feet (1.5m).

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C. Test for proper operation, control and safety devices.

END OF SECTION

## **SECTION 104400 - FIRE PROTECTION SPECIALTIES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Accessories.

#### **1.2 REFERENCE STANDARDS**

- A. FM (AG) - FM Approval Guide current edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers 2022.
- C. UL (DIR) - Online Certifications Directory Current Edition.

#### **1.3 SUBMITTALS**

- A. See Section 013300 Submittal Procedures, for submittal procedures.
- B. Product Data: Provide color and finish and installation instructions.
- C. Shop Drawings: Indicate mounting measurements for wall bracket, installation procedures, and accessories required for complete installation.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

#### **1.4 FIELD CONDITIONS**

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Fire Extinguishers:
  - 1. Activar Construction Products Group, Inc. - JL Industries: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
  - 2. Ansul, a Tyco Business: [www.ansul.com/#sle](http://www.ansul.com/#sle).
  - 3. Kidde, a unit of United Technologies Corp: [www.kidde.com/#sle](http://www.kidde.com/#sle).
  - 4. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  - 5. Potter-Roemer: [www.potterroemer.com/#sle](http://www.potterroemer.com/#sle).
  - 6. Substitutions: See Section 016000 - Product Requirements.

## 2.2 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
  - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
  - 1. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
  - 2. Class: A:B:C type.
  - 3. Size: 10 pound (4.54 kg).
  - 4. Finish: Baked polyester powder coat, color as selected.
  - 5. Provide manufactures standard wall mounting bracket.
  - 6. Temperature range: Minus 65 degrees F (Minus 54 degrees C) to 120 degrees F (49 degrees C).
  - 7. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

## 2.3 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for bracket are correctly sized and located.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and ADA mounting requirements for accessibility. Refer to drawings.
- B. Secure rigidly in place.
- C. Place extinguishers on wall brackets.

END OF SECTION

## SECTION 123600 - COUNTERTOPS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Countertops for architectural cabinet work.
- B. Window sills.

#### 1.2 RELATED REQUIREMENTS

- A. Section 064100 - Architectural Wood Casework.
- B. Section 224000 - Plumbing Fixtures: Sinks.

#### 1.3 REFERENCE STANDARDS

- A. AWI (QCP) - Quality Certification Program Current Edition.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- C. AWMAC (GIS) - Guarantee and Inspection Services Program Current Edition.
- D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.
- E. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- F. PS 1 - Structural Plywood 2009 (Revised 2019).

#### 1.4 SUBMITTALS

- A. See Section 013300 Submittal Procedures for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Verification Samples: For each finish product specified, minimum size 8 inches (203 mm) square, representing actual product, color, and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Installation Instructions: Manufacturer's installation instructions and recommendations.
- G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience.
- B. Quality Standards:
  - 1. Comply with AWI (QCP) woodwork association quality standards in accordance with requirements for work specified in this section: [www.awiqcp.org/#sle](http://www.awiqcp.org/#sle).
  - 2. Comply with AWMAC (GIS) woodwork association quality standards in accordance with requirements for work specified in this section.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

## 1.7 FIELD 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 absolute limits.

## PART 2 PRODUCTS

### 2.1 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
  - 1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
  - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic resin, unfilled, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    - a. Manufacturers:
      - 1) Dupont; <>: [www.corian.com](http://www.corian.com).
      - 2) Formica Corporation; <>: [www.formica.com](http://www.formica.com).
      - 3) Wilsonart; <>: [www.wilsonart.com](http://www.wilsonart.com).
      - 4) Substitutions: See Section 016000 - Product Requirements.
    - b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    - c. Color and Pattern: As indicated on drawings.

3. Other Components Thickness: 1/2 inch (12 mm), minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/2 inch (<math>\lt; \infty \text{ mm}</math>) thick; edge profile as indicated on drawings.
5. Back Splash: Same sheet material, integral, eased edge, minimum 4" high.
6. Skirts: As indicated on drawings.
7. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Premium Grade.

## 2.2 WINDOW SILLS

- A. Flat Sheet Thickness: 1/2 inch, minimum.
- B. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic resin, unfilled, and pigments; homogeneous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
  1. Manufacturers:
    - a. Dupont: [www.corian.com](http://www.corian.com).
    - b. Formica Corporation: [www.formica.com](http://www.formica.com).
    - c. Wilsonart: [www.wilsonart.com](http://www.wilsonart.com).
  2. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
  3. Color and Pattern: As indicated on drawings.
- C. Other Components Thickness: 1/2 inch, minimum.

## 2.3 ACCESSORY MATERIALS

- A. Wood-Based Components:
  1. Wood fabricated from old growth timber is not permitted.
- B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
- C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- D. Joint Sealant: Mildew-resistant silicone sealant, white.
- E. Support Brackets for countertops without base cabinets: Heavy-duty steel
  1. Provide where shown on plans and elevations and at 48" o.c. maximum.
    - a. Color: To be selected by Architect from manufacturer's entire selection.



2. Manufacturers:
  - a. Knappe and Vogt; 208 TI 550 Ultimate L-Bracket: [www.kv.com](http://www.kv.com).
  - b. A & M Hardware, Inc.; 18X24 Regular Brackets, Gray: [www.aandmhardware.com](http://www.aandmhardware.com).
  - c. Architect approved equal.
  - d. Substitutions: See Section 01 6000 - Product Requirements.

## 2.4 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  1. Join lengths of tops using best method recommended by manufacturer.
  2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
  3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide integral back splash wherever counter edge abuts vertical surface unless otherwise indicated.
  1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  2. Height: 4 inches (102 mm), unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops up to 144 inches (3,657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

### 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. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).
- C. Seal joint between back/end splashes and vertical surfaces.

3.4 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.
- B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.
- C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.5 CLEANING

- A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

## **SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Above ground piping.
- B. Escutcheons.
- C. Pipe hangers and supports.
- D. Pipe sleeves.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 078400 - Firestopping.
- B. Section 210523 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- C. Section 210553 - Identification for Fire Suppression Piping and Equipment: Piping identification.
- D. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

#### **1.3 REFERENCE STANDARDS**

- A. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.
- C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- D. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2022).
- E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- F. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use 2021.
- G. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2022a.
- H. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- I. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40 2017.
- J. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 2019.

- K. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR) 2020.
- L. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings 2022.
- M. ITS (DIR) - Directory of Listed Products Current Edition.
- N. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL (DIR) - Online Certifications Directory Current Edition.
- P. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

#### 1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.
- B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- C. Installer's qualification statement.
- D. Operation and Maintenance Data: Include installation instructions and spare parts lists.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section.
  - 1. Minimum three years experience.
- C. Comply with UL (DIR) requirements.
- D. Valves: Bear UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- E. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
- F. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

### PART 2 PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

- A. Sprinkler-based System:
  - 1. Comply with NFPA 13D.

- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

## 2.2 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A795 Schedule 40, black.
  - 1. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
  - 2. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
- B. CPVC Pipe: ASTM F442/F442M, SDR 13.5.
  - 1. Fittings: ASTM F438 Schedule 40, or ASTM F439 schedule 80, CPVC.
  - 2. Joints: Solvent welded, using ASTM F493 cement.

## 2.3 PIPE SLEEVES

- A. Vertical Piping:
  - 1. Sleeve Length: 1 inch (25 mm) above finished floor.
  - 2. Provide sealant for watertight joint.
- B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- C. Not required for wall hydrants for fire department connections or in drywall construction.
- D. Clearances:
  - 1. Provide allowance for insulated piping.
  - 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external; pipe diameter.
  - 3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

## 2.4 ESCUTCHEONS

- A. Manufacturers:
  - 1. Fire Protection Products, Inc: [www.fppi.com/#sle.com](http://www.fppi.com/#sle.com).
  - 2. Tyco Fire Protection Products: [www.tyco-fire.com](http://www.tyco-fire.com).
  - 3. Viking Group Inc: [www.vikinggroupinc.com](http://www.vikinggroupinc.com).
- B. Material:

1. Fabricate from nonferrous metal.
2. Metals and Finish: Comply with ASME A112.18.1.

C. Construction:

1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.5 PIPE HANGERS AND SUPPORTS

A. Nonmetallic Piping Hangers:

1. Manufacturers:
  - a. DecoShield Systems, Inc; Snap-2 Hangers: [www.decoshield.com](http://www.decoshield.com).

B. Seismic Hangers and Couplings:

1. Provide coupling with a factory set disengagement rating of 140 percent to 160 percent of the static weight.
2. Provide resettable and reusable, break away couplings.
3. Coupling to be manufactured from non-corrosive materials.
4. Manufacturers:
  - a. The Metraflex Company; Seismic BreakAway Hanger: [www.metrafire.com](http://www.metrafire.com).

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13D.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Pipe Hangers and Supports:
  1. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
  2. Place hangers within 12 inches (300 mm) of each horizontal elbow.
  3. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

4. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
  - F. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
  - G. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
    1. Aboveground Piping:
      - a. Pack solid using mineral fiber complying with ASTM C592.
      - b. Fill space with an elastomer caulk to a depth of 0.50 inch (15 mm) where penetrations occur between conditioned and unconditioned spaces.
    2. All Rated Openings: Caulk tight with firestopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
  - H. Escutcheons:
    1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
    2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
  - I. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.
- 3.2 CLEANING
- A. Upon completion of work, clean all parts of the installation.
  - B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

## **SECTION 210523 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Two-piece ball valves with indicators.
- B. Check valves.
- C. Trim and drain valves.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 078400 - Firestopping.
- B. Section 210500 - Common Work Results for Fire Suppression: Pipe and fittings.
- C. Section 210553 - Identification for Fire Suppression Piping and Equipment.
- D. Section 211300 - Fire-Suppression Sprinkler Systems.
- E. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

#### **1.3 REFERENCE STANDARDS**

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).
- B. FM (AG) - FM Approval Guide current edition.
- C. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL (DIR) - Online Certifications Directory Current Edition.
- E. UL 312 - Check Valves for Fire-Protection Service Current Edition, Including All Revisions.
- F. UL 1091 - Standard for Butterfly Valves for Fire-Protection Service Current Edition, Including All Revisions.

#### **1.4 SUBMITTALS**

- A. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications:



1. Company must specialize in manufacturing products specified in this section, with not less than three years of experience.
  - B. Where listed products are specified, provide products listed, classified, and labeled by UL (DIR) as suitable for the purpose indicated.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Prepare valves for shipping as follows:
    1. Protect internal parts against rust and corrosion.
    2. Protect threads and flange faces.
    3. Set valves open to minimize exposure of functional surfaces.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. UL Listed: Provide valves listed in UL (DIR) under following headings and bearing UL mark:
  1. Main Level: HAMV - Fire Main Equipment.
    - a. Level 3: HLUG - Ball Valves, System Control.
    - b. Level 3: HMER - Check Valves.
- B. Comply with NFPA 13R for valves.
- C. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.
- D. Valve Sizes: Same as upstream piping unless otherwise indicated.

### 2.2 TWO-PIECE BALL VALVES WITH INDICATORS

- A. UL 1091, except with ball instead of disc and FM (AG) standard listing for indicating valves (butterfly or ball type), Class Number 1112.
- B. Description:
  1. Minimum Pressure Rating: 175 psig (1200 kPa).
  2. Body Design: Two piece.
  3. Body Material: Forged brass or bronze.
  4. Port Size: Full or standard.
  5. Seat: PTFE.
  6. Stem: Bronze or stainless steel.

7. Ball: Chrome-plated brass.
8. End Connections for Valves 1 NPS (25 DN) through 2 NPS (50 DN): Threaded ends.

### 2.3 CHECK VALVES

- A. UL 312 and FM (AG) standard listing for check valves, Class Number 1045.
- B. Minimum Pressure Rating: 175 psig (1200 kPa).
- C. Type: Center guided check valve.
- D. Body Material: Cast iron, ductile iron.
- E. Center guided check with elastomeric seal.
- F. Hinge Spring: Stainless steel.
- G. End Connections: Flanged, grooved, or threaded.

### 2.4 TRIM AND DRAIN VALVES

- A. Ball Valves:
  1. Description:
    - a. Pressure Rating: 175 psig (1200 kPa).
    - b. Body Design: Two piece.
    - c. Body Material: Forged brass or bronze.
    - d. Port Size: Full or standard.
    - e. Seat: PTFE.
    - f. Stem: Bronze or stainless steel.
    - g. Ball: Chrome-plated brass.
    - h. Actuator: Hand-lever.
    - i. End Connections for Valves 1 NPS (25 DN) through 2-1/2 NPS (65 DN): Threaded ends.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Confirm valve interior to be free of foreign matter and corrosion.
- B. Remove packing materials.
- C. Examine guides and seats by operating valves from the fully open position to the fully closed position.

- D. Examine valve threads and mating pipe for form and cleanliness.

### 3.2 INSTALLATION

- A. Comply with specific valve installation requirements and application in the following Sections:
  - 1. Section 211300 for application of valves in wet and dry pipe, fire-suppression sprinkler systems.
- B. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.
- C. Valves in horizontal piping installed with stem at or above the pipe center.
- D. Position valves to allow full stem movement.

END OF SECTION

## **SECTION 210553 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Nameplates

#### **1.2 REFERENCE STANDARDS**

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

#### **1.3 SUBMITTALS**

- A. Product Data: Provide manufacturers catalog literature for each product required.

### **PART 2 PRODUCTS**

#### **2.1 IDENTIFICATION APPLICATIONS**

- A. Valves: Nameplates.

#### **2.2 NAMEPLATES**

- A. Manufacturers:
  - 1. Brimar Industries, Inc: [www.pipemarker.com](http://www.pipemarker.com).
  - 2. Kolbi Pipe Marker Co: [www.kolbipipemarkers.com](http://www.kolbipipemarkers.com).
  - 3. Seton Identification Products, a Tricor Direct Company: [www.seton.com](http://www.seton.com).
- B. Description: Laminated three-layer plastic with engraved letters.
  - 1. Letter Color: White.
  - 2. Letter Height: 1/4 inch (6 mm).
  - 3. Background Color: Black.
  - 4. Thickness: 1/8 inch (3 mm).
  - 5. Plastic: Comply with ASTM D709.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

END OF SECTION

## **SECTION 211300 - FIRE-SUPPRESSION SPRINKLER SYSTEMS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 210500 - Common Work Results for Fire Suppression: Pipe and fittings.
- B. Section 210523 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.
- D. Section 284600 - Fire Detection and Alarm.

#### **1.3 REFERENCE STANDARDS**

- A. ITS (DIR) - Directory of Listed Products Current Edition.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL (DIR) - Online Certifications Directory Current Edition.

#### **1.4 SUBMITTALS**

- A. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- B. Shop Drawings:
  - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
  - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
  - 3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.
- C. Designer's qualification statement.
- D. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.
2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
3. Sprinkler Wrenches: For each sprinkler type.

#### 1.5 QUALITY ASSURANCE

- A. Comply with UL (DIR) requirements.
- B. Designer Qualifications: Design system under direct supervision of a Professional Fire Protection Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- C. Installer Qualifications: Company specializing in performing the work of this section.
- D. Equipment and Components: Provide products that bear UL (DIR) label or marking.
- E. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

#### PART 2 PRODUCTS

##### 2.1 MANUFACTURERS

- A. Sprinklers, Valves, and Equipment:
  1. Anvil International: [www.anvilintl.com](http://www.anvilintl.com).
  2. Tyco Fire Protection Products: [www.tyco-fire.com](http://www.tyco-fire.com).
  3. Viking Corporation: [www.vikinggroupinc.com](http://www.vikinggroupinc.com).

##### 2.2 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Occupancy: Residential, Comply with NFPA 13D.
- C. Water Supply: Determine volume and pressure from water flow test data.
- D. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

##### 2.3 SPRINKLERS

- A. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
  1. Response Type: Quick.
  2. Coverage Type: Extended.
  3. Finish: Chrome plated.

4. Escutcheon Plate Finish: Chrome plated.
  5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- B. Residential Sprinklers: Concealed pendant type with matching push on escutcheon plate.
1. Response Type: Quick.
  2. Finish: Brass.
  3. Cover Plate Finish: Chrome plated.
  4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

## 2.4 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
1. Activate electric alarm.
  2. Test and drain valve.
  3. Replaceable internal components without removing valve from installed position.
  4. Manufacturers:
    - a. Victaulic Company; Series 751 with Series 760 motor alarm: [www.victaulic.com/#sle](http://www.victaulic.com/#sle).
- B. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Place pipe runs to minimize obstruction to other work.
- D. Place piping in concealed spaces above finished ceilings.
- E. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- F. Flush entire piping system of foreign matter.
- G. Hydrostatically test entire system.

Construct Six New Cabins  
Echo Bluff State Park

X2208-01  
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H. Require test be witnessed by Authority Having Jurisdiction.

END OF SECTION



## **SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Pipe sleeves.
- B. Pipe sleeve-seals.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 078400 - Firestopping.
- B. Section 220523 - General-Duty Valves for Plumbing Piping.
- C. Section 220553 - Identification for Plumbing Piping and Equipment: Piping identification.
- D. Section 220719 - Plumbing Piping Insulation.

#### **1.3 REFERENCE STANDARDS**

- A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2022a.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- C. UL (DIR) - Online Certifications Directory Current Edition.

#### **1.4 SUBMITTALS**

- A. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

### **PART 2 PRODUCTS**

#### **2.1 PIPE SLEEVES**

- A. Manufacturers:
  - 1. Flexicraft Industries; Pipe Wall Sleeve: [www.flexicraft.com](http://www.flexicraft.com).
  - 2. Metraflex Compant (The).
  - 3. Proco Products, Inc..

4. Substitutions: See Section 016000 - Product Requirements.
- B. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- C. Pipe Passing Through Below Grade Exterior Walls:
  1. Zinc coated or cast iron pipe.
  2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- D. Clearances:
  1. Provide allowance for insulated piping.
  2. Wall, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external pipe diameter.
  3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

## 2.2 PIPE-SLEEVE SEALS

- A. Manufacturers:
  1. Advance Products & Systems, LLC; Innerlynx: [www.apsonline.com](http://www.apsonline.com).
  2. American Polywater Corporation; PGKD Modular Seals: [www.polywater-haufftechnik.com](http://www.polywater-haufftechnik.com).
  3. Flexicraft Industries; PipeSeal: [www.flexicraft.com](http://www.flexicraft.com).
- B. Modular Mechanical Sleeve-Seal:
  1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
  2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
  3. Size and select seal component materials in accordance with service requirements.
  4. Glass-reinforced plastic pressure end plates.
- C. Sealing Compounds:
  1. Provide packing and sealing compound to fill pipe to sleeve thickness.
  2. Combined packing and sealing compounding to match partition fire-resistance hourly rating.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
  - 1. Aboveground Piping:
    - a. Pack solid using mineral fiber complying with ASTM C592.
    - b. Fill space with an elastomer caulk to a depth of 0.50 inch (15 mm) where penetrations occur between conditioned and unconditioned spaces.
  - 2. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
  - 3. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- E. Manufactured Sleeve-Seal Systems:
  - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
  - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
  - 3. Locate piping in center of sleeve or penetration.
  - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
  - 5. Tighten bolting for a water-tight seal.
  - 6. Install in accordance with manufacturer's recommendations.
- F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

END OF SECTION

## **SECTION 220519 - METERS AND GAUGES FOR PLUMBING PIPING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Thermometers.

#### **1.2 REFERENCE STANDARDS**

- A. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014 (Reapproved 2020).
- B. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers 2014 (Reapproved 2021).
- C. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- D. NSF 372 - Drinking Water System Components - Lead Content 2022.
- E. UL (DIR) - Online Certifications Directory Current Edition.

#### **1.3 SUBMITTALS**

- A. Product Data: Provide red-marked product data sheets for each furnished item with associated components and accessories.

### **PART 2 PRODUCTS**

#### **2.1 THERMOMETERS**

- A. Manufacturers:

1. Dwyer Instruments, Inc: [www.dwyer-inst.com](http://www.dwyer-inst.com).
2. Watts Water Technologies, Inc: [www.watts.com](http://www.watts.com).
3. Weiss Instruments, LLC: [www.weissinstruments.com](http://www.weissinstruments.com).
4. Weksler Glass Thermometer Corp: [www.wekslerglass.com](http://www.wekslerglass.com).

- B. General:

1. Product Compliance: ASTM E1.
2. Lens: Clear glass, except where stated.
3. Accuracy: One percent, when tested in accordance with ASTM E77, except where stated.
4. Scale: Black markings depicting single scale in degrees F where expected process value falls half-span of standard temperature range.

- C. Thermometers - Adjustable Angle: 7 inch (177.8 mm) v-shape aluminum case with clear glass window scale, 6 inch (152.4 mm) NPT stem, red or blue organic non-toxic liquid filled glass tube, and adjustable

joint with positive locking device allowing 360 degrees in horizontal plane or 180 degrees in vertical plane adjustments.

- D. Thermometers - Dial Type:

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports, and test plugs.

#### 3.2 INSTALLATION

- A. Install thermometers as follows:
  - 1. Hot Water Heaters: Place upstream and downstream of heater. Add one on the inlet end when using steam as the water heating medium.

END OF SECTION

## **SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Ball valves.
- B. Gate valves.
- C. Lubricated plug valves.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 078400 - Firestopping.
- B. Section 220553 - Identification for Plumbing Piping and Equipment.
- C. Section 220719 - Plumbing Piping Insulation.
- D. Section 221005 - Plumbing Piping.

#### **1.3 REFERENCE STANDARDS**

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).
- B. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2022.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- D. ASME B16.34 - Valves — Flanged, Threaded, and Welding End 2020.
- E. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2022.
- F. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).
- G. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.
- H. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends 2011.
- I. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves 2019.
- J. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .
- K. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- L. NSF 372 - Drinking Water System Components - Lead Content 2022.

#### **1.4 SUBMITTALS**

- A. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

- B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

## PART 2 PRODUCTS

### 2.1 APPLICATIONS

- A. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).
- B. Provide the following valves for the applications if not indicated on drawings:
  - 1. Shutoff: Ball, butterfly, gate or plug.
- C. Required Valve End Connections for Non-Wafer Types:
  - 1. Steel Pipe:
    - a. 2 inch (50 mm, DN) and Smaller: Threaded ends.
  - 2. Copper Tube:
    - a. 2 inch (50 mm, DN) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
- D. Domestic, Hot and Cold Water Valves:
  - 1. 2 inch (50 mm, DN) and Smaller:
    - a. Bronze and Brass: Provide with solder-joint ends.
    - b. Ball: Two piece, full port, brass or bronze with brass trim.
    - c. Bronze Gate: Class 125, NRS.

### 2.2 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
  - 1. Handwheel: Valves other than quarter-turn types.
  - 2. Hand Lever: Quarter-turn valves 6 inch (150 mm, DN) and smaller except plug valves.
- D. Valve-End Connections:
  - 1. Threaded End Valves: ASME B1.20.1.
  - 2. Solder Joint Connections: ASME B16.18.
- E. General ASME Compliance:

1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Solder-joint Connections: ASME B16.18.

F. Potable Water Use:

1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

2.3 BRASS, BALL VALVES

A. Two Piece, Full Port with Brass Trim and Female Thread, Male thread, or Solder Connections:

1. Comply with MSS SP-110.
2. WSP Rating: 150 psi (1,035 kPa).
3. WOG Rating: 600 psi (4,140 kPa).
4. Body: Forged brass.
5. Seats: PTFE.
6. Ball: Chrome-plated brass.
7. Operator: Lockable handle and memory stop.
8. Manufacturers:

2.4 BRONZE, BALL VALVES

A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. One Piece, Reduced Port with Bronze Trim:

1. Comply with MSS SP-110.
2. WSP Rating: 400 psi (2,760 kPa).
3. CWP Rating: 600 psi (4,140 kPa).
4. Body: Bronze.
5. End Connections: Pipe press.
6. Seats: PTFE.

C. Two Piece, Full Port with Bronze Trim:

1. Comply with MSS SP-110.



2. WSP Rating: 150 psi (1,035 kPa).
3. WOG Rating: 600 psi (4,140 kPa).
4. Body: Forged bronze or dezincified-brass alloy.
5. Ends Connections: Pipe thread or solder.
6. Seats: PTFE.
7. Ball: Chrome plated brass.
8. Manufacturers:

## 2.5 BRONZE, GATE VALVES

### A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

## 2.6 LUBRICATED PLUG VALVES

### A. Regular Gland with Threaded Ends:

1. Comply with MSS SP-78, Type II.
2. Class 125: CWP Rating: 200 psi (1,380 kPa).
3. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
4. Pattern: Regular or short.
5. Plug: Cast iron or bronze with sealant groove.
6. Manufacturers:

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

END OF SECTION

## **SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Pipe hangers.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 055000 - Metal Fabrications.

#### **1.3 REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- E. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- F. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

#### **1.4 SUBMITTALS**

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems and thermal insulated pipe supports.

#### **1.5 QUALITY ASSURANCE**

- A. Comply with applicable building code.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL REQUIREMENTS**

- A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.
- B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
- C. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

- D. Materials for Metal Fabricated Supports: Comply with Section 055000.
  - 1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
  - 2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.
- E. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
  - 1. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

## 2.2 PIPE HANGERS

- A. Band Hangers, Adjustable:
  - 1. Manufacturers:
    - a. B-Line, a brand of Eaton Corporation: [www.eaton.com](http://www.eaton.com).
    - b. Gripple, Inc; Universal Clamp (Threaded): [www.griipple.com](http://www.griipple.com).
    - c. Eaton.
  - 2. MSS SP-58 type 7 or 9, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
- B. Clevis Hangers, Adjustable:
  - 1. Manufacturers:
    - a. B-Line, a brand of Eaton Corporation: [www.eaton.com](http://www.eaton.com).
    - b. FNW; 7005: [www.fnw.com](http://www.fnw.com).
    - c. nVent Caddy, a brand of nVent: [www.erico.com](http://www.erico.com).
  - 2. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
  - 3. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- F. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- G. Secure fasteners according to manufacturer's recommended torque settings.
- H. Remove temporary supports.

END OF SECTION

## **SECTION 220533 - HEAT TRACING FOR PLUMBING PIPING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Self-regulating parallel resistance electric heating cable.
- B. Cable outer jacket markings.
- C. Connection kits.
- D. Accessories.
- E. Controls.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 220553 - Identification for Plumbing Piping and Equipment
- B. Section 220719 - Plumbing Piping Insulation.
- C. Section 221005 - Plumbing Piping.
- D. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
- E. Section 260583 - Wiring Connections.

#### **1.3 REFERENCE STANDARDS**

- A. IEEE 515.1 - IEEE Approved Draft Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications 2022.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL (DIR) - Online Certifications Directory Current Edition.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with other trades to provide ground fault protection for electric heat tracing circuits as required by NFPA 70.
- B. Coordinate the work with other trades to provide circuit breaker ratings suitable for installed circuit lengths.

#### **1.5 SUBMITTALS**

- A. Product Data: Provide data for electric heat tracing.
- B. Manufacturer's Installation Instructions: Indicate installation instructions and recommendations.
- C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of experience.

PART 2 PRODUCTS

2.1 SELF-REGULATING PARALLEL RESISTANCE ELECTRIC HEATING CABLE

- A. Manufacturers:
  - 1. Chromalox, Inc: [www.chromalox.com](http://www.chromalox.com).
  - 2. Pentair: [www.pentairthermal.com](http://www.pentairthermal.com).
  - 3. Thermon Manufacturing Company: [www.thermon.com](http://www.thermon.com).
- B. Provide products listed, classified, and labeled by UL (DIR) or testing firm acceptable to authorities having jurisdiction (AHJ).
- C. Factory Rating and Testing: Comply with IEEE 515.1.
- D. Heating Element:
  - 1. Provide pair of parallel No.16 tinned or nickel coated stranded copper bus wires embedded in cross linked conductive polymer core with varying heat output in response to temperature along its length.
  - 2. Terminations: Waterproof, factory assembled, non-heating leads with connector at one end and water-tight seal at opposite end.
  - 3. Capable of crossing over itself without overheating.
- E. Insulated Jacket: Flame retardant polyolefin.
- F. Cable Cover: Provide tinned copper and polyolefin outer jacket with UV inhibitor.
- G. Maximum Power-On Operating Temperature: 150 degrees F (65 degrees C).
- H. Maximum Power-Off Exposure Temperature: 185 degrees F (85 degrees C).
- I. Electrical Characteristics:
  - 1. 120 volts, single phase, 60 Hz.
  - 2. Refer to Section 260583.

2.2 CABLE OUTER JACKET MARKINGS

- A. Name of manufacturer, trademark, or other recognized symbol of identification.

- B. Catalog number, reference number, or model.
- C. Month and year of manufacture, date coding, applicable serial number, or equivalent.
- D. Agency listing or approval.

### 2.3 CONNECTION KITS

- A. Provide power connection, splice/tee, and end seal kits compatible with the heating cable and without requiring cutting of the cable core to expose bus wires.
- B. Provide with NEMA 4X rating for prevention of corrosion and water ingress.

### 2.4 ACCESSORIES

- A. Provide Accessories As Indicated or As Required for Complete Installation.

### 2.5 CONTROLS

- A. Pipe Mounted Thermostats:
  - 1. Remote bulb unit with adjustable temperature range from 30 to 50 degrees F (minus one to 10 degrees C).
  - 2. Control Enclosure: Corrosion resistant and waterproof.
- B. Line sensing high-limit temperature control and high-limit alarm.
- C. Programmable Controller:
  - 1. 365 day calendar with 20 programmable holidays.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that piping and equipment are ready to receive work.
- B. Verify field measurements are as indicated on shop drawings.
- C. Verify required power is available, in proper location, and ready for use.

### 3.2 PREPARATION

- A. Clean exposed surfaces prior to installation.
- B. Prepare surfaces using approved methods as recommended by manufacturer.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's written installation instructions.
- B. Comply with installation requirements of IEEE 515.1 and NFPA 70, Article 427.

- C. Apply heating cable linearly on pipe with fiberglass tape only after piping has successfully completed any required pressure testing.
- D. Comply with applicable local building codes and requirements of authorities having jurisdiction.
- E. Identification:
  - 1. After thermal insulation installation, apply external pipeline decals to indicate presence of the thermal insulation cladding at intervals not to exceed 20 ft (6 m) including cladding over each valve or other equipment that may require maintenance.
- F. Equipment Wiring: Refer to Section 260583.
- G. Electrical Connections: Refer to Section 260519.

### 3.4 FIELD QUALITY CONTROL

- A. Perform start-up by factory technician as per requirements.
- B. Field Testing and Inspections:
  - 1. Commission system in accordance with installation and operation manual.
  - 2. Inspect for sources of water entry and proper sealing.
  - 3. Inspect weather barrier to confirm that no sharp edges are contacting the trace heating.
  - 4. Insulation Resistance: Greater than 20 megohms at a test voltage of 2500 VDC for polymer insulated trace heaters.
  - 5. Test heating cable integrity with megohmmeter at the following intervals:
    - a. After installing the connection kits.
    - b. Prior to initial start-up (commissioning).
  - 6. Measure voltage and current at each unit.
  - 7. Controls:
    - a. Verify control parameters are set to the application requirements.

### 3.5 CLOSEOUT ACTIVITIES

- A. Demonstrate operation of controls.

### 3.6 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION



## **SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Vibration isolation requirements.
- B. Seismic control requirements.
  - 1. Includes requirements for seismic qualification of equipment not specified in this section.
- C. Seismic restraint systems.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment.

#### **1.3 DEFINITIONS**

- A. Plumbing Component: Where referenced in this section in regards to seismic controls, applies to any portion of the plumbing system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

#### **1.4 REFERENCE STANDARDS**

- A. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2014.
- B. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.
- C. FEMA 414 - Installing Seismic Restraints for Duct and Pipe 2004.
- D. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.
- E. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components 2010, with Editorial Revision (2015).
- F. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

#### **1.5 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
  - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Seismic Controls:
  - a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
  - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.6 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
  1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
  2. Seismic Controls: Include seismic load capacities.
- B. Shop Drawings - Seismic Controls:
  1. Include dimensioned plan views and sections indicating proposed plumbing component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
  2. Identify mounting conditions required for equipment seismic qualification.
  3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
  4. Indicate proposed arrangement of distributed system trapeze support groupings.
  5. Indicate proposed locations for distributed system flexible fittings and/or connections.
  6. Indicate locations of seismic separations where applicable.
- C. Seismic Design Data:
  1. Compile information on project-specific characteristics of actual installed plumbing components necessary for determining seismic design forces required to design appropriate seismic controls.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Manufacturer's detailed field testing and inspection procedures.

## 1.7 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

## PART 2 PRODUCTS

### 2.1 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing plumbing equipment and/or plumbing connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
  - 1. Select vibration isolators to provide required static deflection.
  - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

### 2.2 SEISMIC CONTROL REQUIREMENTS

- A. Design and provide plumbing component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor plumbing components.
- B. Seismic Design Criteria: Obtain from project Structural Engineer of Record.
- C. Component Importance Factor (Ip): Plumbing components to be assigned a component importance factor (Ip) of 1.5 unless otherwise indicated.
- D. Seismic Qualification of Equipment:
  - 1. Provide special certification for plumbing equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
  - 2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
  - 3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
  - 4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

E. Seismic Restraints:

1. Provide seismic restraints for plumbing components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
2. Seismic Restraint Exemptions:
  - a. Exemptions for Seismic Design Category C:
    - 1) Plumbing components where either of the following apply:
      - a) The component importance factor ( $I_p$ ) is 1.0 and the component is positively attached to the structure.
      - b) The component weighs 20 pounds (89 N) or less or, in the case of a distributed system, 5 pounds per foot (73 N/m) or less.
    - 2) Plumbing piping with component importance factor ( $I_p$ ) of 1.5 and nominal pipe size of 2 inch (50 mm) or less, where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, and where piping is positively attached to the structure; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).
  - b. Plumbing Piping Exemptions, All Seismic Design Categories:
    - 1) Plumbing piping where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, where piping is positively attached to the structure, and where one of the following apply:
      - a) Trapeze supported piping with trapeze assemblies using 3/8 inch (10 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, where all pipes supported have a component importance factor ( $I_p$ ) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 100 pounds (445 N) or less.
      - b) Hanger supported piping with individual rod hangers 3/8 inch (10 mm) or 1/2 inch (13 mm) in diameter not exceeding 12 inches (305 mm) in length from support point connection to the supporting structure, where pipe has a component importance factor ( $I_p$ ) of 1.0 and meets size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single rod is 50 pounds (220 N) or less.
3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
  - a. FEMA 412.

- b. FEMA 413.
  - c. FEMA 414.
  - d. FEMA E-74.
  - e. SMACNA (SRM).
4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
5. Seismic Restraint Systems:
- a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
  - b. Use only one restraint system type for a given plumbing component or distributed system (e.g., piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
  - c. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain plumbing component in all lateral directions; consider bracket geometry in anchor load calculations.
  - d. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported plumbing component weight.
  - e. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
- F. Seismic Attachments:
- 1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
- G. Seismic Interactions:
- 1. Include provisions to prevent seismic impact between plumbing components and other structural or nonstructural components.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

### 3.3 FIELD QUALITY CONTROL

- A. Inspect vibration isolation and/or seismic control components for damage and defects.
- B. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

## **SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Pipe markers.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 099123 - Interior Painting: Identification painting.

#### **1.3 REFERENCE STANDARDS**

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

#### **1.4 SUBMITTALS**

- A. Product Data: Provide manufacturers catalog literature for each product required.
- B. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

### **PART 2 PRODUCTS**

#### **2.1 PLUMBING COMPONENT IDENTIFICATION GUIDELINE**

- A. Pipe Markers: 3/4 inch (20 mm) diameter and higher.

#### **2.2 PIPE MARKERS**

- A. Manufacturers:

1. Brimar Industries, Inc: [www.pipemarker.com](http://www.pipemarker.com).
2. Craftmark Pipe Markers: [www.craftmarkid.com](http://www.craftmarkid.com).
3. Kolbi Pipe Marker Co: [www.kolbipipemarkers.com](http://www.kolbipipemarkers.com).
4. Seton Identification Products: [www.seton.com](http://www.seton.com).

- B. Comply with ASME A13.1.

- C. Flexible Tape Marker: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

- D. Identification Scheme, ASME A13.1:

1. Primary: External Pipe Diameter, Uninsulated or Insulated.
  - a. 3/4 to 1-1/4 inches (19 to 32 mm): Use 8 inch (203 mm) field-length with 1/2 inch (13 mm) text height.
2. Secondary: Color scheme per fluid service.
  - a. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive identification products.

3.2 INSTALLATION

- A. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.
- B. Apply ASME A13.1 Pipe Marking Rules:
  - 1. Place pipe marker adjacent to changes in direction.
  - 2. Place pipe marker adjacent each valve port and flange end.
  - 3. Place pipe marker at both sides of floor and wall penetrations.
  - 4. Place pipe marker every 25 to 50 feet (7.6 to 15.2 m) interval of straight run.

END OF SECTION



## **SECTION 220716 - PLUMBING EQUIPMENT INSULATION**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Flexible removable and reusable blanket insulation.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 220553 - Identification for Plumbing Piping and Equipment.
- B. Section 221005 - Plumbing Piping: Placement of hangers and hanger inserts.

#### **1.3 REFERENCE STANDARDS**

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- D. ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service 2022.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

#### **1.4 SUBMITTALS**

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.
- B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of experience.

#### **1.6 FIELD CONDITIONS**

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

## PART 2 PRODUCTS

### 2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

### 2.2 FLEXIBLE REMOVABLE AND REUSABLE BLANKET INSULATION

#### A. Manufacturers:

1. Auburn Manufacturing Inc; Ever Green Cut 'n Wrap: [www.auburnmfg.com](http://www.auburnmfg.com).
2. Fabsrv.
3. The E.J. Davis Company.

#### B. Insulation: ASTM C553 Type V; flexible, noncombustible.

1. Comply with ASTM C1695.
2. K (Ksi) Value: 0.37 at 100 degrees F (0.053 at 38 degrees C), when tested in accordance with ASTM C177 or ASTM C518.
3. Minimum Service Temperature: 32 degrees F (0 degrees C).
4. Maximum Service Temperature: 500 degrees F (260 degrees C).
5. Maximum Water Vapor Absorption: Less than 5.0 percent by weight.
6. Color: Gray, Green.
7. Weight: 7.65 oz/sq ft (2334.4 g/sq m).
8. Effective Thickness: 1.25 plus/minus 0.25 inch (0.032 plus/minus 0.0064 m).

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that equipment has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Factory Insulated Equipment: Do not insulate.
- C. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- D. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

- E. For hot equipment containing fluids over 140 degrees F (60 degrees C), insulate flanges and unions with removable sections and jackets.
- F. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.
- G. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

### 3.3 SCHEDULES

#### A. Plumbing Systems:

- 1. Domestic Water Heater & Storage Tanks:
  - a. Glass Fiber, Flexible Insulation: 1 inches ([ ] mm) thick.

END OF SECTION

## **SECTION 220719 - PLUMBING PIPING INSULATION**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Flexible elastomeric cellular insulation.
- B. Glass fiber insulation.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 078400 - Firestopping.
- B. Section 221005 - Plumbing Piping: Placement of hangers and hanger inserts.

#### **1.3 REFERENCE STANDARDS**

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022a.
- D. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2022.
- E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.
- H. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth 2016b.
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

#### **1.4 SUBMITTALS**

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

#### **1.5 QUALITY ASSURANCE**

- A. Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

## 1.6 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

## PART 2 PRODUCTS

### 2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

### 2.2 GLASS FIBER INSULATION

- A. Manufacturers:
  - 1. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - 2. Johns Manville Corporation: [www.jm.com](http://www.jm.com).
  - 3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: [www.knaufinsulation.com](http://www.knaufinsulation.com).
  - 4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: [www.ocbuildingspec.com](http://www.ocbuildingspec.com).
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
  - 1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
  - 2. Maximum Service Temperature: 850 degrees F (454 degrees C).
  - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm (0.029 ng/(Pa s m)).

### 2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
  - 1. Aeroflex USA, Inc; Aerocel Stay-Seal with Protape (SSPT): [www.aeroflexusa.com](http://www.aeroflexusa.com).
  - 2. Armacell LLC; AP Armaflex: [www.armacell.us](http://www.armacell.us).
  - 3. K-Flex USA LLC; Insul-Tube: [www.kflexusa.com](http://www.kflexusa.com).
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
  - 1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
  - 2. Maximum Service Temperature: 220 degrees F (104 degrees C).
  - 3. Connection: Waterproof vapor barrier adhesive.

- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
- D. Weather Barrier: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

#### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- D. Glass fiber insulated pipes conveying fluids below ambient temperature:
  - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
  - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- E. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- F. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.
- G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

END OF SECTION

## **SECTION 220719.11 - UNDER-LAVATORY PIPE AND SUPPLY COVERS - PLUMBEREX**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Under-lavatory pipe and supply covers.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 221005 - Plumbing Piping.

#### **1.3 REFERENCE STANDARDS**

- A. ABA Standards - ABA Accessibility Standards 2004, with Amendments (2015).
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures 2011 (Reaffirmed 2022).
- D. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping 2021.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

#### **1.4 SUBMITTALS**

- A. Product Data: Provide catalog illustrations of covers, sizes, and finishes.
- B. Manufacturer's Instructions: Indicate installation methods and procedures.

### **PART 2 PRODUCTS**

#### **2.1 UNDER-LAVATORY PIPE and SUPPLY COVERS**

- A. Basis of Design: Plumberex Specialty Products, Inc; [www.plumberex.com](http://www.plumberex.com).
  - 1. Fusion Molded Under-Lavatory Insulators (Non-Sewn): Plumberex Handy-Shield Maxx.
  - 2. Slim Fit Under-Lavatory Insulators (Non-Sewn): Plumberex Trap Gear.
- B. General:
  - 1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks per ADA Standards.
  - 2. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
- C. ASTM E84 Compliant, Under-Lavatory Insulators:

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that walls, floor finishes, lavatories, and piping are prepared and ready for installation of under-lavatory guards.
- B. Confirm location and size of fixtures and piping before installation.

3.2 INSTALLATION

- A. Install under-lavatory guards according to manufacturer's written instructions..

3.3 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION



## **SECTION 221005 - PLUMBING PIPING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Sanitary waste piping, buried within 5 feet (1500 mm) of building.
- B. Sanitary waste piping, above grade.
- C. Domestic water piping, buried within 5 feet (1500 mm) of building.
- D. Domestic water piping, above grade.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 074112: Standing Seam Metal Roof Panels.
- B. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment.
- C. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- D. Section 220553 - Identification for Plumbing Piping and Equipment.
- E. Section 220719 - Plumbing Piping Insulation.
- F. Section 312316 - Excavation.
- G. Section 312316.13 - Trenching.
- H. Section 312323 - Fill.

#### **1.3 REFERENCE STANDARDS**

- A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing 2019.
- B. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems 2015 (Reaffirmed 2020).
- C. ANSI Z223.1 - National Fuel Gas Code 2021.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- G. ASME B31.1 - Power Piping 2022.
- H. ASME B31.9 - Building Services Piping 2020.
- I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- J. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings 2021.

- K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
- L. ASTM B32 - Standard Specification for Solder Metal 2020.
- M. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.
- N. ASTM B75/B75M - Standard Specification for Seamless Copper Tube 2020.
- O. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2022.
- P. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- Q. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- R. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- S. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings 2020a.
- T. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 2021a.
- U. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 2021.
- V. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.
- W. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.
- X. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.
- Y. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.
- Z. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.
- AA. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- BB. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.
- CC. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2018.
- DD. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2021.
- EE. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2020.

- FF. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- GG. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves 2019.
- HH. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .
- II. NFPA 58 - Liquefied Petroleum Gas Code 2020, with Amendment.
- JJ. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- KK. NSF 372 - Drinking Water System Components - Lead Content 2022.
- LL. UL (DIR) - Online Certifications Directory Current Edition.
- MM. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

#### 1.4 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

#### 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

### PART 2 PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

#### 2.2 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

- A. Cast Iron Pipe: ASTM A74 service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
- B. PVC Pipe: ASTM D2665 or ASTM D3034.
  - 1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.
- 2.3 SANITARY WASTE PIPING, ABOVE GRADE
- A. PVC Pipe: ASTM D2729.
    1. Fittings: PVC.
    2. Joints: Solvent welded, with ASTM D2564 solvent cement.
- 2.4 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING
- A. Copper Pipe: ASTM B42, annealed.
    1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
    2. Joints: AWS A5.8M/A5.8, BCuP copper/silver braze.
- 2.5 DOMESTIC WATER PIPING, ABOVE GRADE
- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
    1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
    2. Joints: ASTM B32, alloy Sn95 solder.
    3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
      - a. Manufacturers:
        - 1) Anvil International: [www.anvilintl.com](http://www.anvilintl.com).
        - 2) Apollo Valves: [www.apollovalves.com](http://www.apollovalves.com).
        - 3) Grinnell Products: [www.grinnell.com](http://www.grinnell.com).
        - 4) Viega LLC: [www.viega.us](http://www.viega.us).
- 2.6 PROPANE GAS PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING
- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
    1. Fittings: ASTM A234/A234M, wrought steel welding type, with AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.
    2. Joints: ASME B31.1, welded.
- 2.7 PROPANE GAS PIPING, ABOVE GRADE
- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
    1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
    2. Joints: NFPA 58, threaded or welded to comply with ASME B31.1.

## 2.8 PIPE FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 inch (80 mm, DN) and Under:
  - 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
  - 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
- B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

### 3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- C. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- D. Group piping whenever practical at common elevations.
- E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- F. Install vent piping penetrating roofed areas to maintain integrity of roof assembly; see Section 074112- Standing Seam Metal Roof Panels.
- G. Excavate in accordance with Section 312316.
- H. Backfill in accordance with Section 312323.
- I. Install bell and spigot pipe with bell end upstream.
- J. Install valves with stems upright or horizontal, not inverted. See Section 220523.
- K. Install water piping to ASME B31.9.
- L. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

- M. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- N. Inserts:
1. Provide inserts for placement in concrete formwork.
  2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm, DN).
  4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
  5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- O. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
  2. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
  3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
  4. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  7. Provide copper plated hangers and supports for copper piping.
  8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

### 3.4 FIELD TESTS AND INSPECTIONS

- A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.
- B. Domestic Water Systems:
1. Perform hydrostatic testing for leakage prior to system disinfection.
  2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
  3. General:

- a. Fill the system with water and raise static head to 10 psi (345 kPa) above service pressure. Minimum static head of 50 to 150 psi (345 to 1,034 kPa). As an exception, certain codes allow a maximum static pressure of 80 psi (551.6 kPa).

C. Gas Distribution Systems:

1. Test Preparation: Close each appliance valve or disconnect and cap each connected appliance.

2. General Systems:

- a. Inject a minimum of 10 psi (68.9 kPa) of compressed air into the piping system for a duration of 15 minutes and verify with a gauge that no perceptible pressure drop is measured.
- b. Ensure test pressure gauge has a range of twice the specific pressure rate selected with an accuracy of 1/10 of 1 pound (0.45 kg).

- D. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

3.6 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, and sand strainer.

END OF SECTION

## **SECTION 221006 - PLUMBING PIPING SPECIALTIES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Drains.
- B. Cleanouts.
- C. Hydrants.
- D. Refrigerator valve and recessed box.
- E. Backflow preventers.
- F. Water hammer arrestors.
- G. Mixing valves.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 221005 - Plumbing Piping.
- B. Section 223000 - Plumbing Equipment.
- C. Section 224000 - Plumbing Fixtures.

