

# PROJECT MANUAL

*Modify HVAC System*

*Missouri Supreme Court Building*

*Jefferson City, Missouri*

Designed By: Klingner & Associates, P.C.  
907 East Ash Street  
Columbia, MO 65203

Date Issued: December 2, 2022

Project No.: O2010-01

STATE *of* MISSOURI

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OFFICE *of* ADMINISTRATION  
Facilities Management, Design & Construction

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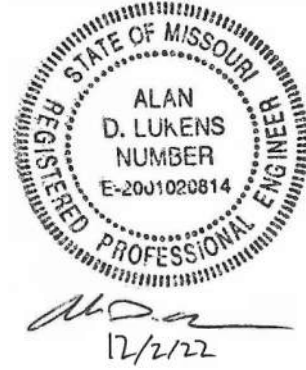
**SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS**

**PROJECT NUMBER: O2010-01**

**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:**



**Michael Friese, Architect**  
**AIA-3333**  
**Project Manual Sections 013591, 017329,**  
**024119, 024296, 057000, 060312, Division 06,**  
**07, and 09**



**Alan Lukens, Engineer**  
**PE-2001020814**  
**Project Manual Section 051200**



**Lance L. Schuette, Engineer**  
**PE-2008008674**  
**Asbestos Project Designer –**  
**7118090320MOPDR16152**  
**Project Manual Sections 022000 and 028213**



**Anthony Diewold, Engineer**  
**PE-2016000028**  
**Project Manual Divisions 23 and 26**

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## SECTION 000115 – LIST OF DRAWINGS

### 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>TITLE</u>	<u>SHEET #</u>	<u>DATE</u>	<u>CAD #</u>
1.	COVER SHEET	G001	12/02/2022	G001
2.	GENERAL NOTES & SHEET INDEX	G002	12/02/2022	G002
3.	LOWER LEVEL – WORK AREA PLAN	G100	12/02/2022	G100
4.	MAIN LEVEL – WORK AREA PLAN	G110	12/02/2022	G110
5.	SECOND LEVEL – WORK AREA PLAN	G120	12/02/2022	G120
6.	THIRD LEVEL – WORK AREA PLAN	G130	12/02/2022	G130
7.	LOWER LEVEL DEMOLITION RCP	AD101	12/02/2022	AD101
8.	MAIN LEVEL DEMOLITION RCP	AD111	12/02/2022	AD111
9.	SECOND LEVEL DEMOLITION RCP	AD121	12/02/2022	AD121
10.	THIRD LEVEL DEMOLITION RCP	AD131	12/02/2022	AD131
11.	LOWER LVL. ASBESTOS ABATEMENT	ASB101	12/02/2022	ASB101
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14.	MAIN LEVEL FLOOR PLAN	A110	12/02/2022	A110
15.	MAIN LEVEL RCP	A112	12/02/2022	A112
16.	SECOND LEVEL RCP	A122	12/02/2022	A122
17.	THIRD LEVEL RCP	A132	12/02/2022	A132
18.	STRUCTURAL NOTES	S001	12/02/2022	S001
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21.	MEP GENERAL NOTES & SYMBOLS	MEP001	12/02/2022	MEP001

22.	MECHANICAL DEMOLITION PLAN	MD101	12/02/2022	MD101
23.	LOWER LEVEL – HVAC PLAN	M101	12/02/2022	M101
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26.	THIRD LEVEL – HVAC PLAN	M104	12/02/2022	M104
27.	MEZZANINE LEVEL – HVAC PLAN	M105	12/02/2022	M105
28.	MECHANICAL DETAILS	M501	12/02/2022	M501
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34.	TEMPERATURE CONTROL DETAILS	M802	12/02/2022	M802
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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. Modify HVAC System  
Missouri Supreme Court Building  
Jefferson City, Missouri  
**Project No.: O2010-01**

### 3.0 BIDS WILL BE RECEIVED:

- A. Until: 1:30 PM, Thursday, April 20, 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 installation of hydronic piping, duct heaters, and dedicated outdoor air unit; building automation system modifications; abatement; and historical finish repairs.
- 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: 10:00 AM, Wednesday, April 5, 2023, at Missouri Supreme Court Building, 207 W. High Street, Jefferson City, 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: Klingner & Associates, P.C., John Neyens, (573) 355-5988, email: [jjn@klingner.com](mailto:jjn@klingner.com)
- B. Project Manager: Glenn Smith, (573) 751-1367, email: [Glenn.Smith@oa.mo.gov](mailto:Glenn.Smith@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 Cathy Holliday at 573-751-3491 or by email: [cathy.holliday@oa.mo.gov](mailto:cathy.holliday@oa.mo.gov).

## 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. In awarding the contract the Owner may take into consideration the bidder's skill, facilities, capacity, experience, responsibility, previous work record, financial standing and the necessity of prompt and efficient completion of work herein described. Inability of any bidder to meet the requirements mentioned above may be cause for rejection of his bid. However, no contract will be awarded to any individual, partnership or corporation, who has had a contract with the State of Missouri declared in default within the preceding twelve months.
- 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 low 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 a 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.

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:**                    **Modify HVAC System  
Missouri Supreme Court Building  
Jefferson City, Missouri**

**Project Number:**            **O2010-01**

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 **280 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: \$

**TOTAL CONTRACT AMOUNT: (\$CONTRACT AMOUNT)**

**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
---------------

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
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**REVIEW AND ACTION**

Resubmit Substitution Request with the following additional information:

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Substitution is accepted.

Substitution is accepted with the following comments:

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Substitution is not accepted.

ARCHITECT/ENGINEER	DATE
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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) \$
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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 EMBOSSEER OR BLACK INK RUBBER STAMP SEAL	STATE	COUNTY (OR CITY OF ST. LOUIS)
	SUBSCRIBED AND SWORN BEFORE ME, THIS	
	DAY OF	YEAR
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES
NOTARY PUBLIC NAME (TYPED OR PRINTED)		<b>USE RUBBER STAMP IN CLEAR AREA BELOW</b>

FILE: Closeout Documents

# GENERAL CONDITIONS

## INDEX

ARTICLE:

**1. General Provisions**

- 1.1. Definitions
- 1.2. Drawings and Specifications
- 1.3. Compliance with Laws, Permits, Regulations and Inspections
- 1.4. Nondiscrimination in Employment
- 1.5. Anti-Kickback
- 1.6. Patents and Royalties
- 1.7. Preference for American and Missouri Products and Services
- 1.8. Communications
- 1.9. Separate Contracts and Cooperation
- 1.10. Assignment of Contract
- 1.11. Indemnification
- 1.12. Disputes and Disagreements

**2. Owner/Designer Responsibilities**

**3. Contractor Responsibilities**

- 3.1. Acceptable Substitutions
- 3.2. Submittals
- 3.3. As-Built Drawings
- 3.4. Guaranty and Warranties
- 3.5. Operation and Maintenance Manuals
- 3.6. Other Contractor Responsibilities
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- 4.1. Changes in the Work
- 4.2. Changes in Completion Time

**5. Construction and Completion**

- 5.1. Construction Commencement
- 5.2. Project Construction
- 5.3. Project Completion
- 5.4. Payments

**6. Bond and Insurance**

6.1. Bond

6.2. Insurance

**7. Termination or Suspension of Contract**

7.1. For Site Conditions

7.2. For Cause