#### **1.3 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASME A112.6.3 - Floor and Trench Drains 2019.
- C. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies 2021.
- D. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance 2011 (Reaffirmed 2016).
- E. ASSE 1047 - Performance Requirements for Reduced Pressure Detector Backflow Prevention Assemblies 2021.
- F. ASTM B75/B75M - Standard Specification for Seamless Copper Tube 2020.
- G. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- H. NSF 372 - Drinking Water System Components - Lead Content 2022.
- I. PDI-WH 201 - Water Hammer Arresters 2017.

#### **1.4 SUBMITTALS**

- A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.



- B. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- C. Operation Data: Indicate frequency of treatment required for interceptors.
- D. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

### PART 2 PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

#### 2.2 DRAINS

- A. Description: Refer to the Plumbing drawings for Drain requirements.

#### 2.3 CLEANOUTS

- A. Description: Refer to the Plumbing drawings for Cleanout requirements.

#### 2.4 HYDRANTS

- A. Description: Refer to the Plumbing drawings for exterior Hydarnt requirements.

#### 2.5 REFRIGERATOR VALVE AND RECESSED BOX

- A. Description: Refer to the Plumbing drawings for Refridgerator Box requirements.

#### 2.6 BACKFLOW PREVENTERS

- A. Description: Refer to the Plumbing drawings for Backflow Preventer requirements.

#### 2.7 WATER HAMMER ARRESTORS

- A. Manufacturers:
  1. Cash Acme, a brand of Reliance Worldwide Corporation: [www.cashacme.com](http://www.cashacme.com).
  2. Jay R. Smith Manufacturing Company: [www.jrsmith.com](http://www.jrsmith.com).
  3. Watts Regulator Company, a part of Watts Water Technologies: [www.wattsregulator.com](http://www.wattsregulator.com).
  4. Zurn Industries, LLC: [www.zurn.com](http://www.zurn.com).
- B. Water Hammer Arrestors:

1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F (minus 73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

## 2.8 MIXING VALVES

### A. Thermostatic Mixing Valves:

1. Description: Refer to the plumbing drawings for thermostatic mixing valve requirements.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Pipe relief from backflow preventer to nearest drain.
- E. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks.

END OF SECTION

## **SECTION 223000 - PLUMBING EQUIPMENT**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Water heaters.
  - 1. Residential electric.
- B. Diaphragm-type compression tanks.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

#### **1.3 REFERENCE STANDARDS**

- A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2021.
- B. ICC (IPC) - International Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- E. UL 174 - Standard for Household Electric Storage Tank Water Heaters Current Edition, Including All Revisions.

#### **1.4 SUBMITTALS**

- A. Product Data:
  - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
  - 2. Provide electrical characteristics and connection requirements.
- B. Shop Drawings:
  - 1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.
- C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of experience.
- B. Certifications:
  - 1. Water Heaters: NSF approved.
  - 2. Electric Water Heaters: UL listed and labeled to UL 174.
  - 3. Water Tanks: ASME labeled to ASME BPVC-VIII-1.
  - 4. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

### 1.7 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer warranty for domestic water heaters.

## PART 2 PRODUCTS

### 2.1 WATER HEATERS

- A. Description: Refer to the Plumbing drawings for Water Heater requirements.

### 2.2 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Description: Refer to the Plumbing drawings for Expansion Tank requirements.
- B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig (860 kPa), with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig (80 kPa).

### 2.3 ELECTRICAL WORK

- A. Electrical characteristics to be as specified or indicated.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related electrical work to achieve operating system.

- C. Domestic Water Storage Tanks:
1. Provide steel pipe support, independent of building structural framing members.
  2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

END OF SECTION

## **SECTION 224000 - PLUMBING FIXTURES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Tank type water closets.
- B. Lavatories.
- C. Sinks.
- D. Bathtubs and showers.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 064100 - Architectural Wood Casework: Counters for sinks and lavatories.
- B. Section 079200 - Joint Sealants: Sealing joints between fixtures and walls and floors.
- C. Section 123600 - Countertops: Counters for sinks and lavatories.
- D. Section 221005 - Plumbing Piping.
- E. Section 221006 - Plumbing Piping Specialties.
- F. Section 223000 - Plumbing Equipment.

#### **1.3 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- C. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures 2011 (Reaffirmed 2022).
- D. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018, with Errata.
- E. ASME A112.19.3 - Stainless Steel Plumbing Fixtures 2022.
- F. ASME A112.19.14 - Six-Liter Water Closets Equipped with a Dual Flushing Device 2013 (Reaffirmed 2018).
- G. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers 2020.
- H. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices 2020.
- I. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping 2021.
- J. ITS (DIR) - Directory of Listed Products Current Edition.
- K. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- L. NSF 372 - Drinking Water System Components - Lead Content 2022.

- M. UL (DIR) - Online Certifications Directory Current Edition.

#### 1.4 SUBMITTALS

- A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- B. Manufacturer's Instructions: Indicate installation methods and procedures.
- C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of experience.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

#### 1.7 WARRANTY

### PART 2 PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.
- C. Maximum Fixture or Faucet Supply Pressure: 60 psi (4.1 bar) unless stated otherwise.

#### 2.2 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for installation of plumbing systems.
- B. Comply with UL (DIR) requirements.
- C. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

#### 2.3 TANK TYPE WATER CLOSETS

- A. Description: Refer to the plumbing drawings for Water Closet requirements.

2.4 LAVATORIES

- A. Description: Refer to the Plumbing drawings for Lavatory requirements.

2.5 SINKS

- A. Description: Refer to the Plumbing drawings for Sink requirements.

2.6 BATHTUBS AND SHOWERS

- A. Description: Refer to the Plumbing drawings for Bathtub/Shower requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

- A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.



- C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

## **SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

### **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. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

- B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. Section 230548 "Vibration Seismic Controls for HVAC" for vibration isolation devices.
4. Section 233113 "Metal Ducts" for duct hangers and supports.

#### **1.3 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

#### **1.5 ACTION SUBMITTALS**

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

- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Pipe stands.
  - 4. Equipment supports.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

#### 1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

### PART 2 - PRODUCTS

#### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. Copper Pipe Hangers:
  - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

#### 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## 2.3 METAL FRAMING SYSTEMS

### A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Allied Tube & Conduit; a part of Atkore International.
  - b. Cooper B-Line, Inc.; a division of Cooper Industries.
  - c. Flex-Strut Inc.
  - d. Unistrut; an Atkore International company.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturred lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dipped galvanized.
8. Paint Coating: Vinyl or Epoxy.
9. Plastic Coating: PVC, Polyurethane, Epoxy, or Polyester.

## 2.4 THERMAL-HANGER SHIELD INSERTS

### A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. National Pipe Hanger Corporation.
2. Pipe Shields Inc.
3. Piping Technology & Products, Inc.
4. Value Engineered Products, Inc.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at

changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
  - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to **1-1/2 inches**.

### 3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  - 4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.

6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  11. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  13. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  14. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
  15. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
  16. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  17. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  18. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  2. C-Clamps (MSS Type 23): For structural shapes.
  3. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  4. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  5. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.



- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

END OF SECTION

## SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

### 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. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Elastomeric hangers.
11. Spring hangers.
12. Snubbers.
13. Restraint channel bracings.
14. Restraint cables.
15. Seismic-restraint accessories.
16. Mechanical anchor bolts.
17. Adhesive anchor bolts.
18. Vibration isolation equipment bases.
19. Restrained isolation roof-curb rails.

- B. Related Requirements:

1. Section 210548 "Vibration and Seismic Controls for Fire Suppression" for devices for fire-suppression equipment and systems.
2. Section 220548 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

#### 1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.

#### 1.4 ACTION SUBMITTALS

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

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
    - b. Annotate to indicate application of each product submitted and compliance with requirements.
  3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
  2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
1. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic forces required to select vibration isolators and seismic restraints and for designing vibration isolation bases.
    - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
  3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
  4. Seismic-Restraint Details:
    - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
    - d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.
- D. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
  - 1. Site Class as Defined in the IBC: C.
  - 2. Seismic Design Category: C
  - 3. Assigned Seismic Use Group or Building Category as Defined in the IBC: III.
    - a. Component Importance Factor: TBD by Contractor's Engineer, based on Component type.
    - b. Component Response Modification Factor: TBD by Contractor's Engineer, based on Component type.
    - c. Component Amplification Factor: TBD by Contractor's Engineer, based on Component type.
  - 4. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.530.
  - 5. Design Spectral Response Acceleration at 1.0-Second Period: 0.166.
  - 6. Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.
    - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

## 2.2 ELASTOMERIC ISOLATION PADS

### A. Elastomeric Isolation Pads.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Isolation Technology, Inc.
  - b. Kinetics Noise Control, Inc.
  - c. Mason Industries, Inc.
  - d. Vibration Eliminator Co., Inc.
  - e. Vibration Isolation.
2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Smooth, Ribbed, or Waffle pattern.

## 2.3 ELASTOMERIC ISOLATION MOUNTS

### A. Double-Deflection, Elastomeric Isolation Mounts.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Isolation Technology, Inc.
  - b. Kinetics Noise Control, Inc.
  - c. Mason Industries, Inc.
  - d. Vibration Eliminator Co., Inc.
  - e. Vibration Isolation.
2. Mounting Plates:
  - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded.
  - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

## 2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

### A. Restrained Elastomeric Isolation Mounts.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Isolation Technology, Inc.
  - b. Kinetics Noise Control, Inc.
  - c. Mason Industries, Inc.
  - d. Vibration Eliminator Co., Inc.
  - e. Vibration Isolation.

2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
  - a. Housing: Cast-ductile iron or welded steel.
  - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

## 2.5 HOUSED-SPRING ISOLATORS

### A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Isolation Technology, Inc.
  - b. Kinetics Noise Control, Inc.
  - c. Mason Industries, Inc.
  - d. Vibration Eliminator Co., Inc.
  - e. Vibration Isolation.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
  - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
  - b. Top housing with attachment and leveling bolt.

## 2.6 HOUSED-RESTRAINED-SPRING ISOLATORS

### A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Isolation Technology, Inc.
  - b. Kinetics Noise Control, Inc.
  - c. Mason Industries, Inc.
  - d. Vibration Eliminator Co., Inc.
  - e. Vibration Isolation.
2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
  - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.

- b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

## 2.7 PIPE-RISER RESILIENT SUPPORT

- A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.
  1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
  2. Maximum Load Per Support: 500 psigon isolation material providing equal isolation in all directions.

## 2.8 RESILIENT PIPE GUIDES

- A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.
  1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

## 2.9 ELASTOMERIC HANGERS

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Isolation Technology, Inc.
    - b. Kinetics Noise Control, Inc.
    - c. Mason Industries, Inc.
    - d. Vibration Eliminator Co., Inc.
  2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
  3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

## 2.10 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Kinetics Noise Control, Inc.
  - b. Mason Industries, Inc.
  - c. Vibration Eliminator Co., Inc.
  - d. Vibration Isolation.
2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
  3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
  8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
  9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

## 2.11 SNUBBERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Kinetics Noise Control, Inc.
  2. Mason Industries, Inc.
  3. Vibration Mountings & Controls, Inc.
- B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
  1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
  2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
  3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

## 2.12 RESTRAINT CHANNEL BRACINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. B-line, an Eaton business.
  2. Hilti, Inc.
  3. Mason Industries, Inc.
  4. Unistrut; Part of Atkore International.
- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

## 2.13 RESTRAINT CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:



1. Kinetics Noise Control, Inc.
2. Loos & Co., Inc.
3. Mason Industries, Inc.
4. Vibration Mountings & Controls, Inc.

- B. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

#### 2.14 SEISMIC-RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-line, an Eaton business.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. TOLCO.

- B. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

#### 2.15 MECHANICAL ANCHOR BOLTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-line, an Eaton business.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.

- B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

#### 2.16 ADHESIVE ANCHOR BOLTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hilti, Inc.
2. Kinetics Noise Control, Inc.

3. Mason Industries, Inc.

- B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## 2.17 VIBRATION ISOLATION EQUIPMENT BASES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. Vibration Eliminator Co., Inc.
4. Vibration Isolation.

- B. Steel Rails: Factory-fabricated, welded, structural-steel rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.
  - a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Rails shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

- C. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
  - a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

- D. Concrete Inertia Base: Factory-fabricated or field-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
  - a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

## 2.18 RESTRAINED ISOLATION ROOF-CURB RAILS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Ace Mountings Co., Inc.
  2. California Dynamics Corporation.
  3. Kinetics Noise Control, Inc.
  4. Mason Industries, Inc.
  5. Thybar Corporation.
- B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic forces.
- C. Upper Frame: The upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic forces.
- D. Lower Support Assembly: The lower support assembly shall be formed sheet metal section containing adjustable and removable steel springs that support the upper frame. The lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly. Adjustable, restrained-spring isolators shall be mounted on elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
- E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.
- F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

### 3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- D. Equipment Restraints:
  - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
  - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
  - 3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.
- E. Piping Restraints:
  - 1. Comply with requirements in MSS SP-127.
  - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
  - 3. Brace a change of direction longer than 12 feet.
- F. Install cables so they do not bend across edges of adjacent equipment or building structure.
- G. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.
- H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- K. Drilled-in Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

#### 3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

#### 3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

#### 3.6 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

END OF SECTION

## **SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

### **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. Pipe labels.
  - 3. Duct labels.
  - 4. Valve tags.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

### **PART 2 - PRODUCTS**

#### **2.1 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlton Industries, LP.
    - b. Craftmark Pipe Markers.
    - c. Kolbi Pipe Marker Co.
    - d. LEM Products Inc.
    - e. Marking Services, Inc.
    - f. Seton Identification Products.

2. Material and Thickness: stainless steel, 0.025-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Minimum Label Size: Length and width vary for required label content, 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. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brimar Industries, Inc.
  - b. Carlton Industries, LP.
  - c. Craftmark Pipe Markers.
  - d. Kolbi Pipe Marker Co.
  - e. LEM Products Inc.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. 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-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carlton Industries, LP.
2. Craftmark Pipe Markers.
3. Kolbi Pipe Marker Co.
4. LEM Products Inc.
5. Marking Services Inc.

6. Seton Identification Products.

- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Do not use pipe labels or plastic tapes for bare pipes conveying fluids at temperatures of 125 deg F or higher.
- D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.3 DUCT LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carlton Industries, LP.
  - 2. Craftmark Pipe Markers.
  - 3. Kolbi Pipe Marker Co.
  - 4. LEM Products Inc.
  - 5. Marking Sevices Inc.
  - 6. Seton Identification Products.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: White.
- D. Background Color: Blue, green or red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. 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-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.



1. 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.

## 2.4 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Carlton Industries, LP.
  2. Craftmark Pipe Markers.
  3. Kolbi Pipe Marker Co.
  4. Marking Sevices Inc.
  5. Seton Identification Products.
- B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  1. Tag Material: Brass, 0.032-inch, stainless steel, 0.025-inch, aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  2. Fasteners: Brass beaded chain or S-hook.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  1. Valve-tag schedule shall be included in operation and maintenance data.

## 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, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### 3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.4 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting."
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- E. Pipe Label Color Schedule:
  - 1. Condenser-Water Piping: White letters on a safety-green background.

### 3.5 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
  - 1. Blue: For cold-air supply ducts.
  - 2. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

### 3.6 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  - 1. Valve-Tag Size and Shape:

- a. Condenser Water: 1-1/2 inches square.
2. Valve-Tag Colors:
  - a. Condenser Water: white letters on a safety-black background

END OF SECTION

## **SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC**

### **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. Balancing Air Systems:
    - a. Constant-volume air systems.
  - 2. Testing, Adjusting, and Balancing Equipment:
    - a. Motors.
    - b. Condensing units.
  - 3. Duct leakage tests.
  - 4. Control system verification.

#### **1.3 DEFINITIONS**

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.
- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.

#### **1.4 PREINSTALLATION MEETINGS**

- A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days advance notice of scheduled meeting time and location.
  - 1. Minimum Agenda Items:

- a. The Contract Documents examination report.
- b. The TAB plan.
- c. Needs for coordination and cooperation of trades and subcontractors.
- d. Proposed procedures for documentation and communication flow.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 60 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. System Readiness Checklists: Within 60 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
  1. Instrument type and make.
  2. Serial number.
  3. Application.
  4. Dates of use.
  5. Dates of calibration.

#### 1.6 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC, NEBB or TABB.
  1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC, NEBB or TABB.
  2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB or TABB as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

### 1.7 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

### 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.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan curves.
  - 1. 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.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible, and their controls are connected and functioning.

- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine operating safety interlocks and controls on HVAC equipment.
- M. 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 the following:
  - 1. Equipment and systems to be tested.
  - 2. Strategies and step-by-step procedures for balancing the systems.
  - 3. Instrumentation to be used.
  - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
  - 1. Airside:
    - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
    - b. Duct systems are complete with terminals installed.
    - c. Volume, smoke, and fire dampers are open and functional.
    - d. Clean filters are installed.
    - e. Fans are operating, free of vibration, and rotating in correct direction.
    - f. Variable-frequency controllers' startup is complete and safeties are verified.
    - g. Automatic temperature-control systems are operational.
    - h. Ceilings are installed.
    - i. Windows and doors are installed.
    - j. Suitable access to balancing devices and equipment is provided.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," and Section 230719 "HVAC Piping Insulation."

- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material 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. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

### 3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
  - 2. Measure fan static pressures as follows:
    - a. Measure static pressure directly at the fan outlet or through the flexible connection.



- b. Measure static pressure directly at the fan inlet or through the flexible connection.
    - c. Measure static pressure across each component that makes up the air-handling system.
    - d. Report artificial loading of filters at the time static pressures are measured.
  3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  4. Obtain approval from Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  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 occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
  1. Measure airflow of submain and branch ducts.
  2. Adjust submain and branch duct volume dampers for specified airflow.
  3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
  1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
  2. Measure inlets and outlets airflow.
  3. Adjust each inlet and outlet for specified airflow.
  4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
  1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
  2. Re-measure and confirm that total airflow is within design.
  3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
  4. Mark all final settings.
  5. Test system in economizer mode. Verify proper operation and adjust if necessary.
  6. Measure and record all operating data.
  7. Record final fan-performance data.

### 3.6 DUCT LEAKAGE TESTS

- A. Witness the duct pressure testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified tolerances.
- C. Report deficiencies observed.

### 3.7 CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
  1. Verify temperature control system is operating within the design limitations.
  2. Confirm that the sequences of operation are in compliance with Contract Documents.

3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

### 3.8 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### 3.9 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

- B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

- B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
  2. Name and address of the TAB specialist.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB supervisor who certifies the report.
  10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  14. Notes to explain why certain final data in the body of reports vary from indicated values.
  15. Test conditions for fan performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Settings for supply-air, static-pressure controller.
    - g. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Duct, outlet, and inlet sizes.
  3. Pipe and valve sizes and locations.
  4. Terminal units.
  5. Balancing stations.
  6. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches and bore.
    - i. Center-to-center dimensions of sheave and amount of adjustments in inches.

- j. Number, make, and size of belts.
  - k. Number, type, and size of filters.
2. Motor Data:
- a. Motor make, and frame type and size.
  - b. Horsepower and rpm.
  - c. Volts, phase, and hertz.
  - d. Full-load amperage and service factor.
  - e. Sheave make, size in inches, and bore.
  - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
- a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Filter static-pressure differential in inches wg.
  - f. Preheat-coil static-pressure differential in inches wg.
  - g. Cooling-coil static-pressure differential in inches wg.
  - h. Heating-coil static-pressure differential in inches wg.
  - i. Outdoor airflow in cfm.
  - j. Return airflow in cfm.
  - k. Outdoor-air damper position.
  - l. Return-air damper position.
  - m. Vortex damper position.
- F. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
1. Unit Data:
- a. System identification.
  - b. Location.
  - c. Make and type.
  - d. Model number and unit size.
  - e. Manufacturer's serial number.
  - f. Fuel type in input data.
  - g. Output capacity in Btu/h.
  - h. Ignition type.
  - i. Burner-control types.
  - j. Motor horsepower and rpm.
  - k. Motor volts, phase, and hertz.
  - l. Motor full-load amperage and service factor.
  - m. Sheave make, size in inches, and bore.
  - n. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Test Data (Indicated and Actual Values):
- a. Total airflow rate in cfm.
  - b. Entering-air temperature in deg F.
  - c. Leaving-air temperature in deg F.
  - d. Air temperature differential in deg F.
  - e. Entering-air static pressure in inches wg.

- f. Leaving-air static pressure in inches wg.
  - g. Air static-pressure differential in inches wg.
  - h. Low-fire fuel input in Btu/h.
  - i. High-fire fuel input in Btu/h.
  - j. Manifold pressure in psig.
  - k. High-temperature-limit setting in deg F.
  - l. Operating set point in Btu/h.
  - m. Motor voltage at each connection.
  - n. Motor amperage for each phase.
  - o. Heating value of fuel in Btu/h.
- G. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
  - 2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    - g. Number, make, and size of belts.
  - 3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Suction static pressure in inches wg.
- H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
- 1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft.
    - g. Indicated airflow rate in cfm.
    - h. Indicated velocity in fpm.

- i. Actual airflow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.

I. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Apparatus used for test.
- d. Area served.
- e. Make.
- f. Number from system diagram.
- g. Type and model number.
- h. Size.
- i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Air velocity in fpm.
- c. Preliminary airflow rate as needed in cfm.
- d. Preliminary velocity as needed in fpm.
- e. Final airflow rate in cfm.
- f. Final velocity in fpm.
- g. Space temperature in deg F.

J. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.
- B. Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
  2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
  3. If the second verification also fails, Owner may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- F. Prepare test and inspection reports.

END OF SECTION

## SECTION 230713 - DUCT 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 insulating the following duct services:
  - 1. Indoor, concealed supply and outdoor air.
  - 2. Indoor, exposed supply and outdoor air.
  - 3. Indoor, concealed return located in unconditioned space.
  - 4. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
- B. Related Sections:
  - 1. Section 230719 "HVAC Piping Insulation."
  - 2. Section 233113 "Metal Ducts" for duct liners.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
  - 3. Detail application of field-applied jackets.
  - 4. Detail application at linkages of control devices.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.



## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## 1.6 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.

## 1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## 1.8 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.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

- C. 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.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.
    - c. K-Flex USA.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. Knauf Insulation.
    - d. Owens Corning.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. Knauf Insulation.
    - d. Owens Corning.
- I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.

- c. Knauf Insulation.
- d. Owens Corning.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. K-Flex USA.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive 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."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
  - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive 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."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Dow Corning Corporation.
  - b. Johns Manville; a Berkshire Hathaway company.
  - c. P.I.C. Plastics, Inc.
  - d. Speedline Corporation.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Foster Brand; H. B. Fuller Construction Products.
  - b. Knauf Insulation.
  - c. Vimasco Corporation.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Childers Brand; H. B. Fuller Construction Products.
  - b. Foster Brand; H. B. Fuller Construction Products.
  - c. Mon-Eco Industries, Inc.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.

3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Childers Brand; H. B. Fuller Construction Products.
  - b. Eagle Bridges - Marathon Industries.
  - c. Foster Brand; H. B. Fuller Construction Products.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

## 2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Childers Brand; H. B. Fuller Construction Products.
  - b. Eagle Bridges - Marathon Industries.
  - c. Foster Brand; H. B. Fuller Construction Products.
  - d. Mon-Eco Industries, Inc.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. Sealants 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. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Childers Brand; H. B. Fuller Construction Products.
  - b. Eagle Bridges - Marathon Industries.
  - c. Foster Brand; H. B. Fuller Construction Products.
  - d. Mon-Eco Industries, Inc.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.5 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.
  4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
  5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. P.I.C. Plastics, Inc.
    - c. Proto Corporation.
    - d. Speedline Corporation.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: White.
- D. Metal Jacket:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. ITW Insulation Systems; Illinois Tool Works, Inc.
    - c. RPR Products, Inc.
  2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

- a. Finish and thickness are indicated in field-applied jacket schedules.
  - b. Moisture Barrier for Indoor Applications: 1-mil thick, heat-bonded polyethylene and kraft paper or 2.5-mil thick polysurlyn.
3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
- a. Material, finish, and thickness are indicated in field-applied jacket schedules.
  - b. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper or 2.5-mil- (0.063-mm-) **thick polysurlyn**.

## 2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Ideal Tape Co., Inc.; an American Biltrite company.
    - d. Knauf Insulation.
    - e. Venture Tape.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Knauf Insulation.
    - d. Venture Tape.
  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.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Compac Corporation.
  - b. Ideal Tape Co., Inc.; an American Biltrite company.
  - c. Venture Tape.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Avery Dennison Corporation, Specialty Tapes Division.
  - b. Compac Corporation.
  - c. Ideal Tape Co., Inc.; an American Biltrite company.
  - d. Knauf Insulation.
  - e. Venture Tape.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

## 2.8 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AMS Industries LLC.
  - b. ITW Insulation Systems; Illinois Tool Works, Inc.
  - c. RPR Products, Inc.
2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) AGM Industries, Inc.



- 2) Gemco.
  - 3) Hardcast, Inc.
  - 4) Midwest Fasteners, Inc.
  - 5) Nelson Stud Welding.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) AGM Industries, Inc.
    - 2) CL WARD & Family Inc.
    - 3) Gemco.
    - 4) Hardcast, Inc.
    - 5) Midwest Fasteners, Inc.
    - 6) Nelson Stud Welding.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) AGM Industries, Inc.
    - 2) Gemco.
    - 3) Midwest Fasteners, Inc.
  - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Aluminum or Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) AGM Industries, Inc.
    - 2) Gemco.
    - 3) Hardcast, Inc.
    - 4) Midwest Fasteners, Inc.
  - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Aluminum or Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive-backed base with a peel-off protective cover.

5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, aluminum or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) AGM Industries, Inc.
    - 2) Gemco.
    - 3) Hardcast, Inc.
    - 4) Midwest Fasteners, Inc.
    - 5) Nelson Stud Welding.
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Gemco.
    - 2) Hi-Q Components.
    - 3) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy or 0.062-inch soft-annealed, stainless steel.

## 2.9 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.

- B. 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.

### 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 ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. 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.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. 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.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. 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. 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, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. 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.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: 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 with requirements in Section 078413 "Penetration Firestopping" firestopping and fire-resistant joint sealers.

### 3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. 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. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. 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 one edge and one 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 punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
  5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
  6. 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.
  7. 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.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. 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. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

- b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not overcompress insulation during installation.
  - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. 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 one edge and one 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 punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
  5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. 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.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
  1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
  3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
  1. Draw jacket material smooth and tight.
  2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC 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 tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  1. Indoor, concealed supply and outdoor air.
  2. Indoor, exposed supply and outdoor air.
  3. Indoor, concealed return located in unconditioned space.
  4. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
- B. Items Not Insulated:
  1. Factory-insulated flexible ducts.
  2. Factory-insulated plenums and casings.
  3. Flexible connectors.
  4. Vibration-control devices.
  5. Factory-insulated access panels and doors.

### 3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:
  1. Flexible Elastomeric: 1 inch thick.
  2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
  3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
- B. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:
  1. Flexible Elastomeric: 1 inch thick.
  2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
  3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
- C. Concealed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
  1. Flexible Elastomeric: 1 inch thick.
  2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
  3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
- D. Concealed, rectangular, supply-air duct insulation shall be one of the following:
  1. Flexible Elastomeric: 1 inch thick.
  2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
  3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
- E. Concealed, rectangular, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
  2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft nominal density.
  3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft nominal density.
- F. Concealed, rectangular, outdoor-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
  2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft nominal density.
  3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft nominal density.
- G. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.
- H. Concealed, return-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
  2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft nominal density.
  3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft nominal density.
- I. Concealed, outdoor-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft nominal density.
  2. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft nominal density.
- J. Exposed, round and flat-oval, supply-air duct insulation shall be[ **one of**] the following:
1. Flexible Elastomeric: 1 inch thick.
  2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft nominal density.
  3. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft nominal density.
- K. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.

### 3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Concealed:
  1. PVC: 30 mils thick.
  2. Aluminum, Stucco Embossed: 0.020 inch.
  3. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish Stucco Embossed: 0.020 inch thick.

END OF SECTION



## SECTION 233113 - METAL DUCTS

### 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. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Double-wall round ducts and fittings.
4. Sheet metal materials.
5. Sealants and gaskets.
6. Hangers and supports.

- B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

- B. Shop Drawings:

1. Factory- and shop-fabricated ducts and fittings.
2. Reinforcement and spacing.

3. Seam and joint construction.
4. Penetrations through fire-rated and other partitions.
5. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
  2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
  3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible,"

Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Retain subparagraph below to require factory-fabricated, single-wall round and flat-oval ducts and fittings; delete to allow shop-fabricated ducts and fittings.
- C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Ductmate Industries, Inc.
  - 2. Lindab Inc.
  - 3. McGill AirFlow LLC.
- D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- F. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 DOUBLE-WALL ROUND DUCTS AND FITTINGS

- A. Retain first paragraph below to require factory-fabricated, double-wall round and flat-oval ducts and fittings; delete to allow shop-fabricated ducts and fittings.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Lindab Inc.
  - 2. McGill AirFlow LLC.
  - 3. MKT Metal Manufacturing, Inc.
  - 4. SEMCO Incorporated.
- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.
- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
  2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
  3. Coat insulation with antimicrobial coating.
  4. Cover insulation with polyester film complying with UL 181, Class 1.
- F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

#### 2.4 SHEET METAL MATERIALS

- A. General Material Requirements: 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. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- 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.

## 2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  2. Tape Width: 4 inches.
  3. Sealant: Modified styrene acrylic.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  7. Service: Indoor and outdoor.
  8. Service Temperature: Minus 40 to plus 200 deg F.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
  10. 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).
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Solids Content: Minimum 65 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Base: Synthetic rubber resin.
  3. Solvent: Toluene and heptane.
  4. Solids Content: Minimum 60 percent.
  5. Shore A Hardness: Minimum 60.
  6. Water resistant.
  7. Mold and mildew resistant.
  8. 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).
  9. VOC: Maximum 395 g/L.
  10. 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."
  11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
  12. Service: Indoor or outdoor.
  13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

- E. Flanged Joint Sealant: Comply with ASTM C 920.
  - 1. General: Single-component, acid-curing, silicone, elastomeric.
  - 2. Type: S.
  - 3. Grade: NS.
  - 4. Class: 25.
  - 5. Use: O.
  - 6. 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).
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:
  - 1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
  - 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  - 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
3. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
4. Unconditioned Space, Exhaust Ducts: Seal Class C.
5. Unconditioned Space, Return-Air Ducts: Seal Class B.
6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
7. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
8. Conditioned Space, Exhaust Ducts: Seal Class B.
9. Conditioned Space, Return-Air Ducts: Seal Class C.

#### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

#### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

#### 3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

#### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Duct System Cleanliness Tests:



1. Visually inspect duct system to ensure that no visible contaminants are present.

### 3.8 DUCT CLEANING

#### A. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

### 3.9 START UP

#### A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

### 3.10 DUCT SCHEDULE

#### A. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
  - a. Pressure Class: Positive 2-inch wg.
  - b. Minimum SMACNA Seal Class: B.
2. Ducts Connected to Constant-Volume Air-Handling Units:
  - a. Pressure Class: Positive 3-inch wg.
  - b. Minimum SMACNA Seal Class: B.

#### B. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
  - a. Pressure Class: Positive or negative 1-inch wg.
  - b. Minimum SMACNA Seal Class: C.
2. Ducts Connected to Air-Handling Units:
  - a. Pressure Class: Positive or negative 2-inch wg.
  - b. Minimum SMACNA Seal Class: B.

#### C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    - a. Pressure Class: Negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
  2. Ducts Connected to Air-Handling Units:
    - a. Pressure Class: Positive or negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
- D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    - a. Pressure Class: Positive or negative 1-inch wg.
    - b. Minimum SMACNA Seal Class: B.
- E. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel.
- F. Double-Wall Duct Interstitial Insulation:
1. Supply Air Ducts: 1 inch thick.
- G. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
    - a. Rectangular Main to Rectangular Branch: 45-degree entry.
    - b. Rectangular Main to Round Branch: Spin in.
  2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
    - a. Velocity 1000 fpm or Lower: 90-degree tap.
    - b. Velocity 1000 to 1500 fpm: Conical tap.
    - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

## **SECTION 233300 - AIR DUCT ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Backdraft and pressure relief dampers.
  - 2. Manual volume dampers.
  - 3. Control dampers.
  - 4. Fire dampers.
  - 5. Ceiling radiation dampers.
  - 6. Smoke dampers.
  - 7. Flange connectors.
  - 8. Turning vanes.
  - 9. Remote damper operators.
  - 10. Duct-mounted access doors.
  - 11. Flexible connectors.
  - 12. Flexible ducts.
  - 13. Duct accessory hardware.

#### **1.3 ACTION SUBMITTALS**

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

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

#### **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

## PART 2 - PRODUCTS

### 2.1 ASSEMBLY DESCRIPTION

- 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 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.

### 2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90 (Z275).
  - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed and exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. 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.

### 2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. United Enertech.
  - 2. Greenheck Fan Corporation.
  - 3. Nailor Industries Inc.
  - 4. Pottorff.
  - 5. Ruskin Company.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 1000 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Blade Action: Parallel.

- F. Blade Seals: Felt, Vinyl foam, mechanically locked Extruded vinyl, mechanically locked Neoprene.
- G. Blade Axles:
  - 1. Material: Galvanized steel.
  - 2. Diameter: 0.20 inch.
- H. Tie Bars and Brackets: Galvanized steel.
- I. Return Spring: Adjustable tension.
- J. Bearings: synthetic pivot bushings.
- K. Accessories:
  - 1. Adjustment device to permit setting for varying differential static pressure.
  - 2. Counterweights and spring-assist kits for vertical airflow installations.

#### 2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Warming and Ventilating; a Mestek Architectural Group company.
    - b. Flexmaster U.S.A., Inc.
    - c. McGill AirFlow LLC.
    - d. Nailor Industries Inc.
    - e. Pottorff.
    - f. Ruskin Company.
    - g. Trox USA Inc.
  - 2. Standard leakage rating, with linkage outside airstream.
  - 3. Suitable for horizontal or vertical applications.
  - 4. Frames:
    - a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
    - 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- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064 inch thick.
  - 6. Blade Axles: Galvanized steel.
  - 7. Bearings:
    - a. Molded synthetic.

- b. Dampers in ducts with pressure classes of 3-inch wg 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: 0.5-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 required to connect linkage of each damper in multiple-damper assembly.
  - C. Damper Hardware:
    - 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick 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.
- 2.5 CONTROL DAMPERS
- A. If multiple control-damper types are required, copy this article and re-edit for each type; assign each type a drawing designation and indicate each type on Drawings.
  - B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. American Warming and Ventilating; a Mestek Architectural Group company.
    - 2. Cesco Products; a division of MESTEK, Inc.
    - 3. Greenheck Fan Corporation.
    - 4. McGill AirFlow LLC.
    - 5. Nailor Industries Inc.
    - 6. Pottorff.
    - 7. Ruskin Company.
    - 8. Young Regulator Company.
  - C. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
  - D. Frames:
    - 1. Hat shaped.
    - 2. 0.094-inch- thick, galvanized sheet steel.
    - 3. Mitered and welded corners.
  - E. Blades:
    - 1. Multiple blade with maximum blade width of 8 inches.
    - 2. Parallel- and opposed-blade design.
    - 3. Galvanized-steel.
    - 4. 0.064 inch thick single skin or 0.0747-inch-thick dual skin.
    - 5. Blade Edging: Closed-cell neoprene.
    - 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

- F. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
  - 1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- G. Bearings:
  - 1. Oil-impregnated bronze or oil-impregnated stainless-steel sleeve.
  - 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  - 3. Thrust bearings at each end of every blade.

## 2.6 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Aire Technologies.
  - 2. Greenheck Fan Corporation.
  - 3. Nailor Industries Inc.
  - 4. Ruskin Company.
- B. General Requirements: Label according to UL 555S by an NRTL.
- C. Smoke Detector: Integral, factory wired for single-point connection.
- D. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with mechanically attached corners and mounting flange.
- E. Blades: Roll-formed, horizontal, interlocking or overlapping 0.063-inch-thick, galvanized sheet steel.
- F. Leakage: Class I.
- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Mounting Sleeve: Factory-installed, 0.05-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
- I. Damper Motors: Modulating or two-position] action.
- J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
  - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
  - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
  - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.

5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

## 2.7 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Greenheck Fan Corporation.
  2. Nailor Industries Inc.
  3. Pottorff.
  4. Ruskin Company.
- B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity. If both 1-1/2- and 3-hour ratings are required in "Fire Rating" Paragraph below, indicate location of each rating on Drawings.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Curtain type with blades outside airstream, Multiple-blade type, Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  1. Minimum Thickness: 0.138 inch thick and of length to suit application.
  2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

## 2.8 CEILING RADIATION DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Nailor Industries Inc.
  2. Pottorff.
  3. Ruskin Company.



- B. General Requirements:
  - 1. Labeled according to UL 555C by an NRTL.
  - 2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."
- C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.
- D. Blades: Galvanized sheet steel with refractory insulation.
- E. Heat-Responsive Device: Replaceable, 212 deg F rated, fusible links.
- F. Fire Rating: 1 hours.

## 2.9 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Duro Dyne Inc.
  - 3. Elgen Manufacturing.
  - 4. METALAIRE, Inc.
  - 5. Ward Industries, Inc.
- B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Double wall.

## 2.10 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Pottorff.
  - 2. Ventfabrics, Inc.
  - 3. Young Regulator Company.
- B. Description: Cable system designed for remote manual damper adjustment.
- C. Tubing: Aluminum.
- D. Cable: Stainless steel.
- E. Wall-Box Mounting: Recessed.
- F. Wall-Box Cover-Plate Material: Stainless steel.

## 2.11 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a Mestek Architectural Group company.
  2. Ductmate Industries, Inc.
  3. Elgen Manufacturing.
  4. Greenheck Fan Corporation.
  5. McGill AirFlow LLC.
  6. Nailor Industries Inc.
  7. Pottorff.
  8. Ward Industries, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
1. Door:
    - a. Double wall, rectangular.
    - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
    - c. Vision panel.
    - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
    - e. Fabricate doors airtight and suitable for duct pressure class.
  2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  3. Number of Hinges and Locks:
    - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
    - b. Access Doors up to 18 Inches Square: Continuous and two sash locks.

## 2.12 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Ductmate Industries, Inc.
  2. Duro Dyne Inc.
  3. Elgen Manufacturing.
  4. Ventfabrics, Inc.
  5. Ward Industries, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

## 2.13 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Flexmaster U.S.A., Inc.
2. Flex-Tek Group.
3. McGill AirFlow LLC.
4. Ward Industries, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

C. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

D. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

E. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

F. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Liquid adhesive plus tape.

2.14 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

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 and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
1. Install steel volume dampers in steel ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install fire dampers according to UL listing.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
1. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
  2. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
  3. At each change in direction and at maximum 50-foot spacing.
  4. Upstream from turning vanes.
  5. Control devices requiring inspection.
  6. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.

- I. Access Door Sizes:
  - 1. One-Hand or Inspection Access: 8 by 5 inches.
  - 2. Two-Hand Access: 12 by 6 inches.
  - 3. Head and Hand Access: 18 by 10 inches.
  - 4. Head and Shoulders Access: 21 by 14 inches.
  - 5. Body Access: 25 by 14 inches.
  - 6. Body plus Ladder Access: 25 by 17 inches.
  
- J. Label access doors according to Section 230553 Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
  
- K. Install flexible connectors to connect ducts to equipment.
  
- L. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
  
- M. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
  
- N. Connect flexible ducts to metal ducts with liquid adhesive plus tape.
  
- O. Install duct test holes where required for testing and balancing purposes.
  
- P. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
  - 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
  - 4. Inspect turning vanes for proper and secure installation.
  - 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

## **SECTION 233423 - HVAC POWER 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. Section Includes:
  - 1. Ceiling-mounted ventilators.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For unit hangars and supports 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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
  - 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  - 1. Roof framing and support members relative to duct penetrations.
  - 2. Ceiling suspension assembly members.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- B. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

## 1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

## 1.9 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof jacks, equipment supports, and roof penetrations with actual equipment provided.

## PART 2 - PRODUCTS

### 2.1 CEILING-MOUNTED VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Broan-NuTone LLC.
  2. Carnes Company.
  3. Greenheck Fan Corporation.
  4. JencoFan.
  5. Loren Cook Company.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Grille: Aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- F. Accessories:
1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
  3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
  4. Motion Sensor: Motion detector with adjustable shutoff timer.
  5. Isolation: Rubber-in-shear vibration isolators.
  6. Manufacturer's standard roof jack or wall cap, and transition fittings.
- G. Capacities and Characteristics: See schedules on plans.

## 2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

## 2.3 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to 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. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.



## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Equipment Mounting:
  - 1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
  - 2. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration Controls for HVAC."
- C. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

### 3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 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. Tests and Inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Adjust damper linkages for proper damper operation.
  - 5. Verify lubrication for bearings and other moving parts.
  - 6. Verify that manual and automatic volume control in connected ductwork systems are in fully open position.

7. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  8. Shut unit down and reconnect automatic temperature-control operators.
  9. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

#### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

END OF SECTION

## **SECTION 233713 - DIFFUSERS, REGISTERS, AND 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:

- 1. Rectangular and square ceiling diffusers.
- 2. Louver face diffusers.
- 3. Registers and grilles.

- B. Related Sections:

- 1. Section 089119 "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
- 2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated, include the following:

- 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
- 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Source quality-control reports.

### **PART 2 - PRODUCTS**

#### **2.1 CEILING DIFFUSERS**

- A. Rectangular and Square Ceiling Diffusers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Anemostat Products; a Mestek company.
  - b. Carnes Company.
  - c. Krueger.
  - d. METALAIRE, Inc.
  - e. Nailor Industries Inc.
  - f. Price Industries.
  - g. Titus.
2. Material: See schedule on drawings.
  3. Finish: See schedule on drawings.
  4. Face Size: See schedule on drawings.
  5. Face Style: See drawings.
  6. Mounting: See schedule on drawings.
  7. Pattern: Fixed.
  8. Dampers: See schedule on drawings.
  9. Accessories: See schedule on drawings.
- a. Plaster ring.
  - b. Sectorizing baffles.
- B. Louver Face Diffuser:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anemostat Products; a Mestek company.
    - b. Carnes Company.
    - c. METALAIRE, Inc.
    - d. Nailor Industries Inc.
    - e. Price Industries.
    - f. Titus.
  2. Material: See schedule on drawings.
  3. Finish: Baked enamel, white.
  4. Face Size: See schedule on drawings.
  5. Mounting: See schedule on drawings.
  6. Pattern: See drawings.
  7. Dampers: See schedule on drawings.
  8. Accessories:
    - a. Square to round neck adaptor.
    - b. Adjustable pattern vanes.
    - c. Throw reducing vanes.
    - d. Equalizing grid.
    - e. Plaster ring.
    - f. Sectorizing baffles.

## 2.2 REGISTERS AND GRILLES

### A. Adjustable Bar Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Anemostat Products; a Mestek company.
  - b. Carnes Company.
  - c. Krueger.
  - d. METALAIRE, Inc.
  - e. Nailor Industries Inc.
  - f. Price Industries.
  - g. Titus.
2. Material: See schedule on drawings..
  3. Finish: Baked enamel, white.
  4. Face Blade Arrangement: Vertical spaced 3/4 inch or 1/2 inch apart.
  5. Core Construction: Integral.
  6. Frame: 1-1/4 inches or 1 inch wide.
  7. Mounting: Concealed where possible.
  8. Damper Type: See schedule on drawings.

### 2.3 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 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. 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 practical. 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.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

## **SECTION 235416.13 - GAS-FIRED FURNACES - HEAT PUMP UNITS**

### **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. Gas-fired, condensing furnaces and accessories complete with controls.
  - 2. Air filters.
  - 3. Heat Pump Refrigeration components.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
  - 1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Include diagrams for power, signal, and control wiring.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For each furnace to include in emergency, operation, and maintenance manuals.
  - 1. In addition to manufacturer's standard documentation, include the following:
    - a. Furnace and accessories complete with controls.
    - b. Air filter.
    - c. Heat Pump Refrigeration components.

#### **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- 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. Disposable Air Filters: Furnish two complete sets.

## 1.6 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- B. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- C. Comply with NFPA 70.

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:
  - 1. Warranty Period, Commencing on Date of Substantial Completion:
    - a. Furnace Heat Exchanger: 10 years.
    - b. Integrated Ignition and Blower Control Circuit Board: Five years.
    - c. Draft-Inducer Motor: Five years.
    - d. Refrigeration Compressors: 10 years.
    - e. Evaporator and Condenser Coils: Five years.

## PART 2 - PRODUCTS

### 2.1 ASSEMBLY DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a qualified testing agency, and marked for intended location and application.
- B. General Requirements for Noncondensing Gas-Fired Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

### 2.2 GAS-FIRED FURNACES, CONDENSING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amana Heating & Air Conditioning; under license to Goodman Company, L.P.
  - 2. Carrier Corporation; a unit of United Technologies Corp.
  - 3. Lennox Industries, Inc.; Lennox International.
  - 4. Rheem Manufacturing Company; Heating and Cooling Products.
  - 5. Ruud Air Conditioning Division.
  - 6. Trane.
- B. Cabinet: Steel or Galvanized steel.
  - 1. Cabinet interior around heat exchanger shall be factory-installed insulation.
  - 2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
  - 3. Factory paint external cabinets in manufacturer's standard color.
  - 4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

- C. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
  - 1. Fan Motors: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - 2. Special Motor Features: Single speed, premium efficiency, as defined in Section 230513 "Common Motor Requirements for HVAC Equipment," and with internal thermal protection and permanent lubrication.
  - 3. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
  - 4. Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.
- D. Type of Gas: Propane.
- E. Heat Exchanger:
  - 1. Primary: Stainless steel.
  - 2. Secondary: Stainless steel.
- F. Burner:
  - 1. Gas Valve: 100 percent safety two-stage or modulating main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
  - 2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.
- G. Gas-Burner Safety Controls:
  - 1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
  - 2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
  - 3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
- H. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.
- I. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories; diagnostic light with viewport.
- J. Accessories:
  - 1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through outside wall or roof.
  - 2. CPVC Plastic Vent Materials:
    - a. CPVC Plastic Pipe: Schedule 40, complying with ASTM F 441/F 441M.
    - b. CPVC Plastic Fittings: Schedule 40, complying with ASTM F 438, socket type.
    - c. CPVC Solvent Cement: ASTM F 493.
      - 1) CPVC solvent cement shall have a VOC content of 490 g/L or less.
      - 2) Adhesive primer shall have a VOC content of 550 g/L or less.
      - 3) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the



California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

3. PVC Plastic Vent Materials:
  - a. PVC Plastic Pipe: Schedule 40, complying with ASTM D 1785.
  - b. PVC Plastic Fittings: Schedule 40, complying with ASTM D 2466, socket type.
  - c. PVC Solvent Cement: ASTM D 2564.
    - 1) PVC solvent cement shall have a VOC content of 510 g/L or less.
    - 2) Adhesive primer shall have a VOC content of 550 g/L or less.
    - 3) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
  
- K. Capacities and Characteristics: See schedules on drawings.

## 2.3 THERMOSTATS

- A. Controls shall comply with requirements in ASHRAE/IES 90.1, "Controls."
- B. Solid-State Thermostat: Wall-mounted, programmable, microprocessor-based unit with automatic or manual switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, and battery backup protection against power failure for program settings.
- C. Control Wiring: Unshielded twisted-pair cabling.
  1. No. 24 AWG, 100 ohm, four pair.
  2. Cable Jacket Color: Blue.

## 2.4 AIR FILTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Aprilaire; Research Products Corp.
  2. Filtrete Home Filtration Products; a 3M brand.
  3. General Filters, Inc.
  4. Permatron Corporation.
- B. Disposable Filters: 1-inch- thick fiberglass media with ASHRAE 52.2 MERV rating of 6 or higher, in sheet metal frame.

## 2.5 HEAT PUMP REFRIGERATION COMPONENTS

- A. General Refrigeration Component Requirements:

1. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC-free refrigerants.
  2. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IES 90.1.
- B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with AHRI 210/240. Match size with furnace. Include condensate drain pan with accessible drain outlet complying with ASHRAE 62.1.
1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.
- C. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.
- D. Air-Cooled Heat Pump Compressor-Condenser Unit:
1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
  2. Compressor: Hermetically sealed reciprocating or scroll type.
    - a. Crankcase heater.
    - b. Restrained vibration or Vibration isolation mounts for compressor.
    - c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
    - d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
    - e. Refrigerant Charge: R-410A.
    - f. Refrigerant: R-410A.
  3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with AHRI 210/240, and with liquid subcooler.
  4. Heat-Pump Components: Reversing valve and low-temperature air cut-off thermostat.
  5. Fan: Aluminum-propeller type, directly connected to motor.
  6. Motor: Permanently lubricated, with integral thermal-overload protection.
  7. Low Ambient Kit: Permits operation down to 45 deg F.
  8. Mounting Base: Polyethylene.
- E. Capacities and Characteristics: See schedules on drawings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.

- C. Examine roughing-in for gas and refrigerant piping systems to verify actual locations of piping connections before equipment installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.
- B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.
  - 1. Install seismic restraints to limit movement of furnace by resisting code-required seismic acceleration.
- C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.
  - 1. Anchor furnace to substrate to resist code-required seismic acceleration.
- D. Controls: Install thermostats at mounting height of 48 inches above floor.
- E. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.
- F. Install ground-mounted, compressor-condenser components on 4-inch-thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete." Or Section 033053 "Miscellaneous Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

### 3.3 CONNECTIONS

- A. Gas piping installation requirements are specified in Section 231126 "Facility Liquefied-Petroleum Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Vent Connection, Noncondensing, Gas-Fired Furnaces: Connect Type B vents to furnace vent connection and extend outdoors. Type B vents and their installation requirements are specified in Section 235123 "Gas Vents."
- D. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.
  - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
  - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  - 3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
    - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

- b. CPVC Piping: Join according to ASTM D 2846/D 2846M, Appendix.
- c. 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.
- d. Requirements for Low-Emitting Materials:
  - 1) CPVC solvent cement shall have a VOC content of 490 g/L or less.
  - 2) PVC solvent cement shall have a VOC content of 510 g/L or less.
  - 3) Adhesive primer shall have a VOC content of 550 g/L or less.
  - 4) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 4. Slope pipe vent back to furnace or to outside terminal.
- E. Connect ducts to furnace with flexible connector. Comply with requirements in Section 233300 "Air Duct Accessories."
- F. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled compressor-condenser unit.
  - 1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."
  - 2. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
  - 3. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
- G. Comply with requirements in Section 232300 "Refrigerant Piping" for installation and joint construction of refrigerant piping.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Perform electrical test and visual and mechanical inspection.
  - 2. Leak Test: After installation, charge systems with refrigerant and test for leaks. Repair leaks, replace lost refrigerant, and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
  - 4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
  - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

### 3.5 STARTUP SERVICE

- A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Inspect for physical damage to unit casings.
2. Verify that access doors move freely and are weathertight.
3. Clean units and inspect for construction debris.
4. Verify that all bolts and screws are tight.
5. Adjust vibration isolation and flexible connections.
6. Verify that controls are connected and operational.

B. Adjust fan belts to proper alignment and tension.

C. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.

D. Measure and record airflows.

E. Verify proper operation of capacity control device.

F. After startup and performance test, lubricate bearings.

### 3.6 ADJUSTING

A. Adjust initial temperature set points.

B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

### 3.7 CLEANING

A. After completing installation, clean furnaces internally according to manufacturer's written instructions.

B. Install new filters in each furnace within 14 days after Substantial Completion.

### 3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain condensing units.

END OF SECTION

## **SECTION 238239.19 - WALL AND CEILING UNIT 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 wall and ceiling heaters with propeller fans and electric-resistance heating coils.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For wall and ceiling unit heaters to include in emergency, operation, and maintenance manuals.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Berko; Marley Engineered Products.
  - 2. INDEECO.
  - 3. Markel Products; TPI Corporation.
  - 4. QMark; Marley Engineered Products.
  - 5. Trane.

#### **2.2 DESCRIPTION**

- A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.
- 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.

### 2.3 CABINET

- A. Front Panel: Extruded-aluminum bar grille, with removable panels fastened with tamperproof fasteners.
- B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

### 2.4 COIL

- A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

### 2.5 FAN AND MOTOR

- A. Fan: Aluminum propeller directly connected to motor.
- B. Motor: Permanently lubricated. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

### 2.6 CONTROLS

- A. Controls: Unit-mounted thermostat.
- B. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

### 2.7 CAPACITIES AND CHARACTERISTICS

- A. See schedule on mechanical drawings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive wall and ceiling unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall and ceiling unit heaters to comply with NFPA 90A.
- B. Install wall and ceiling unit heaters level and plumb.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION



## SECTION 260010 - BASIC ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1. RELATED DOCUMENTS

- A. This Section supplements Division 1, General Requirements.
- B. Where contradictions occur between this Section and Division 1, the more stringent of the two shall apply. Architect shall decide which is most stringent.
- C. Provisions of this section shall also apply to all sections of Division 26, Division 27, and Division 28.
- D. The specifications are complementary to the drawings and their requirements shall have the same priority as the drawings

#### 1.2. COORDINATION WITH OTHER TRADES

##### A. Contract Documents:

- 1. General: The Contract Documents are diagrammatic, showing certain physical relationships which must be established within the electrical work and its interface with other work. Such establishment is the exclusive responsibility of the Contractor. Drawings shall not be scaled for the purpose of establishing material quantities.
- 2. Work out all conditions in advance of installation. If necessary, and before work proceeds in those areas, prepare coordination drawings showing all work in congested areas. Provide additional work necessary to overcome congested conditions at no increase in contract sum.
- 3. Coordinate the electrical work to the progress of the work of other trades.
- 4. Complete the entire installation as soon as the condition of the building will permit.
- 5. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install electrical and electric systems within the cavity space allocation in the following order:
  - a. Lighting.
  - b. Plumbing piping.
  - c. Mechanical ductwork.
  - d. Fire sprinkler piping.
  - e. Air diffusers.
  - f. Domestic water piping.

##### B. Discrepancies:

- 1. Examine Drawings and Specifications.
- 2. Report any discrepancies to the Architect and obtain written instructions before proceeding.

3. Should there be a conflict within or between the Specifications or Drawings, the more stringent or higher quality requirements shall apply. The determination of the more stringent or higher quality shall lie with the Architect.
4. Items called for in either specifications or drawings shall be required as if called for in both.
5. Be responsible for providing proper documentation of equipment product data and shop drawings to all entities providing service.
6. Coordination Drawings:
  - a. Acceptance by the Architect does not imply acceptance of any deviations from contract documents requirements or acceptance of uncoordinated work. Review is for general conformance to the design concept and general compliance with the information given in the contract documents.
  - b. Prepare Coordination Drawings at a  $1/4" = 1'-0"$  scale, showing the required dimensions. In addition to the mentioned areas above, also submit the following:
    - 1) All electrical equipment rooms such as fan rooms, boiler rooms, chiller rooms, etc.
    - 2) Indicate all major piping, electrical equipment and conduits, Structural and Architectural elements in these areas as well. Provide all necessary sections and elevations for clarification.
    - 3) When electronic Building Information Modeling (BIM) files have been provided to the contractor, the contractor shall only consider the files as design to only show the intent of the design. The contractor shall be responsible for the Coordination drawings based on the design.
    - 4) Utility Connections:
      - (a) Coordinate the connection of electrical systems with utilities.
      - (b) Comply with requirements of utilities.
      - (c) Coordinate electrical utility interruptions at least one week in advance with the Owner and the Utility Company unless otherwise indicated.
        - (1) Plan work so that duration of the interruption is kept to a minimum.

### 1.3. COORDINATION WITH EXISTING OCCUPIED AREAS

- A. Minimize disruptions to operation of electrical systems in occupied areas.
- B. Coordinate any required disruptions with the Owner, one week in advance.
- C. Provide temporary connections to prevent long disruptions.

### 1.4. DELEGATED DESIGN BY CONTRACTOR

- A. The construction of this building requires the Contractor to design several systems or subsystems. All such designs shall be the complete responsibility of the Contractor.

- B. Systems or subsystems which require engineering responsibility by the Contractor include, but are not limited to:
  - 1. Any system not fully detailed.
  - 2. Equipment supports, not fully detailed.
  - 3. Conduit hangers and anchors not specified in these documents or cataloged by the manufacturer.
  - 4. Lighting controls and wiring.
  - 5. Fire Alarm Systems.
  - 6. Conduit systems for, Data and Fire Alarm.

#### 1.5. REGULATORY REQUIREMENTS

- A. Codes: Comply with the codes adopted by authority having jurisdiction (which shall include but not be limited to):
  - 1. Applicable editions of NFPA.
  - 2. Requirements of Fire Departments serving the project.
  - 3. Regulations of the Health Department having jurisdiction.
  - 4. Regulations of the Office of State Fire Marshal or its equivalent.
  - 5. Americans with Disabilities Act (ADA).
- B. Requirements of Local Utility Companies:
  - 1. Comply with rules and requirements of local utility companies. Include in bid the cost of all service fees, EUSERC cabinets, meter boxes, meters, conduit, and such equipment which will be required for the project.
- C. Other Regulations: Comply with the latest applicable regulations and ordinances of the following:
  - 1. U. S. and State Department of Labor Safety Regulations pertaining to the completed project.
  - 2. Clean Air Act.
  - 3. Clean Water Act.
  - 4. Requirements of product listings by nationally recognized listing agencies as recognized by the Occupational Safety and Hazards Agency (OSHA).
- D. Contradictions: Where Codes are contradictory, follow the most stringent, unless otherwise indicated in Plans or Specifications. Architect shall determine which is most stringent.
- E. Codes are a minimum requirement approved by the AHJ, in many cases the Project Documents will exceed the minimum requirements of the codes.

- F. When Project Documents exceed the requirements of the codes, Project Documents must be followed.
- G. Inspections and Tests:
  - 1. Inspections and tests required shall be completed by a third-party NETA Testing Agency/Contractor. Contractor shall arrange for all required inspections and testing.
  - 2. Contractor shall pay all inspections and testing charges.
  - 3. Notify Architect two (2) business days before tests.
  - 4. Inspections reports and Test Reports shall be provided to the Architect for review and shall be included in the final Record Documents.

#### 1.6. OWNER-FURNISHED EQUIPMENT

- A. All equipment called out in the Specifications or shown on the Drawings as "Owner-Furnished Equipment" or equipment furnished by other Divisions shall be installed and connected as required for a complete and operational system. Provide rough ins for all future connections indicated.

#### 1.7. INSTALLATION GENERAL REQUIREMENTS

- A. Furnish, apply, install, connect, erect, clean, and condition manufactured materials and equipment as recommended in manufacturer's printed directions (maintained on job site during installation).
- B. Provide all attachment devices and materials necessary to secure materials together or to other materials.
- C. Make allowance for ample and normal expansion and contraction for all building components and piping systems that are subject to such.
- D. Install materials only when conditions of temperature, moisture, humidity, and conditions of adjacent building components are conducive to achieving the best installation results.
- E. Erect, install, and secure components in a structurally sound and appropriate manner.
- F. Where necessary, temporarily brace, shore, or otherwise support members until final connections are installed.
- G. Leave all temporary bracing, shoring, or other structural supports in place as long as practical for safety and to maintain proper alignment.
- H. Handle materials in a manner to prevent scratching, abrading, distortion, chipping, breaking, or other disfigurement.
- I. Conduct work in a manner to avoid injury or damage to previously placed work. Any work so impaired or damaged shall be replaced at no expense to Owner.
- J. Fabricate and install materials true to line, plumb, and level.
- K. Leave finished surfaces smooth and flat, free from wrinkles, warps, scratches, dents, and other imperfections.

- L. Furnish materials in longest practical lengths and largest practical sizes to avoid all unnecessary jointing.
- M. Make all joints secure, tightly fitted, and as inconspicuous as possible by the best accepted practice in joining and fabricating.
- N. Contact Architect for mounting height or position of any unit not specifically indicated or located on Drawings or specified in Specifications.
- O. Job mixed multi-component materials used in the work shall be mixed in such regulated and properly sized batches that material can be used before it begins to "set."
- P. Mixing of a partially "set" batch with another batch of fresh materials will not be accepted and entire batch shall be discarded and removed from site.
- Q. Clean all mixing tools and appliances that can be contaminated prior to mixing of fresh materials.
- R. In addition to the above, refer to each Section of the Specifications for additional installation requirements for the proper completion of all work.

## PART 2 - PRODUCTS

### 2.1. GENERAL

- A. Certain products are specified without equals. Substitutions for these will not be considered.
- B. Follow substitution instructions in Front End Documents for any manufacturer not listed in the Project Manual or the drawings that the contractor may want considered for substitution.
- C. Coordination of general equivalents and substitutions: Where Contract Documents permit selection from several general equivalents, or where substitutions are authorized, coordinate clearance and other interface requirements with electrical and other work.
  - 1. Provide necessary additional items so that selected or substituted item operates equivalent to the basis of design and properly fits in the available space allocated for the basis of design.
  - 2. Provide all features which are standard and specified on the basis of design.
  - 3. Contractor is responsible for assuring that piping, conduit, duct, flue, and other service locations for general equivalents or substitutions do not cause access, service, or operational difficulties any greater than would be encountered with the basis of design. Acceptance by the Architect does not imply acceptance of any deviations from contract documents.
  - 4. Confirm if modifications to electrical, structural or architectural requirements for substituted or general equivalents are needed such as: wire size, conduit size, MCA, MOCP, weight, support, etc. Coordinate with General and Electrical Contractor prior to bid.

## PART 3 – EXECUTION

### 3.1. COORDINATION OF ELECTRICAL INSTALLATION.

- A. Inspection and Preparation:

1. Examine the work interfacing with electrical work, and the conditions under which the work will be performed and notify the Architect of conditions detrimental to the proper completion of the work.
2. Do not proceed with the work until unsatisfactory conditions have been corrected. Lack of notifying Architect of conditions is in no way cause for change order request.

B. Layout:

1. Layout the electrical work in conformity with the Contract Drawings, Coordination Drawings and other Shop Drawings, product data and similar requirements so that the entire electrical plant will perform as an integrated system, properly interfaced with other work, recognizing that portions of the work are shown only in diagrammatic form.
2. Where coordination requirements conflict with individual system requirements, comply with the Architect's decision on resolution of the conflict.
3. Take necessary field measurements to determine space and connection requirements.
4. Provide sizes and shapes of equipment so the final installation conforms to the intent of the Contract Documents.

- C. Integrate electrical work in ceiling spaces with suspension system, light fixtures and other work so that required performances of each will be achieved.

3.2. PRODUCT INSTALLATION

A. Manufacturer's Instructions:

1. Except where more stringent requirements are indicated, comply with the product manufacturer's instructions and recommendations.
2. Consult with manufacturer's technical representatives, who are recognized as technical experts, for specific instructions on special project conditions.
3. If a conflict exists, notify the Architect in writing and obtain his instruction before proceeding with the work in question.

B. Movement of Equipment:

1. Wherever possible, arrange for the movement and positioning of equipment so that enclosing partitions, walls, and roofs will not be delayed or need to be removed. Otherwise, advise Contractor of opening requirements to be maintained for the subsequent entry of equipment.

C. Heavy Equipment:

1. Coordinate the movement of heavy items with shoring and bracing so that the building structure will not be overloaded during the movement and installation.
2. Where electrical products to be installed on an existing roof are too heavy to be hand-carried, do not transport across the existing roof deck; position by crane or other device so as to avoid overloading the roof deck.

D. Support:

1. Anchor and secure all equipment to the building substrate and structure.
- E. Clearances:
1. Install conduit and cables:
    - a. Straight and true.
    - b. Aligned with other work and with general lines of the building.
    - c. Concealed, where possible, in occupied spaces.
    - d. Out of the way with maximum passageway and headroom remaining in each space.
  2. Except as otherwise indicated, arrange electrical services and overhead equipment with a minimum of:
    - a. 7'6" headroom in storage spaces. Do not obstruct windows, doors, or other openings.
  3. Give the right-of-way to piping systems required to slope for drainage (over other service lines and ductwork).

### 3.3. PROTECTION OF WORK

- A. All conduit ends, panelboards, motor controls, disconnecting means, and equipment left unconnected shall be capped, plugged, or otherwise properly protected to prevent damage or the intrusion of foreign matter.
- B. Any equipment or conduit system found to have been damaged or contaminated shall be replaced or cleaned to the Engineer's satisfaction.

### 3.4. ADJUSTING

- A. Adjust all equipment and system components as shown or as otherwise required to result in intended system operation.
- B. At completion of work, provide written certification that all systems are functioning properly without defects.

### 3.5. START-UP

- A. Contractor shall assign a Start-Up Coordinator for his portion of work on the project.
- B. The Start-Up Coordinator shall develop detailed start-up procedures, equipment checkout procedure and data forms for recording compliance with contract document performance criteria and will assist in developing schedules for checkout and Owner acceptance.
- C. The Start-Up Coordinator shall be responsible for maintaining documentation of Start-Up activities until final acceptance of the project.
- D. The documentation shall be kept current by the Start-Up Coordinator and shall be always available for inspection. At the time of acceptance of the project, the Start-Up Coordinator shall surrender 3 completed copies of the documentation to the Owner's representative.

1. Coordinate with the mechanical installation the requirements for the startup of mechanical and plumbing systems:
  - a. All equipment, components, and systems have been set, started-up, and adjusted including checking the following: proper equipment electrical rotation, control connections, factory trained technician startup, etc.
  - b. All electric power connections, disconnects, fuses, circuit breakers, etc. are properly sized and installed.

### 3.6. TRAINING

- A. Refer to Division 1 sections of the specifications regarding requirements of Record Drawings, Operation and Maintenance Manual submittal and systems training.
  1. Demonstrate that each system operates properly.
  2. Explain the operation of each system to the Owner's Representative.
  3. Explain use of O&M manual in operating and maintaining systems.
  4. Date, time, and duration of training will be determined by Owner.
  5. Training agendas and schedules shall be developed and approved by Owner, Commissioning Authority, Engineer, and Architect prior to training.
  6. Document and turn over to owner the training sessions on USB flash drive and placed in O & M Manuals. At the end of all sessions, compile all sessions on a single USB flash drive and turn over to owner as part of the O & M manuals.
- B. For specific systems requiring extended instruction, refer to individual Division 26 sections.

END OF SECTION



## SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 GENERAL

#### 1.1. SECTION INCLUDES

- A. Single conductor building wire.
- B. Service entrance cable.
- C. Metal-clad cable.
- D. Wiring connectors.
- E. Electrical tape.
- F. Heat shrink tubing.
- G. Oxide inhibiting compound.
- H. Wire pulling lubricant.
- I. Cable ties.

#### 1.2. RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 28 4600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

#### 1.3. REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.
- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes 2020.

- G. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- H. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable 2018.
- I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2021.
- J. NETA ATS - Standard for Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- M. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.
- N. UL 267 - Outline of Investigation for Wire-Pulling Compounds Most Recent Edition, Including All Revisions.
- O. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- P. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.
- Q. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.
- R. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.
- S. UL 854 - Service-Entrance Cables Current Edition, Including All Revisions.
- T. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
  - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

#### 1.6. QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

#### 1.8. FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

### PART 2 PRODUCTS

#### 2.1. CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is not permitted.
- E. Service entrance cable is permitted only as follows:
  - 1. Where not otherwise restricted, may be used:
    - a. For underground service entrance, installed in raceway.
- F. Armored cable is not permitted.

- G. Metal-clad cable is permitted only as follows:
  - 1. Where not otherwise restricted, may be used:
    - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
      - 1) Maximum Length: 6 feet (1.8 m).
  - 2. In addition to other applicable restrictions, may not be used:
    - a. Where not approved for use by the authority having jurisdiction.
    - b. Where exposed to view.
    - c. Where exposed to damage.
    - d. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.

## 2.2. CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.
- H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
- I. Conductor Material:
  - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
  - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
  - 3. Tinned Copper Conductors: Comply with ASTM B33.
- J. Minimum Conductor Size:
  - 1. Branch Circuits: 12 AWG.

- a. Exceptions:
    - 1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
    - 2) 20 A, 277 V circuits longer than 150 feet (46 m): 10 AWG, for voltage drop.
  - 2. Control Circuits: 14 AWG.
  - K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  - L. Conductor Color Coding:
    - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
    - 2. Color Coding Method: Integrally colored insulation.
      - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
    - 3. Color Code:
      - a. 240/120 V, Single Phase, 3 Wire System:
        - 1) Phase A: Black.
        - 2) Phase B: Red.
        - 3) Neutral/Grounded: White.
      - b. Equipment Ground, All Systems: Green.
      - c. For control circuits, comply with manufacturer's recommended color code.
- 2.3. SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
  - 1. Copper Building Wire:
    - a. Cerro Wire LLC: [www.cerrowire.com](http://www.cerrowire.com).
    - b. Encore Wire Corporation: [www.encorewire.com](http://www.encorewire.com).
    - c. Southwire Company: [www.southwire.com](http://www.southwire.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
  - 1. Feeders and Branch Circuits:

- a. Size 10 AWG and Smaller: Solid.
- b. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
  - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
    - a. Installed Underground: Type XHHW-2.

#### 2.4. SERVICE ENTRANCE CABLE

- A. Manufacturers:
  - 1. Copper Service Entrance Cable:
    - a. Cerro Wire LLC: [www.cerrowire.com](http://www.cerrowire.com).
    - b. Encore Wire Corporation: [www.encorewire.com](http://www.encorewire.com).
    - c. Southwire Company: [www.southwire.com](http://www.southwire.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2 and with UL 44 Type RHH/RHW-2.
- C. Conductor Stranding: Stranded.
- D. Insulation Voltage Rating: 600 V.

#### 2.5. METAL-CLAD CABLE

- A. Manufacturers:
  - 1. AFC Cable Systems Inc: [www.afcweb.com](http://www.afcweb.com).
  - 2. Encore Wire Corporation: [www.encorewire.com](http://www.encorewire.com).
  - 3. Southwire Company: [www.southwire.com](http://www.southwire.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569 and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
  - 1. Size 10 AWG and Smaller: Solid.
  - 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.

- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Provide oversized neutral conductors where indicated or required.
- G. Provide dedicated neutral conductor for each phase conductor where indicated or required.
- H. Grounding: Full-size integral equipment grounding conductor.
  - 1. Provide additional isolated/insulated grounding conductor where indicated or required.
- I. Armor: Steel, interlocked tape.
- J. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

## 2.6. WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 0526.
- C. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
  - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Provide motor pigtail connectors for connecting motor leads to facilitate disconnection.
  - 3. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors where connectors are required.
  - 4. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- G. Mechanical Connectors: Provide bolted type or set-screw type.
- H. Compression Connectors: Provide circumferential type or hex type crimp configuration.
- I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

## 2.7. ACCESSORIES

### A. Electrical Tape:

1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.
4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil (3.2 mm); suitable for continuous temperature environment up to 176 degrees F (80 degrees C).
5. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).

### B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

### C. Wire Pulling Lubricant:

1. Listed and labeled as complying with UL 267.
2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
3. Suitable for use at installation temperature.

### D. Cable Ties: Material and tensile strength rating suitable for application.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.



### 3.2. PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

### 3.3. INSTALLATION

#### A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
9. Provide oversized neutral/grounded conductors where indicated and as specified below.
  - a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
  - b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

#### B. Install products in accordance with manufacturer's instructions.

#### C. Perform work in accordance with NECA 1 (general workmanship).

#### D. Install metal-clad cable (Type MC) in accordance with NECA 120.

#### E. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
  - 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
  - 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- H. Terminate cables using suitable fittings.
  - 1. Metal-Clad Cable (Type MC):
    - a. Use listed fittings.
    - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- I. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
- J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet (1.5 m) of slack.
- K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- M. Make wiring connections using specified wiring connectors.
  - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
  - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
  - 3. Do not remove conductor strands to facilitate insertion into connector.
  - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
  - 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
  2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
    - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
  3. Wet Locations: Use heat shrink tubing.
- O. Insulate ends of spare conductors using vinyl insulating electrical tape.
- P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- Q. Identify conductors and cables in accordance with Section 26 0553.
- R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
- 3.4. FIELD QUALITY CONTROL
- A. See Section 01 4000 - Quality Requirements, for additional requirements.
  - B. Inspect and test in accordance with NETA ATS, except Section 4.
  - C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
    1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
  - D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

## SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.1. SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.
- F. Ground enhancement material.
- G. Ground access wells.

#### 1.2. RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
  - 1. Includes oxide inhibiting compound.
- B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

#### 1.3. REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2017.
- D. NETA ATS - Standard for Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Verify exact locations of underground metal water service pipe entrances to building.

2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Field quality control test reports.
- E. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6. QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1. GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding System Resistance:
  - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
  - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method or alternate test described in IEEE 81.
  - 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- E. Grounding Electrode System:
  - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    - a. Provide continuous grounding electrode conductors without splice or joint.
    - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
  - 2. Metal Underground Water Pipe(s):
    - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
    - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
    - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
  - 3. Metal In-Ground Support Structure:
    - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
  - 4. Concrete-Encased Electrode:
    - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
  - 5. Ground Rod Electrode(s):

- a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
  - b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
  - c. Where location is not indicated, locate electrode(s) at least 5 feet (1.5 m) outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
  - d. Provide ground access well for first connected electrode.
6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
- a. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
  - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
  - c. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.
8. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.
- F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
  2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
  2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.

3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
  - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
  - b. Metal gas piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame.
10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.

H. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
  - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
  - b. Raceway Size: 3/4-inch (21 mm) trade size unless otherwise indicated or required.
  - c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
  - d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

2.2. GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.



- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
1. Use insulated copper conductors unless otherwise indicated.
    - a. Exceptions:
      - 1) Use bare copper conductors where installed underground in direct contact with earth.
      - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
  2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
    - a. Exceptions:
      - 1) Use mechanical connectors for connections to electrodes at ground access wells.
  3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
    - a. Exceptions:
      - 1) Use exothermic welded connections for connections to metal building frame.
  4. Manufacturers - Mechanical and Compression Connectors:
    - a. Advanced Lightning Technology (ALT): [www.altfab.com](http://www.altfab.com).
    - b. Burndy LLC: [www.burndy.com](http://www.burndy.com).
    - c. Harger Lightning & Grounding: [www.harger.com](http://www.harger.com).
    - d. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
    - e. Substitutions: See Section 01 6000 - Product Requirements.
  5. Manufacturers - Exothermic Welded Connections:
    - a. Advanced Lightning Technology (ALT): [www.altfab.com](http://www.altfab.com).
    - b. Burndy LLC: [www.burndy.com](http://www.burndy.com).
    - c. nVent ERICO; Cadweld: [www.nvent.com/#sle](http://www.nvent.com/#sle).
    - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: [www.thermoweld.com](http://www.thermoweld.com).
    - e. Substitutions: See Section 01 6000 - Product Requirements.

D. Ground Bars:

1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
  - a. Advanced Lightning Technology (ALT): [www.altfab.com](http://www.altfab.com).
  - b. Harger Lightning & Grounding: [www.harger.com](http://www.harger.com).
  - c. nVent ERICO: [www.nvent.com/#sle](http://www.nvent.com/#sle).
  - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: [www.thermoweld.com](http://www.thermoweld.com).

E. Ground Rod Electrodes:

1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.
4. Manufacturers:
  - a. Advanced Lightning Technology (ALT): [www.altfab.com](http://www.altfab.com).
  - b. Galvan Industries, Inc: [www.galvanelectrical.com](http://www.galvanelectrical.com).
  - c. Harger Lightning & Grounding: [www.harger.com](http://www.harger.com).
  - d. nVent ERICO: [www.nvent.com/#sle](http://www.nvent.com/#sle).
  - e. Substitutions: See Section 01 6000 - Product Requirements.

F. Ground Access Wells:

1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
  - a. Areas Exposed to Vehicular Traffic: Rated for not less than 8,000 pounds (35.6 kN) vertical design load.
2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
  - a. Round Wells: Not less than 8 inches (200 mm) in diameter.
  - b. Rectangular Wells: Not less than 12 by 12 inches (300 by 300 mm).

3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches (250 mm).
4. Cover: Factory-identified by permanent means with word "GROUND".
5. Manufacturers:
  - a. Advanced Lightning Technology (ALT): [www.altfab.com](http://www.altfab.com).
  - b. Galvan Industries, Inc: [www.galvanelectrical.com](http://www.galvanelectrical.com).
  - c. Harger Lightning & Grounding: [www.harger.com](http://www.harger.com).
  - d. nVent ERICO: [www.nvent.com/#sle](http://www.nvent.com/#sle).
  - e. Substitutions: See Section 01 6000 - Product Requirements.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45-degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70.
  1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.
  2. Indoor Installations: Unless otherwise indicated, install with 4 inches (100 mm) of top of rod exposed.
- D. Make grounding and bonding connections using specified connectors.
  1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking, or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 26 0553.

### 3.3. FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.
- E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

## **SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

### **PART 1 GENERAL**

#### **1.1. SECTION INCLUDES**

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

#### **1.2. RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- C. Section 26 0533.16 - BOXES: Additional support and attachment requirements for boxes.
- D. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- E. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

#### **1.3. REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- D. MFMA-4 - Metal Framing Standards Publication 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 5B - Strut-Type Channel Raceways and Fittings Current Edition, Including All Revisions.

#### **1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
  - 2. Coordinate work to provide additional framing and materials required for installation.
  - 3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.

4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 3000.

1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Installer's qualification statement.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6. QUALITY ASSURANCE

- A. Maintain at project site one copy of each referenced document that prescribes execution requirements.
- B. Installer Qualifications for Powder-Actuated Fasteners: Certified by fastener system manufacturer with current operator's license.
- C. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1. SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
  1. Comply with the following. Where requirements differ, comply with most stringent.
    - a. NFPA 70.
    - b. Requirements of authorities having jurisdiction.
  2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.

3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
  4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
  5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
  6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
  7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
    - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
    - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    - d. Galvanized Steel: Hot dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Materials for Metal Fabricated Supports: See Section 05 5000.
- C. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
  2. Conduit Clamps: Bolted type unless otherwise indicated.
- D. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
- E. Metal Channel/Strut Framing Systems:
1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
  2. Comply with MFMA-4.
  3. Channel Material:
    - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
  4. Minimum Channel Thickness: Steel sheet, 12-gauge, 0.1046 inch (2.66 mm).
  5. Minimum Channel Dimensions: 1-5/8 inch (41 mm) wide by 13/16 inch (21 mm) high.
- F. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:

- a. Equipment Supports: 1/2-inch (13 mm) diameter.
  - b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch (6 mm) diameter.
  - c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch (10 mm) diameter.
  - d. Trapeze Support for Multiple Conduits: 3/8-inch (10 mm) diameter.
  - e. Outlet Boxes: 1/4-inch (6 mm) diameter.
  - f. Luminaires: 1/4-inch (6 mm) diameter.
- G. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
  2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
  4. Mounting Height: Provide minimum clearance of 6 inches (150 mm) under supported component to top of roofing.
- H. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
  2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
  3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
  4. Hollow Masonry: Use toggle bolts.
  5. Hollow Stud Walls: Use toggle bolts.
  6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
  7. Sheet Metal: Use sheet metal screws.
  8. Wood: Use wood screws.
  9. Plastic and lead anchors are not permitted.
  10. Powder-actuated fasteners are permitted only as follows:
    - a. Where approved by Architect.
    - b. Use only threaded studs; do not use pins.
  11. Hammer-driven anchors and fasteners are permitted only as follows:



- a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction.
  - b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction.
12. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
- a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
  - b. Comply with MFMA-4.
  - c. Channel Material: Use galvanized steel.
  - d. Minimum Channel Thickness: Steel sheet, 12-gauge, 0.1046 inch (2.66 mm) minimum base metal thickness.
13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1.
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Equipment Support and Attachment:
  1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.

2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  4. Unless otherwise indicated, mount floor-mounted equipment on properly sized concrete pad 3 inches (80 mm) in height; see Section 03 3000.
  5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Conduit Support and Attachment: See Section 26 0533.13 for additional requirements.
  - J. Box Support and Attachment: See Section 26 0533.16 for additional requirements.
  - K. Interior Luminaire Support and Attachment: See Section 26 5100 for additional requirements.
  - L. Exterior Luminaire Support and Attachment: See Section 26 5600 for additional requirements.
  - M. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
  - N. Secure fasteners in accordance with manufacturer's recommended torque settings.
  - O. Remove temporary supports.
  - P. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.
- 3.3. FIELD QUALITY CONTROL
- A. Inspect support and attachment components for damage and defects.
  - B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
  - C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

## SECTION 260533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.1. SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Stainless steel rigid metal conduit (RMC).
- C. Galvanized steel intermediate metal conduit (IMC).
- D. Stainless steel intermediate metal conduit (IMC).
- E. Flexible metal conduit (FMC).
- F. Liquid-tight flexible metal conduit (LFMC).
- G. Galvanized steel electrical metallic tubing (EMT).
- H. Stainless steel electrical metallic tubing (EMT).
- I. Rigid polyvinyl chloride (PVC) conduit.

#### 1.2. RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 07 8400 - Firestopping.
- C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.
- D. Section 26 0526 - Grounding and Bonding for Electrical Systems.
  - 1. Includes additional requirements for fittings for grounding and bonding.
- E. Section 26 0529 - Hangers and Supports for Electrical Systems.
- F. Section 26 0533.16 - BOXES.
- G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

#### 1.3. REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
- I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
- J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
- L. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- M. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel Current Edition, Including All Revisions.
- N. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.
- O. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- P. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- Q. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.
- R. UL 797A - Electrical Metallic Tubing - Aluminum and Stainless-Steel Current Edition, Including All Revisions.
- S. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.
- T. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.
- U. UL 1653 - Electrical Nonmetallic Tubing Current Edition, Including All Revisions.
- V. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
  - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.

4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Shop Drawings:
  1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
  2. Include proposed locations of roof penetrations and proposed methods for sealing.
- D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.6. QUALITY ASSURANCE

- A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.
- B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1. CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for the application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or rigid PVC conduit.
  2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or rigid PVC conduit.
  3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or rigid PVC conduit.
  4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or schedule 80 rigid PVC conduit where emerging from underground.
  5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows, stainless steel rigid metal conduit (RMC) elbows, galvanized steel intermediate metal conduit (IMC) elbows, stainless steel intermediate metal conduit (IMC) elbows, PVC-coated galvanized steel rigid metal conduit (RMC) elbows, or concrete-encased PVC elbows for bends.
  6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection.
- D. Embedded Within Concrete:
1. Within Slab on Grade: Not permitted.
  2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or rigid PVC conduit.
  3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or rigid PVC conduit.
  4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) where emerging from concrete.
  5. Where galvanized steel electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion

protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches (100 mm) on either side of where conduit emerges.

- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
  - 1. Locations subject to physical damage include, but are not limited to:
    - a. Where exposed below 8 feet (2.4 m), except within electrical and communication rooms or closets.
    - b. Where exposed below 20 feet (6.1 m) in warehouse areas.
- K. Exposed, Exterior: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- L. Concealed, Exterior, Not Embedded in Concrete or in Contact with Earth: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- M. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
  - 1. Maximum Length: 6 feet (1.8 m).
- N. Flexible Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit (FMC).
2. Damp, Wet, or Corrosive Locations: Use liquid-tight flexible metal conduit (LFMC).
3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
  - a. Motors.

## 2.2. CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Electrical Service Conduits: See Section 26 2100 for additional requirements.
- C. Fittings for Grounding and Bonding: See Section 26 0526 for additional requirements.
- D. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- E. Provide products listed, classified, and labeled as suitable for purpose intended.
- F. Minimum Conduit Size, Unless Otherwise Indicated:
  1. Branch Circuits: 3/4-inch (21 mm) trade size.
  2. Branch Circuit Homeruns: 3/4-inch (21 mm) trade size.
  3. Control Circuits: 3/4-inch (21 mm) trade size.
  4. Flexible Connections to Luminaires: 1/2-inch (16 mm) trade size.
  5. Underground, Interior: 3/4-inch (21 mm) trade size.
  6. Underground, Exterior: 3/4-inch (21 mm) trade size.
- G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

## 2.3. GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
  1. Allied Tube & Conduit: [www.alliedeg.com](http://www.alliedeg.com).
  2. Republic Conduit: [www.republic-conduit.com](http://www.republic-conduit.com).
  3. Wheatland Tube Company: [www.wheatland.com](http://www.wheatland.com).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:



1. Manufacturers:
  - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
  - b. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
  - c. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
  - d. Substitutions: See Section 01 6000 - Product Requirements.
2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
3. Material: Use steel or malleable iron.
  - a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

#### 2.4. STAINLESS STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC stainless steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6A.
- B. Fittings:
  1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
  2. Material: Use stainless steel with corrosion resistance equivalent to conduit.
  3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

#### 2.5. GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
  1. Allied Tube & Conduit: [www.alliedeg.com](http://www.alliedeg.com).
  2. Republic Conduit: [www.republic-conduit.com](http://www.republic-conduit.com).
  3. Wheatland Tube Company: [www.wheatland.com](http://www.wheatland.com).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
  1. Manufacturers:

- a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
  - b. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
  - c. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
  - d. Substitutions: See Section 01 6000 - Product Requirements.
2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
  3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
  4. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
  5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

#### 2.6. STAINLESS STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:
  1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.

#### 2.7. FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
  1. AFC Cable Systems, Inc: [www.afcweb.com](http://www.afcweb.com).
  2. Electri-Flex Company: [www.electriflex.com](http://www.electriflex.com).
  3. International Metal Hose: [www.metalhose.com](http://www.metalhose.com).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1 and listed for use in classified firestop systems.
- C. Fittings:
  1. Manufacturers:
    - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).

- c. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
- d. Substitutions: See Section 01 6000 - Product Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
  - a. Do not use die cast zinc fittings.

## 2.8. LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

### A. Manufacturers:

1. AFC Cable Systems, Inc: [www.afcweb.com](http://www.afcweb.com).
2. Electri-Flex Company: [www.electriflex.com](http://www.electriflex.com).
3. International Metal Hose: [www.metalhose.com](http://www.metalhose.com).
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

### C. Fittings:

1. Manufacturers:
  - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
  - b. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
  - c. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
  - d. Substitutions: See Section 01 6000 - Product Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
  - a. Do not use die cast zinc fittings.

## 2.9. GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

### A. Manufacturers:

1. Allied Tube & Conduit: [www.alliedeg.com](http://www.alliedeg.com).
2. Republic Conduit: [www.republic-conduit.com](http://www.republic-conduit.com).
3. Wheatland Tube Company: [www.wheatland.com](http://www.wheatland.com).

4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
  1. Manufacturers:
    - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
    - c. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
  2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  3. Material: Use steel.
    - a. Do not use die cast zinc fittings.
  4. Connectors and Couplings: Use compression (gland) type.
    - a. Do not use indenter type connectors and couplings.
  5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
  6. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

#### 2.10. STAINLESS STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT stainless steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797A.
- B. Fittings:
  1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  2. Connectors and Couplings: Use compression/gland or set-screw type.

#### 2.11. RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
  1. ABB; Carlon: [www.carlon.com/#sle](http://www.carlon.com/#sle).
  2. Allied Tube & Conduit, a division of Atkore International: [www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
  3. Cantex Inc: [www.cantexinc.com](http://www.cantexinc.com).

4. JM Eagle: [www.jmeagle.com](http://www.jmeagle.com).
5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
  1. Manufacturer: Same as manufacturer of conduit to be connected.
  2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

## 2.12. ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch (0.51 mm).
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kN).
- E. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.
- F. Sealing Systems for Concrete Penetrations:
  1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
  2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.

- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- F. Conduit Routing:
  - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
  - 2. When conduit destination is indicated without specific routing, determine exact routing required.
  - 3. Conceal conduits unless specifically indicated to be exposed.
  - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
    - a. Electrical rooms.
    - b. Mechanical equipment rooms.
    - c. Within joists in areas with no ceiling.
  - 5. Unless otherwise approved, do not route exposed conduits:
    - a. Across floors.
    - b. Across roofs.
    - c. Across top of parapet walls.
    - d. Across building exterior surfaces.
  - 6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
  - 7. Arrange conduit to maintain adequate headroom, clearances, and access.
  - 8. Arrange conduit to provide no more than equivalent of three 90-degree bends between pull points.
  - 9. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
  - 10. Route conduits above water and drain piping where possible.
  - 11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  - 12. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
  - 13. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
    - a. Heaters.

- b. Hot water piping.
  - c. Flues.
14. Group parallel conduits in same area on common rack.
- G. Conduit Support:
- 1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 0529.
  - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
  - 4. Use conduit strap to support single surface-mounted conduit.
    - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
  - 5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
  - 6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
  - 7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
  - 8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
  - 9. Use of spring steel conduit clips for support of conduits is not permitted.
  - 10. Use of wire for support of conduits is not permitted.
  - 11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.
- H. Connections and Terminations:
- 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  - 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  - 3. Use suitable adapters where required to transition from one type of conduit to another.
  - 4. Provide drip loops for liquid-tight flexible conduit connections to prevent drainage of liquid into connectors.

5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
8. Secure joints and connections to provide mechanical strength and electrical continuity.

I. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 8400.

J. Underground Installation:

1. Minimum Cover, Unless Otherwise Indicated or Required:
  - a. Underground, Exterior: 18 inches (460 mm).
2. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 0553.

K. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):

1. Maximum Conduit Size: 1-inch (27 mm) trade size unless otherwise approved.
2. Install conduits within middle one third of slab thickness.
3. Secure conduits to prevent floating or movement during pouring of concrete.



- L. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches (76 mm) on all sides unless otherwise indicated; see Section 03 3000.
- M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
  - 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  - 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
  - 3. Where conduits are subject to earth movement by settlement or frost.
- N. Conduit Sealing:
  - 1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
    - a. Where conduits enter building from outside.
    - b. Where service conduits enter building from underground distribution system.
    - c. Where conduits enter building from underground.
    - d. Where conduits may transport moisture to contact live parts.
  - 2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
    - a. Where conduits pass from outdoors into conditioned interior spaces.
    - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- O. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.
- P. Provide grounding and bonding; see Section 26 0526.
- Q. Identify conduits; see Section 26 0553.

### 3.3. FIELD QUALITY CONTROL

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Correct deficiencies and replace damaged or defective conduits.

### 3.4. CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.5. PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

## **SECTION 260533.16 - BOXES**

### PART 1 GENERAL

#### 1.1. SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).
- C. Floor boxes.

#### 1.2. RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 07 8400 - Firestopping.
- C. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- D. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- E. Section 26 0529 - Hangers and Supports for Electrical Systems.
- F. Section 26 0533.13 - Conduit for Electrical Systems:
- G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 26 2726 - Wiring Devices:
- I. Section 26 2813 - Fuses: Spare fuse cabinets.

#### 1.3. REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).
- F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports 2013 (Reaffirmed 2020).
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- J. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.
- K. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.
- L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures and floor boxes.
- C. Samples:
  1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.

- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, and floor boxes.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Keys for Lockable Enclosures: Two of each different key.

#### 1.6. QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.1. BOXES

- A. General Requirements:
  - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
  - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
  - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
  - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
  - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
  - 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
  - 3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.

4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
5. Use suitable concrete type boxes where flush-mounted in concrete.
6. Use suitable masonry type boxes where flush-mounted in masonry walls.
7. Use raised covers suitable for the type of wall construction and device configuration where required.
8. Use shallow boxes where required by the type of wall construction.
9. Do not use "through-wall" boxes designed for access from both sides of wall.
10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
12. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
13. Boxes for Ganged Devices: Use multi-gang boxes of single-piece construction. Do not use field-connected gang-able boxes unless specifically indicated or permitted.
14. Minimum Box Size, Unless Otherwise Indicated:
  - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
  - b. Communications Systems Outlets: 4-inch square by 2-1/8 inch (100 by 54 mm) trade size.
  - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
15. Wall Plates: Comply with Section 26 2726.
16. Manufacturers:
  - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
  - b. Hubbell Incorporated; Bell Products: [www.hubbell-rtb.com](http://www.hubbell-rtb.com).
  - c. Hubbell Incorporated; RACO Products: [www.hubbell-rtb.com](http://www.hubbell-rtb.com).
  - d. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com](http://www.emerson.com).
  - e. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
  - f. Substitutions: See Section 01 6000 - Product Requirements.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
  1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
  2. NEMA 250 Environment Type, Unless Otherwise Indicated:

- a. Indoor Clean, Dry Locations: Type 1, painted steel.
  - b. Outdoor Locations: Type 3R, painted steel.
  3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
    - a. Provide hinged-cover enclosures unless otherwise indicated.
    - b. Boxes 6 square feet (0.56 sq m) and Larger: Provide hinged-cover enclosures.
  4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    - b. Back Panels: Painted steel, removable.
  5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
  6. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
    - b. Hoffman, a brand of Pentair Technical Products: [www.hoffmanonline.com](http://www.hoffmanonline.com).
    - c. Hubbell Incorporated; Wiegmann Products: [www.hubbell-wiegmann.com](http://www.hubbell-wiegmann.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- D. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
  2. Use cast iron floor boxes within slab on grade.
  3. Use sheet-steel or cast-iron floor boxes within slab above grade.
  4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
  5. Manufacturer: Same as manufacturer of floor box service fittings.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Boxes mounted in a stud space shall be mounted with a support bracket that spans the distance between the stud space and is secured to both studs.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide separate boxes for emergency power and normal power systems.
- F. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- G. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- H. Unless otherwise indicated, boxes may be surface mounted where exposed conduits are indicated or permitted.
- I. Box Locations:
  - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
  - 2. Unless dimensioned, box locations indicated are approximate.
  - 3. Locate boxes as required for devices installed under other sections or by others.
    - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
  - 4. Locate boxes so that wall plates do not span different building finishes.
  - 5. Locate boxes so that wall plates do not cross masonry joints.
  - 6. Install flush-mounted boxes on opposite sides of walls in different stud spaces, boxes shall not be installed back-to-back.
  - 7. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
  - 8. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Install in sperate stud cavities, if not possible, provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
  - 9. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.
  - 10. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.



- a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
  - b. Do not install flush-mounted boxes with area larger than 16 square inches (0.0103 sq m) or such that the total aggregate area of openings exceeds 100 square inches (0.0645 sq m) for any 100 square feet (9.29 sq m) of wall area.
11. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or amount of bends between pulling points in accordance with Section 26 0533.13.
  12. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    - a. Concealed above accessible suspended ceilings.
    - b. Within joists in areas with no ceiling.
    - c. Electrical rooms.
    - d. Mechanical equipment rooms.
- J. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
  3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
  4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- K. Install boxes plumb and level.
- L. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
  2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.

- M. Floor-Mounted Cabinets: Mount on properly sized nominal 4 inch (100 mm) high concrete pad constructed in accordance with Section 03 3000.
- N. Install boxes as required to preserve insulation integrity.
- O. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- P. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- R. Close unused box openings.
- S. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- T. Provide grounding and bonding in accordance with Section 26 0526.
- U. Identify boxes in accordance with Section 26 0553.

### 3.3. CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster, and other foreign material.

### 3.4. PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

## SECTION 260540 - DIRECTIONAL BORING FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this section.

#### 1.2. SUMMARY

- A. Section Includes:

- 1. The work specified in this section consists of furnishing and installing underground utilities using the directional boring (horizontal directional drilling, HDD) method of installation, also commonly referred to as guided horizontal boring. This work shall include all services, equipment, materials, and labor for the complete and proper installation, testing, restoration of underground utilities and environmental protection and restoration.

#### 1.3. QUALITY ASSURANCE

- A. The requirements set forth in this document specify a wide range of procedural precautions necessary to ensure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlines in this specification. Adherence to the specifications contained herein, or the Engineer's approval of any aspect of any directional bore operations covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

#### 1.4. SUBMITTALS

- A. Coordination:

- 1. Prior to beginning work, the Contractor must submit to the Architect a general work plan outlining the procedure and schedule to be used to execute the project. The plan shall document the thoughtful planning required to successfully complete the project.

- B. Equipment:

- 1. The Contractor shall submit specifications on directional boring equipment to be used to ensure that the equipment will be adequate to complete the project. Spares inventory shall be included.

- C. Product Data:

- 1. Submit to the Architect product data on material to be used. Product data shall include the pipe, pipe fittings and any other item which is to be an installed component of the project.

- D. Qualifications:

- 1. Documentation of training and relevant experience of personnel operating the equipment shall be submitted.

## PART 2 PRODUCTS

### 2.1. GENERAL

- A. The directional boring equipment shall consist of a directional boring rig of sufficient capacity to perform the bore and pullback the pipe, a boring fluid mixing and delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide the boring operation and trained, competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in a good working order for the duration of the project.

### 2.2. BORING SYSTEM

#### A. Boring Rig:

- 1. The directional boring machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand all pulling, pushing, and rotating pressures required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power boring operations. The hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. The rig shall be grounded during boring and pull-back operations. Sufficient spares shall be kept on hand for any break downs which can be reasonably anticipated.

#### B. Bore Head:

- 1. The bore head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and boring fluid jets.

#### C. Mud Motors (if required):

- 1. Mud motors shall be of adequate power to turn the required boring tools.

#### D. Drill Pipe:

- 1. Shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32 to 36 RC.

### 2.3. GUIDANCE SYSTEM

- A. The guidance system shall be of a proven type and shall be setup and operated by personnel trained and experienced with the system. The operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

### 2.4. BORING FLUID (MUD) SYSTEM

#### A. Mixing System:

- 1. A self-contained, closed, boring fluid mixing system shall be of sufficient size to mix and deliver boring fluid composed of bentonite clay, potable water, and appropriate additives. Mixing system shall be able to molecularly shear individual bentonites particles from the dry powder to avoid

clumping and ensure thorough mixing. Mixing system shall continually agitate the boring fluid during boring operations.

B. Boring Fluids:

1. Drilling fluid shall be composed of clean water and an appropriate additive. Water shall be from a clean source with a pH of 8.5 - 10. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No hazardous additives may be used. Boring fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall.

C. Delivery System:

1. The delivery system shall have liters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used boring fluid and boring fluid spilled during boring operations shall be contained and properly disposed of. A berm, minimum of 12" high, shall be maintained around boring equipment, boring fluid mixing system, entry and exit pits and boring fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess boring fluid from containment areas to storage facilities.

2.5. OTHER EQUIPMENT

A. Pipe Rollers:

1. Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Enough rollers shall be used to prevent excess sagging of pipe.

B. Pipe Rammers/Pullers

1. Hydraulic or pneumatic pipe rammers or pullers may only be used if necessary and with the authorization of Engineer.

- C. Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the Engineer prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the project.

PART 3 EXECUTION

3.1. GENERAL

- A. The Owners Representative must be notified 48 hours in advance of starting work. The Directional Bore shall not begin until the Owners Representative is present at the job site and agrees that proper preparations for the operation have been made. The Owners Representatives approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract. It shall be the responsibility of Owners

Representative to provide inspection personnel at such times as appropriate without causing undue hardship by reason of delay to the Contractor.

### 3.2. PERSONNEL REQUIREMENTS

- A. All personnel shall be fully trained in their respective duties as part of the directional boring crew and in safety. Training shall be provided specific to the project if any potential hazards may be encountered which has not already been included in personnel's training.

### 3.3. BORING PROCEDURE

#### A. Site Preparation:

- 1. Prior to any alterations to work-site, contractor shall photograph or video tape entire work area, including entry and exit points. One copy of which shall be given to Engineer and one copy to remain with contractor for a period of one year following the completion of the project. Work site as indicated on drawings, within right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

#### B. Bore Path Survey:

- 1. Entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If contractor is using a magnetic guidance system, drill path will be surveyed for any surface geomagnetic variations or anomalies.

#### C. Environmental Protection:

- 1. Contractor shall place silt fence between all boring operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or boring fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations. Fuel or oil may not be stored in bulk containers within 200' of any waterbody or wet-land.

#### D. Utility Locates:

- 1. Contactor shall notify all companies with underground utilities in the work area via the state or local "one-call" to obtain utility locates. Once the utilities have been located Contractor shall physically identify the exact location of the utilities by vacuum or hand excavation, when possible, in order to determine the actual location and path of any underground utilities which might be within 20 feet of the bore path. Contractor shall not commence boring operations until the location of all underground utilities within the work area have been verified.

#### E. Safety:

- 1. Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner. Safety meetings shall be conducted at least weekly with a written record of attendance and topic submitted to Engineer.

#### F. Pipe:

1. Pipe shall be connected in one length prior to pull-back operations, if space permits. Steel pipe welds will be X-rayed prior to being placed in bore hole. Pipe will be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe.

G. Pilot Hole:

1. Pilot hole shall be drilled on bore path with no deviations greater than 5% of depth over a length of 100'. If pilot does deviate from bore path more than 5% of depth in 100', contractor will notify Engineer and Engineer may require contractor to pull-back and re-drill from the location along bore path before the deviation. In the event that a boring fluid fracture, inadvertent returns or returns loss occurs during pilot hole boring operations, contractor shall cease boring, wait at least 30 minutes, inject a quantity of boring fluid with a viscosity exceeding 120 seconds as measured by March funnel and then wait another 30 minutes. If mud fracture or returns loss continues, contractor will cease operations and notify Engineer. Engineer and contractor will discuss additional options and work will then proceed accordingly.

H. Reaming:

1. Upon successful completion of pilot hole, contractor will ream bore hole to a minimum of 25% greater than outside diameter of pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the boring equipment and mud system are designed to safely handle.

I. Pull-back:

1. After successfully reaming bore hole to the required diameter, contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations contractor will not apply more than the maximum safe pipe pull pressure at any time. If pipe becomes stuck, contractor will cease pulling operations to allow any potential hydro-lock to subside and will commence pulling operations. If pipe remains stuck, contractor will notify Engineer. Engineer and contractor will discuss options and then work will proceed accordingly.

### 3.4. PIPE TESTING

- A. Following successful pull-back of pipe, contractor will hydro-test pipe using potable water for a period of 2 hours at a pressure of 100 psi. A calibrated pressure recorder will be used to record the pressure during the test period. This record will be presented to Engineer.
- B. After successful completion of hydro-test, pipe will pigged dry.

### 3.5. SITE RESTORATION

- A. Following boring operations, contractor will de-mobilize equipment and restore the worksite to original condition. All excavations will be backfilled and compacted to 95% of original density. Landscaping will be restored to original and sufficiently match that of surrounding areas.

### 3.6. RECORD KEEPING, AS-BUILTS

- A. Contractor shall maintain a daily project log of boring operations and a guidance system log with a copy given to Engineer at completion of project. As-built drawings shall be certified as to accuracy by contractor. Third-party verification of as-built drawings may be done, at owner's expense.

Construct Six New Cabins  
Echo Bluff State Park

X2208-01  
FGI PROJECT NUMBER: 0211626.00

END OF SECTION 260540



## SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.1. SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Floor marking tape.
- F. Warning signs and labels.

#### 1.2. RELATED REQUIREMENTS

- A. Section 09 9113 - Exterior Painting.
- B. Section 09 9123 - Interior Painting.
- C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- D. Section 26 0573 - Power System Studies: Arc flash hazard warning labels.
- E. Section 26 2300 - Low-Voltage Switchgear: Factory-installed mimic bus.
- F. Section 26 2726 - Wiring Devices: Device and wall plate finishes; factory pre-marked wall plates.

#### 1.3. REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs 2011 (Reaffirmed 2017).
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011 (Reaffirmed 2017).
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 70E - Standard for Electrical Safety in the Workplace 2021.
- E. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6. QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.7. FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1. IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
  - a. Switchboards:
    - 1) Identify ampere rating.
    - 2) Identify voltage and phase.
    - 3) Identify power source and circuit number. Include location.
    - 4) Use identification nameplate to identify main overcurrent protective device.
    - 5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
  - b. Panelboards:
    - 1) Identify ampere rating.

- 2) Identify voltage and phase.
  - 3) Identify power source and circuit number. Include location.
  - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
  - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
- c. Enclosed switches, circuit breakers, and motor controllers:
- 1) Identify voltage and phase.
  - 2) Identify power source and circuit number. Include location.
  - 3) Identify load(s) served. Include location.
2. Service Equipment:
- a. Use identification nameplate to identify each service disconnecting means.
3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
  4. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
  5. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
  6. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
  7. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
  8. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
    - a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches (76 mm) wide, painted in accordance with Section 09 9123 and 09 9113.
  9. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
    - a. Service equipment.
    - b. Motor control centers.

10. Arc Flash Hazard Warning Labels: Comply with Section 26 0573.
  11. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
- B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
  2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
  3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    - a. At each source and load connection.
    - b. Within boxes when more than one circuit is present.
    - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
  4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
- C. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet (6.1 m).
  2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet (6.1 m).
    - a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches (76 mm) wide.
      - 1) Field-Painting: Comply with Section 09 9123 and 09 9113.
      - 2) Vinyl Color Coding Electrical Tape: Comply with Section 26 0519.
  3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
- D. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
  2. Use voltage markers or color-coded boxes to identify systems other than normal power system.
    - a. Color-Coded Boxes: Field-painted in accordance with Section 09 9123 and 09 9113 per the same color code used for raceways.

3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
    - a. For exposed boxes in public areas, use only identification labels.
  4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
- E. Identification for Devices:
1. Wiring Device and Wall plate Finishes: Comply with Section 26 2726.
  2. Use identification label to identify fire alarm system devices.
  3. Use engraved wall plate to identify serving branch circuit for all receptacles.
  4. Use engraved wall plate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

## 2.2. IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
1. Materials:
    - a. Indoor Clean, Dry Locations: Use plastic nameplates.
    - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
  2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
    - a. Exception: Provide minimum thickness of 1/8 inch (3 mm) when any dimension is greater than 4 inches (100 mm).
  3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
  4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
  5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.
- B. Identification Labels:
1. Manufacturers:
    - a. Brady Corporation: [www.bradyid.com](http://www.bradyid.com).
    - b. Brother International Corporation: [www.brother-usa.com](http://www.brother-usa.com).

- c. Panduit Corp: [www.panduit.com](http://www.panduit.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
  2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
    - a. Use only for indoor locations.
  3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
  1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
  2. Legend:
    - a. System designation where applicable:
      - 1) Fire Alarm System: Identify with text "FIRE ALARM".
    - b. Equipment designation or other approved description.
    - c. Other information as indicated.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height:
    - a. System Designation: 1 inch (25 mm).
    - b. Equipment Designation: 1/2 inch (13 mm).
    - c. Other Information: 1/4 inch (6 mm).
    - d. Exception: Provide minimum text height of 1 inch (25 mm) for equipment located more than 10 feet (3.0 m) above floor or working platform.
  5. Color:
    - a. Normal Power System: White text on black background.
- D. Format for General Information and Operating Instructions:
  1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
  2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 1/4 inch (6 mm).

5. Color: Black text on white background unless otherwise indicated.
- E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches (51 mm) by 4 inches (100 mm).
  2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 1/2 inch (13 mm).
  5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
  2. Legend: Power source and circuit number or other designation indicated.
    - a. Include voltage and phase for other than 120 V, single phase circuits.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 3/16 inch (5 mm).
  5. Color: Black text on clear background.
- G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
  2. Legend: Load controlled, or other designation indicated.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 3/16 inch (5 mm).
  5. Color: Black text on clear background.
- H. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
  2. Legend: Designation indicated and device zone or address.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 3/16 inch (5 mm).
  5. Color: Red text on white background.

### 2.3. WIRE AND CABLE MARKERS

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradyid.com](http://www.bradyid.com).
  - 2. HellermannTyton: [www.hellermanntyton.com](http://www.hellermanntyton.com).
  - 3. Panduit Corp: [www.panduit.com](http://www.panduit.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
  - 1. Do not use handwritten text.
- F. Minimum Text Height: 1/8 inch (3 mm).
- G. Color: Black text on white background unless otherwise indicated.

### 2.4. VOLTAGE MARKERS

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradyid.com](http://www.bradyid.com).
  - 2. Brimar Industries, Inc: [www.brimar.com](http://www.brimar.com).
  - 3. Seton Identification Products: [www.seton.com](http://www.seton.com).
- B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl type markers.
- C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- D. Minimum Size:
  - 1. Markers for Equipment: 1 1/8 by 4 1/2 inches (29 by 110 mm).
  - 2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
  - 3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
  - 4. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).
- E. Legend:



1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
  - a. Other Systems: Type of service.

F. Color: Black text on orange background unless otherwise indicated.

## 2.5. FLOOR MARKING TAPE

### A. Manufacturers:

1. Brady Corporation: [www.bradyid.com](http://www.bradyid.com).
2. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
3. Seton Identification Products: [www.seton.com](http://www.seton.com).

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches (76 mm) wide, with alternating black and white stripes.

## 2.6. WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

### B. Warning Signs:

1. Materials:
  - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
  - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

### C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
  - a. Do not use labels designed to be completed using handwritten text.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

### PART 3 EXECUTION

#### 3.1. PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

#### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
  - 1. Surface-Mounted Equipment: Enclosure front.
  - 2. Flush-Mounted Equipment: Inside of equipment door.
  - 3. Free-Standing Equipment: Enclosure front; also, enclosure rear for equipment with rear access.
  - 4. Elevated Equipment: Legible from the floor or working platform.
  - 5. Branch Devices: Adjacent to device.
  - 6. Interior Components: Legible from the point of access.
  - 7. Conduits: Legible from the floor.
  - 8. Boxes: Outside face of cover.
  - 9. Conductors and Cables: Legible from the point of access.
  - 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Secure rigid signs using stainless steel screws.
- G. Mark all handwritten text, where permitted, to be neat and legible.

#### 3.3. FIELD QUALITY CONTROL

- A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

## **SECTION 260573 - POWER SYSTEM STUDIES**

### **PART 1 GENERAL**

#### **1.1. SECTION INCLUDES**

- A. Short-circuit study.
- B. Protective device coordination study.
- C. Arc flash and shock risk assessment.
  - 1. Includes arc flash hazard warning labels.
- D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

#### **1.2. RELATED REQUIREMENTS**

- A. Section 26 0553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.
- B. Section 26 2100 - Low-Voltage Electrical Service Entrance.
  - 1. Includes Utility Company contact information.
- C. Section 26 2413 - Switchboards.
- D. Section 26 2416 - Panelboards.
- E. Section 26 2813 - Fuses.
- F. Section 26 2816.13 - Enclosed Circuit Breakers.
- G. Section 26 2816.16 - Enclosed Switches.
- H. Section 26 2913 - Enclosed Controllers.

#### **1.3. REFERENCE STANDARDS**

- A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011 (Reaffirmed 2017).
- B. IEEE 141 - IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants 1993 (Reaffirmed 1999).
- C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems 2001, with Errata (2003).
- D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis 1997.
- E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems 2006.

- F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations 2018, with Errata (2019).
- G. NEMA MG 1 - Motors and Generators 2021.
- H. NETA ATS - Standard for Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 70E - Standard for Electrical Safety in the Workplace 2021.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
  - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Pre-Study Meeting: Conduct meeting with Owner to discuss system operating modes and conditions to be considered in studies.
- C. Sequencing:
  - 1. Submit study reports prior to or concurrent with product submittals.
  - 2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.
  - 3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).

#### 1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.
- B. Study preparer's qualifications.
- C. Field testing agency's qualifications.
- D. Study reports stamped or sealed and signed by study preparer.
- E. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
  - 1. Include characteristic time-current trip curves for protective devices.
  - 2. Include impedance data for busway.

3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
4. Include documentation of listed series ratings upon request.
5. Identify modifications made in accordance with studies that:
  - a. Can be made at no additional cost to Owner.
  - b. As submitted will involve a change to the contract sum.
- F. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.
- G. Site-specific arc flash hazard warning labels.
- H. Field quality control reports.
- I. Certification that field adjustable protective devices have been set in accordance with requirements of studies.
- J. Project Record Documents: Revise studies as required to reflect as-built conditions.
  1. Include hard copies with operation and maintenance data submittals.
  2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

#### 1.6. POWER SYSTEM STUDIES

- A. Scope of Studies:
  1. Perform analysis of new electrical distribution system as indicated on drawings.
  2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g., fault current contribution from motors).
  3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
    - a. Known Operating Modes:
      - 1) Utility as source.
- B. General Study Requirements:
  1. Comply with NFPA 70.
  2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.
- C. Data Collection:

1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
  - a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
    - 1) Obtain up-to-date information from Utility Company.
    - 2) Utility Company: As indicated on drawings.
  - b. Motors: Include manufacturer/model, type (e.g., induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
  - c. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
  - d. Protective Devices:
    - 1) Circuit Breakers: Include manufacturer/model, type (e.g., thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g., zone selective interlocking).
    - 2) Fuses: Include manufacturer/model, type/class (e.g., Class J), size/rating, and speed (e.g., time delay, fast acting).
  - e. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
  - f. Conductors: Include feeder size, material (e.g., copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
- D. Short-Circuit Study:
  1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
  2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
    - a. Maximum utility fault currents.
    - b. Maximum motor contribution.
    - c. Known operating modes.
  3. For each bus location, calculate the maximum available bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
- E. Protective Device Coordination Study:
  1. Comply with applicable portions of IEEE 242 and IEEE 399.

2. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.

F. Arc Flash and Shock Risk Assessment:

1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
  - a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
  - b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.
3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
  - a. Maximum and minimum utility fault currents.
  - b. Maximum and minimum motor contribution.
  - c. Known operating modes.

G. Study Reports:

1. General Requirements:
  - a. Identify date of study and study preparer.
  - b. Identify study methodology and software product(s) used.
  - c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
  - d. Identify base used for per unit values.
  - e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports and indicate bus voltage.
  - f. Include conclusions and recommendations.
2. Short-Circuit Study:
  - a. For each scenario, identify at each bus location:
    - 1) Calculated maximum available symmetrical and asymmetrical fault currents.

- 2) Fault point X/R ratio.
- 3) Associated equipment short circuit current ratings.
- b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
  - a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
  - b. For each graph include (where applicable):
    - 1) Partial single-line diagram identifying the portion of the system illustrated.
    - 2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
    - 3) Conductors: Damage curves.
    - 4) Transformers: Inrush points and damage curves.
    - 5) Motors: Full load current, starting curves, and damage curves.
  - c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
    - 1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
    - 2) Include ground fault pickup and delay.
    - 3) Include fuse ratings.
    - 4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
  - d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.
4. Arc Flash and Shock Risk Assessment:
  - a. For the worst case for each scenario, identify at each bus location:
    - 1) Calculated incident energy and associated working distance.
    - 2) Calculated arc flash boundary.
    - 3) Bolted fault current.
    - 4) Arcing fault current.
    - 5) Clearing time.



- 6) Arc gap distance.
  - b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst-case condition of all scenarios at each bus location.
  - c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

#### 1.7. QUALITY ASSURANCE

- A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years' experience in preparation of studies of similar type and complexity using specified computer software.
  1. Study preparer may be employed by manufacturer of electrical distribution equipment.
  2. Study preparer may be employed by field testing agency.
- B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years' experience; NETA Accredited Company.
  1. Field Supervisor: Certified electrical testing technician; NETA ETT Level III.
- C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
  1. Products:
    - a. EasyPower LLC: [www.easypower.com](http://www.easypower.com).
    - b. ETAP/Operation Technology, Inc: [www.etap.com](http://www.etap.com).
    - c. SKM Systems Analysis, Inc: [www.skm.com](http://www.skm.com).
    - d. Substitutions: Not permitted.

### PART 2 PRODUCTS

#### 2.1. ARC FLASH HAZARD WARNING LABELS

- A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
  1. Materials: Comply with Section 26 0553.
  2. Minimum Size: 4 by 6 inches (100 by 150 mm).
  3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
    - a. Include orange header that reads "WARNING" unless otherwise indicated.

- b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
- c. Include the following information:
  - 1) Arc flash boundary.
  - 2) Available incident energy and corresponding working distance.
  - 3) Site-specific PPE (personnel protective equipment) requirements.
  - 4) Nominal system voltage.
  - 5) Limited approach boundary.
  - 6) Restricted approach boundary.
  - 7) Equipment identification.
  - 8) Study preparer, report reference, and date calculations were performed.

### PART 3 EXECUTION

#### 3.1. INSTALLATION

- A. Install arc flash warning labels in accordance with Section 26 0553.

#### 3.2. FIELD QUALITY CONTROL

- A. Provide the services of field-testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Adjust equipment and protective devices for compliance with studies and recommended settings.
- D. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.
- E. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

#### 3.3. CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.
  - 1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of eight hours of training.

Construct Six New Cabins  
Echo Bluff State Park

X2208-01  
FGI PROJECT NUMBER: 0211626.00

3. Instructor: Representative of entity performing study.
4. Location: At project site.

END OF SECTION

## SECTION 262416 - PANELBOARDS

### PART 1 GENERAL

#### 1.1. SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

#### 1.2. RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0529 - Hangers and Supports for Electrical Systems.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- F. Section 26 2813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

#### 1.3. REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).
- F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- G. NEMA PB 1 - Panelboards 2011.
- H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.
- I. NETA ATS - Standard for Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- M. UL 67 - Panelboards Current Edition, Including All Revisions.
- N. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- P. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- Q. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- R. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.
- S. UL 1699 - Arc-Fault Circuit-Interrupters Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
  - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
  - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  - 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
  - 2. Include wiring diagrams showing all factory and field connections.
- D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Panelboard Keys: Two of each different key.
  - 3. See Section 26 2813 for requirements for spare fuses and spare fuse cabinets.

#### 1.6. QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

#### 1.8. FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
  - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

### PART 2 PRODUCTS

#### 2.1. MANUFACTURERS

- A. ABB/GE: [www.geindustrial.com](http://www.geindustrial.com).
- B. Eaton Corporation: [www.eaton.com](http://www.eaton.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- D. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
- E. Substitutions: See Section 01 6000 - Product Requirements.
- F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

#### 2.2. PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet (2,000 m).
  - 2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- C. Short Circuit Current Rating:
  - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
  - 2. Listed series ratings are not acceptable.
- D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: NEMA 250, Type 1.
    - b. Outdoor Locations: NEMA 250 Type 3R.
    - c. Kitchen Areas: NEMA 250, Type 4X, Stainless steel.
    - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
    - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
  - 2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
  - 3. Fronts:
    - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
    - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
    - d. Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- K. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- L. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.



- M. Load centers are not acceptable.

### 2.3. POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
  - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
  - 1. Phase and Neutral Bus Material: Copper.
  - 2. Ground Bus Material: Copper.
- D. Circuit Breakers:
  - 1. Provide bolt-on type.
  - 2. Provide thermal magnetic circuit breakers unless otherwise indicated.
  - 3. Provide electronic trip circuit breakers where indicated.
- E. Enclosures:
  - 1. Provide surface-mounted enclosures unless otherwise indicated.
  - 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  - 3. Provide clear plastic circuit directory holder mounted on inside of door.

### 2.4. LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
  - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
  - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.

2. Phase and Neutral Bus Material: Copper.
  3. Ground Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
  2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  3. Provide clear plastic circuit directory holder mounted on inside of door.

## 2.5. OVERCURRENT PROTECTIVE DEVICES

### A. Fusible Switches:

1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1 and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
  - a. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
4. Conductor Terminations:
  - a. Provide mechanical lugs unless otherwise indicated.
  - b. Provide compression lugs where indicated.
  - c. Lug Material: Copper, suitable for terminating copper conductors only.

### B. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489 and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
  - a. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:

- a. Provide mechanical lugs unless otherwise indicated.
  - b. Provide compression lugs where indicated.
  - c. Lug Material: Copper, suitable for terminating copper conductors only.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
- a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
  - b. Provide interchangeable trip units where indicated.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
- a. Provide the following field-adjustable trip response settings:
    - 1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
    - 2) Long time delay.
    - 3) Short time pickup and delay.
    - 4) Instantaneous pickup.
    - 5) Ground fault pickup and delay where ground fault protection is indicated.
  - b. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
  - c. Provide communication capability where indicated: Compatible with system indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
- a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
  - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
  - c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
  - d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
  - e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

8. Do not use tandem circuit breakers.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
11. Provide the following features and accessories where indicated or where required to complete installation:
  - a. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
  - b. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
  - c. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
  - d. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

## 2.6. SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2. INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 26 0529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.
- I. Mount floor-mounted power distribution panelboards on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 3000.
- J. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- K. Provide grounding and bonding in accordance with Section 26 0526.
- L. Install all field-installed branch devices, components, and accessories.
- M. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- N. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- O. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 0573.
- P. Provide filler plates to cover unused spaces in panelboards.
- Q. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
  - 1. Fire detection and alarm circuits.
  - 2. Communications equipment circuits.
  - 3. Access control system circuits.
- R. Identify panelboards in accordance with Section 26 0553.

### 3.3. FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers. Tests listed as optional are not required.
  - 1. Perform insulation-resistance tests on all control wiring with respect to ground.
  - 2. Test functions of the trip unit by means of secondary injection.
- C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
  - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- D. Test GFCI circuit breakers to verify proper operation.

- E. Test AFCI circuit breakers to verify proper operation.
- F. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.
- G. Correct deficiencies and replace damaged or defective panelboards or associated components.

#### 3.4. ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

#### 3.5. CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

## **SECTION 262726 - WIRING DEVICES**

### **PART 1 GENERAL**

#### **1.1. SECTION INCLUDES**

- A. Wall switches.
- B. Fan speed controllers.
- C. Receptacles.
- D. Wall plates.
- E. Floor box service fittings.

#### **1.2. RELATED REQUIREMENTS**

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0533.16 - BOXES.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 2913 - Enclosed Controllers: Manual motor starters and horsepower rated motor-starting switches without overload protection.

#### **1.3. REFERENCE STANDARDS**

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2014h, with Amendments (2017).
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification) 2014g, with Amendment (2017).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.

- K. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- L. UL 1310 - Class 2 Power Units Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
  - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
  - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
  - 5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Samples: One sample of each color available for thermoplastic cover plates.
- D. Operation and Maintenance Data:
  - 1. GFCI Receptacles: Include information on status indicators.
- E. Project Record Documents: Record actual installed locations of wiring devices.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

#### 1.6. QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Products: Listed, classified, and labeled as suitable for the purpose intended.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.



## 1.7. DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

## PART 2 PRODUCTS

### 2.1. WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet (1.8 m) of sinks.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Unless noted otherwise, do not use combination switch/receptacle devices.
- G. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

### 2.2. WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices Installed in Finished Spaces: Consult with Architect during shop drawing phase for selection of color with matching nylon wall plate.
- C. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
- D. Flush Floor Box Service Fittings: White wiring devices with aluminum cover and ring/flange.

### 2.3. ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### 2.4. WALL SWITCHES

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell.com](http://www.hubbell.com).
  - 2. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
  - 3. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us](http://www.legrand.us).
  - 4. Acuity Controls, [www.acuity.com](http://www.acuity.com).

- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four-way as indicated on the drawings.
- D. Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

## 2.5. WALL DIMMERS

- A. Manufacturers:
  - 1. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
  - 2. Lutron Electronics Company, Inc; Maestro Series: [www.lutron.com](http://www.lutron.com).
  - 3. Eaton (Cooper):  
[http://www.cooperindustries.com/content/public/en/wiring\\_devices/products/lighting\\_controls/dimmers.html](http://www.cooperindustries.com/content/public/en/wiring_devices/products/lighting_controls/dimmers.html)
  - 4. Wattstopper: [www.legrand.us/wattstopper.aspx](http://www.legrand.us/wattstopper.aspx)
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:

## 2.6. RECEPTACLES

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell.com/wiringdevice-kellems/en](http://www.hubbell.com/wiringdevice-kellems/en).
  - 2. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
  - 3. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us/passandseymour.aspx](http://www.legrand.us/passandseymour.aspx).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
  - 5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wall plates by the same manufacturer in locations indicated.
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.

2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

D. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
  - a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

## 2.7. WALL PLATES

A. Manufacturers:

1. Hubbell Incorporated: [www.hubbell.com/wiringdevice-kellems/en](http://www.hubbell.com/wiringdevice-kellems/en).
2. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
3. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us/passandseymour.aspx](http://www.legrand.us/passandseymour.aspx).
4. Substitutions: See Section 01 6000 - Product Requirements.
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wall plates by the same manufacturer in locations indicated.

B. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

- D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- E. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

## 2.8. FLOOR BOX SERVICE FITTINGS

- A. Manufacturers:
  - 1. Hubbell Incorporated: System ONE Recessed
  - 2. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
  - 3. Wiremold, a brand of Legrand North America, Inc: Evolution Series.
- B. Description: Service fittings compatible with floor boxes provided under Section 26 0533.16 with components, adapters, and trims required for complete installation.
- C. Flush Floor Service Fittings:
  - 1. Dual Service Flush Combination Outlets:
    - a. Cover: Rectangular.
    - b. Configuration:
      - 1) Power: Two standard convenience duplex receptacle(s) with duplex flap opening(s).
  - 2. Accessories:
    - a. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

## 2.9. POKE-THROUGH ASSEMBLIES

- A. Manufacturers:
  - 1. Hubbell Incorporated: System ONE Recessed
  - 2. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
  - 3. Wiremold, a brand of Legrand North America, Inc: Evolution series.
- B. Description: Assembly comprising floor service fitting, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.
- C. Flush Floor Service Fittings:
  - 1. Dual Service Flush Combination Outlets:
    - a. Cover: Hinged door(s).

- b. Configuration:
  - 1) Power: Two standard convenience duplex receptacle(s).
- 2. Accessories:
  - a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

#### 3.3. INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
  - 1. Mounting Heights to top of box: Unless otherwise indicated, as follows:
    - a. Wall Switches: 48 inches (1200 mm) above finished floor.
    - b. Fan Speed Controllers: 48 inches (1200 mm) above finished floor.
    - c. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter back splash if vertical or 4 inches (100 mm) above counter back splash if horizontal.
  - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

3. Where multiple receptacles or wall switches are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
  4. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
- C. Install wiring devices in accordance with manufacturer's instructions.
  - D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
  - E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.
  - F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
  - G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  - H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
  - I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
  - J. Install wall switches with OFF position down.
  - K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
  - L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
  - M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
  - N. Identify wiring devices in accordance with Section 26 0553.

#### 3.4. FIELD QUALITY CONTROL

- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch and fan speed controller with circuit energized to verify proper operation.
- C. Test each receptacle to verify operation and proper polarity.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5. ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.6. CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

## SECTION 262813 - FUSES

### PART 1 GENERAL

#### 1.1. SECTION INCLUDES

- A. Fuses.

#### 1.2. RELATED REQUIREMENTS

- A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- B. Section 26 0573 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.
- C. Section 26 2413 - Switchboards: Fusible switches.
- D. Section 26 2416 - Panelboards: Fusible switches.
- E. Section 26 2816.16 - Enclosed Switches: Fusible switches.
- F. Section 26 2913 - Enclosed Controllers: Fusible switches.

#### 1.3. REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses 2012.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
    - a. Fusible Switches for Switchboards: See Section 26 2413.
    - b. Fusible Switches for Panelboards: See Section 26 2416.
    - c. Fusible Enclosed Switches: See Section 26 2816.16.
    - d. Fusible Switches for Enclosed Motor Controllers: See Section 26 2913.
  - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
  - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.



- B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Fuses: One set(s) of three for each type and size installed.
  - 3. Fuse Pullers: One set(s) compatible with each type and size installed.

#### 1.6. QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### PART 2 PRODUCTS

#### 2.1. MANUFACTURERS

- A. Bussmann, a division of Eaton  
Corporation: [www.cooperindustries.com/content/public/en/bussmann.html](http://www.cooperindustries.com/content/public/en/bussmann.html).
- B. Littelfuse, Inc: [www.littelfuse.com](http://www.littelfuse.com).
- C. Mersen: [ep-us.mersen.com](http://ep-us.mersen.com).
- D. Substitutions: See Section 01 6000 - Product Requirements.

#### 2.2. FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
  - 1. Class RK1, Time-Delay Fuses:

2. Class RK1, Fast-Acting, Non-Time-Delay Fuses:
  3. Class RK5, Time-Delay Fuses:
  4. Class RK5, Fast-Acting, Non-Time-Delay Fuses:
- H. Class J Fuses: Comply with UL 248-8.
1. Class J, Time-Delay Fuses:
  2. Class J, Fast-Acting, Non-Time-Delay Fuses:
    - a. Products:
      - 1) Substitutions: See Section 01 6000 - Product Requirements.
- I. Class L Fuses: Comply with UL 248-10.
1. Class L, Time-Delay Fuses:
  2. Class L, Fast-Acting, Non-Time-Delay Fuses:
- J. Class T Fuses: Comply with UL 248-15.
- K. Class CC Fuses: Comply with UL 248-4.
1. Class CC, Fast-Acting, Non-Time-Delay Fuses:
- L. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- M. Provide the following accessories where indicated or where required to complete installation:
1. Fuse holders: Compatible with indicated fuses.
  2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

### 2.3. SPARE FUSE CABINET

- A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.
- B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.2. INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

## **SECTION 262816.13 - ENCLOSED CIRCUIT BREAKERS**

### **PART 1 GENERAL**

#### **1.1. SECTION INCLUDES**

- A. Enclosed circuit breakers.

#### **1.2. RELATED REQUIREMENTS**

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

#### **1.3. REFERENCE STANDARDS**

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NETA ATS - Standard for Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- J. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- K. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

#### **1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:

1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted enclosed circuit breakers where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.
  1. Include characteristic trip curves for each type and rating of circuit breaker upon request.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  1. Include dimensioned plan and elevation views of enclosed circuit breakers and adjacent equipment with all required clearances indicated.
  2. Include wiring diagrams showing all factory and field connections.
- D. Field Quality Control Test Reports.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- F. Project Record Documents: Record actual installed locations of enclosed circuit breakers.
- G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

#### 1.6. QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

#### 1.8. FIELD CONDITIONS

- A. Maintain ambient temperature between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed circuit breakers.

### PART 2 PRODUCTS

#### 2.1. MANUFACTURERS

- A. ABB/GE: [www.geindustrial.com](http://www.geindustrial.com).
- B. Eaton Corporation: [www.eaton.com](http://www.eaton.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- D. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
- E. Substitutions: See Section 01 6000 - Product Requirements.
- F. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

#### 2.2. ENCLOSED CIRCUIT BREAKERS

- A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet (2,000 m).
  - 2. Ambient Temperature: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- D. Short Circuit Current Rating:
  - 1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
  - 2. Listed series ratings are not acceptable.

- E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- F. Conductor Terminations: Suitable for use with the conductors to be installed.
- G. Provide thermal magnetic circuit breakers unless otherwise indicated.
- H. Provide electronic trip circuit breakers where indicated.
- I. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- J. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.
- K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  - 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
  - 3. Provide surface-mounted enclosures unless otherwise indicated.
- L. Provide externally operable handle with means for locking in the OFF position.
- M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
  - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
  - 2. Where accessory ground fault sensing and relaying equipment is used, equip companion circuit breakers with ground-fault shunt trips.
    - a. Use zero sequence ground fault detection method unless otherwise indicated.
    - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
- N. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

### 2.3. MOLDED CASE CIRCUIT BREAKERS

- A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489 and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

- B. Interrupting Capacity:
  - 1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
    - a. 10,000 rms symmetrical amperes at 240 VAC.
  - 2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
- C. Conductor Terminations:
  - 1. Provide mechanical lugs unless otherwise indicated.
  - 2. Lug Material: Copper, suitable for terminating copper conductors only.
- D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
  - 1. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
  - 2. Provide interchangeable trip units where indicated.
- E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
  - 1. Provide the following field-adjustable trip response settings:
    - a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
    - b. Long time delay.
    - c. Short time pickup and delay.
    - d. Instantaneous pickup.
    - e. Ground fault pickup and delay where ground fault protection is indicated.
- F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
- G. Provide the following circuit breaker types where indicated:
  - 1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
  - 2. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
  - 3. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
- H. Provide the following features and accessories where indicated or where required to complete installation:



1. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install enclosed circuit breakers plumb.
- F. Install flush-mounted enclosed circuit breakers so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
- H. Provide grounding and bonding in accordance with Section 26 0526.
- I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- J. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 0573.
- K. Set field-adjustable ground fault protection pickup and time delay settings as directed.
- L. Identify enclosed circuit breakers in accordance with Section 26 0553.

#### 3.3. FIELD QUALITY CONTROL

- A. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance and for circuit breakers larger than 1200 amperes. Tests listed as optional are not required.

- C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
  - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- D. Test GFCI circuit breakers to verify proper operation.
- E. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.4. ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5. CLEANING

- A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

## **SECTION 262816.16 - ENCLOSED SWITCHES**

### **PART 1 GENERAL**

#### **1.1. SECTION INCLUDES**

- A. Enclosed safety switches.

#### **1.2. RELATED REQUIREMENTS**

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 0573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.
- E. Section 26 2813 - Fuses.
- F. Section 26 2913 - Enclosed Controllers: Manual motor controllers.

#### **1.3. REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- D. NETA ATS - Standard for Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- H. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

#### **1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
  2. Include wiring diagrams showing all factory and field connections.
- D. Field Quality Control Test Reports.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- F. Project Record Documents: Record actual locations of enclosed switches.
- G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 6000 - Product Requirements, for additional provisions.

#### 1.6. QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

### 1.8. FIELD CONDITIONS

- A. Maintain ambient temperature between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed switches.

## PART 2 PRODUCTS

### 2.1. MANUFACTURERS

- A. ABB/GE: [www.geindustrial.com](http://www.geindustrial.com).
- B. Eaton Corporation: [www.eaton.com](http://www.eaton.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- D. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
- E. Substitutions: See Section 01 6000 - Product Requirements.
- F. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

### 2.2. ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet (2,000 m).
  - 2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
  - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault

current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.

2. Minimum Ratings:
  - a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
  - b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
  - c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
  1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- K. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- L. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- M. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- N. Heavy Duty Switches:
  1. Comply with NEMA KS 1.
  2. Conductor Terminations:
    - a. Provide mechanical lugs unless otherwise indicated.
    - b. Lug Material: Copper, suitable for terminating copper conductors only.

3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
  - a. Provide means for locking handle in the ON position where indicated.
- O. Provide the following features and accessories where indicated or where required to complete installation:
  1. Hubs: As required for environment type; sized to accept conduits to be installed.
  2. Integral fuse pullers.
  3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.
  4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 0526.
- H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

- J. Identify enclosed switches in accordance with Section 26 0553.

### 3.3. FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

### 3.4. ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

### 3.5. CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION



## **SECTION 262913 - ENCLOSED CONTROLLERS**

### **PART 1 GENERAL**

#### **1.1. SECTION INCLUDES**

- A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
  - 1. Magnetic motor starters.
  - 2. General purpose contactors.
  - 3. Manual motor starters.
  - 4. Motor-starting switches without overload protection.
- B. Overcurrent protective devices for motor controllers, including overload relays.
- C. Control accessories:
  - 1. Auxiliary contacts.
  - 2. Pilot devices.
  - 3. Control and timing relays.
  - 4. Control power transformers.
  - 5. Control terminal blocks.

#### **1.2. RELATED REQUIREMENTS**

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- E. Section 26 2813 - Fuses: Fuses for fusible switches.

#### **1.3. REFERENCE STANDARDS**

- A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- E. NETA ATS - Standard for Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- I. UL 60947-1 - Low-Voltage Switchgear and Control gear - Part 1: General Rules Current Edition, Including All Revisions.
- J. UL 60947-4-1 - Low-Voltage Switchgear and Control gear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
  - 2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
  - 3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.
  - 4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 6. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.
  - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  - 1. Include dimensioned plan and elevation views of enclosed controllers and adjacent equipment with all required clearances indicated.

2. Include wiring diagrams showing all factory and field connections.
  3. Include documentation demonstrating selective coordination upon request.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Field Quality Control Test Reports.
- F. Project Record Documents: Record actual installed locations of controllers and final equipment settings.
1. Include nameplate data of actual installed motors and associated overload relay selections and settings.
  2. Motor Circuit Protectors: Include magnetic instantaneous trip settings.
- G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Electronic Trip Circuit Breakers: Provide one portable test set.
  3. Indicating Lights: Two of each different type.

#### 1.6. QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

#### 1.8. FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

## PART 2 PRODUCTS

### 2.1. MANUFACTURERS

- A. ABB/GE: [www.geindustrial.com](http://www.geindustrial.com).
- B. Eaton Corporation; Cutler-Hammer Product: [www.eaton.com](http://www.eaton.com).
- C. Rockwell Automation, Inc; Allen-Bradley Products: [ab.rockwellautomation.com/#sle](http://ab.rockwellautomation.com/#sle).
- D. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- E. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
- F. Substitutions: See Section 01 6000 - Product Requirements.
- G. Source Limitations: Furnish enclosed motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.

### 2.2. ENCLOSED CONTROLLERS

- A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Enclosed controllers complying with NEMA ICS 2 and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.
- D. Service Conditions:
  - 1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
    - a. Altitude:
      - 1) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet (2,000 m).
    - b. Ambient Temperature: Between 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C).
  - 2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- E. Short Circuit Current Rating:
  - 1. Provide controllers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
  - 2. Listed series ratings are not acceptable.

- F. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures:
  - 1. Comply with NEMA ICS 6.
  - 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1 or Type 12.
    - b. Outdoor Locations: Type 3R or Type 4.
  - 3. Finish: Manufacturer's standard unless otherwise indicated.
- I. General Purpose Contactors: Combination type unless otherwise indicated.
  - 1. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect, but without integral overload relay(s).
  - 2. Configuration: Full-voltage non-reversing unless otherwise indicated.
  - 3. Minimum Contactor Size: NEMA Size 0.
  - 4. Use of non-standard contactor sizes smaller than specified standard NEMA sizes is not permitted.
  - 5. Disconnects: Circuit breaker type.
    - a. Disconnect Switches: Fusible type unless otherwise indicated.
    - b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
    - c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
  - 6. Pilot Devices Required:
    - a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.
    - b. Contactors for motor applications where overload protection is provided separately or where motor contains integral thermal protectors to be provided with pilot devices as specified for magnetic motor starters above.

### 2.3. OVERCURRENT PROTECTIVE DEVICES

- A. Overload Relays:

1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
  2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
  3. Trip-free operation.
  4. Visible trip indication.
  5. Resettable.
    - a. Employ manual reset unless otherwise indicated.
    - b. Employ automatic reset or remote reset where indicated.
    - c. Do not employ automatic reset with two-wire control.
  6. Solid-State Overload Relays:
    - a. Selectable inverse-time trip class rating; available ratings of Class 10, 20, and 30, minimum.
    - b. Adjustable full load current.
    - c. Phase loss protection.
    - d. Phase imbalance protection.
    - e. Ground fault protection.
    - f. Ambient temperature insensitive.
    - g. Thermal memory.
    - h. Trip test function.
    - i. Provide isolated alarm contact.
- B. Fusible Disconnect Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1 and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
  2. Fuse Clips: As required to accept indicated fuses.
  3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- C. Circuit Breakers:
1. Interrupting Capacity (not applicable to motor circuit protectors):

- a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
  - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
2. Motor Circuit Protectors:
- a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.
  - b. Provide field-adjustable magnetic instantaneous trip setting.
  - c. Provide the following features and accessories where indicated or where required to complete installation:
    - 1) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
    - 2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
    - 3) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
    - 4) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.
3. Molded Case Circuit Breakers:
- a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
    - 1) Provide thermal magnetic circuit breakers unless otherwise indicated.
  - b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
    - 1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
  - c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
    - 1) Provide the following field-adjustable trip response settings:
      - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.

- (b) Long time delay.
  - (c) Short time pickup and delay.
  - (d) Instantaneous pickup.
  - (e) Ground fault pickup and delay where ground fault protection is indicated.
- d. Provide the following features and accessories where indicated or where required to complete installation:
- 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
  - 2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
  - 3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
  - 4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
  - 5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

#### 2.4. CONTROL ACCESSORIES

##### A. Auxiliary Contacts:

- 1. Comply with NEMA ICS 5.
- 2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.

##### B. Pilot Devices:

- 1. Comply with NEMA ICS 5; heavy-duty type.
- 2. Nominal Size: 30 mm.
- 3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
- 4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
- 5. Indicating Lights: Push-to-test type unless otherwise indicated.
- 6. Provide LED lamp source for indicating lights and illuminated devices.

##### C. Control and Timing Relays:

- 1. Comply with NEMA ICS 5.



2. Provide number and type of relays indicated or required to perform necessary functions.
  3. Timing Relays: Electronic or pneumatic as indicated.
    - a. Adjustable Timing Range: As indicated on drawings.
  4. Multi-Speed Motor Starters: Employ accelerating relays, decelerating relays, and compelling relays where indicated.
  5. Accelerating Relays: Starts motor at low speed and then accelerates automatically through definite time intervals for each successive speed until selected speed is attained.
  6. Decelerating Relays: Allows motor to decelerate automatically through definite time intervals for each successive speed until selected speed is attained.
  7. Compelling Relays: Requires motor to start at low speed before a higher speed can be selected.
- D. Control Terminal Blocks: Include 25 percent spare terminals.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings of enclosed controllers are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed controllers.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install controllers in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install enclosed controllers plumb and level.
- F. Provide grounding and bonding in accordance with Section 26 0526.
- G. Install all field-installed devices, components, and accessories.
- H. Provide fuses complying with Section 26 2813 for fusible switches as indicated.
- I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

- J. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.
- K. Identify enclosed controllers in accordance with Section 26 0553.

### 3.3. FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.
- C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers larger than 225 amperes. Tests listed as optional are not required.
- E. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

### 3.4. ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

### 3.5. CLEANING

- A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

### 3.6. CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of enclosed controllers and associated devices.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Instructor: Manufacturer's authorized representative.
  - 4. Location: At project site.

3.7. PROTECTION

- A. Protect installed enclosed controllers from subsequent construction operations.

END OF SECTION

## **SECTION 265100 - INTERIOR LIGHTING**

### **PART 1 GENERAL**

#### **1.1. SECTION INCLUDES**

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Drivers.
- E. Accessories.

#### **1.2. RELATED REQUIREMENTS**

- A. Section 26 0529 - Hangers and Supports for Electrical Systems.
- B. Section 26 0533.16 - BOXES.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 2726 - Wiring Devices: Manual wall switches.
- E. Section 26 5600 - Exterior Lighting.

#### **1.3. REFERENCE STANDARDS**

- A. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- B. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information 2019.
- C. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products 2019.
- D. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources 2021.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems 2006.
- G. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012 (Reaffirmed 2018).
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- J. UL 1598 - Luminaires Current Edition, Including All Revisions.
- K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

#### 1.4. ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
  - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
  - 3. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

#### 1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate dimensions and components for each luminaire.
  - 2. Provide photometric calculations where luminaires are proposed for substitution upon request.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
  - 1. LED Luminaires:
    - a. Include estimated useful life, calculated based on IES LM-80 test data.
    - b. Include IES LM-79 test report upon request.
  - 2. LED's: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
- D. Samples:
  - 1. Provide one sample(s) of each luminaire proposed for substitution upon request.
  - 2. Provide one sample(s) of each product finish illustrating color and texture upon request.
- E. Field quality control reports.

- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
  - 3. Extra LED drivers: Ten percent of total quantity installed for each type of driver, but not less than two of each type.
- I. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

#### 1.6. QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND PROTECTION

- A. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

#### 1.8. FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### 1.9. WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 5-year manufacturer warranty for LED luminaires, including drivers.

### PART 2 PRODUCTS

#### 2.1. MANUFACTURERS - LUMINAIRES

- A. Furnish products from the Manufacturers listed in the Luminaire Schedule found on the drawings.

## 2.2. LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: Proposed substitutions shall be made in electronic format using the proper form found in the front-end documents and must be submitted to the Architect 10 business days prior to Bid.

## 2.3. LUMINAIRES

- A. Manufacturers:
  - 1. Acceptable Manufacturers for each type of luminaire are listed on the luminaire schedule on the drawings.
  - 2. Substitutions: Proposed substitutions shall be made in electronic format using the proper form found in the front-end documents and must be submitted to the Architect 10 business days prior to Bid.
- B. Provide products that comply with requirements of NFPA 70.
- C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Unless otherwise indicated, provide complete luminaires including LED's, reflectors, lenses, drivers, housings, and other components required to position, energize and protect the light source and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.
  - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
- I. LED Luminaires:
  - 1. Components: UL 8750 recognized or listed as applicable.
  - 2. Tested in accordance with IES LM-79 and IES LM-80.
  - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
  - 4. Corrected Color Temperature (CCT): 4000 k unless otherwise indicated.
  - 5. Color Rendering Index (CRI): Not less than 80.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

#### 3.3. INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Provide required support and attachment in accordance with Section 26 0529.
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Recessed Luminaires:
  - 1. Install trims tight to mounting surface with no visible light leakage.
  - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- F. Suspended Luminaires:
  - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
  - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
  - 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet (1.2 m) between supports.
  - 4. Install canopies tight to mounting surface.



5. Unless otherwise indicated, support pendants from swivel hangers.

G. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

H. Install accessories furnished with each luminaire.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

### 3.4. FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

### 3.5. CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

### 3.6. CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

### 3.7. PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

## **SECTION 265600 - EXTERIOR LIGHTING**

### **PART 1 GENERAL**

#### **1.1. SECTION INCLUDES**

- A. Exterior luminaires.
- B. Luminaire accessories.

#### **1.2. RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0529 - Hangers and Supports for Electrical Systems.
- D. Section 26 0533.16 - BOXES.
- E. Section 26 2726 - Wiring Devices: Receptacles for installation in poles.
- F. Section 26 5100 - Interior Lighting.

#### **1.3. REFERENCE STANDARDS**

- A. IEEE C2 - National Electrical Safety Code(R) (NEC(R)) 2023.
- B. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information 2019.
- C. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products 2019.
- D. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources 2021.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

#### **1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

### 1.5. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.
- B. Shop Drawings:
  - 1. Provide photometric calculations where luminaires are proposed for substitution upon request.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
  - 1. LED Luminaires:
    - a. Include estimated useful life, calculated based on IES LM-80 test data.
    - b. Include IES LM-79 test report upon request.
  - 2. Lamps: Include rated life and initial and mean lumen output.
- D. Samples:
  - 1. Provide one sample(s) of each luminaire proposed for substitution upon request.
  - 2. Provide one sample of each product finish illustrating color and texture upon request.
- E. Field Quality Control Reports.
  - 1. Include test report indicating measured illumination levels.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
- I. Project Record Documents: Record actual connections and locations of luminaires, and any pull or junction boxes.

### 1.6. QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7. DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

#### 1.8. WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 5-year manufacturer warranty for all LED luminaires, including drivers.

### PART 2 PRODUCTS

#### 2.1. LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: Proposed substitutions shall be made in electronic format using the proper form found in the front-end documents and must be submitted to the Architect 10 business days prior to Bid.

### PART 3 EXECUTION

#### 3.1. EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2. PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

#### 3.3. INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.

- C. Install luminaires in accordance with NECA/IESNA 501.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Recessed Luminaires:
  - 1. Install trims tight to mounting surface with no visible light leakage.
  - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- G. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- H. Install accessories furnished with each luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.
- J. Install lamps in each luminaire.

#### 3.4. FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Correct wiring deficiencies and repair or replace damaged or defective products.

#### 3.5. CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

#### 3.6. CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. Just prior to Substantial Completion, replace all lamps that have failed.

#### 3.7. PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

## **SECTION 284600 - FIRE DETECTION AND ALARM**

### **PART 1 GENERAL**

#### **1.1. SECTION INCLUDES**

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.
- C. Maintenance of fire alarm system under contract for specified warranty period.

#### **1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping: Materials and methods for work to be performed by this installer.
- B. Section 08 7100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.
- C. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.
- D. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

#### **1.3. REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.
- F. NFPA 76 - Standard for the Fire Protection of Telecommunications Facilities 2020.
- G. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems Current Edition, Including All Revisions.
- I. IFC - International Fire Code; Most Recent Edition Adopted by the Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.4. SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.
- B. Drawings must be prepared as DXF-format CAD drawings.
  - 1. Architect will provide CAD floor plan drawings for Contractor's use upon Contractor's completion of Waiver of Liability Agreement form.
- C. Evidence of designer qualifications. Design must be completed by a NICET level IV designer, minimum.
- D. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
  - 1. Copy (if any) of list of data required by authority having jurisdiction.
  - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
  - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
  - 4. System zone boundaries and interfaces to fire safety systems.
  - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
  - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
  - 7. List of all devices on each signaling line circuit, with spare capacity indicated.
  - 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
  - 9. Air-Sampling Smoke Detection Systems: Include air-sampling pipe network layout with sampling ports identified; include calculations demonstrating compliance with specified requirements.
  - 10. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
  - 11. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
  - 12. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
  - 13. Certification by Contractor that the system design complies with Contract Documents.
- E. Evidence of installer qualifications. Installer must hold a NICET level III certificate, minimum.
- F. Evidence of instructor qualifications; training lesson plan outline.

- G. Evidence of maintenance contractor qualifications, if different from installer.
- H. Inspection and Test Reports:
  - 1. Submit inspection and test plan prior to closeout demonstration.
  - 2. Submit documentation of satisfactory inspections and tests.
  - 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- I. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
  - 1. Original copy of NFPA 72 with portions that are not relevant to this project neatly crossed out by hand; label with project name and date.
  - 2. Complete set of specified design documents, as approved by authority having jurisdiction.
  - 3. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
  - 4. Contact information for firm that will be providing contract maintenance and trouble call-back service.
  - 5. List of recommended spare parts, tools, and instruments for testing.
  - 6. Replacement parts list with current prices, and source of supply.
  - 7. Detailed troubleshooting guide and large scale input/output matrix.
  - 8. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
  - 9. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- J. Project Record Documents: See Section 01 7800 for additional requirements; have one set available during closeout demonstration:
  - 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
  - 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
  - 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- K. Closeout Documents:
  - 1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.



2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
  3. Certificate of Occupancy.
  4. Maintenance contract.
- L. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
  3. In addition to the items in quantities indicated in PART 2, furnish the following:
    - a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
    - b. One copy, on CD-ROM, of all software not resident in read-only-memory.
    - c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

#### 1.5. QUALITY ASSURANCE

- A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.
- B. Designer Qualifications: NICET Level IV (4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
- C. Installer Qualifications: Installer with a minimum NICET Level III (3) and three years experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
  2. Installer Personnel: At least 3 years of experience installing fire alarm systems.
  3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
  4. Contract maintenance office located within 50 miles (80 km) of project site.
  5. Certified in the State in which the Project is located as fire alarm installer.

- D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- E. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.
- F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.6. WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
- C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

### PART 2 PRODUCTS

#### 2.1. MANUFACTURERS

- A. Fire Alarm Control Units: Provided their products meet or exceed the performance of the basis of design product, products of the following are acceptable:
  - 1. Honeywell Security & Fire Solutions/Gamewell-FCI: [www.gamewell-fci.com](http://www.gamewell-fci.com).
  - 2. Honeywell Security & Fire Solutions/Fire-Lite: [www.firelite.com](http://www.firelite.com).
  - 3. Honeywell Security & Fire Solutions/Notifier: [www.notifier.com](http://www.notifier.com).
  - 4. Honeywell Security & Fire Solutions/Silent Knight: [www.silentknight.com](http://www.silentknight.com).
  - 5. Honeywell Security & Fire Solutions/Vista: [www.security.honeywell.com](http://www.security.honeywell.com).
  - 6. Siemens Building Technologies, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
  - 7. Johnson Controls-SimplexGrinnell: [www.tycosimplexgrinnell.com](http://www.tycosimplexgrinnell.com).
  - 8. United Technologies/Edwards: [www.edwardsfiresafety.com](http://www.edwardsfiresafety.com).
  - 9. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Initiating Devices and Notification Appliances:
  - 1. Same manufacturer as control units.
  - 2. Provide initiating devices and notification appliances made by the same manufacturer, where possible.
- C. Substitutions: See Section 01 6000 - Product Requirements.

1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with Contract Documents.
2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with Contract Documents.

## 2.2. FIRE ALARM SYSTEM

### A. Fire Alarm System: Provide a new automatic fire detection and alarm system:

1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
2. Protected Premises: Entire building shown on drawings.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
  - a. ADA Standards.
  - b. The requirements of the State Fire Marshal.
  - c. The requirements of the local authority having jurisdiction.
  - d. Applicable local codes.
  - e. Contract Documents (drawings and specifications).
  - f. NFPA 101.
  - g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
  - h. International Fire Code.
4. Fire-alarm signal initiation shall be by one or more of the following devices :
  - a. Manual stations.
  - b. Heat detectors.
  - c. Flame detectors.
  - d. Smoke detectors.
  - e. Duct smoke detectors.
  - f. Air-sampling smoke-detection system (VESDA).
  - g. Carbon monoxide detectors.
  - h. Combustible gas detectors.
  - i. Automatic sprinkler system water flow.

- j. Preaction system.
  - k. Fire-extinguishing system operation.
  - l. Fire standpipe system.
  - m. Dry system pressure flow switch.
  - n. Fire pump running.
5. Fire-alarm signal shall initiate the following actions:
- a. Supervisory signal initiation shall be by one or more of the following devices and actions, including voice evacuation notices.
  - b. Retain only those devices and actions in subparagraphs below applicable to Project. Coordinate with requirements in other Sections that specify devices and systems.
  - c. Valve supervisory switch.
  - d. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
  - e. Alert and Action signals of air-sampling detector system.
  - f. Elevator shunt-trip supervision.
  - g. Fire pump running.
  - h. Fire-pump loss of power.
  - i. Fire-pump power phase reversal.
  - j. Independent fire-detection and -suppression systems.
  - k. User disabling of zones or individual devices.
  - l. Loss of communication with any panel on the network.
6. System trouble signal initiation shall be by one or more of the following devices and actions:
- a. Open circuits, shorts, and grounds in designated circuits.
  - b. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
  - c. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
  - d. Loss of primary power at fire-alarm control unit.
  - e. Ground or a single break in internal circuits of fire-alarm control unit.
  - f. Abnormal ac voltage at fire-alarm control unit.

- g. Break in standby battery circuitry.
  - h. Failure of battery charging.
  - i. Abnormal position of any switch at fire-alarm control unit or annunciator.
  - j. Voice signal amplifier failure.
  - k. Hose cabinet door open.
7. System Supervisory Signal Actions:
- a. Initiate notification appliances.
  - b. Identify specific device initiating the event at fire-alarm control unit.
  - c. Record the event on system printer.
  - d. After a 3 second time delay, transmit a trouble or supervisory signal to the remote alarm receiving station.
  - e. Transmit system status to building management system.
  - f. Display system status on graphic annunciator.

**B. FIRE-ALARM CONTROL UNIT**

1. General Requirements for Fire-Alarm Control Unit:
- a. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
    - 1) System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
    - 2) Include a real-time clock for time annotation of events on the event recorder and printer.
    - 3) Provide communication between the FCP and remote circuit interface panels, annunciators, and displays.
    - 4) The FCP shall be listed for connection to a central-station signaling system service.
    - 5) Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FCP shall provide a minimum 500-event history log.
  - b. Addressable Initiation Device Circuits: The FCP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
  - c. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FCP shall be listed for releasing service.

- d. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
  - e. Annunciator and Display: Liquid-crystal type, two line(s) of 40 characters, minimum.
  - f. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the systems for control of smoke-density sensitivity and other parameters.
2. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
    - a. Pathway Class Designations: NFPA 72, Class A.
    - b. Pathway Survivability: Level 0.
    - c. Install no more than 50 addressable devices on each signaling-line circuit.
    - d. Serial Interfaces:
      - 1) One dedicated RS 485 port for central station, operation using point ID DACT.
      - 2) One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
      - 3) One USB port for PC configuration.
      - 4) One RS 232 port for VESDA HLI connection.
      - 5) One RS 232 port for voice evacuation interface.
3. Stairwell and Elevator Shaft Pressurization: Provide an output signal using an addressable relay to start the stairwell and Elevator Shaft pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.
    - a. Pressurization starts when any alarm is received at fire-alarm control unit.
    - b. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.
4. Smoke-Alarm Verification:
    - a. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
    - b. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
    - c. Record events by the system printer.
    - d. Sound general alarm if the alarm is verified.

- e. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
5. Notification-Appliance Circuit:
- a. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
  - b. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
  - c. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
6. Elevator Recall:
- a. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
    - 1) Elevator lobby detectors except the lobby detector on the designated floor.
    - 2) Smoke detector in elevator machine room.
    - 3) Smoke detectors in elevator hoist way.
  - b. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
  - c. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
    - 1) Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
7. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall [be] [not be] connected to fire-alarm system.
8. 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.
9. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
10. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located in the fire command center.
- a. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.

- 1) Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
  - 2) Programmable tone and message sequence selection.
  - 3) Standard digitally recorded messages for "Evacuation" and "All Clear."
  - 4) Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.
- b. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
  - c. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
11. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
  12. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, [supervisory signals] [supervisory and digital alarm communicator transmitters] [and] [digital alarm radio transmitters] shall be powered by 24-V dc source.
    - a. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
  13. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
    - a. Batteries: Sealed, valve-regulated, recombinant lead acid.
  14. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
  15. PREACTION SYSTEM
    - a. Initiate Presignal Alarm: This function shall cause an audible and visual alarm and indication to be provided at the FACP. Activation of an initiation device connected as part of a preaction system shall be annunciated at the FACP only, without activation of the general evacuation alarm.
  16. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.



17. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
  18. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
  19. Staff Response Zones: For each smoke zone where occupants are not ambulatory, program notification zone as directed to notify staff in areas outside the normal notification zone and in other buildings, for response to assist in evacuation.
  20. Program notification zones and voice messages as directed by Owner.
  21. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
  22. Fire Command Center: Location indicated on drawings.
  23. Master Control Unit (Panel): New, located as shown on plans.
  24. Combined Systems: Do not combine fire alarm system with other non-fire systems.
- C. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By remote supervising station.
  2. On-Premises Supervising Station: None.
  3. Remote Supervising Station: UL-listed central station under contract to facility.
  4. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.
  5. Auxiliary Connection Type: Local energy.
- D. Circuits:
1. Initiating Device Circuits (IDC): Class B, Style A.
  2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
  3. Notification Appliance Circuits (NAC): Class B, Style W.
- E. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
  2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
  3. Speaker Amplifiers: Minimum 25 percent spare capacity.
  4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

F. Power Sources:

1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

2.3. LIVING UNIT STAND ALONE FIRE ALARM SYSTEM

- A. Each sleeping room and immediately adjacent to each sleeping room shall have a local fire smoke alarm, audible, powered from house voltage (120 Volt) with battery backup (9 volt).
1. Nominal sensitivity shall be 2.5%.
  2. The alarm shall utilize an infrared LED sensing circuit which pulses in 4 to 5 second intervals when subjected to smoke. After 2 consecutive pulses in smoke, the smoke alarm will activate.
  3. The smoke alarm shall have a Duracell MN 1604 9VDC alkaline battery as a back-up in the event building power is lost.
  4. The 9 VDC battery impedance shall be verified by the circuit of the smoke alarm.
  5. The smoke alarm shall provide an indicator when the battery is low in power or high impedance or is missing.
  6. The sensing chamber shall be fully screened to prevent entrance of small insects, thus reducing the probability of false alarms.
  7. A solid state piezo alarm rated at 85dBA at 10ft.
  8. A visual LED monitor (status indicator) will slow pulse in normal operation and rapid pulse in alarm.
  9. An easily accessible test button shall be provided. Push down on button for 5 seconds causing smoke alarm to go into alarm. If smoke alarm does not alarm, the smoke alarm is not working properly.
  10. The smoke alarms shall have tandem interconnect capability of up to 12 units.
  11. The smoke alarms shall have the capability to tandem with interconnect capable smoke alarms.
  12. Unit must be UL 217 listed for both wall and ceiling mount.
  13. Unit shall be equipped with dust-cover to protect unit while construction is complete. Dust-cover must be removed prior to power being supplied to smoke alarm. If dust-cover is not removed operation of smoke alarm will be inhibited.
  14. Unit shall be listed by Underwriters Laboratories, California State Fire Marshal (CSFM) and the Bureau of Standards and Appeals (NYC).

- a. All equipment shall be completely factory assembled, wired and tested, and the contractor shall be prepared to submit a certified letter testifying to this condition. Alarms which do not meet all of the requirements of this specification will not be considered.
- B. Living units identified as "ADA Compliant" shall have in each sleeping room and immediately adjacent to each sleeping room shall have a local fire smoke alarm, audible and visual, powered from house voltage (120 Volt) with battery backup (9 volt).
1. Nominal sensitivity shall be 2.5%.
  2. The smoke alarm shall utilize an infrared LED sensing circuit which pulses in 4 to 5 second intervals; when subjected to smoke the pulse rate shall increase 8 times. After 2 consecutive pulses in smoke, the smoke alarm will alarm.
  3. The smoke alarm shall provide minimum 5-to-1 signal-to-noise ratio in the optics frame to assure stability of operation in environments of high RF and transient conditions.
  4. The sensing chamber shall be fully screened to prevent entrance of small insects, thus reducing the probability of false alarms.
  5. A continuous piezo horn rated at 90dBA at 10 ft. or a temporal 3 piezo horn rated at 90dBA at 10ft.
  6. A visual LED monitor (condition indicator) will pulse in normal operation and will remain solid in alarm.
  7. The visual signal shall have a minimal light output of 177 candela and will flash one time per second.
  8. An easily accessible test knob shall be provided. The test knob in the TEST position will simulate an actual smoke condition of approximately 3.5% causing the smoke alarm to alarm within 20-36 seconds. Also the detector shall test for the most sensitive setting. An alarm during this test will be a maintenance indicator.
  9. The smoke alarm shall be provided with a Form C relay contact for remote annunciation purposes.
  10. The manufacturer shall provide other compatible smoke alarm models with the following optional features: a) auxiliary Form C relay contact for initiating remote functions and annunciation; b) relay option that is capable of activation by tandem interconnect wire.
  11. Unit must be capable of providing a monitored battery back-up.
  12. Unit must be ANSI/UL 217 and ANSI/UL 1971 listed for wall mount or ceiling mount.
  13. Unit shall also meet all requirements of the State of California Fire Marshal, Bureau of Standards and Appeals and the Americans with Disabilities Act ADA).

#### 2.4. FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
  1. Sprinkler water control valves.
  2. Elevator shut-down control circuits.

- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
  - 1. Sprinkler water flow.
  - 2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
  - 3. Duct smoke detectors.
- C. Elevators:
  - 1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
  - 2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
  - 3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.
- D. HVAC:
  - 1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.
- E. Doors:
  - 1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.
  - 2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 7100.

## 2.5. DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture [one] [two] telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
  - 1. Verification that both telephone lines are available.
  - 2. Programming device.
  - 3. LED display.

4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.
6. [Insert local function].

D. Digital data transmission shall include the following:

1. Retain applicable subparagraphs below; revise to match characteristics of fire-alarm control unit and requirements of the central station.
2. Address of the alarm-initiating device.
3. Address of the supervisory signal.
4. Address of the trouble-initiating device.
5. Loss of ac supply.
6. Loss of power.
7. Low battery.
8. Abnormal test signal.
9. Communication bus failure.
10. [Insert signal to be transmitted].

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

## 2.6. RADIO ALARM TRANSMITTER

- A. Retain this article if Project requires transmission of fire-alarm, supervisory, and trouble signals to a remote alarm receiving station by means of radio signals.
- B. Transmitter shall comply with NFPA 1221 and 47 CFR 90.
- C. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.
  1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
  2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
  3. Normal Power Input: 120-V ac.
  4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.

5. Verify that antenna type and required wind resistance in "Antenna" Subparagraph below are suitable for Project location. Wind speed is usually a requirement of the applicable building code.
  6. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand [100 mph (160 km/h)] [Insert value] with a gust factor of 1.3 without failure.
  7. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
  8. Antenna-Cable Connectors: Weatherproof.
  9. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.
- D. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:
1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
  2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
  3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
  4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
  5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
  6. Local Fire-Alarm-System, Supervisory-Alarm Message: [Actuated when the building alarm system indicates a supervisory alarm] [Insert condition].

## 2.7. NETWORK COMMUNICATIONS

- A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.
- B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.
- C. Provide integration gateway using BACnet for connection to building automation system.

## 2.8. COMPONENTS

### A. General:

1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

### B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

### C. Master Control Unit: As specified for Basis of Design above, or equivalent.

### D. Initiating Devices:

#### 1. Addressable Systems:

- a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
- b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

#### 2. Manual Pull Stations: Provide 1 extra.

#### 3. Key Operated Pull Stations: Provide 1 extra.

#### 4. Smoke Detectors: Provide 1 extra.

#### 5. Duct Smoke Detectors: Provide 1 extra.

#### 6. Heat Detectors: Provide 1 extra.

#### 7. Carbon Monoxide Detectors: Provide 1 extra.

#### 8. Air-Sampling Smoke Detection Systems:

- a. Design and provide smoke detection system suitable for application and coverage area indicated, consisting of smoke detector unit with aspirator/fan that continuously draws air into sensing chamber through connected sampling pipe network and associated sampling ports.
- b. Comply with NFPA 72 and list and label as complying with UL 268.
- c. Comply with applicable requirements of NFPA 76 for Very Early Warning Fire Detection (VEWFD).
- d. Detector Unit:
  - 1) Sensitivity: Programmable; capable of meeting NFPA 76 requirements for Very Early Warning Fire Detection (VEWFD).

- 2) Smoke Detection Method: Provide detector units employing laser-based light scattering mass detection.
- 3) Alarm Levels: Programmable; as indicated or as required to perform alert, pre-alarm action, and alarm functions; minimum of three.
- 4) Minimum Number of Output Relays Supported: Equivalent to basis of design.
- 5) Display: Provides local annunciation of detector trouble and alarm status.
- e. Sampling Pipe Network:
  - 1) Use manufacturer's recommended sampling pipe and fittings; plenum rated; identified in accordance with NFPA 72.
  - 2) Designed using manufacturer's product-specific design software or based on manufacturer's pre-engineered design suitable for the application.
9. Addressable Interface Devices: [Provide 1 extra.].
- E. Notification Appliances:
  1. Horns: Provide 1 extra.
    - a. Provide 1 extra.
  2. Speakers: Provide 1 extra.
  3. Strobes: Provide 1 extra.
- F. Circuit Conductors: Copper or optical fiber; provide 200 feet (60 m) extra; color code and label.
- G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
  1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
  2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
  3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.
- H. Locks and Keys: Deliver keys to Owner.
  1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type
- I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.



1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

### PART 3 EXECUTION

#### 3.1. INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, the International Fire Code, and Contract Documents.
- B. Install all cabling in conduit.
- C. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- D. Obtain Owner's approval of locations of devices, before installation.
- E. Install instruction cards and labels.

#### 3.2. INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

#### 3.3. Owner PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
  1. Hands-On Instruction: On-site, using operational system.
  2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
- B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:

1. Initial Training: 1 session pre-closeout.
  2. Refresher Training: 1 session post-occupancy.
- C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
1. Initial Training: 1 session pre-closeout.
  2. Refresher Training: 1 session post-occupancy.
- D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

### 3.4. CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
1. Be prepared to conduct any of the required tests.
  2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
  3. Have authorized technical representative of control unit manufacturer present during demonstration.
  4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
  5. Repeat demonstration until successful.
- B. Occupancy of the project will not occur prior to Substantial Completion.
- C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
1. Specified diagnostic period without malfunction has been completed.
  2. Approved operating and maintenance data has been delivered.
  3. Spare parts, extra materials, and tools have been delivered.
  4. All aspects of operation have been demonstrated to Owner.
  5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
  6. Occupancy permit has been granted.
  7. Specified pre-closeout instruction is complete.
- D. Perform post-occupancy instruction within 3 months after Substantial Completion.

### 3.5. MAINTENANCE

- A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.
- C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
  - 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
  - 2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
  - 3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- D. Provide trouble call-back service upon notification by Owner:
  - 1. Provide on-site response within 2 hours of notification.
  - 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
  - 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- G. Comply with Owner's requirements for access to facility and security.

END OF SECTION

## SECTION 311000 - SITE CLEARING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Protecting existing vegetation to remain.
  - 2. Removing existing vegetation.
  - 3. Clearing and grubbing.
  - 4. Stripping and stockpiling topsoil.
  - 5. Stripping and stockpiling rock.
  - 6. Removing above- and below-grade site improvements.
  - 7. Disconnecting, capping or sealing, and removing site utilities.
  - 8. Temporary erosion and sedimentation control.

#### 1.3 DEFINITIONS

- A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.
- D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 MATERIAL OWNERSHIP

- A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
  - 1. Use sufficiently detailed photographs or video recordings.
  - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.
- B. Rock stockpiling program.
- C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.
- D. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.7 QUALITY ASSURANCE

- A. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 FIELD 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 trafficways if required by Owner or 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. Utility Locator Service: Notify Missouri One Call for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

- F. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."
- G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
  - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."
- 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 erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

### 3.3 TREE AND PLANT PROTECTION

- A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

### 3.4 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
  - 1. Arrange with utility companies to shut off indicated utilities.
  - 2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- B. Interrupting 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 Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

### 3.5 CLEARING AND GRUBBING

- A. Clearing and Grubbing shall be completed prior to the start of this contract. The contractor shall verify that the clearing and grubbing work indicated on the plans has been complete prior to start of construction, and inform the Engineer of any discrepancy.
- B. The contractor shall obtain permission from the Engineer to perform any additional clearing.
- C. Remove obstructions, trees, shrubs, 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. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
  - 3. Use only hand methods or air spade for grubbing within protection zones.
  - 4. Chip removed tree branches and dispose of off-site.
- D. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

### 3.6 STOCKPILING ROCK

- A. Remove from construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.
  - 1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- B. Stockpile rock where indicated on Drawings without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.

1. Limit height of rock stockpiles to 36 inches.
2. Do not stockpile rock within protection zones.
3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus rock to allow later use by the Owner.

### 3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and 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 along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
  2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

### 3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. 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.
- B. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.
- C. 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. Do not interfere with other Project work.

END OF SECTION



## SECTION 312000 - EARTH MOVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
8. Excavating well hole to accommodate elevator-cylinder assembly.

- B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for recording pre-excavation and earth-moving progress.
2. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
3. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Section 312319 "Dewatering" for lowering and disposing of ground water during construction.
5. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
6. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
7. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

#### 1.3 UNIT PRICES

- A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."
- B. Quantity allowances for earth moving are included in Section 012100 "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 inch 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. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.
  2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
  3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
  2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.
- I. 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 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

- J. 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.
- K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

#### 1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct pre-excavation conference at Project.
  - 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 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
  - 1. Geotextiles.
  - 2. Controlled low-strength material, including design mixture.
  - 3. Warning tapes.
- B. Samples for Verification: For the following products, in sizes indicated below:
  - 1. Geotextile: 12 by 12 inches
  - 2. Warning Tape: 12 inches long; of each color.

#### 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
  - 1. Classification according to ASTM D 2487.
  - 2. Laboratory compaction curve according to ASTM D 1557.
- C. Blasting plan approved by authorities having jurisdiction.

- D. Seismic survey report from seismic survey agency.
- E. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

#### 1.8 QUALITY ASSURANCE

- A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
  - 1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
  - 2. Seismographic monitoring during blasting operations.
- B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
  - 1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
  - 2. Seismographic monitoring during blasting operations.
- C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

#### 1.9 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving 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 Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing earth moving 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. Utility Locator Service: Notify Missouri One Call for area where Project is located before beginning earth-moving operations.
- D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.
- E. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.
- F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
  2. Parking vehicles or equipment.
  3. Foot traffic.
  4. Erection of sheds or structures.
  5. Impoundment of water.
  6. Excavation or other digging unless otherwise indicated.
  7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487], or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
1. Liquid Limit:
  2. Plasticity Index: .
- 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. 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 natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and zero to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33/C 33M; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.2 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. Survivability: As follows:
    - a. Grab Tensile Strength: 157 lbf ; ASTM D 4632.
    - b. Sewn Seam Strength: 142 lbf; ASTM D 4632.
    - c. Tear Strength: 56 lbf ;ASTM D 4533.
    - d. Puncture Strength: 56 lbf ASTM D 4833.
  - 3. Apparent Opening Size: [No. 40 (0.425-mm)] [No. 60 (0.250-mm)] [No. 70 (0.212-mm)] sieve, maximum; ASTM D 4751.
  - 4. Permittivity: [0.5] [0.2] [0.1] per second, minimum; ASTM D 4491.
  - 5. 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. Survivability: As follows:
    - a. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
    - b. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
    - c. Tear Strength: 90 lbf (400 N); ASTM D 4533.
    - d. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
  - 3. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
  - 4. Permittivity: 0.02 per second, minimum; ASTM D 4491.
  - 5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

## 2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting[, low-density], flowable concrete material produced from the following:
  - 1. Portland Cement: ASTM C 150/C 150M, [Type I] [Type II] [or] [Type III].
  - 2. Fly Ash: ASTM C 618, Class C or F.
  - 3. Normal-Weight Aggregate: ASTM C 33/C 33M, [3/4-inch (19-mm)] [3/8-inch (10-mm)] <Insert dimension> nominal maximum aggregate size.

4. Foaming Agent: ASTM C 869/C 869M.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260/C 260M.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: [30 to 36 lb/cu. ft. (480 to 576 kg/cu. m)] [36 to 42 lb/cu. ft. (576 to 675 kg/cu. m)] <Insert unit weight range> at point of placement, when tested according to ASTM C 138/C 138M.
2. Compressive Strength: [80 psi (550 kPa)] [140 psi (965 kPa)] <Insert value>, when tested according to ASTM C 495/C 495M.

C. Produce conventional-weight, controlled low-strength material with [80-psi (550-kPa)] [140-psi (965-kPa)] <Insert value> compressive strength when tested according to ASTM C 495/C 495M.

## 2.4 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### 3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

### 3.3 EXPLOSIVES

- A. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
1. Perform blasting without damaging adjacent structures, property, or site improvements.
  2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

### 3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
  2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. 24 inches 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. 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; and 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.

### 3.5 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. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
  3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch . Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
  1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
  2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

### 3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### 3.7 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.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
  1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
  3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
  4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- E. Trenches in Tree- and Plant-Protection Zones:
1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
  2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
  3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

### 3.8 EXCAVATION FOR ELEVATOR CYLINDER

- A. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances in Section 142400 "Hydraulic Elevators"
- B. Provide well casing as necessary to retain walls of well hole.

### 3.9 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons 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. 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.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### 3.10 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
  - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

### 3.11 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.12 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, 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.

### 3.13 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. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete"
- E. Backfill voids with satisfactory soil while removing shoring and bracing.
- F. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
  - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.14 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  1. Under grass and planted areas, use satisfactory soil material.
  2. Under walks and pavements, use satisfactory soil material.
  3. Under steps and ramps, use engineered fill.
  4. Under building slabs, use engineered fill.
  5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.15 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.
  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.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to [ASTM D 1557]:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

### 3.17 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 Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
1. Turf or Unpaved Areas: Plus or minus 1 inch .
  2. Walks: Plus or minus 1 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.

### 3.18 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Section 334600 "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 with a minimum of two passes of a plate-type vibratory compactor.
- 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 one 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 with a minimum of two passes of a plate-type vibratory compactor.
  2. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade.

### 3.19 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
  - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
  - 2. Shape subbase course and base course to required crown elevations and cross-slope grades.
  - 3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
  - 4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  - 5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

### 3.20 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  - 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
  - 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
  - 3. Place drainage 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.
  - 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 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:
  - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
  - 2. Determine that fill material classification and maximum lift thickness comply with requirements.
  - 3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving 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 Architect.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, 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 one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
  2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
  3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two 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 materials 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. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

## **SECTION 313116 - TERMITE CONTROL**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Chemical soil treatment.

#### **1.2 REFERENCE STANDARDS**

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act 2019.

#### **1.3 SUBMITTALS**

- A. See Section 013300 - Submittals, for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.
- D. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
- E. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.
- F. Manufacturer's Instructions: Indicate caution requirement.
- G. Record and document moisture content of soil before application.
- H. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three (3) years of documented experience.
- I. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

#### **1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing this type of work and:
  - 1. Having minimum of three (3) years documented experience.
  - 2. Approved by manufacturer of treatment materials.
  - 3. Licensed in the State in which the Project is located.

#### **1.5 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year installer's warranty against damage to building caused by termites.
  - 1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.



2. Inspect annually and report in writing to Owner. Provide inspection service for 4 years from Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 CHEMICAL SOIL TREATMENT

- A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.
- B. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. BASF Corporation, Agricultural Products; Termidor.
    - b. Bayer Environmental Science; Premise 75.
  2. Diluent: Recommended by toxicant manufacturer.
  3. Mixes: Mix toxicant to manufacturer's instructions.
  4. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

### 2.2 BAIT-STATION SYSTEM

- A. Provide bait stations based on the dimensions of building perimeter indicated on Drawings, according to manufacturer's EPA-Registered Label for product, manufacturer's written instructions, and the following:
  1. Manufacturers:
    - a. BASF Corporation, Agricultural Products; Subterfuge.
    - b. Dow AgroSciences LLC; Sentricon System.
    - c. Ensystem, Inc.; Exterra System.
    - d. FMC Corporation, Agricultural Products Group; First Line.
  2. No fewer than one bait station per 8 linear feet.

### 2.3 METAL MESH BARRIER SYSTEM

- A. Stainless-Steel Mesh: 0.025-by-0.018-inch mesh of 0.08-inch- diameter, stainless-steel wire, Type 316.
  1. Manufacturers
    - a. Termimesh USA, Inc.; Termimesh System.

2.4

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify final grading is complete.

#### 3.2 APPLICATION - CHEMICAL TREATMENT

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
- C. Inject toxicant in accordance with manufacturer's instructions.
- D. Apply toxicant at following locations:
  - 1. Under Slabs-on-Grade.
  - 2. In Crawl Spaces.
  - 3. At Both Sides of Foundation Surface.
  - 4. Soil Within 10 feet (3 m) of Building Perimeter For a Depth of 5 feet.
- E. Under slabs, apply toxicant immediately prior to installation of vapor barrier.
- F. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.
  - 1. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
- G. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- H. Masonry: Treat voids.
- I. Re-treat disturbed treated soil with same toxicant as original treatment.
- J. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

#### 3.3 INSTALLING BAIT-STATION SYSTEM

- A. Place bait stations according to the EPA-Registered Label for the product and manufacturer's written instructions, in the following areas that are conducive to termite feeding and activity:
  - 1. In mulch beds.

2. Areas of high soil moisture.
3. Each area where roof drainage system, including downspouts and scuppers, drains to soil.
4. Where condensate lines from mechanical equipment drip or drain to soil.
5. At plumbing penetrations through ground-supported slabs.
6. Other sites and locations as determined by licensed Installer.

#### 3.4 INSTALLING METAL MESH BARRIER SYSTEM

- A. Install metal mesh barrier system where indicated to provide a continuous barrier to entry of subterranean termites according to manufacturer's written instructions.
  1. Fit mesh tightly around pipe or other penetrations, and terminate at slab and foundation perimeters.
  2. Install mesh under the perimeter of concrete slab edges and joints after vapor barrier and reinforcing steel are in place, and comply with manufacturer's written installation methods.

#### 3.5 PROTECTION

- A. Do not permit soil grading over treated work.
- B. Protect mesh materials from damage after completed installation. Repair damage with manufacturer's recommended products and according to the manufacturer's written instructions.

END OF SECTION

## SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes temporary excavation support and protection systems.
- B. Related Requirements:
  - 1. Section 013233 "Photographic Documentation" for recording preexisting conditions and excavation support and protection system progress.
  - 2. Section 312000 "Earth Moving" for excavating and backfilling and for controlling surface-water runoff and ponding.
  - 3. Section 312319 "Dewatering" for dewatering excavations.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review geotechnical report.
  - 2. Review existing utilities and subsurface conditions.
  - 3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
  - 4. Review proposed excavations.
  - 5. Review proposed equipment.
  - 6. Review monitoring of excavation support and protection system.
  - 7. Review coordination with waterproofing.
  - 8. Review abandonment or removal of excavation support and protection system.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.
- B. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.
  - 1. Include plans, elevations, sections, and details.
  - 2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.
  - 3. Indicate type and location of waterproofing.

4. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Professional Engineer.
- B. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Existing Conditions: Using photographs, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.
- D. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

#### 1.6 FIELD CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
  1. Notify Construction Manager no fewer than two days in advance of proposed interruption of utility.
  2. Do not proceed with interruption of utility without Construction Manager's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
  1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements.
  2. The geotechnical report is included elsewhere in Project Manual. – Appendix A
- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.
  1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified State of Missouri professional engineer.
  2. Prevent surface water from entering excavations by grading, dikes, or other means.

3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

## 2.2 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
- C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
  1. Corners: Roll-formed corner shape with continuous interlock.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.
- E. Shotcrete: Comply with Section 033713 "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.
- F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
- G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- H. Tiebacks: Steel bars, ASTM A 722/A 722M.
- I. Tiebacks: Steel strand, ASTM A 416/A 416M.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
  1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

### 3.2 SOLDIER PILES AND LAGGING

- A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

### 3.3 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.
- B. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- C. Cut tops of sheet piling to uniform elevation at top of excavation.

### 3.4 TIEBACKS

- A. Drill, install, grout, and tension tiebacks.
- B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
  - 1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.
- C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

### 3.5 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
  - 1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
  - 2. Install internal bracing if required to prevent spreading or distortion of braced frames.
  - 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

### 3.6 FIELD QUALITY CONTROL

- A. Survey-Work Benchmarks: Resurvey benchmarks weekly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an

accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

- B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
- C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

### 3.7 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
  - 1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.
  - 2. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."
  - 3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

END OF SECTION



## SECTION 321313 - CONCRETE PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes Concrete Paving. Including the Following:
  - 1. Roadways.
  - 2. Parking lots.
  - 3. Curbs and gutters.
  - 4. Walks.
- B. Related Requirements:
  - 1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
  - 2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
  - 3. Section 321723 "Pavement Markings."

#### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.
- C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified, ready-mix concrete manufacturer and testing agency.
- B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Applied finish materials.
6. Bonding agent or epoxy adhesive.
7. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by the Construction Representative and not less than 96 inches by 96 inches.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless the Construction Representative specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.7 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

- C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
  - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

## PART 2 - PRODUCTS

### 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

### 2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
  - 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

### 2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064, fabricated from steel wire into flat sheets.
- B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064, flat sheet.
- C. Epoxy-Coated Welded-Wire Reinforcement: ASTM A 884, Class A, plain steel.
- D. Plain-Steel Wire: ASTM A 1064.
- E. Deformed-Steel Wire: ASTM A 1064.
- F. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A; coated,.
- G. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars[; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating]. Cut bars true to length with ends square and free of burrs.
- H. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 plain-steel bars.
- 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 paving 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 specified, and as follows:
  - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
  - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
- L. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.
- M. Zinc Repair Material: ASTM A 780/A 780M.

#### 2.4 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
  - 1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type I and Type III
  - 2. Fly Ash: ASTM C 618, Class C or Class F.
  - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: 1 inch nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C 260.
- D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- E. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
  - 1. Color: As selected by Owner from manufacturer's standard colors.
- F. Water: Potable and complying with ASTM C 94/C 94M.

## 2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, 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.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

## 2.6 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy-Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
  - 1. Types II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
- E. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
  - 1. Color: As selected by the Construction Representative from manufacturer's standard colors.
- F. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

## 2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
  - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

- B. Cementitious Materials Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash or Pozzolan: 25 percent.
  - 2. Slag Cement: 30 percent.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
  - 1. Air Content: 3 percent plus or minus 1-1/2 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 high-range, water-reducing 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. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- G. Concrete Mixtures: Normal-weight concrete.
  - 1. Compressive Strength (28 Days): 4000 psi
  - 2. Maximum W/C Ratio at Point of Placement: 0.45.
  - 3. Slump Limit: 4 inches.

## 2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94 and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
  - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
  - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

## PART 3 - EXECUTION

### 3.1 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 paving to identify soft pockets and areas of excess yielding.
  - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
  - 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
  - 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 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 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 INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

- G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

### 3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
  - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
  - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
  - 2. Provide tie bars at sides of paving strips where indicated.
  - 3. Butt Joints: Use epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
  - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
  - 1. Extend joint fillers full width and depth of joint.
  - 2. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
  - 3. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
  - 4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
  - 5. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Expansion Joints: Contractor shall submit recommended expansion joint locations plan to Construction Representative for approval ten (10) working days prior to paving.
- E. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:
  - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes.
    - a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.
  - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.



- a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.
- 3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- F. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes.

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
  - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels and joint devices.
- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
- K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
  - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

### 3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
  - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
  - 2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
  - 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

### 3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

### 3.9 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
  - 1. Elevation: 3/4 inch.

2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet-long; unlevel straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
  1. Testing Frequency: Obtain at least one composite sample for each 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C 231/C 231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
  5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
  6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
    - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to the Construction Representative, 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 the Construction Representative 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 the Construction Representative.
- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

### 3.11 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by the Construction Representative.
- B. Drill test cores, where directed by the Construction Representative, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

## SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Joint-sealant backer materials.
4. Primers.

- B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Paving-Joint-Sealant Schedule: Include the following information:
  1. Joint-sealant application, joint location, and designation.
  2. Joint-sealant manufacturer and product name.
  3. Joint-sealant formulation.
  4. Joint-sealant color.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Certificates: For each type of joint sealant and accessory.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.

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. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 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.

2.2 COLD-APPLIED JOINT SEALANTS

- A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D 5893, Type NS.
  - 1. Manufactures

2.3 HOT-APPLIED JOINT SEALANTS

- A. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type II.
  - 1. Manufactures

2.4 JOINT-SEALANT BACKER MATERIALS

- A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

## 2.5 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints 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: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
- 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. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.
- C. Install joint-sealant backings to support joint 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 joint-sealant backings.
  - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
  - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
  - 1. Place joint sealants so they fully contact 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.
- E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements 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 joint sealant from surfaces adjacent to joints.
  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.

#### 3.4 CLEANING AND PROTECTION

- A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.
- B. 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 in repaired areas are indistinguishable from the original work.

#### 3.5 PAVING-JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Joints within concrete paving.
  1. Joint Location:
    - a. Expansion and isolation joints in concrete paving.
    - b. Contraction joints in concrete paving.
    - c. Other joints as indicated.
  2. Joint Sealant: Single-component, nonsag, silicone joint sealant. Retain "Joint-Sealant Color" Subparagraph below if joint sealants specified are offered in a range of colors and colors are not indicated on Drawings. Typically, color choice is unavailable for paving joint sealants.
  3. Joint-Sealant Color: gray

END OF SECTION



## **SECTION 321713 - PARKING BUMPERS**

### 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 wheel stops.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of exposed finish requiring color selection.
- C. Samples for Verification: For wheel stops, 6 inches long, showing color and cross section; with fasteners.

### PART 2 - PRODUCTS

#### 2.1 PARKING BUMPERS

- A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 4000-psi minimum compressive strength, 4-1/2 inches high by 10-3/8 inches wide by 72 inches long Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.
  - 1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
  - 2. Mounting Hardware: As indicated on the plans

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
- B. Install wheel stops in bed of adhesive before anchoring.
- C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION

## SECTION 321723 - PAVEMENT MARKINGS

### 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 painted markings applied to concrete pavement.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include technical data and tested physical and performance properties.
- B. Shop Drawings: For pavement markings.
  - 1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
  - 2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Missouri DOT for pavement-marking work.
  - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

### PART 2 - PRODUCTS

#### 2.1 PAVEMENT-MARKING PAINT

- A. 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: As indicated.
- B. Glass Beads: AASHTO M 247, Type 1.
  1. Roundness: Minimum 75 percent true spheres by weight.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

#### 3.2 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 a minimum of 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. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.
  2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal. (0.72 kg/L).

#### 3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

## SECTION 329113 - SOIL PREPARATION

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Requirements:
  - 1. Section 329113 "Soil Preparation
  - 2. Section 329200 "Turf and Grasses
  - 3. Section 329300 "Plant Material & Accessories"

#### 1.2 SUMMARY

- A. This Section includes the following: All materials and labor required to complete all soil preparation work shown on the drawings and outlined herein. Provide soil and soil amendment products. Execute labor to achieve soil preparation, complete, as shown and as specified including but not limited to:
  - 1. Stockpiling Topsoil: After construction areas have been cleared and grubbed, remove the existing topsoil as directed by the Field Engineer stockpiled to be amended and placed
    - a. back prior to seeding.
  - 2. Test Stockpiled Topsoil: Test soil from source for sand, silt, and clay, NPK, Mg, soluble salt content, pH value, and organic matter. Samples of each stockpile area will be tested, and the contractor will be responsible to amend the topsoil prior to placing the material on site.
  - 3. Soil Tests: Supply required soil test data on representative samples taken from the proposed topsoil. Testing will be carried out by an approved testing laboratory, appointed, and paid for by the contractor.
  - 4. Landscape Planting Excavation: In areas with more concentrated landscape improvements adjacent to buildings or other site elements, excavate all proposed planting areas and tree pits. Test the stockpiled soil and amend prior to placing on site.
  - 5. Soil Placement: Provide and place topsoil as required to meet finish grade elevations. Prepare soil mix for placing in beds and backfilling of tree and plant pits and beds during planting operations.
  - 6. Spreading Soil Mix: Provide, place, and spread amended topsoil for plantings, to depths shown on drawings to meet final finished grades, including any berms or mounds shown. Establish rough grade in areas prior to planting.
  - 7. Finish Grading: Rake smooth and meet required finished grades within tolerances specified herein.

1.3 DEFINITIONS

- A. Existing Soil: Area of undisturbed native soil where no rough grading is to be done. No topsoil is to be placed. Only surface cultivation and soil amending are included in this section.
- B. Subgrade: Soil level resulting from the rough grading work under another section.
- C. Topsoil: Soil stockpiled for spreading over prepared subgrade.
  - 1. Stockpiled Native Topsoil: Topsoil stripped from the site prior to rough grading work under another section, to be spread and amended as work under this section.

1.4 SUBMITTALS:

- A. Soil Tests: Perform tests and provide test results for the following:
  - 1. Required Test: One Chemical Analysis and one Mechanical Analysis Test specified hereunder of each sample.
  - 2. Required Sample: One sample each taken from three different locations of each.
- B. Soil Test Results: Bind all test results into a report and submit in duplicate to the landscape architect the following:
  - 1. Chemical Analysis: A full chemical analysis of the soil including pH, cation exchange capacity (CEC), Organic Matter (OM), phosphorous, total, and available potassium, and essential nutrients, including trace elements, and any harmful residual chemicals.
    - a. On topsoil which has had crops grown on it at any time during the last two years, provide test results for triazine and di-nitro-aniline herbicides.
    - b. On soil which is taken from a location within 200 feet of a road wider than two lanes, provide a test for soluble salts.
  - 2. Mechanical Analysis: A mechanical analysis giving content by percent of clay, silt, and sand.
  - 3. Lab Recommendations: Provide Testing Laboratory's recommendations for amending and fertilizing the soil, as well as any toxicity comments.
- C. Topsoil Sample: Prior to preparation of topsoil mix, the landscape architect may require the contractor to provide an actual topsoil sample.
- D. Soil Mix Materials: Submit one quart size plastic container with specified soil mix ingredients, such as organic amendment, sand, vermiculite, etc.
- E. Fill Material: Submit product data consisting of certification that each material proposed for use complies with specified requirements.
- F. Other Samples: Submit one each sample of extruded polystyrene and landscape vegetation mat measuring one square foot.
- G. Manufacturer's Data: Prior to preparation of soil mix, provide manufacturer's data for fertilizers, amendments or adjusters.

1.5 QUALITY ASSURANCE:

- A. Installer Qualifications: Installer shall be a contractor with a minimum of five (5) years' experience on comparable projects.
- B. Warranty: This Contractor shall warrant the final grades to be characteristically smooth and uniform according to the elevations and contours shown on the drawings, for a period of one year. Any such irregularities shall be repaired by him, including any work which would have to be repaired as a result of his work.
  - 1. Drainage Problems: If during the construction period and one year thereafter, any drainage problems arising from Contractor's work, such as, but not limited to, low spots, slides, gullies, and general erosion; the Contractor shall be responsible to repair these areas as well as other work damaged by these problems to a condition equal to their original specified conditions and in so doing shall prevent future reoccurrence of drainage problems.
  - 2. Slopes: The Contractor shall be responsible for the stability of all embankments formed and for all topsoil added to existing embankments under the contract and shall replace any which has become displaced due to carelessness or negligence on his part.
- C. Codes and Standards: Perform the excavation, removal, and grading in compliance with the requirements of the governing authorities having jurisdiction, except to the extent more stringent requirements are shown on the Drawings or specified herein.
- D. Soil Testing: As soon as award of contract, employ a soil testing agency acceptable to the landscape architect. Using methods approved by the Association of Agricultural Chemists, conduct all tests, interpret results, and prepare reports specified herein for topsoil to be provided. Each report shall state whether or not the test specimens conform to all requirements of the Contract Documents and shall specifically note any deviations there from. Contractor shall secure this test in a timely fashion. On the basis of the above tests, soil amendments other than those specified herein may be authorized.

1.6 PRODUCT HANDLING:

- A. Delivery Handling and Storage of Soil Mix Materials: Do not deliver, amend, place, spread, or grade topsoil while in a frozen or muddy condition. Coordinate staging areas for soil mix materials with general contractor.

1.7 JOB CONDITIONS:

- A. Availability of On-Site Topsoil: On-site topsoil will be stockpiled from all construction areas prior to being tested, amended and placed back for use.
- B. Division of Responsibility: All soil preparation operations for landscape areas above subgrade elevations shall be performed by this installer, including scarifying subgrade to depth of 10" min to remove compaction from construction operations, providing acceptable topsoil and soil mixes, placing topsoil and soil mixes, spreading and rough grading topsoil and soil mixes to within 1/10 foot of finished grade, and finish grading.
- C. Topography: Refer to existing grades, new grades for adjacent pavements, and new landscape grades shown on the Drawings. Data on existing elevations, grades, structures or other topographic features of the site were determined by topographic survey. The data are not intended as representations or

warranties of exact conditions that may be encountered at the time of construction. It is expressly understood that the Owner and Architect will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. The Contractor shall examine the construction site, coordinate his work with the General Contractor and determine, to his own satisfaction, the existing conditions under which construction shall proceed.

1. Construction Survey Staking: Provide field surveys for landscape finish grading at appropriate intervals to meet required grades.
- D. Review of Subgrade: Subgrade acceptance is subject to depths described herein, and the following conditions.
1. Confirm Subgrade Elevations: Confirm required subgrade elevations to within 1/10-foot tolerance, as follows:
    - a. 24" below finished grade.
    - b. 6" below finished grade
    - c. Seeded areas at existing grades to remain at grade
  2. Confirm Compaction: Inspect subgrade and all embankments to depth of 12", checking composition and stability. Fill material encountered within planting areas shall be "Suitable Subgrade Fill Material". Confirm compaction at subgrade, as follows, and notify Architect of any discrepancies before proceeding with work. Contractor to scarify subgrade to depth needed within plating and seeded areas to establish soil density not to exceed below compaction rate.
    - a. Under plant beds: 85% maximum
    - b. Under pedestrian paved areas: 90 - 95%.
- E. Protection of the Drainage Courses: Prevent damage to drainage courses including soil separator fabric during topsoil placement and grading operations.
- F. Protection of Adjacent Property and Dust Control: Prevent any substances from blowing, spilling, dropping, or depositing on adjacent property. Keep soil materials off of constructed stonework and retaining walls. Keep the construction area sufficiently dampened to control dust caused by operations.
- G. Utilities: Prior to opening an excavation, determine whether underground installations, i.e., sewer, telephone, water, fuel, electricity lines, etc., will be encountered, and if so, where such utilities are located. Stake the exact location with the Utility Owner. When uncovered, provide proper supports for the existing installation. Contact and advise Utility companies of proposed, work prior to the start of actual excavation.
- H. Excavation Around Existing Utilities: Data on the location and nature of existing and proposed utilities, as shown on the Drawings, are made available solely for the convenience of the Contractor. Neither the Owner nor the Architect guarantees the accuracy or completeness of the data. Contractor shall investigate the location, size, depth, and nature of all utilities which may interfere with his work. Stake locations with Utility Owner, report discrepancies and consult with Utility Owner and Architect immediately prior to proceeding with work.



1. Utilities to Remain: If utilities are to remain in place, protect them from damage, and repair them if damaged to a condition satisfactory to the Utility Owner and Architect, at no additional cost to the Owner.
  2. Utilities to be Removed: If utilities are to be removed, they shall be demolished and completely removed from the site. Consult with the Architect and Utility Owner before any utility services are shut off or disconnected.
  3. Excavation in Gas Easements: Notify Architect immediately if plants are designated for locations on or near gas easements. All excavation located on or near gas easements shall be hand-dug only after utility is staked and depth known. Exercise all caution according to utility owner recommendations and industry standards necessary to insure safe operations.
- I. Phasing Area Limits: Grades at limits of phasing within Owner's property shall be transitioned with slopes which shall not exceed 4:1 maximum slope, or as otherwise specifically detailed, or noted or delineated on the Drawings. Notify Architect immediately when discovered and prior to work if discrepancies existed which would not allow said transition within an area of 6 feet or less, or if obstructions are encountered. Regardless of extent of transition area, inform Architect of perimeter conditions in this circumstance.

## PART 2 PRODUCTS

### 2.1 MATERIALS:

- A. Subgrade Fill Material: Suitable subgrade fill material shall be used only if required to fill in voids left by the General Contractor.
1. Suitable Subgrade Fill Material: A clean, debris-free mineral material with sandy brown clay content and granular material, and no stones measuring larger than two-inch diameter. Gray clay is not acceptable. Subgrade in landscape plant beds shall be compacted to 85% maximum density. Material from the site may be used provided it conforms to the above specification.
- B. Stockpiled Native Topsoil: Use the stocked piled native topsoil for all planting operations. Confirm before starting that enough soil is stockpiled on site for all landscape operations.
- C. Topsoil for Planting Beds: Planting Soil Mixture / Amended topsoil. Obtain topsoil displaced from construction where topsoil occurs. Do not obtain from bogs or marshes. Do not import topsoil without owner approval.
- D. All the above specified soil mixes shall be adjusted with soil amendments to adjust pH (quantity determined by soil test) and thoroughly mixed by hand or by mechanical means prior to placement.
1. Sand: Clean, sharp, well-graded, coarse sand passing 1/4" mesh screen, free of foreign and organic matter, with a pH of 5.5 to 6.5.
- E. pH Adjustment: Adjustments to soil pH shall be pursuant to soil test recommendations to achieve a slightly acid soil.
1. Limestone: Ground limestone (calcium carbonate) if required, shall have the following analysis: At least 50% shall pass a No. 200 USS mesh sieve. At least 90% shall pass a No. 100 USS mesh sieve. 100% shall pass a No. 10 USS mesh sieve. Total carbonates shall not be less

than 80% or 44.8% calcium oxide equivalent; for purposes of calculation total carbonates shall be considered as calcium carbonates. Do not apply limestone to soil unless pH of soil is less than 6.3.

2. Sulphur: Sulphur shall be wettable granular sulphur, mixed and applied according to the soil test recommendations and to the types of plantings in the area requiring amendments. If soil pH is above 7.1, multiple applications may be required.
- F. Organic Matter: Adjust soil to add organic matter if less than 3% by soil test. Test the soil before final placement to ensure the organic level is between 4% - 6%
1. Organic Matter: Submit proposed alternate, approved by soil laboratory, for approval by Landscape Architect. Other organic materials may be acceptable only if they do not adversely affect pH of soil mix.

### PART 3 EXECUTION

#### 3.1 SITE PREPARATION:

- A. Protection of Existing Facilities: Protect all existing service lines and related structures encountered in excavation work. Where such lines and structures have been undermined due to excavation work, restore to original conditions including supports. If damaged, repair such lines or structures or arrange for their repair with the proper authorities or companies. Report any uncharted or incorrectly charted lines to the Architect for further direction.
- B. Preparation of Seeding and Planting Areas:
1. Loosen subgrade to a depth of 12 inches minimum. Do not install topsoil or planting soil mix for plant beds, until subgrade has been sufficiently loosened to allow for an intermingling of topsoil and subsoil.
  2. Clean seeding and planting areas of all trash and debris before placement of soil mix. Remove all debris/rock pieces over 2 inches in diameter from turf and planting areas to a depth of 12" 4 inches. Remove and dispose of debris off site.

#### 3.2 OPERATIONS:

- A. Confirmation of Grades: Confirm grades prior to the start of work, and at each interval requiring a change of operation. Excavation depth and depth of soil mix shall be set according to the Drawings. Rough grades shall be within 1/10 foot of specified finish grades, tolerance below 10-foot straight edge to be 1 ½ inches
- B. Prepare Planting Soil Mixes for Plant Beds & Tree Pits:
1. Prepare planting soil mix prior to placement in plant beds and prior to backfilling tree pits.
  2. Topsoil shall be dry and pulverized prior to amending. Clean topsoil of lumps, stones, debris and noxious weeds before mixing. Mix specified soil amendments at rates according to soil test recommendations. Mix pH adjusters with dry soil prior to adding any fertilizers. Fertilize according to soil test recommendation, and with superphosphate as specified.
- C. Placing Planting Soil: Provide, place, spread and rough grade specified planting soil mixes to depths specified in all areas to be planted. Place no planting soil above the foundation line of any adjacent

structure. Notify Architect immediately if such conditions exist, including conditions that would not allow enough space for required drainage courses and planting soils to be installed below the top of foundation. Place enough soil mix to meet finish grades within specified tolerances, including any berms or rolls to grades as described on the Drawings.

1. Finished surface of plant bed areas shall show no evidence of colds or clumped soil.
  2. Promptly plant and mulch all areas which have had topsoil amended to alleviate clay conditions to avoid a cement or adobe crust formation.
- D. Landscape Excavation: Contractor shall excavate topsoil including all individual plant and tree pits for the purpose of placing soil mix.
1. Water Retention and Dewatering: Excavation conditions permitting retention of water for more than 24 hours shall not occur. At all times during the excavation period and until all soil mix is placed and work is complete, provide ample means and equipment with which to remove promptly and dispose of properly all water entering any excavation or other part of the work. Water pumped or drained from the work herein shall be disposed of in a suitable manner without damage to adjacent property or to other work under construction. Do not place topsoil or planting soil mix on areas where free water is standing on frozen subsoil areas.
- E. Tree Pits: Excavate individual tree pits to a depth necessary to accommodate plantings as specified and shown on the Drawings. Backfill tree pits with soil layers per drawing details. Where tree pits occur in plant beds, beds shall be excavated deep enough to accommodate the tree pit, including soil area between bottom of the root ball and top of the drainage course.
- F. Over Drainage Courses: Planting soil shall be placed over drainage courses as shown on the Drawings. Where subgrades pitch, beds vary as to depth of planting soil mix. Where tree pits occur in plant beds, beds shall be excavated deep enough to accommodate not only the drainage course, but also the tree pit, including soil area between bottom of the root ball and top of the drainage course.
- G. Finish Grading: Rake smooth and finish grade all planted areas. Crown of berms shall be raked smooth so that they form a convex curve, not a point. Any undulations or irregularities on the surface shall be raked to smooth planes prior to planting, grading tolerance below ten-foot-straight edge not to exceed 1 ½ inches. All areas shall slope to drain as indicated on drawings. Elevations in landscape areas after planting shall be +/- .10 foot of the finished grades shown on the drawings.
- H. Final Grades: Final finish grades of all planting areas, including beds and pits, after settling, shall be as shown on the Drawings. Required final grades and elevations shall be as shown by figured elevations or dimensioned depths; or where none are indicated, final grades and elevations shall be even lines or planes between such figured elevations, or between figured elevations and tops of paving or curbs. Verify grades established during final grading as being true to finish contours shown, and maintain such areas until the effective date to begin any operations.
- I. Finish grades adjacent to pavement for seeding's and turf to be ½ inch below top of pavement; finish grade for plantings adjacent to pavement to be 2 ½ inches below top of pavement to allow for 2" depth of mulch (or as otherwise specified).

3.3 REPAIR AND CLEANING

- A. Disposal of Materials: All unclassified excavated cut material and any fill material in excess of required volumes, including excess topsoil, supplemental topsoil, and soil mix materials, shall be removed and legally disposed of off the site with consent of Owner.
- B. Repair: Maintain grades and slopes until plantings are established. Repair and re-establish grades in settled areas. Repair any washouts, eroded areas or areas damaged otherwise immediately to specified requirements.
- C. Clean-Up: Remove and properly dispose of any resultant dirt and debris. Sidewalks and other paved areas shall be kept clean. Upon completion of work, promptly remove all equipment and unused materials provided for work and put the premises in a neat and clean condition.
- D. Review: Review required grades with landscape architect prior to planting operations, and again after planting operations.

END OF SECTION

## SECTION 329200 - TURF AND GRASSES

### PART 1 GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Turfgrass Seeding.
2. Top Soil

B. Related Requirements:

1. Section 329113 "Soil Preparation"
2. Section 329300 "Plant Material & Accessories"

#### 1.2 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- E. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- F. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- G. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- H. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.
- I. TPI: Turfgrass Producers International, Rolling Meadows, Illinois "Guideline Specifications to Turfgrass Sodding", revised 2006 ([www.turfgrasssod.org](http://www.turfgrasssod.org)). A copy is available from the Landscape Architect upon request.

1.3 ACCEPTANCE

- A. Substantial Completion: All work in this Section must be complete for Substantial Completion. The sixty (60) day maintenance period and one year guarantee will begin when the Landscape Architect prepares the Certificate of Substantial Completion.
- B. Upon written request by the Contractor, the Owner (or Landscape Architect) will make a substantial completion inspection. The Contractor shall provide all submittals to the Owner (Landscape Architect) 5 days prior to the Substantial or Final Completion Inspection. Final Completion will be given at the end of the sixty (60) day maintenance period.

1.4 SUBMITTALS

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

1. Turfgrass Seed Mix.

2. Erosion Blanket

- B. Certification of grass seed.

1. Turfgrass Seed Mixtures

- C. Additional Submittals

1.5 QUALITY ASSURANCE

- A. Warranty: Provide a written one year warranty from the Date of Substantial Completion at the final inspection.
- B. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

1. Pesticide Applicator: State licensed, commercial.

- C. Soil Analysis: For each topsoil location, furnish soil analysis and a written report by a qualified soil-testing laboratory.
- D. Planting Soil Testing: Provide one "Complete Test" from each topsoil source. Have test performed by State approved Soil Testing Facility. Submit test to owner prior to starting installation of planting soils.

1. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Turfgrass Seed/Native Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

1.7 MAINTENANCE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Seeded Turf: 60 days from date of Substantial Completion.

PART 2 PRODUCTS

2.1 TURFGRASS - SEED

- A. Turfgrass 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. Turfgrass Mix:

1. Tall Fescue Blend of the following:

- a. 34% Aztec II Tall Fescue
- b. 33% Caesar Tall Fescue
- c. 33% Honky Tonk Tall Fescue

2. Application Rate: 10 lbs / 1000 sq. ft. – 425 lbs. / Acre

3. Seed shall be from a grower within 200 miles of the project site. Submit complete grower information including location, seed harvest information, and seed mixture breakdown.

2.2 FERTILIZERS

- A. FERTILIZERS

1. Turfgrass Seed:

- a. Apply per soil test results. Approved suppliers:
  - 1) Lesco
  - 2) BEST by Simplot
  - 3) Lebanon Turf Proscap

- B. PLANTING SOILS

1. On-Site Top Soil: Topsoil, with pH range of 5.5 to 7, a minimum of 2 percent organic material content. Verify suitability of soil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

2. Imported Top Soil: If sufficient suitable topsoil is not available on-site, provide imported topsoil in sufficient quantities to meet specified depths. Imported topsoil 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 agricultural land, bogs or marshes.

C. MULCHES & EROSION BLANKETS

1. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley as directed on the drawings.
2. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples.
  - a. Products: Subject to compliance with requirements provide the following:
    - 1.) North American Green – S75BN

D. PESTICIDES

1. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 EXECUTION

3.1 TURFGRASS SEED AREA PREPARATION

- A. Newly Graded Sub-grades: Loosen sub-grade to a maximum 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. Thoroughly blend planting soil before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil by machine tilling in place.
  2. Spread planting soil to a depth as directed by the drawings, but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- B. Unchanged Sub-grades: If turf is 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 maximum depth of 4 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 directly to surface soil after loosening.
  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.



- C. 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.
- D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### 3.2 TURFGRASS SEED INSTALLATION

- A. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
  - B. Sow seed at a total rate as provided by the seed supplier.
  - C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
  - D. Protect seeded areas with erosion blanket as shown on the plans. Install erosion blankets per manufacturer's directions.
1. Anchor erosion blankets with staples as directed by the manufacturer.
- E. Install straw mulch on all areas that don't receive erosion control blankets. Apply at a rate of 2 tons per acre. The mulch shall be loose enough to permit air to circulate compacted enough to reduce erosion

### 3.3 TURFGRASS (Seeded & Sodded) MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
- B. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain height appropriate for species without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Maintain grass height between 2-3".
- C. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- D. The contractor shall make whatever provisions are necessary to water the Turfgrass areas, as needed, during the maintenance period. This includes all labor, equipment, and cost of water.

### 3.4 SWALE PROTETION

- A. Install erosion blanket as indicated on the drawings for swale protection within 24 hours of completing the seeding installation. Center the width of the blanket over the bottom of the swale and extend 2' up each side of the swale. Install and anchor per the manufacturers recommendations.

3.5 SATISFACTORY TURFGRASS AND NATIVE SEED AREAS

- A. Installations shall meet the following criteria as determined by Landscape Architect:
  - 1. Satisfactory Areas: 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. and bare spots not exceeding 2 by 2 inches
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

END OF SECTION

## SECTION 329300 - PLANT MATERIAL AND ACCESSORIES

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Plants.
  - 2. Tree stabilization.
  - 3. Tree-watering devices.
  - 4. Landscape boulders
  - 5. Stone/Cobbles landscape mulch.
  - 6. Landscape stone outcrops.
- B. Related Requirements:
  - 1. Section 329113 "Soil Preparation"
  - 2. Section 329200 "Turf and Grasses"

#### 1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

- F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- G. Finish Grade: Elevation of finished surface of planting soil.
- H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- J. Planting Area: Areas to be planted.
- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" for drawing designations for planting soils.
- L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- P. **Native Plant Material: All plant material shall be native stock to this region. It shall have been collected and grown within 100 miles of the project site. No cultivars shall be accepted. All plant material submittals shall be reviewed and approved by the landscape architect and the Missouri Department of Natural Resources. Refer to the submittal section below for specific submittal information.**

#### 1.4 COORDINATION

- A. Coordination with Turf Areas (Lawns) and native grass/wildflower areas: Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
  - 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

#### 1.5 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at the project site a minimum of 14 days prior to starting any plant material preparation or installation. All plant materials related submittals shall be submitted and approved prior to this conference. Provide copies of all approved plant material related submittals for review at this conference.

## 1.6 ACTION SUBMITTALS

- A. Landscape Contractor: The General Contractor shall inform the owner within 30 days of the Intent to Award the Project Date of the Landscape Contractor assigned to the project. The Landscape Contractor shall provide the following information within 30 days from the Intent to Award the Project Date.
1. Qualification Data: For landscape installer. Include list of similar projects completed by installer demonstrating installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
  2. Site Foreman Experience: Submit a resume of the Site Foreman's experience listing projects of similar size and scope that he managed.
- B. Plant Material Information:
1. Plant Materials: Submit a written summary including quantities, sizes, nursery location, and tagging status for all plant material within 60 days of the Intent to Award the Project Date. All plant material shall be native (per the definition in 1.3) to the project site and no cultivars shall be accepted.
  2. Plant Material History: Along with the information requested in 1.6, B., 1, submit documentation that the original plant material source was collected and grown within the 100 mile radius requirement from the site. Plant material that cannot be documented will not be approved for the site.
- C. Samples for Verification: For each of the following:
1. Compost: 1 lb. volume in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
  2. Bark Mulch: 1 lb in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on-site; provide an accurate indication of color, texture, and makeup of the material.
- D. Stone Submittals for 2.3, & 2.4:
1. Stone Boulders: The contractor shall provide the Construction Representative with natural stone boulder samples for review and approval prior to construction. The approved natural stone boulder sample shall be kept on site for reference until the stone boulder installation is complete.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
1. Manufacturer's certified analysis of standard products.
  2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- B. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

- C. Sample Warranty: For special warranty.
- D. Fertilizer: Provide soil test recommendations per Specification 32 3113 along with Fertilizer information per Part 2, Fertilizers.

#### 1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods. Submit the following in a binder at the substantial completion inspection:
  - 1. Final plant material list with sizes, and nursery sources.
  - 2. A one year maintenance calendar showing month by month landscape maintenance operations.
  - 3. A 5 year written plan for establishment of all native planting grass/wildflower mixes

#### 1.9 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
  - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
  - 2. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
  - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  - 4. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
  - 1. Provide plant material as selected and tagged by the Landscape Architect.
  - 2. Notify the Landscape Architect 7 days prior to delivery of plant material to the project site.
- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
  - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
  - 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- D. Plant Material Tagging: The Landscape Architect & Owner shall tag all plant material. The contractor shall submit a potential list of plant material locations and coordinate the tagging schedule with the Landscape Architect and owner.

1. A maximum of 3 trips shall be taken by the landscape architect to tag material at nurseries.
2. The contractor shall maintain a written record of all tagged material.
3. Notify the Landscape Architect a minimum of 14 days prior to a tagging trip.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:
  1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  3. Accompany each delivery of bulk materials with appropriate certificates.
- C. Deliver bare-root stock plants within 36 hours of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.
- D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- E. Handle planting stock by root ball.
- F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.
- G. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
  1. If deciduous trees or shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again two weeks after planting.
- H. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- I. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
  1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.

2. Set balled stock on ground and cover ball with soil, compost, mulch, sawdust, or other acceptable material.
  3. Do not remove container-grown stock from containers before time of planting.
  4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.
- J. Any plant material that is not maintain per this section will be rejected and the contractor shall replace it at their own cost.

#### 1.11 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
1. Tree and shrub plantings: October - March
  2. Grasses / Perennial plantings: September and October; March and April
- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Plantings during periods of frozen soils are not acceptable. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

#### 1.12 WARRANTY

- A. Plant Material Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
    - b. Structural failures including plantings falling or blowing over.
    - c. Faulty performance of tree stabilization.
    - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  2. Warranty Periods: All plant material shall be warranted for one year starting from the date of Substantial Completion and acceptance of work.
  3. Include the following remedial actions as a minimum:
    - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.



- b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
- c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
- d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

## PART 2 PRODUCTS

### 2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
  - 1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 1/2 inch in diameter; or with stem girdling roots are unacceptable.
  - 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to the Landscape Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant. Tags shall not be removed until aware of substantial completion of the project.
- E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

### 2.2 FERTILIZERS

- A. Fertilize all plant material as recommended by the soil test prepared for each area. The landscape contractor shall submit test results and fertilizer recommendations as part of the preconstruction meeting for the landscape work. The submittal shall include:
  - 1. Fertilizer recommendation
  - 2. Fertilizer materials cut sheets
  - 3. Method to be used for fertilization.

- B. Fertilizer Tablets
  - 1. Agriform Planting Tablets / Scotts
  - 2. Gro Power, Inc. Planting Tablets
  - 3. AgSafe Fertilizer Tablets / AgriTab Corporation

### 2.3 BOULDER / OUTCROP STONE

- A. Boulders: Regional, natural weathered limestone to layer rocks and boulders with Lichen and moss
- B. Outcrop Stone: Regional, natural weathered limestone to layer rocks and boulders with Lichen and moss.
- C. See Schedule on planting plans for sizes and quantities.
- D. The contractor shall use the existing stock piled stone boulders from the grading contractor for all boulder / stone outcrops. Stone shall match the sizes called out in the Boulder Schedules.
- E. The contractor shall stake locations for all boulder / stone outcrop locations and review with the landscape architect prior to installation.
- F. Manufacturers / Suppliers
  - 1. Semco Stone, Perryville, MO.
  - 2. Earthworks, Inc., Perryville, MO.
  - 3. Buechel Stone; Clinton, WI.
  - 4. Halquist Stone; Sussex, WI.

### 2.4 STONE BOULDERS / BRIDGE AREA ONLY

- A. Description: This item of work consists of furnishing, transporting and placing the natural stone boulder material at the intermediate bents as shown on the plans and as directed by the Construction Representative.
- B. Material: The stone material shall be a weathered regional natural limestone ledge rock boulder. The minimum thickness of the stone boulder material shall be 24 inches (610 mm). Provide full color range of stone boulder material as available from the same quarry. The stone boulder material shall conform to the following:
  - 1. Marble Institute of American (MIA)
  - 2. National Building Quarries Association, Inc. (NBQA)
- C. The minimum unit weight (material density) of weathered regional natural limestone ledge rock shall be 150 lb/ft<sup>3</sup> (2,400 kg/m<sup>3</sup>).
- D. Manufacturers / Suppliers
  - 1. Semco Stone, Perryville, MO.

2. Earthworks, Inc., Perryville, MO.
3. Buechel Stone; Clinton, WI.
4. Halquist Stone; Sussex, WI.

## 2.5 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
  1. Type: Shredded, double ground, well decomposed hardwood mulch.
  2. Size Range: 2 inches maximum, 1/2 inch minimum.
  3. Color: Natural.
  4. Supplier: Maximum distance from the site 200 miles.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch sieve; soluble-salt content of 5 dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
  1. Organic Matter Content: 50 to 60 percent of dry weight.
  2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
  3. Supplier: Maximum distance from the site 200 miles
- C. Stone Mulch for Bio Swales: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of the following type, size range, and color:
  1. Type: Angular, dry stream river gravel.
  2. Size Range: 30% 12-18", 50% 6-10", 20% 3-4"
  3. Color: Natural
  4. Suppliers:
    - a. Semco Stone, Perryville, MO.
    - b. Earthworks, Inc., Perryville, MO.
    - c. Buechel Stone, Chilton, WI.
    - d. Halquist Stone, Sussex, WI.
- D. Cobbles Landscape Mulch
  1. Type: Angular, dry stream river gravel.
  2. Size Range: Range: 30% 12-18", 50% 6-10", 20% 3-4".

3. Color: Natural.
4. Suppliers:
  - a. Semco Stone, Perryville, MO.
  - b. Earthworks, Inc., Perryville, MO.
  - c. Buechel Stone, Chilton, WI.
  - d. Halquist Stone, Sussex, WI.

## 2.6 PESTICIDES

- A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

## 2.7 TREE-STABILIZATION MATERIALS

- A. Trunk-Stabilization Materials:
  1. Upright and Guy Stakes: Rough-sawn, sound, wooden, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
  2. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
  3. Guy Cables: Five-strand, 3/16-inch-diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
  4. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

## 2.8 TREE-WATERING DEVICES

- A. Watering Pipe: PVC pipe 4 inches in diameter, site-cut to length as required, and with snug-fitting removable cap.
- B. Slow-Release Watering Device: Standard product manufactured for drip irrigation of plants and emptying its water contents over two to nine hours; manufactured from UV-light-stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.
  1. A.M. Leonard Arbor Rain
  2. Treegator

3. DeWitt Tree Watering Bag

2.9 TREE PROTECTION

- A. Tree Guard: Provide one corrugated plastic tree guard per tree. The size shall be a minimum of 1" dia. larger than the tree dia. being planted. The guard shall reach from ground level to the first lateral branch of the tree.

1. Suppliers:

- a. ADS Drainage Systems
- b. A.M. Leonard Corrugated Tree Guard
- c. JM Eagle

2.10 MISCELLANEOUS PRODUCTS

- A. Wood Pressure-Preservative Treatment: AWPA U1, Use Category UC4a; acceptable to authorities having jurisdiction, and containing no arsenic or chromium.
- B. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- C. Burlap: Non-synthetic, biodegradable.
- D. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with 1 ½ inch diameter.
- E. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
  3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

### 3.3 PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation and soils plans.
- B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade.
- C. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
- D. Application of Mycorrhizal Fungi: At time directed by Landscape Architect, broadcast dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations.

### 3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
  - 1. Excavate planting pits with sides sloping inward as indicated on the planting details. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
  - 2. Excavate approximately three times as wide as ball diameter for balled and burlapped, container-grown stock.
  - 3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
  - 4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.

5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
  6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
  7. Maintain supervision of excavations during working hours.
  8. Keep excavations covered or otherwise protected overnight.
  9. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.
- B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.
- C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
1. Hardpan Layer: Drill 6-inch diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.
- D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

### 3.5 TREE, SHRUB, AND VINE PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
1. Backfill: See Planting Details on drawings
  2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

4. Place planting tablets and/or soils amendments per soils report and testing agency's recommendations equally distributed around each planting pit when pit is approximately one-half filled. Place tablets and amendments beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
  5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
1. Backfill: Per Planting Details
  2. Carefully remove root ball from container without damaging root ball or plant.
  3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
  5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. Fabric Bag-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch adjacent finish grades.
1. Backfill: Install per planting details.
  2. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
  5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- F. Bare-Root Stock: Set and support each plant in center of planting pit or trench with root flare 2 inches above adjacent finish grade.
1. Backfill: Per planting details
  2. Spread roots without tangling or turning toward surface. Plumb before backfilling, and maintain plumb while working.
  3. Carefully work backfill in layers around roots by hand. Bring roots into close contact with the soil.



4. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  5. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside soil-covered roots about 1 inch from root tips; do not place tablets in bottom of the hole or touching the roots.
  6. Continue backfilling process. Water again after placing and tamping final layer of soil.
- G. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

### 3.6 MECHANIZED TREE-SPADE PLANTING

- A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.
- B. Use the same tree spade to excavate the planting hole as will be used to extract and transport the tree.
- C. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.
- D. Cut exposed roots cleanly during transplanting operations.
- E. Where possible, orient the tree in the same direction as in its original location.

### 3.7 TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.
- C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

### 3.8 TREE STABILIZATION

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:
  1. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend to the dimension indicated on Drawings above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
  2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
- B. Trunk Stabilization by Staking and Guying: Install trunk stabilization as follows unless otherwise indicated on Drawings. Stake and guy trees more than 14 feet in height and more than 3 inches in caliper unless otherwise indicated.
  1. Site-Fabricated, Staking-and-Guying Method: Install no fewer than three guys spaced equally around tree.
    - a. Securely attach guys to stakes 30 inches long, driven to grade. Adjust spacing to avoid penetrating root balls or root masses. Provide turnbuckle for each guy wire and tighten securely.
    - b. For trees more than 6 inches, anchor guys to wood deadmen buried at least 36 inches below grade. Provide turnbuckle for each guy wire and tighten securely.
    - c. Support trees with bands of flexible ties at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.
    - d. Support trees with guy cable, connected to the brass grommets of tree-tie webbing at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.
    - e. Attach flags to each guy wire, 30 inches above finish grade.
    - f. Paint turnbuckles with luminescent white paint.
  2. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

### 3.9 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.
- B. Use planting soil for backfill per soils plan.
- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.10 STONE / BOULDER LAYOUT

- A. Refer to schedules and details on plans for sizes and general layout.
- B. Stake and review all stone layouts with the Landscape Architect prior to starting the work.
- C. Provide a full range of natural stone boulder sizes indicated and place in locations as shown on the plans. Layout the stone boulders as indicated on the plans and review on-site with the Construction Representative. Adjust stone boulders as necessary to achieve an aesthetically pleasing natural appearance.

3.11 PLANTING AREA MULCHING

- A. Mulch backfilled surfaces of planting areas and other areas indicated.
  - 1. Trees in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with radius as call out on the drawings. Do not place mulch within 3 inches of trunks or stems.
  - 2. Organic Mulch in Planting Areas: Apply 2 inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.
  - 3. Mineral Mulch in Planting Areas: Apply 3-inch average thickness of mineral mulch extending over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems. Contractor to review special applications and details for bio swales.

3.12 EDGING INSTALLATION

- A. Shovel-Cut Edging: Separate mulched areas from turf and seeded areas, curbs, and paving with a 45-degree, 4- to 6-inch- deep, shovel-cut edge as indicated on Drawings.

3.13 INSTALLING SLOW-RELEASE WATERING DEVICE

- A. Provide one device for each tree.
- B. Place device on top of the mulch at base of tree stem and fill with water according to manufacturer's written instructions.

3.14 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.15 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.16 REPAIR AND REPLACEMENT

- A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Landscape Architect.
  - 1. Submit details of proposed pruning and repairs.
  - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
  - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.
  - 1. Provide new trees of same size as those being replaced.
  - 2. Species of Replacement Trees: Same species being replaced.

3.17 CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.
- C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.18 MAINTENANCE SERVICE

- A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
  - 1. Preliminary Maintenance Period: From date of planting completion to substantial Completion.
  - 2. 60 Day Maintenance Period: Begins at date of award of substantial completion of the project.
  
- B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
  - 1. Preliminary Maintenance Period: From date of planting completion to substantial Completion. Ends 60 days after substantial completion. Make all corrections to the planting installation as required by the Landscape Architect at the substantial completion inspection during this period. Review the entire completed project at the end of the 60 days with the Landscape Architect for Final Completion of the project.
  - 2. 60 Day Maintenance Period: Begins at date of award of substantial completion of the project. Ends 60 days after substantial completion. Make all corrections to the planting installation as required by the Landscape Architect at the substantial completion inspection during this period. Review the entire completed project at the end of the 60 days with the Landscape Architect for Final Completion of the project.

END OF SECTION

## SECTION 331113 – WATER UTILITY DISTRIBUTION PIPING

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes:
  - 1. Pipe and fittings for Site water line, including potable water line and fire water line.
  - 2. Gate Valves.
  - 3. Yard hydrants.
  - 4. Underground pipe markers.
  - 5. Valve boxes.
  - 6. Bedding and cover materials.
  - 7. Curb stops
  - 8. Hydrant assemblies

#### 1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure Ratings: Except where otherwise indicated, the following are minimum pressure requirements for water system piping.
  - 1. Underground Piping, 200 psig (1380 kPa).

#### 1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data: including pressure rating, rated capacity, and settings of selected models for pipe, fittings and accessories.
- C. Manufacturer's installation instructions: Indicate special procedures required to install products.
- D. Manufacturer's certificate: Certify that pipe, accessories, and fittings meet or exceeds specified requirements.

#### 1.5 QUALITY ASSURANCE

- A. Comply with requirements of the authority supplying water. Including tapping of water mains and backflow prevention.
- B. Testing and Inspection: Owner will provide engineering, testing, and inspection.

#### 1.6 SEQUENCING AND SCHEDULING

- A. Coordinate work in accordance with Work Sequence outlined in Section 01 10 00 – Summary.

- B. Coordinate all installation, cleaning, flushing, jetting, testing and disinfection, etc. with other utility installation.

## PART 2 PRODUCTS

### 2.1 WATER MAIN

- A. Pipe 4 inch diameter and Larger: Polyvinyl Chloride (PVC) Pipe: ASTM D2241 (SDR-21) NSF 14.
  - 1. Minimum SDR rating 21 (SDR-21) with minimum pressure rating of 200 psi (1379 kPa) at 23°C.
  - 2. Pipe marking NSF 14.
  - 3. Fittings ductile iron AWWA C-110 or AWWA C-153 with gasket joints compatible with pipe furnished. All joints at fittings to be restrained mechanical joints.
  - 4. Gaskets ASTM F477 elastomeric seal.
  - 5. Provide internal restrained joints on pipe for horizontally directionally drilled installation where shown on the PLANS.
- B. Pipe smaller than 4-inch diameter: Polyethylene Pipe: AWWA C901, DR 11 for 200 psi pressure rating.
  - 1. Fittings: AWWA C901, molded.
  - 2. Joints: Butt fusion.

### 2.2 GATE VALVES

- A. 3 Inch (75 mm) and Larger: AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, restrained mechanical joint ends, valve box, and one valve key per twelve valves installed.
- B. 2-1/2 Inch (64 mm) and Smaller: Brass or bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, post indicator, valve box, and one valve key per twelve valves installed.
- C. Acceptable manufacturers:
  - 1. US Pipe and Foundry
  - 2. American Flow Control
  - 3. Clow Valves Company
  - 4. Approved Equal
- D. Provide valve box with rubber insert in the base of the valve box. This rubber insert shall be the Valve Box Adaptor II of West Allis, Wisconsin, or approved equal. Valve boxes are to be furnished with lids marked "WATER". The Contractor shall adjust all new valve boxes to be flush with the proposed finished surface.

### 2.3 YARD HYDRANTS

- A. Manufacturers:
  - a. Cambell
  - b. Kupferle

c. Woodford

B. Description:

- a. Automatic-draining, non-freezing yard hydrant for hose connection.
- b. Inlet:
  - i. Size: 1 inch (25 mm) NPT.
  - ii. Fitting: Female.
- c. Nozzle:
  - i. Size: 3/4 inch (20 mm).
  - ii. Material: Brass.
  - iii. Fitting: Male.
- d. Casing:
  - i. Description: Galvanized steel pipe.
  - ii. Size: 1-1/4 inch (32 mm).
- e. Drain Hole: Tapped, 1/8 inch (6 mm) NPT.
- f. Operating Rod:
  - i. Description: Galvanized steel pipe.
  - ii. Size: 3/8 inch (10 mm).
- g. Working Pressure: 125 psig (862 kPa).

2.4 UNDERGROUND PIPE MARKERS

A. Tracer Wire: #12 THWN Copper Wire

2.5 VALVE BOXES

A. Description:

- 1. Valve boxes and covers, including valve extensions as indicated on Drawings.
- 2. Material: Cast iron.
- 3. Type: Extension, with slide adjustment.
- 4. Covers marked WATER SERVICE to indicate utility.

2.6 MATERIALS

A. Bedding and Cover:

- a. Pipes 4 inch diameter and larger:
  - i. Provide sand bedding, haunching and initial backfill on all buried pipes from 4 inches below the invert of the pipe to 12 inches above the pipe.
  - ii. Backfill above trenches located within 2 feet of paved surfaces with compacted granular materials. All other areas may be backfilled with suitable native materials.

2.7 CURB STOPS



- A. Manufacturers:
  - a. Mueller
  - b. Ford
  - c. AY McDonald
- B. Description:
  - a. Quarter turn ball curb valves with curb box.

## 2.8 HYDRANT ASSEMBLIES

- A. Manufacturers:
  - a. American Flow Control
  - b. Mueller Corp.
  - c. Clow
  - d. Approved Equal
- B. Hydrant Valves
  - a. Provide RW gate valve.
- C. Hydrants to be per AWWA C502 Dry Barrel
  - a. Breakaway barrel shall be set 2" above finished grade elevation. Set each hydrant on a concrete block and not less than ½ cubic yard of clean coarse aggregate shall be provided at the base for drainage.
  - b. Brace hydrants with concrete thrust block extending from the hydrant to the wall of excavation, and placed to permit the removal of the hydrant. All joints from the main to the hydrant shall be restrained.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Pipe shall be installed in accordance with the plans and above referenced specifications except as modified below.
- B. Installation shall be in accordance with manufacturer's instructions.

### 3.2 PIPING INSTALLATION

- A. Installation Standards: Install work according to Missouri Department of Natural Resources Standards and plumbing code.

### 3.3 FIELD QUALITY CONTROL

- A. Construction Observation and Inspection: Owner will employ a qualified engineering agency to perform construction observation and inspection.
- B. Disinfection of Water Mains

1. Flushing of new mains: There will be no charge by the Owner to the Contractor for the water used to flush the mains, chlorinate, and flush the mains a second time. If it is necessary to flush the mains more than twice as noted, Contractor will be charged by the Owner for water used to flush the mains. Contractor shall provide and install any hose necessary to direct the water being flushed away from any area it might damage.

C. Final Flushing and Testing

1. All samples must be collected by the Contractor and tested at an approved laboratory. Contractor shall transport the samples to the laboratory and pay all lab fees.
2. Water mains that fail the initial bacterial test shall be flushed again before additional sampling is commenced. If the second sample also fails the bacterial test, disinfection shall be repeated and the main flushed again prior to the third sampling. If the third sample fails the bacterial test, the next step shall be determined by the the Engineer. All sterilization shall be performed with the Owner in attendance.

Test results shall be mailed to the Engineer. Water sample bottles shall be furnished by the laboratory.

END OF SECTION

## SECTION 331313 – SANITARY SEWER PIPING AND ACCESSORIES

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions, Special Provisions and other Division 1 Specifications, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes:
  - 1. Sanitary piping and appurtenances
  - 2. Force main piping and appurtenances
- B. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Section 011010 – Summary of Work Sequence
  - 2. Section 011400 – Coordination
  - 3. Section 013300 - Submittals
  - 4. Section 310500 – Earthwork
  - 5. Section 311000 - Site Clearing
  - 6. Section 312300 – Dewatering and Drainage
  - 7. Section 330000 – Cast-in-Place Concrete

#### 1.3 SUBMITTALS

- A. General: Submit the following in accordance with the conditions of Contract and Division 1 Specification Sections.
- B. Product Data: Provide data indicating pipe, pipe accessories, fittings, pressure rating, and rated capacity.
- C. Manufacturer's installation instructions: Indicate special procedures required to install products.
  - 1. Laying schedule
  - 2. Any special construction or manufacture to meet the requirements of 1.4.F. below.
- D. Manufacturer's certificate: Certify that pipe meets or exceeds specified requirements.
  - 1. Shall include but not be limited to:
    - a. Manufacturer's drawings for pipe selected, showing full details of design, joints, fittings, manhole tees, flexible connection at structures, parallel pipe section, special requirements for bedding and backfill between parallel pipe segments.
    - b. Complete design calculations, load conditions, construction conditions, construction vehicle loadings and buoyancy.
    - c. Design calculations on pipe wall and thrust restraint system
    - d. The pipe manufacturer shall be responsible to verify the pipe design for the external loads due to soil loading and design specified live surface loads.
- E. Field Quality Control Method, Procedures, Plan and Schedule.

#### 1.4 DESIGN OF PIPE

- A. All pipe shall be designed as detailed on the plans and conform to latest standard specified. Provide bedding and haunching at rigid structures as noted on the plans and conforming to the latest standard specified in the proposal alternate selected.
- B. All sewer pipe shall be designed considering the combination of external loads with zero internal pressure for the interceptor sewer; and earth cover depths as shown on the plan drawings. A minimum AASHTO HS-20, surface vehicle loading shall be used for surface live loading along the entire pipe. It is anticipated heavy construction equipment will be traversing the pipe. All pressure pipe shall be designed considering the combination of external loads and design internal pressures for forcemains and pressure pipes.
- C. Pipe design shall include, but not be limited to, operating pressure, upsurge, downsurge, pipe material and its safety factor. All pipe shall be designed considering the combination of specified external loads with zero internal pressure for the interceptor sewer; proposed heavy construction equipment loads (driving over the pipe under minimum and proposed final cover); and buoyancy (groundwater at finished grade with pipe empty), and earth cover depths as shown on the plan drawings.
- D. Lift holes in pipe will not be permitted.
- E. Pipe shall be made by a manufacturer experienced in producing pipe of the type and size specified herein.
- F. The pipe design shall account for specified surface and earth loading. Any and all special requirements, but not limited to additional pipe wall thickness, casing, concrete encasement, select backfill or other means as necessary to adequately meet the design loading criteria shall be included and provided with the base bid price and included in the shop drawing submittals prior to pipe material fabrication.
- G. Design Conditions Forcemain:
  - 1. Pressure 150 psi operating; 250 psi surge/test; Safety Factor 2.0
  - 2. Velocity 7 fps
  - 3. Trench per standards specification 20-4

#### 1.5 QUALITY ASSURANCE

- E. Codes and Standards: Comply with the requirements of the latest edition of the following:
  - 1. 10 CSR 20-8.020 design guidelines for sewer requirements.
- B. Pipe Manufacturer
  - 1. Experienced in the design, manufacture and commercial supplying of the specific material for a minimum period of five years.
  - 2. Experienced in the design, manufacture and commercial supplying of the specific size of pipe for a period of three years.
- C. All pipe and fittings shall be from a single manufacturer.
- D. The manufacturer shall be responsible for the performance of all acceptance tests.
- E. Inspection of the pipe shall also be made by the Construction Representative after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification

requirements, even though pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the project.

#### 1.6 PROJECT CONDITIONS

- A. Verify Site Conditions
- B. Site Information: Call Missouri One Call 1-800-DIG-RITE 48 hours before you excavate.

#### 1.7 SEQUENCING AND SCHEDULING

- A. Coordinate with other work performed on site. Sequence installation, cleaning, flushing, jetting, pressure testing, disinfection, backfilling with other work performed on site.
- B. Coordinate with other utility work.

### PART 2 PRODUCTS

#### 2.1 SANITARY SEWER PIPE AND FITTINGS

- A. Polyvinyl Chloride (PVC) Pipe: ASTM D 2241 (SDR-PR) to be used for all sewer main unless otherwise noted.
  - 1. Minimum SDR rating 21 (SDR-21) with minimum pressure rating of 200 psi (1380 kPa) at 23°C.
  - 2. Joints shall be in accordance with ASTM D3139.
  - 3. Gaskets ASTM F 477 elastomeric seal.
  - 4. Fittings: same as pipe.
  - 5. Sanitary Service Connections (Laterals): shall be connected using the appropriate size tee.
    - a. PVC Hub: ASTM D3034 SDR 26
    - b. Gaskets: ASTM F477
    - c. Band: 301 SS
    - d. Rubber Sleeve: ASTM F477

#### 2.2 SANITARY SEWER SERVICES

- A. Polyvinyl Chloride (PVC) Pipe: ASTM D 2241 (SDR-PR) to be used for all sewer service pipe unless otherwise noted.
  - 1. Minimum SDR rating 21 (SDR-21) with minimum pressure rating of 200 psi (1380 kPa) at 23°C.
  - 2. Joints shall be in accordance with ASTM D3139.
  - 3. Gaskets ASTM F 477 elastomeric seal.
  - 4. Fittings: same as pipe

#### 2.3 SANITARY FORCEMAIN PIPE AND FITTINGS

- A. High-Density Polyethylene (HDPE) pipe and fittings
  - 1. Pipe shall be minimum of DR 11.

2. Manufacturer shall conform to ISO 9001.
3. Pipe shall be high-density PE 3408 polyethylene resin meeting the specification of ASTM D 3350 (cell classification 345444C)
4. Pipe shall be made to the dimensions and tolerances specified in ASTM D3035.
5. HDPE fittings shall be in accordance with ASTM 3261 and shall be manufactured by injection molding or fabrication from HDPE pipe conforming to this specification, made to match pipe dimension and class.
6. Butt fusion process shall be used to join sections of HDPE pipe into continuous length at job site. Fusion method shall be performed in strict accordance with pipe manufacturer's recommendations.
7. Plastic Mechanical Couplings: NPS 1-1/2 (DN 40) and Smaller: Capable of joining PE pipe to PE pipe.
  - a. Manufacturers:
    - 1) Lyall, R. W. & Company, Inc.
    - 2) Mueller Co.; Gas Products Div.
    - 3) Perfection Corporation; a subsidiary of American Meter Company.
    - 4) Or approved equal.
  - b. PE body with molded-in, stainless-steel support ring.
  - c. Buna-nitrile seals.
  - d. Acetal collets.
  - e. Electro-zinc-plated steel stiffener.
8. Plastic Mechanical Couplings: NPS 2 (DN 50) and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
  - a. Manufacturers:
    - 1) Lyall, R. W. & Company, Inc.
    - 2) Mueller Co.; Gas Products Div.
    - 3) Perfection Corporation; a subsidiary of American Meter Company.
    - 4) Or approved equal.
  - b. Fiber-reinforced plastic body.
  - c. PE body tube.
  - d. Buna-nitrile seals.
  - e. Acetal collets.
  - f. Stainless-steel bolts, nuts, and washers. Couplings in first subparagraph below are available in NPS 1 (DN 25) and larger. Verify acceptability of couplings below with authorities having jurisdiction before retaining.
9. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
  - a. Stainless-steel flanges and tube with epoxy finish.
  - b. Buna-nitrile seals.
  - c. Stainless-steel bolts, washers, and nuts.
  - d. Factory-installed anode for steel-body couplings installed underground.

#### 2.4 PLASTIC PIPE (PVC)

- A. Schedule 80, Type 1, Grade 1 per ASTM D-1784, D-1785 and NSF Standard 14 unless otherwise noted on the plans.

- B. Solvent cement ASTM D-2564
  - C. Fittings
    - 1. Same material as pipe
  - D. Schedule 80: ASTM D-2467 solvent weld joints
  - E. Design Stress Rating 200 psi at 73° F
  - F. Stamped with NSF seal of approval and schedule number
  - G. Schedule:
    - 1. Where noted on plans.
- 2.5 TRACER CABLE (FOR BURIED PVC AND HDPE PIPING)
- A. #12 THWN
- 2.6 WARNING TAPE (ALL BURIED PIPING)
- A. .035-in. thick by 6-in. wide continuous band of metal detection tape marked (CAUTION: SEWER BURIED BELOW) shall be placed directly above the trench alignment of all buried piping. Warning tape buried maximum 18-in., minimum 12-in. below finished grade.
- 2.7 VALVES AND ACCESSORIES
- A. Globe Valves
    - 1. Globe valves shall be of thermoplastic construction and have no metal parts that come in contact with media. Sizes ½” through 2” shall be of union bonnet design, 2 ½” through 4” shall be of outside stem and yoke type. PVC shall conform to ASTM D1784 Cell Classification 12454-A and PP conforming to ASTM D4101 Cell classification PP0210B67272. PVC valves shall be rated to 150psi at 70° F sizes 1/2" through 2" 110psi at 70° F sizes 2-1/2" through 4". PP rated to 110psi at 70° F sizes 1/2" through 4", as manufactured by Asahi/America, Inc. or equal.
  - B. Ball Valves
    - 1. All ball valves sized ½” – 6” shall be of True-Union design with 2-way blocking capability. PTFE seats shall have elastomeric backing cushions to provide smooth even stem torque and to compensate for wear. Valves shall feature molded ISO mounting top flange for actuation installation and Panel Mount feature on bottom of valve for securing in-line. The handle shall double as the spanner wrench for maintenance and carrier adjustment. All valves shall be of thermoplastic construction.
- 2.8 MANHOLE
- A. External Joint Seals
    - 1. External joint seals shall meet, or exceed, the requirements of ASTM C-877, Type II. External joint seals conform to the following requirements.

External joint seals shall consist of a collar 9 inches wide with an outer layer of polyethylene, with a minimum tensile strength of 4000 psi and a minimum tear resistance of 1500 psi, and an under layer of rubberized mastic that is reinforced with a woven polypropylene fabric. Two 5/8 inches steel straps shall be located within the collar 3/4 inches from each edge. The straps shall be confined in tubes that isolate them from the mastic and allow them to slip freely when mechanically tightened and locked around the manhole. The collar shall be furnished with a minimum 6 inches overlap and a closing flap to cover any remaining exposed strap.

B. Chimney Seals

1. External Chimney Seals conforming to the following requirements. The external chimney seals are not required if the contractor can build a manhole that can pass the Vacuum test without it. Internal chimney seals are not to be used.

The seal shall remain flexible throughout a 25-year design life, allowing repeated vertical movement of the frame of not less than 2 inches and repeated horizontal movement of the frame of not less than 1/2 inch. The sleeve portion of the seal shall have a nominal vertical height of 7", 11", or 16" depending on the size of the chimney. The sleeve shall have a minimum thickness of 60 mils and shall be made from high quality E.P.D.M. rubber suitable for both above and below grade applications. A butyl rubber strip conforming to AASHTO M-198 shall be attached 1/4" from the bottom edge of the sleeve. The butyl rubber strip shall be 1- 1/2" by 1/4" thick. Both the top and bottom compression bands shall contain take-up mechanisms capable of developing a minimum of 400 lbs. of torque.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Pipe shall be installed in accordance with the plans and above-referenced specifications except as modified below.
- B. Installation shall be in accordance with manufacturer's instructions.
- C. Protection for pipe installation shall be included in the Contractor's Base Bid.
- D. All buried PVC and HDPE piping shall be wrapped with continuous tracer wire.

3.2 EXISTING UTILITIES

- A. Missouri One Call: Call the toll-free Missouri One Call. telephone number, 1-800-DIG-RITE, before starting excavation. Allow 48 hours for other than emergency assistance.

3.3 FIELD QUALITY CONTROL

- A. All pipe shall be tested.
  1. Sewers: per 10 CSR 20-8 as incorporated below
    - a. Leakage testing.

Contractor to provide leakage testing using exfiltration or infiltration of water or air testing. The testing methods selected should take into consideration the range in groundwater elevations during the test and anticipated during the design life of the sewer. Exfiltration of water or infiltration of water or air testing per ASTM F1417.



i. Water (hydrostatic) test.

The leakage exfiltration or infiltration shall not exceed one hundred (100) gallons per inch of pipe diameter per mile per day (0.38 m<sup>3</sup>/cm of pipe diameter/km/day) for any section between manholes of the system. An exfiltration or infiltration test shall be performed with a minimum positive head of two feet (2') (0.6 m).

ii. Air test.

The air test shall, as a minimum, conform to the test procedure described in ASTM C828 for clay pipe, ASTM C924 for concrete pipe twenty-four inches (24") or less in diameter, ASTM C1103 for concrete pipe twenty-seven inches (27") or greater in diameter, and ASTM F1417 for plastic, composite, and ductile iron pipe.

b. Televised with tape supplied to the Construction Representative

c. Deflection testing.

i. Deflection tests shall be performed on all flexible pipe. The test shall be conducted after the final backfill has been in place at least thirty (30) days to permit stabilization of the soil-pipe system.

ii. No pipe shall extend a deflection of five percent (5%). If the deflection exceeds five percent (5%), the pipe shall be excavated. Replacement or correction shall be accomplished in accordance with requirements in the department-approved specifications.

iii. The rigid ball or mandrel used for the deflection test shall have a diameter not less than ninety-five percent (95%) of the base inside diameter or average inside diameter of the pipe depending on which is specified in the ASTM specification, including the appendix, to which the pipe is manufactured. The test shall be performed without mechanical pulling devices. A mandrel must have nine (9) or more odd number of flutes or points.

B. Pressure and Leakage Testing of Force Mains:

1. The hydrostatic pressure shall be 1.5 times static pressure or 150 psi (1,050 kPa) whichever is greater for at least a two-hour duration and not vary more than 5 psi (35 kPa).

C. All manholes shall be leakage tested per ASTM C 1244-93 "Standard Test Method for Concrete Sewer Manholes by the Negative Pressure (Vacuum) Test," Vol. 04.05, Chemical Resistant Materials, Vitrified Clay, Concrete, Fiber-Cement Products; Mortars; Masonry (1996 or latest edition). Manholes will not be vacuum tested until all adjusting rings and the manhole frame are installed, otherwise the test will not be considered valid. Final test should be done with manhole backfilled. Contractor may run other vacuum tests prior to backfilling if they are concerned about passing the test, but they are not required.

E. Contractor is responsible for testing of the pipe and manholes. These tests are to be witnessed by the Construction Representative.

3.5 CLEANUP

- A. Excess Excavation: All excess excavated materials shall be come the responsibility of the Contractor for distribution on site per the site grading plan or disposal off the construction site. The Construction Representative reserves the right to have selected excavated materials deposited at designated locations within the project site area at no additional cost to the Owner.

3.6 WARRANTY

- A. The manufacturer's warranty shall be a minimum of one year from the date of equipment start up and owner acceptance.

END OF SECTION

## SECTION 333600 – SEPTIC TANKS

### GENERAL

#### 1.1 WORK INCLUDES

- A. The GENERAL CONTRACTOR shall supply all labor, materials, equipment, and transportation necessary to complete the Work performed under this Section.
- B. Furnishing and installation of one (1) septic tanks including all ancillary appurtenances as detailed on the drawings and specified herein for a complete and satisfactory operating installation.

#### 1.2 RELATED WORK

- A. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Section 011100 – Project Summary
  - 2. Section 013300 - Submittals
  - 3. Section 022010 - Earthwork
  - 4. Section 033000 – Cast-in-Place Concrete

#### 1.3 QUALITY ASSURANCE

- A. Governing Standards, as applicable:
  - 1. The supplier shall use a tank manufacturer that is in the business of manufacturing tanks to Underwriters Laboratories (UL) Standard 1316.
  - 2. The supplier shall use a tank manufacturer that is in the business of manufacturing tanks with materials conforming to the requirements of ANSI/AWWA D120-02 Thermosetting Fiberglass-Reinforced Plastic Tanks.

#### 1.4 SUBMITTALS

- A. Product Data: The equipment manufacturer shall provide literature, specifications and data for all components and accessories.
- B. Manufacturer Certification: At the time of equipment shop drawing submittal, the manufacturer shall provide a certificate stating the following:
  - 1. The equipment meets the detailed requirements and intent of the Specifications or stating in itemized detail the variance between that specified and that being offered.
  - 2. The equipment can be installed and will operate satisfactorily in the location as shown on the plans without reducing any clearances or stating the changes that must be made so that it can be installed.
  - 3. A guarantee to make any necessary revisions or replace the equipment if it is determined after initial start-up that the equipment or ancillary components will not meet the detailed requirements and intent of the specifications.
- C. Shop Drawings: The manufacturer shall submit shop drawings delineating the dimensions, equipment components, wiring diagrams and all essential details.
- D. Manufacturer shall provide installation instructions and required installation and assembly drawings to the contractor detailing all installation requirements for a complete on-line operating installation of the specified equipment and ancillary appurtenances.
- E. Operation and Maintenance Manual: The manufacturer shall submit four (4) complete copies of an Operation

and Maintenance Manual detailing all equipment maintenance and operation requirements and procedures. The manuals shall be in 3-ring binder form and be sectioned by component item with appropriate indexing. Addresses, phone numbers and points of contact for repair/replacement equipment parts, tools, lubricants and service shall be included.

## PART 2 PRODUCTS

### 2.1 DESIGN BASIS

#### A. Loading Conditions – Tanks shall meet the following design criteria:

1. Internal Load – Tank shall withstand a 5-psig air-pressure test with 5:1 safety factor. When tank is designed for onsite testing, contractor shall individually test tank for leakage prior to installation. Maximum test pressure is 5 psig.
2. Surface Loads – Tanks shall be designed with no external loading criteria other than the soil overhead when properly installed according to tank manufacturer's current Installation Manual and Operating Guidelines unless otherwise noted on the plans.
3. External Hydrostatic Pressure – Tank shall be capable of being buried in ground with 7' of overburden over the top of the tank, the hole fully flooded and a safety factor of 5:1 against general buckling.
4. Tank shall support accessory equipment – such as inlet and outlet piping, effluent filter chamber, ladders and baffles – when installed according to tank manufacturer's current Installation Manual and Operating Guidelines.
5. There shall be 130 pcf for minimum weight of saturated backfill, or 100 pcf for unsaturated backfill (400 psf minimum).
6. Minimum lateral loading shall be 62.4 pcf. Lateral loading shall be determined from ground surface.
7. Tanks requiring deep burial (>36") or subject to truck or heavy traffic loading require special consideration. (A minimum soil cover of 12 inches shall be used, unless specified otherwise by manufacturer.)
8. *All tanks shall be structurally sound and watertight and shall be guaranteed in writing by the tank manufacturer for a period of two years from the date of final acceptance. Manufacturer's signed guarantee shall accompany bids. The tank guarantee/warranty shall be furnished at the time of submittal. Tank warranty shall not have a limited liability in regards to replacement cost of the tanks. The septic tank shall be capable of withstanding long-term hydrostatic loading, in addition to the soil loading, due to a water table maintained at ground surface.*
9. Tanks shall be manufactured and furnished with a minimum access opening of 20 inches in diameter and of the configuration shown on the manufacturer's drawings. Modification of completed tanks will not be permitted.

#### B. Product Storage

1. Tank shall be capable of storing wastewater products limited to the collection and storage of human solid or liquid organic sewage.
2. Tank shall be vented to atmospheric pressure.

#### C. Water Testing

1. Water testing shall be performed on each tank and shall be witnessed by the engineer. Every tank shall be assembled by the manufacturer and filled with water to the brim of the access opening for a minimum of two (2) hours. The tank shall show no leakage from section seams, pinholes or other imperfections. Any leakage is cause for rejection.
2. When leakage occurs, if the tank is not rejected by the engineer, an additional water test shall be made on the tank after repairs have been completed, upon request by the engineer. The manufacturer shall be responsible for making all corrective measures in production or assembly

- necessary to ensure a completely watertight tank.
3. After installation of tank with riser is completed, each tank shall be filled with water to a point 2" into the access riser and the water loss measured after a two-hour period. Every tank test shall be witnessed by the engineer. Any leakage shall be cause for rejection. Backfill of a depth equal to the water height in the riser must be in place over the tank to prevent damage due to hydrostatic uplift.

D. Sizing information:

1. The table on Sheet C-503 has all the tank sizing information for the septic tank including the inlet piping size. See the plan details for riser openings and sizing.

## 2.2 SINGLE-WALL FIBERGLASS REINFORCED PLASTIC (FRP) UNDERGROUND STORAGE TANKS

A. FRP Tank Dimensions

1. The table on Sheet C-503 have all the tank sizing information for the septic tank including the inlet piping size.

C. Materials

1. Tank shall be manufactured with 100% resin and glass-fiber reinforcement. No sand fillers.
2. Resin used in tank and accessories shall be premium isophthalic polyester.
3. Inspections may be made by the engineer in the supplier's yard, within the plant, upon delivery and again after installation. The minimum wall thickness shall be 3/16". If the wall thickness is suspected to be less than 3/16" or if delamination is suspected within any portion of the tank, the engineer may drill a 1/4" diameter hole through the tank wall for inspection purposes. If the required minimum 3/16" thickness is not found, repair if feasible shall be the responsibility of the contractor. If repair is judged not feasible, the tank shall be rejected. If twenty percent (20%) or more of the tanks are rejected for any of the aforementioned reasons, each tank under this bid will become suspect of substandard quality and subject to rejection by the engineer. If the required minimum 3/16" thickness is found and no delamination is present, the repair of the inspection holes shall be the responsibility of the engineer.

F. Calculations

1. Fiberglass tanks shall be analyzed using finite element analysis for buried structures.
2. Calculations shall address the following:
  - a. Strength
  - b. Buckling
  - c. Deflection of 5% of the tank diameter, based on service load (including long-term deflection lag)
  - d. Buoyancy
3. The laminates considered in this analysis shall be of general-purpose ortho-polyester resin with E-type fiberglass reinforcement or higher grade. The thicknesses for different regions of the tanks shall be described and shown in shop drawings for each individual tank.

The laminate properties listed here, along with the minimum thicknesses as described herein, are considered typical design values that must be maintained during the manufacturing of the tanks.

Typical primary strength properties are listed below:

Tensile Modulus (psi)	1,000,000
Ultimate Tensile strength (psi)	10,000
Ultimate Compressive strength (psi)	21,000
Ultimate Flexural strength (psi)	18,000
Ultimate Shear In-Plane (psi)	7,800

G. Performance Testing (in-lieu of calculations)

1. In-situ testing of each tank model shall include use of strain gauge and deflection gauge. The tank will be subjected to external forces equal to twice the actual load.
2. Maximum initial deflection based on test loading shall not exceed 3% of the tank diameter.
3. Performance testing will be evaluated by a Registered Professional Engineer (P.E.). The Engineer will have the sole responsibility to determine the maximum external loading on any of the tank models.

H. Other Requirements

1. The manufacturer shall specify the minimum weight of each tank model that will be allowed. The manufacturer will permanently mark the weight of each tank on the top near the access hole.
2. The minimum tank weight shall be specified by the manufacturer's engineer (e.g., 350 lbs for 1000-gallon tanks, 400 lbs for 1500-gallon tanks  $\pm$ ).
3. Holes specified for the tank shall be provided by the manufacturer. Resin or other appropriate sealant shall be properly applied to all cut or ground edges so that no glass fibers are exposed and all voids are filled.
4. Each tank shall be marked in the uppermost surface above or near the outlet and include a permit or identification number, weight of tank, type of tank, and date of manufacture.

2.3 ACCESSORIES

A. Piping

1. Schedule 40 PVC or FRP pipe shall be used for inlet and outlet piping.
2. When a PVC pipe is affixed to the tank, a fiberglass lay-up is used.
3. All piping shall be factory-sealed to enable field tightness testing with at least one pipe opening provided with a threaded fitting for connecting a pressure-test manifold.
4. EPDM gaskets, shall be used at the inlet pipe opening to join the tank wall and the inlet piping. ABS or Schedule 40 PVC pipe and fittings shall be used at the inlets.
5. Inlet plumbing shall include an inlet tee that penetrates 18" into the liquid from the inlet flow line. (The depth may vary depending on the tank's height; in all cases, though, the inlet should extend to a level below the bottom of the maximum scum depth). The inlet plumbing shall allow for natural ventilation back through the building sewer and vent stack.

B. Access Openings

1. All access openings 24"-diameter or larger shall be manufactured of FRP.
2. Location(s) shall be as shown on the drawings.

C. Anchor Straps and Anchorage (If required by the manufacturer based on calculations)

1. Straps shall be FRP anchor straps as supplied by tank manufacturer.
2. Number and location of straps shall be specified in current literature by tank manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Tank shall be installed in strict accordance to the Manufacturers' recommendations in effect at time of installation.
- B. Contractor shall be trained in proper installation procedures by the tank manufacturer, the state or other approved agency.

3.2 WARRANTY

- A. The manufacturer's warranty shall be a minimum of one year from the date of equipment start up and owner acceptance.

END OF SECTION

## SECTION 333616 – SEPTIC TANK EFFLUENT PUMPING

### PART 1 GENERAL

#### 1.1 WORK INCLUDES

- A. The GENERAL CONTRACTOR shall supply all labor, materials, equipment, and transportation necessary to complete the Work performed under this Section.
- B. Furnishing and installation of one (1) septic tank effluent pumping systems including all ancillary appurtenances as detailed on the drawings and specified herein for a complete and satisfactory operating installation.

#### 1.2 RELATED WORK

- A. Related Sections: The following Sections contain requirements that relate to this Section:

- 1. Section 011100 – Project Summary
- 2. Section 013300 - Submittals
- 3. Section 221313 – Sanitary Sewer Piping and Accessories
- 4. Division 26 - Electrical

#### 1.3 QUALITY ASSURANCE

- A. In order to assure uniform quality, ease of maintenance and minimal parts storage, it is the intent of these Specifications that all equipment called for under this Section shall be supplied by a single manufacturer. The equipment manufacturer shall, in addition to the Contractor, assume the responsibility for proper design, supply, construction, installation and performance of the complete systems.

#### 1.4 SUBMITTALS

- A. Product Data: The equipment manufacturer shall provide literature, specifications and data for all components and accessories.
- B. Manufacturer Certification: At the time of equipment shop drawing submittal, the manufacturer shall provide a certificate stating the following:
  - 1. The equipment meets the detailed requirements and intent of the Specifications or stating in itemized detail the variance between that specified and that being offered.
  - 2. The equipment can be installed and will operate satisfactorily in the location as shown on the plans without reducing any clearances or stating the changes that must be made so that it can be installed.
  - 3. A guarantee to make any necessary revisions or replace the equipment if it is determined after initial start-up that the equipment or ancillary components will not meet the detailed requirements and intent of the specifications.
- C. Shop Drawings: The manufacturer shall submit shop drawings delineating the dimensions, equipment components, wiring diagrams and all essential details.
- D. Manufacturer shall provide installation instructions and required installation and assembly drawings to the contractor detailing all installation requirements for a complete on-line operating installation of the specified equipment and ancillary appurtenances.
- E. Operation and Maintenance Manual: The manufacturer shall submit four (4) complete copies of an Operation and Maintenance Manual detailing all equipment maintenance and operation requirements and procedures. The manuals shall be in 3-ring binder form and be sectioned by component item with appropriate indexing.



Addresses, phone numbers and points of contact for repair/replacement equipment parts, tools, lubricants and service shall be included.

## PART 2 PRODUCTS

### 2.1 DESIGN BASIS

- A. See the table on Sheet C-503 of the plans for the size and capability of each pumping system to be provided.

### 2.2 SEPTIC TANK EFFLUENT PUMPING

- A. Acceptable Manufacturers:

1. Orenco Systems, Inc., 814 Airway Avenue, Sutherlin, OR 97479, (locally represented by Flo-systems (618)667-7890).
2. Quanics by AUNA, 4106 Bernau Avenue, Greensboro, NC 27407, (336) 547-9338.
3. Polylok, Inc., 3 Fairfield Blvd., Wallingford, CT 06492, (888) 765-9565.
4. Or approved equal

- B. Risers

Risers shall be required for access to internal vaults and access into the septic tanks for septage pumping. All risers shall be constructed watertight. The risers shall be attached to the tanks such that a watertight seal is provided. Risers shall extend 3" above original grade to allow for settlement and to ensure positive drainage away from the access. Risers for inspection ports shall be 24" in nominal diameter. Risers containing pumping assemblies or electrical splice boxes shall be 30" in diameter and shall be of sufficient diameter to allow removal of internal vaults without removing splice boxes, etc. All risers shall vary in height depending on the depth of bury on the various tanks. Adhesive required to adhere the PVC or fiberglass risers to either fiberglass or ABS tank adapter shall be either a two-part Methacrylate epoxy or a single component Methacrylate adhesive. To ensure product compatibility, risers, lids, and attachment components shall be supplied by a single manufacturer.

1. Inlet Riser

Inlet risers shall be ribbed PVC. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2". Risers shall extend to 2" above the ground surface to allow for settlement and shall have a nominal diameter of 24".

- a. Discharge Grommets: the manufacturer for discharge piping, to assure a watertight seal, shall install EPDM grommets. The manufacturer of the access risers shall install the grommets at the factory.
- b. Adhesive: When bonding to concrete or fiberglass grooves, a two-part self-leveling Methacrylate epoxy should be used, one pint required per 18-inch or 24-inch diameter riser and one quart required per 30-inch diameter riser. When bonding to a flanged riser tank adapter, either a two-part Methacrylate epoxy or a single component Methacrylate adhesive shall be used.

2. Outlet Riser

Outlet risers shall be ribbed PVC. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1/2". Risers shall be 30" in diameter and shall be factory-equipped with the following:

- a. Electrical and Discharge Grommets: when applicable, EPDM grommets shall be installed by the manufacturer for discharge piping, vent piping, and/or the electrical conduit to assure a watertight seal. The grommets shall be installed at the factory by the manufacturer of the access risers.
- b. Adhesive: When bonding to concrete or fiberglass grooves, a two-part self-leveling Methacrylate epoxy should be used, one pint required per 24" diameter riser and one quart required per 30" diameter riser. When bonding to a flanged riser tank adapter, either a two-part Methacrylate epoxy or a single component Methacrylate adhesive shall be used.

3. Riser-To-Tank Attachment:

Risers shall be attached to tanks with one of the following attachment systems: riser to tank attachment kit; (2) tank adapters used with a compatible bolt down kit, and two-part Methacrylate epoxy or a single component Methacrylate adhesive; (3) tank adapter used with compatible bolt down kit and two-part self-leveling Methacrylate epoxy adhesive. All attachment components shall be constructed of waterproof, non-corrosive materials, such as PVC, ABS, fiberglass, or stainless steel. Adhesives and sealants shall be waterproof, corrosion resistant and approved for the intended application. The riser-to-tank connection shall be watertight and structurally sound. The riser-to-tank connection shall be capable of withstanding a vertical uplift of 5000 pounds to prevent riser separation due to tank settlement, frost heave, or accidental vehicle traffic over the tank.

4. Lids

Lids shall be 24" or 30" in diameter as indicated on the plans. Manufacturer shall provide evidence that lids have been used successfully in continuous field service for a minimum of five years to demonstrate long-term integrity and suitability for the application. Lids shall be waterproof, corrosion resistant and UV resistant. Lids shall be flat, with no noticeable upward dome. A crown or dome of no more than 1/8" is allowable. Lids shall not allow water to pond on them. Lids shall have a green non-skid finish. Self-lubricating plastics, such as polyethylene, shall not be considered non-skid without addition of a non-skid coating. Lids shall form a watertight seal with the top of riser. Lids shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1-1/2".

Lids shall be provided with tamper-resistant stainless steel fasteners and a tool for fastener removal. Tamper-resistant fasteners include recessed drives, such as hex, Torx, and square. Fasteners that can be removed with common screwdrivers, such as slotted and Philips, or fasteners that can be removed with standard tools, such as pliers or crescent wrenches, are not considered tamper-resistant. To prevent a tripping hazard, fasteners shall not extend above the surface of the lid.

Rigid closed-cell foam insulation of 2" or 4" thickness shall be mechanically attached to the underside of the lid. All fasteners shall be made of corrosion resistant stainless steel. The

insulation shall have an R-value of no less than 10 per 2" increment.

C. Pump Vault:

1. A pump vault with a biological filter, installed in conformance with the engineer's plans. The filter shall have a minimum effective screen area of no less than the quantity shown on the table on Sheet C-503. The pump vault shall consist of a 12" diameter, 68" deep HDPE vault with 2" diameter holes evenly spaced around the perimeter, located appropriately to allow for maximum sludge and scum accumulation before requiring pumping (approximately 70% of minimum liquid level). Housed inside the polyethylene vault shall be the filter assembly consisting of 1/8" mesh polypropylene tubes. Attached to the vault is a flow inducer to accept one or two high-head effluent pumps.

D. Discharge Hose and Valve Assemblies:

Provide a 150 psi PVC ball valve, 150 psi PVC check valve, PVC flex hose with working pressure rating of 80 psi, and Schedule 40 PVC pipe to match pump discharge size and material. Provide an anti-siphon assembly of the appropriate size.

E. Float Switch Assembly:

Float assembly with four switch floats mounted on a PVC stem attached to the filter cartridge. The floats must be adjustable and must be removable without removing the pump vault. The high- and low-level alarms and on/off functions shall be preset as shown in the engineer's plans. Each float lead shall be secured with a nylon strain relief bushing at the splice box. The floats shall be UL or CSA listed and shall be rated for a minimum of 5.0A @ 120 VAC.

F. High-Head Effluent Pumps:

Pump shall be as indicated on the table on Sheet C-503. They should include a 20 foot long extra heavy duty (SO) electrical cord with ground. Pump shall be UL and CSA listed as an effluent pump. **Pumps shall comply with National Electrical Code, Class 1 Div. 1, Groups A, B, C, D for hazardous locations.** Pump shall be provided with a non-prorated five-year warranty.

G. Electrical Splice Boxes:

The electrical splice box shall be UL approved for wet locations, equipped with 3 electrical cord grips for the float wires and a explosion-proof splice box for connection of the pump leads and a 1 or 1.25-inch outlet fitting. Also included shall be UL listed waterproof butt splice connectors.

H. Controls and Alarms

1. Shall be listed per UL 508 or UL 698A for Class 1, Division 1. Panels shall be repairable in the field without the use of soldering irons or substantial disassembly. See the table on Sheet C-503 to verify specified pump information. Panel shall be a duplex control panel meeting the following:
  - a. Programmable Logic Unit: 115/230 VAC programmable logic unit with built-in LCD screen and programming keys. Provides control functions and timing for panel operation.
  - b. Main panel disconnect, Rated for pump amperage, HP, and voltage.
  - c. Motor-Start Contactor: Rated for pump amperage, HP, and voltage, 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA).
  - d. Toggle Switch: MOA switch. Rated for pump load.
  - e. Controls Circuit Breaker: 10 amps, OFF/ON switch. Single-pole 115 VAC. DIN rail mounting with thermal magnetic tripping characteristics.

- f. Pump Circuit Breaker: Rated for pump amperage and voltage, OFF/ON switch. DIN rail mounting with thermal magnetic tripping characteristics.
- g. Audio Alarm: 80 dB at 24", warble-tone sound.
- h. Visual Alarm: 7/8" diameter red lens, "Push-to-silence." NEMA 4, 1-watt bulb, 115 VAC.
- i. Panel Enclosure: Measures 13.5" high x 11.3" wide x 5.6" deep or greater if needed. NEMA 4X rated. Constructed of stainless steel; hinges and latch are stainless steel. Conduit couplings provided.
- j. Event Counter: 115 VAC, 6-digit, non-resettable.
- k. Elapsed Time Meter: 115 VAC, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.
- l. Pump Run Light: 7/8" green lens. NEMA 4, 1-watt bulb, 115 VAC.
- m. Heater: Anti-condensation heater. Self-adjusting; radiates additional wattage as temperature drops.
- n. Intrinsically Safe Control Relays: 115 VAC. Listed per UL 913, for Class 1 Div. 1, Groups A, B, C, D hazardous locations. Larger enclosure required.
- o. Current Sensor: 115 VAC. Go/no-go operation. Pump fail indicator light on panel. Manual reset switch.

2. Control Panel Location

The pump control panel shall be mounted near the tank and pump as indicated on the drawings. The control panel shall be located within 50 feet and in sight of the pump motor or shall be provided with a lockable disconnect switch. The panel should be located at a convenient height (usually about five feet above the ground) and where it will be accessible for maintenance.

PART 3 EXECUTION

3.1 TESTING

- A. Treatment system shall be tested to the satisfaction of the **Construction Representative** to verify that the system operates as designed.

3.2 INSTALLATION

- A. The septic tank shall be installed in strict accordance to the Manufacturer's recommendations in effect at time of installation.
- B. Contractor is responsible to provide for a proper installation of the treatment system by working with the treatment system manufacturer to provide a complete and fully functional system.
- C. Contractor is responsible for installing all the pumps and electrical equipment from the control panel on. The park package electrical contractor will supply the power to the control panels. Depending on timing, the contractor may have to return to site to perform startup of the wastewater equipment. Electrical power is required to start up the septic tank effluent pumping.

3.3 START-UP

- A. The contract should provide for the answering of questions by the manufacturer and the manufacturer's representative during construction.
- B. The contract should also provide for three days of on-site start-up assistance by the manufacturer's representative.

3.4 WARRANTY

- A. The manufacturer's warranty shall be a minimum of one year from the date of equipment start up and owner acceptance.

END OF SECTION

## **SECTION 334100 - STORM UTILITY DRAINAGE PIPING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Pipe and fittings.
  - 2. Nonpressure transition couplings.
  - 3. Expansion joints and deflection fittings.
  - 4. Cleanouts.
  - 5. Drains.
  - 6. Manholes.
  - 7. Channel drainage systems.
  - 8. Catch basins.
  - 9. Stormwater inlets.
  - 10. Pipe outlets.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. Manholes: Include plans, elevations, sections, details, frames, and covers.
  - 2. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- B. Field quality-control reports.

#### **1.5 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.
- C. Handle manholes according to manufacturer's written rigging instructions.

- D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

## PART 2 - PRODUCTS

### 2.1 STEEL PIPE AND FITTINGS

- A. Corrugated-Steel Pipe and Fittings: ASTM A 760/A 760M, Type I with fittings of similar form and construction as pipe.
  - 1. Special-Joint Bands: Corrugated steel with O-ring seals.
  - 2. Standard-Joint Bands: Corrugated steel.
  - 3. Coating: Zinc.

### 2.2 CONCRETE PIPE AND FITTINGS

- A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.
  - 1. Bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets

### 2.3 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
  - 1. For Concrete Pipes: ASTM C 443, rubber.

### 2.4 MANHOLES

- A. Standard Precast Concrete Manholes:
  - 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
  - 2. Diameter: 48 inches minimum unless otherwise indicated.
  - 3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
  - 4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
  - 5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
  - 6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
  - 7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
  - 8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
  - 9. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.

10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
6. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

## 2.5 PIPE OUTLETS

- A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
- B. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
  1. Average Size: NSSGA No. R-5, screen opening 5 inches
- C. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

### 3.2 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.



### 3.3 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade, anchored with concrete, where indicated.
- D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- E. Construct energy dissipaters at outlets, as indicated.

### 3.4 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

### 3.5 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately of backfill is in place, and again at completion of Project.
  - 1. Submit separate reports for each system inspection.
  - 2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - c. Infiltration: Water leakage into piping.
    - d. Exfiltration: Water leakage from or around piping.
  - 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
  - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
  - 3. Submit separate report for each test.
  - 4. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Option: Test concrete piping according to ASTM C 924.

### 3.6 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION



**SCI ENGINEERING, INC.**

1372 S. Bishop Avenue

Rolla, Missouri 65401

573-426-4901

www.sciengineering.com

## APPENDIX "A"

**Geotechnical Report**

**ECHO BLUFF STATE PARK  
ADDITIONAL CABINS  
SHANNON COUNTY, MISSOURI**

**November 2022**

**STATE OF MISSOURI  
Owner**

**FARNSWORTH GROUP, INC.  
Project Engineer**

**SCI No. 2014-7007.12**



**DocuSigned by:**

A handwritten signature in blue ink that reads 'Tim J. Barrett'.

7C4EB73EF381454...



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GEOTECHNICAL  
ENVIRONMENTAL  
NATURAL RESOURCES  
CULTURAL RESOURCES  
CONSTRUCTION SERVICES

November 14, 2022

Nicholas Bruner, AIA, NCARB  
Farnsworth Group, Inc.  
20 Allen Avenue, Suite 200  
St. Louis, Missouri 63119

RE: Geotechnical Report  
Echo Bluff State Park  
Additional Cabins  
Shannon County, Missouri  
SCI No. 2014-7007.12

Dear Nicholas Bruner:

Attached is our *Geotechnical Report*, dated November 2022. It should be read in its entirety, and our recommendations applied to the design and construction of the project. Selected excerpts from the report are highlighted below:

- Fat clays were encountered at shallow depths in all boring throughout the site. Based on the provided cabin finished floor elevations (FFE), remediation is anticipated to be required for the cabin foundations and floor slabs as discussed in Section 4.1.
- Existing fill was encountered in B-301 to a depth of 1.5 feet. Documentation regarding the placement and compaction of the existing fill was not available at the time of this report; however, based on the age of the fill and the results of field and laboratory testing, the risk of supporting the proposed cabins on the fill is judged to be low with proper proofrolling and treatment as discussed in Section 4.2.
- Bedrock was encountered at depths of 3.5 to 10 feet. Based on the proposed FFEs, rock excavation is not anticipated for the cabins; however, pinnacled rock may be present at shallower depths between the widely spaced borings. As such, we recommend establishing a contingency for select rock excavation for footings and utilities. Where rock is encountered in footing excavations, we recommend it be removed to a minimum of 12 inches below the footings and be backfilled with crushed rock to reduce differential settlement.
- Shallow spread foundations bearing on remediated fat clay or engineered fill can be sized for maximum net allowable bearing pressures of 2,500 pounds per square foot (psf) for continuous wall footings and 3,000 psf for isolated spread footings.
- Seismic Site Class C should be used for the project, with seismic design parameters as follows:  $F_a = 1.30$ ,  $F_v = 1.50$ ,  $S_{DS} = 0.38$ , and  $S_{D1} = 0.18$  which results in a Seismic Design Category (SDC) of C for a site with a Risk Category of I, II, or III.

Nicholas Bruner, AIA, NCARB  
Farnsworth Group, Inc.

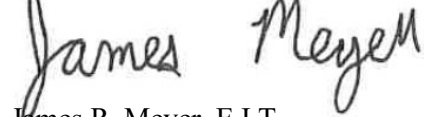
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November 14, 2022  
SCI No. 2014-7007.12

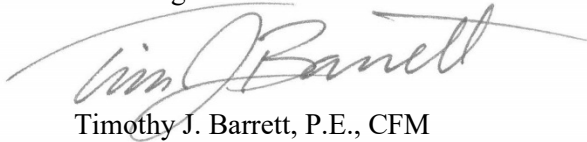
We appreciate the opportunity to be of service and look forward to working with you during the construction phase of the project. If you have any questions or comments, please do not hesitate to contact me.

Respectfully,

**SCI ENGINEERING, INC.**



James R. Meyer, E.I.T.  
Staff Engineer



Timothy J. Barrett, P.E., CFM  
Senior Engineer

JRM/TJB/nmn

Enclosure  
Geotechnical Report

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## **FIGURES**

Figure 1 – Vicinity and Topographic Map

Figure 2 – Aerial Photograph

Figure 3 – Site Plan

## **APPENDIX**

Appendix A – Boring Log Legend and Nomenclature and Boring Logs

## **Geotechnical Report**

### **ECHO BLUFF STATE PARK ADDITIONAL CABINS SHANNON COUNTY, MISSOURI**

#### **1.0 INTRODUCTION**

At the request of Nicholas Bruner, of Farnsworth Group, Inc. (Farnsworth), SCI Engineering, Inc. (SCI) conducted a geotechnical exploration for the proposed lodge and cabins. The purpose of our exploration was to characterize and evaluate the subsurface conditions, provide recommendations for foundations, and address other geotechnical aspects as related to the referenced structures. Our services were provided in general accordance with our proposal dated October 3, 2022 and authorized by Robert Kolhase of Farnsworth on October 12, 2022.

#### **2.0 SITE AND PROJECT DESCRIPTION**

Six additional cabins are planned for the 500-acre Echo Bluff State Park development in Shannon County, Missouri. The location of the site is shown on the *Vicinity and Topographic Map*, Figure 1. The cabins are planned for a greenspace south of the existing parking area and west of South Drive and was used as a laydown area for equipment during the park's construction. The site slopes from the east downwards to the west with approximately 16 feet of relief. The existing site conditions are shown on the enclosed *Aerial Photograph*, Figure 2.

Based on the *Grading and Erosion Control Plan*, prepared by Farnsworth and dated August 30, 2022, the cabin footprints will be filled 1 to 4 feet. The cabins will likely be single-story, structures supported on shallow footings or piers, with associated parking. The proposed construction is shown on the *Site Plan*, Figure 3.

Structural loads were not available at the time of this report; however, we have assumed the cabins will have column loads of less than 100 kips and wall loads of less than 4 kips per linear foot.

SCI has prepared a *Structural Geotechnical Report* for the vehicular bridges in September 2014, a *Geotechnical Report* for the proposed roadway, pedestrian bridge, and bluff walk in October 2014, a *Geotechnical Report* for the proposed lodge and cabins in December 2014, and a *Global Stability Analysis Letter Report* on June 25, 2015. We have not reviewed, nor are we aware of, any additional geotechnical studies on this specific site, by SCI or others, that would affect the preparation of this report.

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### **3.0 SUBSURFACE CONDITIONS**

A total of six borings, designated B-301 through B-306, were drilled at the approximate locations shown on the enclosed *Site Plan*. The boring locations were staked in the field by SCI personnel using a handheld global positioning system. Approximate ground surface elevations at the boring locations were interpolated off the *Grading and Erosion Control Plan* prepared by Farnsworth and dated August 30, 2022. Detailed information regarding the nature and thickness of the soils and rock encountered, and the results of the field sampling and laboratory testing are shown on the *Boring Logs* contained in Appendix A.

#### **3.1 Existing Fill**

Existing fill was encountered in B-301 to a depth of 1.5 feet (approximate Elevation (El) 743.5). The existing fill consisted of fat clay with varying amounts of sand and gravel. Based on historical aerial imagery, we anticipate that the fill was placed during the construction of the campground structures 2015; however, we are not aware of documentation regarding the placement and compaction of the fill.

#### **3.2 Native Soil Profile**

The native soils consisted of fat clay (CH in accordance with the Unified Soil Classification System and ASTM D 2487) to the depths of auger refusal or weathered dolomite at depths ranging from 4.5 to 9.5 feet. The native fat clays had varying amounts of dolomite and chert gravel. As an exception well-graded gravel (GW) was encountered in B-303 and B-306 at depths of 3 and 8 feet and extended to auger refusal at 4.5 feet and weathered dolomite at 9.5 feet, respectively.

SPT N-values in the native fat clay ranged from 11 to 23 blows per foot (bpf), with an average value of 14 bpf, characterizing the soils as stiff to very stiff in consistency. Moisture contents in the native fat clay ranged from 9 to 49 percent, with an average of 35 percent. Split spoon refusal (SSR) was encountered in the well-graded gravel encountered in B-303 at a depth of 3.5 feet. SSR is a designation applied to any sample that cannot be advanced 6 inches with 50 hammer blows. Moisture contents in the well-graded gravel ranged from 8 and 18 percent with an average of 13 percent.



### 3.3 Bedrock Geology

The site is located within the Current River Hills portion of the Ozark Highlands which is characterized by gently rolling hills or an undulating topography with some areas consisting of steep hillsides separated by ravine-like drainages. The bedrock present throughout the site consists of the Gunther Sandstone and Eminence Dolomite. Soils consist of thin, cherty, silty clay and silt solution residuum. Near the creeks, alluvial gravels and sands are present.

Due to the geologic setting, there is a potential for karst feature development (e.g. caves, sinkholes, etc.). In general, these features are formed when groundwater dissolves a portion of the dolomite bedrock, usually where it travels along fractures in the rock. Typically these features can be found in areas where the groundwater daylights to a nearby creek or other drainageway. SCI is aware that approximately five caves are visible on the Echo Bluff State Park site. The known caves do not appear in close proximity to the cabin areas. Our borings did not reveal any buried rubble, organics, or voids which are commonly found in filled sinkholes and developing karst features.

Auger refusal was encountered in all six borings at depths of 4.5 to 10 feet. Auger refusal is a designation applied to any material that cannot be further penetrated by the power auger without extraordinary effort and is indicative of a very hard or very dense material, usually boulders or bedrock. Weathered dolomite was also encountered above auger refusal in three of the six borings. The depths at which weathered rock and auger refusal were encountered and their respective boring locations are provided below in Table 3.1.

**Table 3.1 - Weathered Rock and Auger Refusal Summary**

Boring	Approximate Ground Surface Elevation (feet)	Approximate Weathered Dolomite Depth (feet)	Approximate Weathered Dolomite Elevation (feet)	Approximate Auger Refusal Depth (feet)	Approximate Auger Refusal Elevation (feet)
B-301	745	NE	--	5.0	740
B-302	745	3.5	741.5	4.5	740.5
B-303	741	NE	--	4.5	736.5
B-304	742	5	737	6	736
B-305	744	NE	--	4.5	739.5
B-306	751	9.5	741.5	10	741.0

NE - Not Encountered

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### 3.4 Groundwater

Groundwater was not encountered in any of the six borings during drilling. The groundwater level depends on seasonal and climatic variations and water level in the nearby Sinking Creek and may be present at different depths in the future. In addition, without extended periods of observation, accurate groundwater level measurements may not be possible, particularly in low permeability soils.

## 4.0 GEOTECHNICAL RECOMMENDATIONS

### 4.1 Expansive Clay Remediation

Fat clays were encountered in the native soils at shallow depths throughout the site. These soils are susceptible to excessive volume change, with variations in moisture content, which can lead to movement of concrete slabs and foundations of lightly loaded structures, retaining walls, or pavements. **Based on the provided cabin finished floor elevations (FFE)s, expansive clay remediation is anticipated to be required for all foundations and the majority of floor slabs where slab-on-grade construction is planned.** Where the bearing soils consist of clays with liquid limits (LLs) of 45 or higher, we recommend that they be removed to a minimum depth of 2 feet beneath the bearing level of the footings and 3 feet beneath the bottom of the floor slab. Ultimately, the actual need for, and extents of, expansive clay remediation should be delineated by SCI personnel in the field during construction.

The overexcavation should extend at least 2 feet beyond the outside edge of the footings and the building's footprint to facilitate uniform compaction of the replacement materials and, may require additional widening at the building corners to allow equipment access for proper compaction. The overexcavation should be backfilled with properly compacted low plastic soil or 1-inch minus crushed limestone. As an alternate, the footing overexcavation may be backfilled with lean concrete or flowable fill. With this option, widening of the footing excavation is not required. If clean rock is used as backfill material, it must be drained to daylight or to a sump with a pump. The footings and floor slab would then be constructed on the newly placed fill.

As an alternative to overexcavation and replacement, the fat clay may be remediated by the addition of lime in combination with a recompaction operation. If lime stabilization is performed, we recommend thoroughly mixing in "Code L" (a locally available calcium oxide by-product also known as lime kiln dust) at a rate of 7 percent, or approximately 8 pounds of Code L per cubic foot of soil, to the depths and lateral limits described in the preceding paragraph. Water may need to be added during mixing to allow

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for proper hydration of the lime. Pulverizing and tilling equipment, such as “gators,” are preferred for mixing the lime into the soil. The treated soil should be placed in compacted lifts as discussed in the “Fill Materials and Compaction” section.

The methods of treatment described above are based on generally accepted standards in the local engineering community; however, swell pressures and volume change potential greater than can be mitigated by these methods may exist. Consequently, the owner should recognize that there is an inherent, but reduced risk that foundation and floor slab damage may occur, even after remedial treatment of the subgrade soil.

#### **4.2 Existing Fill**

Existing fill was encountered in B-301 to a depth of 1.5 feet (approximate El 743.5). The existing fill was likely placed during construction of the existing site features in 2015; however, documentation regarding the placement and compaction of the existing fill was not available at the time of this report. Therefore, the engineering properties and performance of the existing fill cannot be predicted with certainty and there is some risk of settlement or other performance problems if the foundations or floor slabs are supported on the existing fill material. To eliminate the risk associated with the fill, all the existing fill would have to be excavated and either recompact or replaced.

However, based on the age of the fill and its shallow depth, the risk of supporting the proposed cabins on the fill is judged to be low with proper proofrolling and treatment as discussed in Sections 4.1, 5.1 and 5.2.

#### **4.3 Shallow Rock**

Bedrock was encountered at depths of 3.5 to 10 feet. Based on the proposed FFEs, rock excavation is not anticipated for the cabins; however, pinnacled rock may be present at shallower depths between the widely spaced borings. **As such, we recommend establishing a contingency for select rock excavation for footings and utilities. Where rock is encountered in footing excavations, we recommend it be removed to a minimum of 12 inches below the footings and be backfilled with crushed rock to reduce differential settlement.** Alternately, all the foundations could be extended to bedrock; however, based on the depths of bedrock and the planned FFEs, this option will not likely be cost effective.

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Chipping or blasting will likely be required for bedrock below the auger refusal depths. Weathered rock zones above auger refusal can typically be excavated utilizing ripping rock buckets mounted on heavy duty equipment; however, isolated areas may require chipping. If blasting will be performed at the site, SCI should be contacted for further consultation regarding peak velocities, a pre-blast survey of the surrounding structures, and vibration monitoring considerations.

#### **4.4 Shallow Foundations**

Shallow spread footing foundations bearing on remediated fat clay or engineered fill are suitable for support of the proposed cabins. These foundations can be sized for a maximum net allowable bearing pressure of 2,500 pounds per square foot (psf) and 3,000 psf for continuous wall footings and isolated spread footings, respectively. If all the foundations are extended to bedrock, then they may be sized for a net allowable bearing pressure of 5,000 psf. A one-third increase in the net allowable bearing pressures may be used for transient loads, such as wind and earthquake.

We anticipate that some localized areas of inadequate bearing materials may be encountered during construction; therefore, we recommend that an allowance be made in the construction budget for selected footing overexcavations.

Exterior footings and foundations in unheated areas of the cabins should be provided with at least 30 inches of soil cover for frost protection. Interior footings in heated areas can be located at nominal depths below the finished floor. For footings designed and constructed in accordance with our recommendations, total settlement should be less than 1-inch, and differential settlement between adjacent footings should be less than  $\frac{3}{4}$  inch.

#### **4.5 Seismic Considerations**

Ground shaking at the foundation of structures and liquefaction of the soil under the foundation are the principle seismic hazards to be considered in design of earthquake-resistant structures. Liquefaction occurs when a rapid buildup in water pressure, caused by the ground motion, pushes sand particles apart, resulting in a loss of strength and later densification as the water pressure dissipates. This loss of strength can cause bearing capacity failure, while the densification can cause excessive settlement. Potential earthquake damage can be mitigated by structural and/or geotechnical measures or procedures common to earthquake resistant design.

**4.5.1 Design Earthquake**

According to International Building Code (2021 edition) (IBC 2021), structures such as those proposed for this project are required to be designed to a design earthquake with a 2 percent Probability of Exceedance over a 50-year exposure period (i.e., a 2,475-year design earthquake).

**4.5.2 International Building Code Site Classification**

Seismic design parameters for the site as determined from data provided by the 2021 IBC, the United States Geological Survey National Seismic Hazard Mapping Project, are shown in Table 4.1.

**Table 4.1 - Seismic Design Parameters**

Site Class	C
$M_w$	7.50
PGA	0.23
$F_{PGA}$	1.20
Site Modified $PGA_M$	0.28
$S_S$	0.44
$S_I$	0.18
$F_a$	1.30
$F_v$	1.50
$S_{DS}$ (Design Spectral Acceleration at 0.2 sec)	0.38
$S_{D1}$ (Design Spectral Acceleration at 1.0 sec)	0.18
Seismic Design Category (Risk Category I, II, or III)	C

**4.5.3 Liquefaction Potential Analysis**

The liquefaction potential analysis for the site was conducted using data from the field exploration and laboratory test results and the techniques outlined in the National Center for Earthquake Engineering (NCEER) Technical Report NCEER-97-0022. Based on our analyses, the soils at the project site have sufficient strength values to resist liquefaction and/or a plasticity index that make the threat of liquefaction minimal during the design earthquake. While the amount of the seismically induced settlement is dependent on the magnitude and distance from the seismic event, some vertical and horizontal movement may be experienced during a major earthquake event, particularly if the earthquake occurs during a period of elevated groundwater, even with proper seismic design.

#### 4.6 Floor Slab

If the cabins will include a slab-on-grade, the following recommendations will apply. They assume a floor slab load of 150 psf or less. If sections of the floor slab will support loads greater than the assumed floor slab loads, then SCI should be provided the opportunity to review the final design plans and specifications to determine if the underlying subsurface soils can adequately support the loads. Proofrolling, as discussed in Section 5.1, should be accomplished to identify soft or unstable soils that should be removed from the floor slab area prior to fill placement and/or floor slab construction.

We recommend that the floor slab be designed using a modulus of subgrade reaction,  $k$  value, of 150 pounds per cubic inch based on values typically obtained from 1-foot by 1-foot plate load tests. Depending on how the slab load is applied, the value will have to be geometrically modified. The value should be adjusted for larger areas using the following expression for cohesive and cohesionless soil:

$$\text{Modulus of Subgrade Reaction, } k_s = \left(\frac{k}{B}\right) \text{ for cohesive soil; and}$$

$$k_s = k \left(\frac{B+1}{2B}\right)^2 \text{ for cohesionless soil.}$$

where:  $k_s$  = coefficient of vertical subgrade reaction for loaded area;  
 $k$  = coefficient of vertical subgrade reaction for 1x1 square foot area; and  
 $B$  = width of area loaded, in feet.

The floor slab should be supported on a minimum 4-inch-thick layer of crushed stone. This will help to distribute concentrated loads and equalize moisture conditions beneath the slab.

It is generally preferable to maintain structural separation between floor slab and the foundation walls and column pads using isolation joints. We also suggest that joints be placed in the floor slab with spacing (in feet) equal to approximately three times the thickness of the slab (in inches) in both directions. Such joints permit slight movements of the independent elements and help reduce random cracking that might otherwise be caused by restraint of shrinkage, slight rotations, heave, or settlement.

Where occupied space or moisture sensitive floor coverings are planned, we recommend a 6-mil-thick polyethylene sheeting be placed immediately beneath the floor slab and above the crushed rock or gravel to reduce the transfer of capillary moisture to the slab. However, without careful attention to curing of the floor slab, the polyethylene sheeting can cause excessive shrinkage cracking and "curling".

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The precautions listed below should be followed for construction of slab-on-grade pads. These details will not reduce the amount of movement, but are intended to reduce potential damage, should some settlement of the supporting subgrade take place. Some increase in moisture content is inevitable as a result of development and associated landscaping. However, extreme moisture content increases can be largely controlled by proper and responsible site drainage, building maintenance and irrigation practices.

- Cracking of slab-on-grade concrete is normal and should be expected. Cracking can occur not only as a result of heaving of the supporting soil, but also as a result of concrete curing stresses. The occurrence of concrete shrinkage cracking, and problems associated with concrete curing may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement, finishing, curing, and by the placement of crack control joints at frequent intervals, particularly where re-entrant slab corners occur.
- Areas supporting slabs should be properly moisture conditioned and compacted. Backfill in all interior and exterior water and sewer line trenches should be carefully compacted to reduce the shear stress in the concrete extending over these areas.

Exterior slabs should be isolated from the proposed cabins. These slabs should be reinforced to function as independent units. Movement of these slabs should not be transmitted to the cabin's foundations or superstructure.

#### **4.7 Site Grading and Drainage**

Positive site drainage should be provided to reduce surface water infiltration around the perimeter of the cabins and beneath the floor slabs. All grades should be sloped away from the cabins. Roof and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill of the cabins.

Large trees and shrubs should be planted away from exterior footings as they may cause drying and shrinkage of the foundation soils and, with the passage of time, potentially detrimental settlement of the cabin floor slab and foundations. A minimum distance of 20 feet or the mature tree's dripline, whichever is greater, is suggested.

#### **4.8 Underground Utilities**

Underground utilities can provide a pathway for water to migrate below floor slabs. Drain and utility pipes beneath floors should have tight joints to prevent leakage. If utility excavations are backfilled with free-draining granular materials, then cutoffs should be provided at the exterior walls to reduce the

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potential for water to migrate beneath the building. Impermeable cutoffs may consist of a 3-foot-long “plug” of cohesive soil or bentonite soil mix, or a 1-foot-long plug of lean concrete. Soil may be used for the balance of the backfill.

With the exception of individual service lines to the buildings that intersect foundations perpendicularly, below-grade utilities should not be located within the stress influence zone of the building foundations. Accordingly, below-grade utilities should be located outside a zone extending 45 degrees downward and outward from the edge of the footings.

## **5.0 SITE DEVELOPMENT AND CONSTRUCTION CONSIDERATIONS**

### **5.1 Site Preparation**

Areas to be cut or to receive fill should be stripped of any surface vegetation or organic topsoil. The strippings should be removed and stockpiled for later placement in landscaped or common ground areas, as appropriate.

Trees and brush may be burned on site if approved by local ordinances. Burn pits should be located in cut areas such that the ashes are completely removed during site grading. If this is not practical, burn pits must be located outside of building, street, and areas designated as slopes steeper than 5H:1V. Stumps that cannot be burned should be removed from the site.

After stripping, the site should be proofrolled by systematically passing over the subgrade to achieve complete coverage with proper compaction or loaded construction equipment, and observing the subgrade for pockets of excessively soft, wet, or disturbed soil, or otherwise unacceptable materials. **In particular, any soft areas within the existing fill, to remain in place, should be identified during this process.**

Soft areas or otherwise unacceptable materials, if encountered, should be removed and replaced with structural fill or stabilized prior to placing additional fill. If removal of soft soils is impractical due to their excessive depth, they should be stabilized or “bridged over” in a manner approved by SCI. “Bridging” of the soft soils can often be accomplished by working 2- to 4-inch clean crushed rock into the softer soils and then placing a geofabric, such as Mirafi 600X or equivalent, prior to placing additional fill.



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Slopes to receive fill which are steeper than 5H:1V should be benched prior to the placement of fill. Benching will provide level surfaces for compaction and reduce the potential for development of inclined planes of weakness between the natural soil and compacted fill. The benches should be spaced such that the height of the cut at the up-slope end of the bench is less than 5 feet.

## 5.2 Fill Materials and Compaction

Prior to fill placement and compaction, the upper 8 inches of the exposed subgrade should be scarified, moisture conditioned and recompactd. Structural fill should be placed in maximum 8-inch-thick loose lifts and mechanically compacted in accordance with Table 5.1. We recommend that any fill placed in building areas have LLs less than 45 and plasticity indexes (PIs) less than 25. If higher plasticity soils are placed within 3 feet of the floor slab subgrade, or 2 feet of the bottom of the footings, then remediation will be required. Acceptable non-organic fill soils include materials designated CL, ML, CL-ML, GP, and GW by ASTM D 2487-11. Demolished pavements or concrete debris is typically suitable for use as structural fill provided the materials are broken to less than 4 inches in maximum dimension and properly blended with acceptable soil and placed as approved by SCI. Clays with LLs of 45 or higher may be lime stabilized in accordance with Section 4.2 and used as structural fill.

**Table 5.1 - Typical Compaction Requirements for Fill**

Material Tested	Proctor Type	Minimum Percentage Dry Density
Structural Fill (Cohesive)	Modified (ASTM D 1557)	90
	Standard (ASTM D 698)	95
Structural Fill (Granular)	Modified	95
	Standard	98
Landscaped Areas (non-load bearing)	Modified	88
	Standard	92
Utility Trench Backfill	Modified	90
	Standard	95

Prior to compaction, the soil may require moisture adjustment. During warm weather, moisture reduction can generally be accomplished by disking or otherwise aerating the soil. When air drying is not feasible, a moisture reducing chemical additive, such as hydrated lime, could be incorporated into the soil. During dry weather, some addition of moisture may be required to facilitate compaction. This should also be done in a controlled manner using a tank truck with a spray bar. The moistened soil should be

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thoroughly blended with a disk or pulverizer to produce a uniform moisture content. If construction is performed during the winter season, fill materials should be carefully observed to see that no frozen soil is placed as fill or remains in the base materials upon which fill is placed.

Rock blasted or ripped from on-site cut areas may be used as fill material. Rock contained in a fine-grained soil matrix should not exceed 4 inches in maximum dimension, or as approved by SCI, within 3 feet of the proposed finished grade, bottom of the floor slab(s) or footings, or within utility alignments. Below these depths the maximum particle size may be increased to 12 inches.

For mixtures of soil and rock, the moisture content of the soil portion should be compatible with the desired results, i.e., approximately the same as would be required to obtain the recommended compaction if rock were not present. If the mixture is soil dominated, a sheepsfoot roller will likely be most efficient in achieving compaction; if the mixture is rock-dominated, compaction can often be better achieved with a vibratory roller or heavy rubber-tired equipment, such as loaded scrapers or quarry trucks. Compaction testing of these materials may not be practical using conventional methods (nuclear density gauge or drive tubes), due to the varying quantities of soil and rock at any one location and, is usually based on a performance guideline in the field. Poorly compacted areas can generally be detected by observing the fill subgrade during the passing of a loaded scraper or compactor over the fill area and should be recompacted with additional passes or removed and replaced with more stable material.

Backfill placed next to walls should be compacted with hand operated equipment and not large, self-propelled or machine operated equipment, which could result in potential overcompaction and higher lateral pressures. Compaction should be reduced within approximately one foot of the walls, and the walls should be observed periodically for signs of movement. If movement is detected, it may be necessary to provide bracing and/or change backfill procedures.

In addition to the minimum density requirements listed above, the soil must be stable, i.e., not “pumping” or rutting excessively under construction traffic, prior to placing additional fill or constructing foundations or floor slab. Field density tests should be performed on each lift of fill to document that proper compaction is achieved.

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### **5.3 Shallow Foundation Excavations**

SCI should observe all shallow footing and floor slab excavations for problem areas, such as soft zones or areas of untreated fat clay or existing fill, prior to placing concrete. Excessive disturbance of siltier soils in footing excavations should be avoided and could complicate construction. The potential for such disturbance will increase during wetter times of the year. Footing excavations that have been excessively disturbed should be overdeepened to approved undisturbed soils. Overexcavation and replacement with structural fill should be performed where inadequate bearing materials are present in footing excavations.

The base of all excavations should be clean, free of loose soil or uncompacted fill, relatively dry and maintained near their optimum moisture content. Excavations should be protected from extreme temperatures, precipitation, and construction disturbances. To reduce the possibility of desiccation or saturation of the foundation soils, we recommend that the concrete be placed as soon as possible after excavations are made.

Groundwater is not anticipated to be encountered in the footing excavations. However, in most situations, small amounts of groundwater seepage into the excavations can be handled by means of gravity ditching and a sump pump. If greater flows are experienced, SCI should be retained to provide additional consultation.

### **5.4 Subgrade Considerations**

Floor slab and pavement subgrades may be subjected to construction traffic and exposure to weather for an extended period and significant problems may be incurred. It may be necessary to proofroll the subgrade, in both cut and fill areas, and recompact the subgrade immediately prior to placing base rock for the floor slabs or pavement. In addition, subgrades covered with base rock may be very slow to dry if precipitation occurs after placing the base rock. Therefore, we recommend that proofrolling and placement of the base rock be done as close to the time of pouring the floor slabs or paving as is practical. Proofroll passes should be limited, particularly on silty subgrades, to reduce the potential for pumping of moisture from deeper within the soil profile.

Special measures may be required to facilitate construction during wet or cold weather, or where excessive areas of soft soils are identified. These measures may include, but are not limited to, the addition of lime to the subgrade soils for drying purposes, or the removal of soft spongy soils and their replacement with crushed limestone. Soft areas should be selectively undercut and backfilled with

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properly compacted cohesive soil. A geotextile, such as Mirafi 600X, or geogrid, such as Tensar TriAx-140, or equivalents, may be used to help stabilize particularly soft areas. Where possible, the subgrade should be sloped to provide drainage.

### **5.5 Excavation Bracing Requirements**

In the *Federal Register*, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its “Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P.” This document was issued to provide for the safety of workers entering excavations, including utility trenches, basements, footings, and others. All operations should be performed under the supervision of qualified site personnel in accordance with OSHA regulations.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor’s “responsible person”, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor’s safety procedures. In no case should slope height, sloped inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

SCI is providing this information solely as a service to our client. SCI does not assume responsibility for construction site safety or the contractor’s or other party’s compliance with local, state, and federal safety or other regulations.

### **5.6 Erosion Control and Land Disturbance Monitoring Program**

Appropriate erosion and sediment control measures, such as proper contouring during site grading activities, the installation of siltation fences, and/or inlet protection, should be used during construction to keep eroded materials from being carried onto adjacent properties or waterbodies. Depending on the length of time the subgrade is exposed and the amount of siltation that occurs, it may be necessary to periodically remove materials collected by the sediment control systems. Timely sodding and/or seeding of sloped surfaces will help reduce this potential problem.

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SCI recommends following the procedures detailed in the Stormwater Pollution Prevention Plan (SWPPP). Any site disturbing more than one acre of ground must obtain a Land Disturbance Permit from the Missouri Department of Natural Resources (MDNR). As part of the permit compliance procedures, weekly and rain-event site observations must be performed to document the changing site conditions and maintenance of control measures.

## **6.0 CONSTRUCTION MONITORING PROGRAM**

The following list summarizes SCI's recommendations for a construction monitoring program. These services are recommended to provide quality assurance in assessing design assumptions and to document earth-related construction procedures for compliance with plans, specifications, and good engineering practice. A geotechnical engineer should be retained to:

- Participate in a formal preconstruction meeting with the Owner's Representative, Civil Engineer, and Contractor, prior to construction at the site.
- Observe site preparation activities prior to construction, including stripping and proofrolling.
- Conduct and document weekly and rain-event observations at the site, maintain and update on-site paperwork, and provide submittals required by the SWPPP and Land Disturbance Permit.
- Assess the suitability of potential fill materials, including both on-site and off-site sources.
- Monitor placement and compaction of structural fill and backfill.
- Observe foundation excavations and the floor slab subgrade to assess the impact of expansive soils and existing fill, and to recommend the extent of remedial measures.
- Observe footing excavations for adequacy of bearing materials.
- Observe the floor slab subgrade prior to placing base rock.
- Observe backfilling of below-grade utility excavations.
- Observe pavement subgrade preparation and provide observation and testing services for the base course and pavement section.
- Check the thickness of pavement sections and, for asphaltic concrete, its density.
- Provide quality assurance testing of structural concrete and pavement materials.

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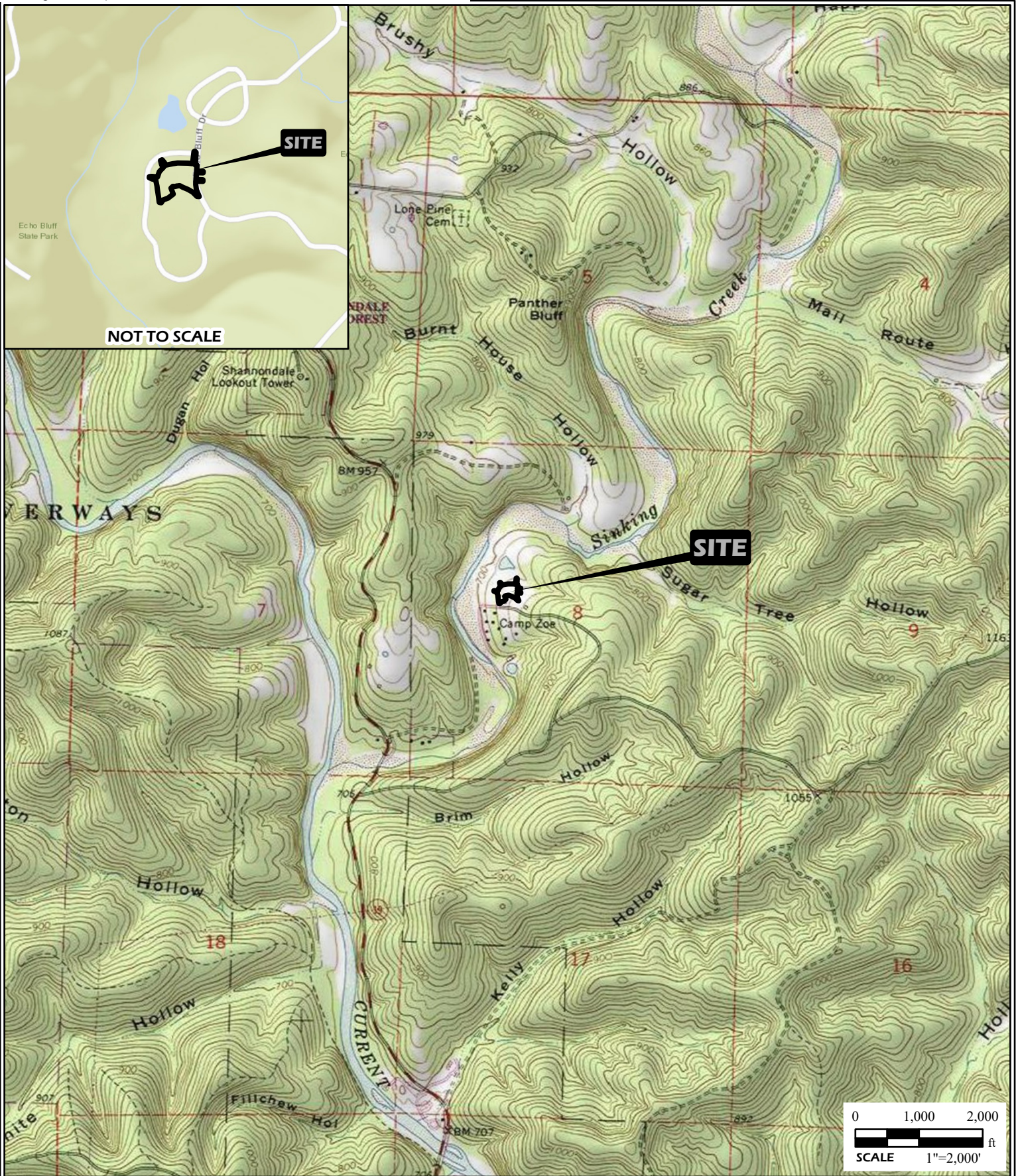
Echo Bluff State Park - Additional Cabins  
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## **7.0 LIMITATIONS**

The recommendations provided herein are for the exclusive use of the State of Missouri and Farnsworth. It is imperative that SCI be contacted by any third-party interests to evaluate the applicability of this report relative to use by anyone other than State of Missouri and Farnsworth. Our recommendations are specific only to the project described and are not meant to supersede more stringent requirements of local ordinances. They are based on subsurface information obtained at six, widely spaced, boring locations within the project area; our understanding of the project as presented in Section 2.0, "Site and Project Description"; and geotechnical engineering practice consistent with the standard of care. No other warranty is expressed or implied. SCI should be contacted if conditions encountered are not consistent with those described.

We should also be provided with a set of final development plans, once they are available, to review whether our recommendations have been understood and applied correctly, and to assess the need for additional exploration or analysis. Failure to provide these documents to SCI may nullify some or all of the recommendations provided herein. In addition, any changes in the planned project or changed site conditions may require revised or additional recommendations on our part.

The final part of our geotechnical service should consist of direct observation during construction, to observe that conditions actually encountered are consistent with those described in this report, and to assess the appropriateness of the analyses and recommendations contained herein. SCI cannot assume responsibility or liability for the adequacy of its recommendations without being retained to observe construction.



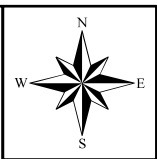
**PROJECT NAME**  
 ECHO BLUFF STATE PARK ADDITIONAL CABINS  
 SHANNON COUNTY, MISSOURI

**VICINITY AND TOPOGRAPHIC MAP**

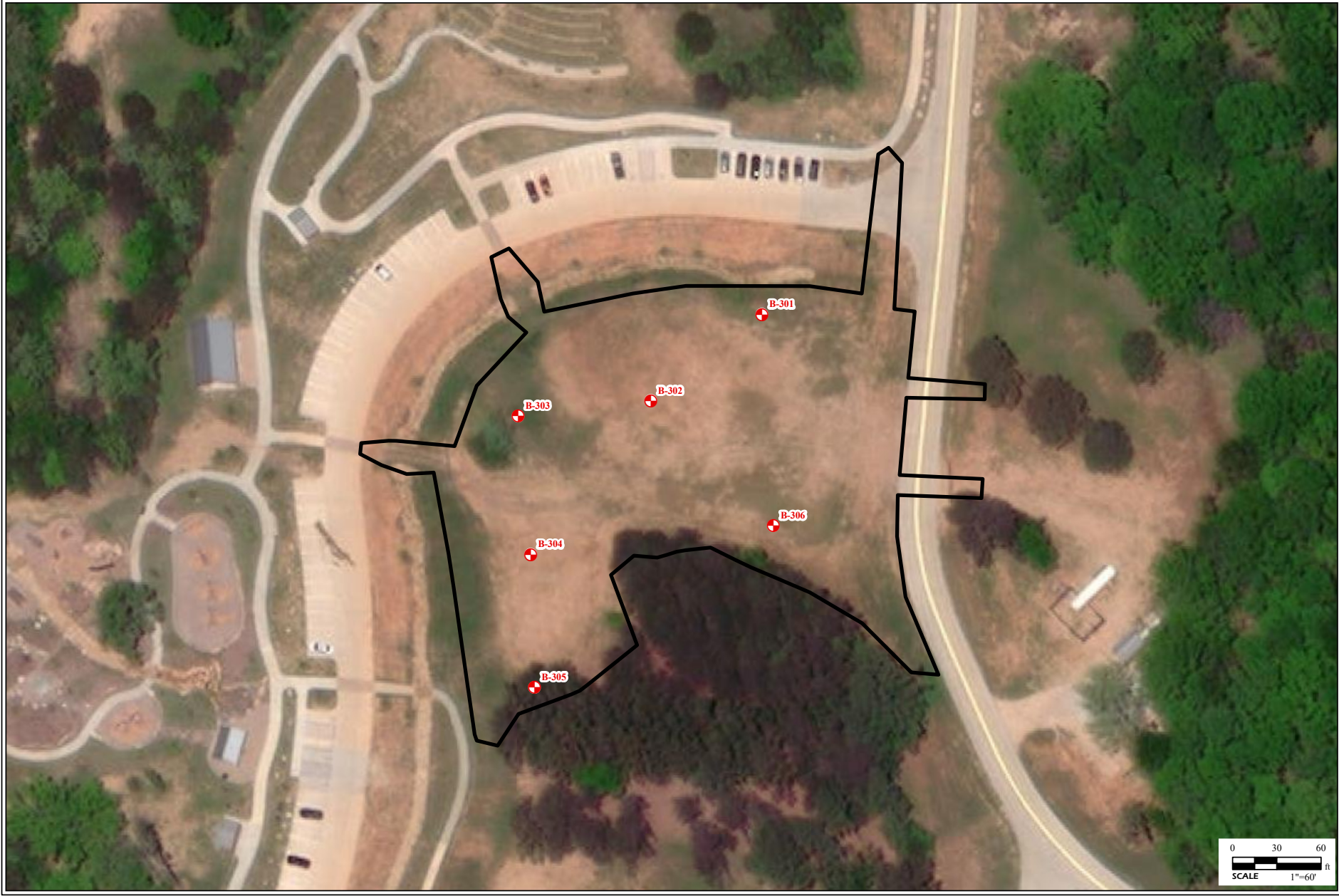
<b>DRAWN BY</b>	RCV	<b>DATE</b>	11/2022	<b>JOB NUMBER</b>	2014-7007.12
<b>CHECKED BY</b>	TJB				

**GENERAL NOTES/LEGEND**  
 USGS TOPOGRAPHIC MAP  
 ROUND SPRING, MISSOURI QUADRANGLE  
 DATED 1985  
 20' CONTOURS

**STREET MAP**  
[HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD\\_STREET\\_MAP](http://GOTO.ARCGISONLINE.COM/MAPS/WORLD_STREET_MAP)



**FIGURE**  
 1



**GENERAL NOTE/LEGEND:**  
 [Symbol] APPROXIMATE SOIL BORINGS LOCATIONS  
 AERIAL PHOTOGRAPH OBTAINED FROM ARCGIS ONLINE. WORLD IMAGERY.  
 DIMENSIONS AND LOCATIONS ARE APPROXIMATE; ACTUAL MAY VARY. DRAWING SHALL NOT BE USED OUTSIDE THE CONTEXT OF THE REPORT FOR WHICH IT WAS GENERATED.

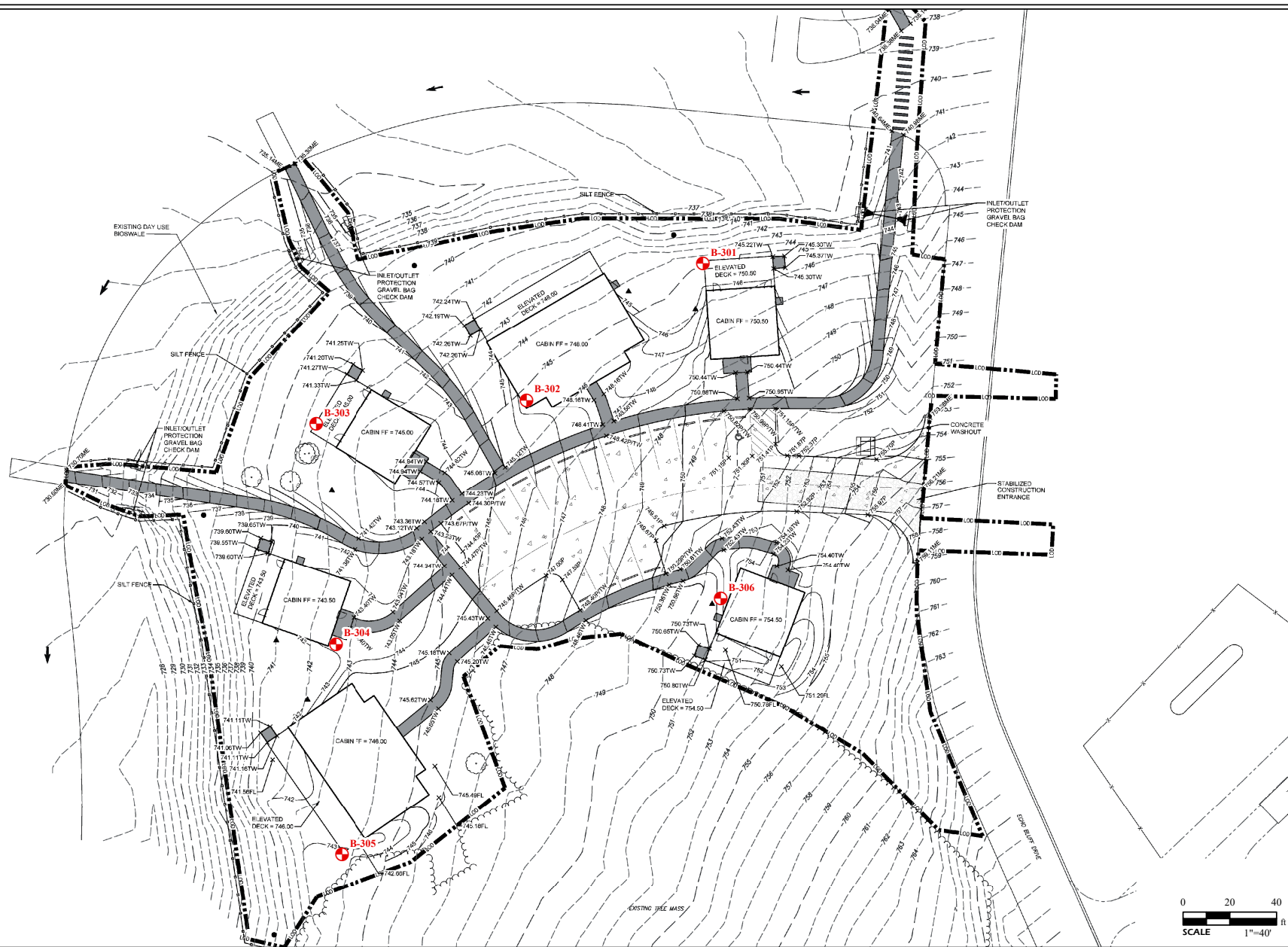
**PROJECT NAME**  
 ECHO BLUFF STATE PARK ADDITIONAL CABINS  
 SHANNON COUNTY, MISSOURI  
**AERIAL PHOTOGRAPH**



**JOB NUMBER**  
 2014-7007.12  
**DATE**  
 11/2022  
**DRAWN BY** RCV  
**CHECKED BY** TJB  
**FIGURE**  
 2







**GENERAL NOTES/LEGEND**

APPROXIMATE SOIL BORING LOCATION

PLAN DATED 8/30/2022 BY FARNSWORTH

DIMENSIONS AND LOCATIONS ARE APPROXIMATE; ACTUAL MAY VARY. DRAWING SHALL NOT BE USED OUTSIDE THE CONTEXT OF THE REPORT FOR WHICH IT WAS GENERATED.

**PROJECT NAME**

ECHO BLUFF STATE PARK ADDITIONAL CABINS  
SHANNON COUNTY, MISSOURI

**SITE PLAN**



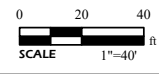
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2014-7007.12

**DATE**  
11/2022

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RCV

**CHECKED BY**  
TJB

**FIGURE**  
3



# Appendix A



**SCI ENGINEERING, INC.**  
 1372 S. Bishop Avenue  
 Rolla, Missouri 65401  
 573-426-4901  
 www.sciengineering.com

## BORING LOG LEGEND AND NOMENCLATURE

**Depth** is in feet below ground surface. **Elevation** is in feet mean sea level, site datum, or as otherwise noted.

### Sample Type

- SS** Split-spoon sample, disturbed, obtained by driving a 2-inch-O.D. split-spoon sampler (ASTM D 1586).
- NX** Diamond core bit, nominal 2-inch-diameter rock sample (ASTM D 2113).
- ST** Thin-walled (Shelby) tube sample, relatively undisturbed, obtained by pushing a 3-inch-diameter, tube (ASTM D 1587).
- CS** Continuous sample tube system, relatively undisturbed, obtained by split-barrel sampler in conjunction with auger advancement.
- SV** Shear vane, field test to determine strength of cohesive soil by pushing or driving a 2-inch-diameter vane, and then shearing by torquing soil in existing and remolded states (ASTM D 2573).
- BS** Bag sample, disturbed, obtained from cuttings.

**Recovery** is expressed as a ratio of the length recovered to the total length pushed, driven, cored.

**Blows** Numbers indicate blows per 6 inches of split-spoon sampler penetration when driven with a 140-pound hammer falling freely 30 inches. The number of total blows obtained for the second and third 6-inch increments is the N value (Standard Penetration Test or SPT) in blows per foot (ASTM D 1586). Practical refusal is considered to be 50 or more blows without achieving 6 inches of penetration, and is expressed as a ratio of 50 to actual penetration, e.g., 50/2 (50 blows for 2 inches).

For analysis, the N value is used when obtained by a cathead and rope system. When obtained by an automatic hammer, the N value may be increased by a factor of 1.3.

**Vane Shear Strength** is expressed as the peak strength (existing state) / the residual strength (remolded state).

**Description** indicates soil constituents and other classification characteristics (ASTM D 2488) and the Unified Soil Classification (ASTM D 2487). Secondary soil constituents (expressed as a percentage) are described as follows:

Trace	<5
Few	5-15
With	>15-30

**Stratigraphic Breaks** may be observed or interpreted, and are indicated by a dashed line. Transition between described materials may be gradual.

### Laboratory Test Results

- Natural moisture content (ASTM D 2216) in percent.
- Dry density in pounds per cubic foot (pcf).
- Hand penetrometer value of apparently intact cohesive sample in kips per square foot (ksf).
- Unconfined compressive strength (ASTM D 2166) in kips per square foot (ksf).
- Liquid and Plastic Limits (ASTM D 4318) in percent.

**RQD (Rock Quality Designation)** is the ratio between the total length of core segments 4 inches or more in length and the total length of core drilled. RQD (expressed as a percentage) indicates insitu rock quality as follows:

Excellent	90 to 100
Good	75 to 90
Fair	50 to 75
Poor	25 to 50
Very Poor	0 to 25



# BORING LOG

**PROJECT** Echo Bluff State Park Additional Cabins **BORING NUMBER** B-301  
**LOCATION** Shannon County, Missouri **SHEET** 1 of 1  
**DRILLER** Midwest Drilling, Inc. **HAMMER** Automatic **PROJECT NO.** 2014-7007.12  
**EQUIPMENT** CME-750 w/CFA **ELEVATION** 745± **DATE DRILLED** 10/19/2022

DEPTH (ft)	SAMPLE				DESCRIPTION (UNIFIED SOIL CLASSIFICATION)	GRAPHIC	SEE REMARK NO.	LABORATORY TEST RESULTS						ELEVATION (ft)
	NUMBER	TYPE	RECOVERY (in/in)	BLOWS (per 6 in)				MOISTURE CONTENT (%)	DRY DENSITY (pcf)	HAND PENETROMETER (ksf)	UNCONFINED COMPRESSIVE STRENGTH (ksf)	LIQUID LIMIT	PLASTICITY INDEX	
3	1	SS	3/18	10 13	FILL: Reddish-brown, gravelly fat clay, some fine- to coarse-grained sand, gravel is fine to coarse  GRAVELLY FAT CLAY (CH): Reddish-brown, some fine- to coarse-grained sand, gravel is fine to coarse			9		6.5				744
	2	ST	16/20	10	FAT CLAY (CH): Reddish-brown, some fine- to coarse-grained sand, trace fine to coarse gravel			40	79.1		4.5	107	73	741
6					Auger refusal at 5 feet on dolomite.									738
9														735
12														732
15														729
18														726

<b>WATER LEVEL:</b> _____ X NONE OBSERVED WHILE DRILLING _____ ft WHILE DRILLING _____ ft _____ HRS AFTER DRILLING _____ ft _____ DAYS AFTER DRILLING	<b>REMARKS:</b>   
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# BORING LOG

**PROJECT** Echo Bluff State Park Additional Cabins **BORING NUMBER** B-302  
**LOCATION** Shannon County, Missouri **SHEET** 1 of 1  
**DRILLER** Midwest Drilling, Inc. **HAMMER** Automatic **PROJECT NO.** 2014-7007.12  
**EQUIPMENT** CME-750 w/CFA **ELEVATION** 745± **DATE DRILLED** 10/19/2022

DEPTH (ft)	SAMPLE				DESCRIPTION (UNIFIED SOIL CLASSIFICATION)	GRAPHIC	SEE REMARK NO.	LABORATORY TEST RESULTS						ELEVATION (ft)	
	NUMBER	TYPE	RECOVERY (in/in)	BLOWS (per 6 in)				MOISTURE CONTENT (%)	DRY DENSITY (pcf)	HAND PENETROMETER (ksf)	UNCONFINED COMPRESSIVE STRENGTH (ksf)	LIQUID LIMIT	PLASTICITY INDEX		
1	1	SS	10/18	4 5 6	FAT CLAY (CH): Reddish-brown, some fine to coarse gravel, trace fine- to coarse-grained sand			28		8.5					744
3	2	SS	3/3	50/3"	WEATHERED DOLOMITE: Tan, with reddish-brown, fat clay			40		5.0					741
6					Auger refusal at 4.5 feet on dolomite.										738
9															735
12															732
15															729
18															726

<b>WATER LEVEL:</b> X NONE OBSERVED WHILE DRILLING _____ ft WHILE DRILLING _____ ft _____ HRS AFTER DRILLING _____ ft _____ DAYS AFTER DRILLING	<b>REMARKS:</b>   
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# BORING LOG

**PROJECT** Echo Bluff State Park Additional Cabins **BORING NUMBER** B-303  
**LOCATION** Shannon County, Missouri **SHEET** 1 of 1  
**DRILLER** Midwest Drilling, Inc. **HAMMER** Automatic **PROJECT NO.** 2014-7007.12  
**EQUIPMENT** CME-750 w/CFA **ELEVATION** 741± **DATE DRILLED** 10/19/2022

DEPTH (ft)	SAMPLE				DESCRIPTION (UNIFIED SOIL CLASSIFICATION)	GRAPHIC	SEE REMARK NO.	LABORATORY TEST RESULTS						ELEVATION (ft)
	NUMBER	TYPE	RECOVERY (in/in)	BLOWS (per 6 in)				MOISTURE CONTENT (%)	DRY DENSITY (pcf)	HAND PENETROMETER (ksf)	UNCONFINED COMPRESSIVE STRENGTH (ksf)	LIQUID LIMIT	PLASTICITY INDEX	
1	1	SS	12/18	5	FAT CLAY (CH): Reddish-brown, with fine to coarse gravel			40	7.5					
				7										
3				8										
3	2	SS	2/3	50/3"	WELL-GRADED GRAVEL WITH CLAY (GW-GC): Brown, gravel is fine to coarse, with fine- to coarse-grained sand, with reddish-brown, fat clay			18	-					
6					Auger refusal at 4.5 feet on dolomite.									
9														
12														
15														
18														

<b>WATER LEVEL:</b> _____ X NONE OBSERVED WHILE DRILLING _____ ft WHILE DRILLING _____ ft _____ HRS AFTER DRILLING _____ ft _____ DAYS AFTER DRILLING	<b>REMARKS:</b>  
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# BORING LOG

**PROJECT** Echo Bluff State Park Additional Cabins **BORING NUMBER** B-304  
**LOCATION** Shannon County, Missouri **SHEET** 1 of 1  
**DRILLER** Midwest Drilling, Inc. **HAMMER** Automatic **PROJECT NO.** 2014-7007.12  
**EQUIPMENT** CME-750 w/CFA **ELEVATION** 742± **DATE DRILLED** 10/19/2022

DEPTH (ft)	SAMPLE				DESCRIPTION (UNIFIED SOIL CLASSIFICATION)	GRAPHIC	SEE REMARK NO.	LABORATORY TEST RESULTS						ELEVATION (ft)
	NUMBER	TYPE	RECOVERY (in/in)	BLOWS (per 6 in)				MOISTURE CONTENT (%)	DRY DENSITY (pcf)	HAND PENETROMETER (ksf)	UNCONFINED COMPRESSIVE STRENGTH (ksf)	LIQUID LIMIT	PLASTICITY INDEX	
3	1	SS	12/18	8	FAT CLAY (CH): Reddish-brown, some fine to coarse gravel			45	5.0				741	
				5										6
6	2	SS	15/18	4	Trace fine to coarse gravel			49	4.5	94	53		738	
				5										7
6					WEATHERED DOLOMITE									
6					Auger refusal at 6 feet on dolomite.								735	
9													732	
12													729	
15													726	
18													723	

<b>WATER LEVEL:</b> _____ X NONE OBSERVED WHILE DRILLING _____ ft WHILE DRILLING _____ ft _____ HRS AFTER DRILLING _____ ft _____ DAYS AFTER DRILLING	<b>REMARKS:</b>   
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# BORING LOG

**PROJECT** Echo Bluff State Park Additional Cabins **BORING NUMBER** B-305  
**LOCATION** Shannon County, Missouri **SHEET** 1 of 1  
**DRILLER** Midwest Drilling, Inc. **HAMMER** Automatic **PROJECT NO.** 2014-7007.12  
**EQUIPMENT** CME-750 w/CFA **ELEVATION** 744± **DATE DRILLED** 10/19/2022

DEPTH (ft)	SAMPLE				DESCRIPTION (UNIFIED SOIL CLASSIFICATION)	GRAPHIC	SEE REMARK NO.	LABORATORY TEST RESULTS						ELEVATION (ft)
	NUMBER	TYPE	RECOVERY (in/in)	BLOWS (per 6 in)				MOISTURE CONTENT (%)	DRY DENSITY (pcf)	HAND PENETROMETER (ksf)	UNCONFINED COMPRESSIVE STRENGTH (ksf)	LIQUID LIMIT	PLASTICITY INDEX	
3	1	SS	10/18	4	FAT CLAY (CH): Reddish-brown, trace fine to coarse gravel Some organics			33	4.5				741	
				5										
				6	Some fine to coarse gravel			31	6.0				738	
2	SS	6/11	5	50/5"										
6					Auger refusal at 4.5 feet on dolomite.								735	
9													732	
12													729	
15													726	
18														

<b>WATER LEVEL:</b> <input checked="" type="checkbox"/> NONE OBSERVED WHILE DRILLING <input type="checkbox"/> ft WHILE DRILLING <input type="checkbox"/> ft _____ HRS AFTER DRILLING <input type="checkbox"/> ft _____ DAYS AFTER DRILLING	<b>REMARKS:</b>  
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# BORING LOG

**PROJECT** Echo Bluff State Park Additional Cabins **BORING NUMBER** B-306  
**LOCATION** Shannon County, Missouri **SHEET** 1 of 1  
**DRILLER** Midwest Drilling, Inc. **HAMMER** Automatic **PROJECT NO.** 2014-7007.12  
**EQUIPMENT** CME-750 w/CFA **ELEVATION** 751± **DATE DRILLED** 10/19/2022

DEPTH (ft)	SAMPLE				DESCRIPTION (UNIFIED SOIL CLASSIFICATION)	GRAPHIC	SEE REMARK NO.	LABORATORY TEST RESULTS						ELEVATION (ft)
	NUMBER	TYPE	RECOVERY (in/in)	BLOWS (per 6 in)				MOISTURE CONTENT (%)	DRY DENSITY (pcf)	HAND PENETROMETER (ksf)	UNCONFINED COMPRESSIVE STRENGTH (ksf)	LIQUID LIMIT	PLASTICITY INDEX	
3	1	ST	24/24		FAT CLAY (CH): Reddish-brown, some fine to coarse gravel			43	75		2.4	114	73	750
6	2	SS	12/18	3 5 9				47		3.0				747
6	3	SS	12/18	1 12 24	GRAVELLY FAT CLAY (CH): Brown, some fine to coarse-grained sand, gravel is fine to coarse			13		3.5				744
9	4	SS	5/14	16 19 50/2"	WELL GRADED GRAVEL (GW): Brown, with fine- to coarse-grained sand, gravel is fine to coarse			8		-				741
12					WEATHERED DOLOMITE									741
12					Auger refusal at 10 feet on dolomite.									738
15														735
18														732

<b>WATER LEVEL:</b> _____ X NONE OBSERVED WHILE DRILLING _____ ft WHILE DRILLING _____ ft _____ HRS AFTER DRILLING _____ ft _____ DAYS AFTER DRILLING	<b>REMARKS:</b>   
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# Important Information about Your Geotechnical Engineering Report

*Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.*

*While you cannot eliminate all such risks, you can manage them. The following information is provided to help.*

## **Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects**

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply the report for any purpose or project except the one originally contemplated.*

## **Read the Full Report**

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

## **A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors**

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

## **Subsurface Conditions Can Change**

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

## **Most Geotechnical Findings Are Professional Opinions**

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

## **A Report's Recommendations Are *Not* Final**

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

### **A Geotechnical Engineering Report Is Subject to Misinterpretation**

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

### **Do Not Redraw the Engineer's Logs**

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

### **Give Contractors a Complete Report and Guidance**

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time to perform additional study.* Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

### **Read Responsibility Provisions Closely**

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that

have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

### **Geoenvironmental Concerns Are Not Covered**

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

### **Obtain Professional Assistance To Deal with Mold**

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

### **Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance**

Membership in ASFE/THE BEST PEOPLE ON EARTH exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.



8811 Colesville Road/Suite G106, Silver Spring, MD 20910

Telephone: 301/565-2733 Facsimile: 301/589-2017

e-mail: [info@asfe.org](mailto:info@asfe.org) [www.asfe.org](http://www.asfe.org)

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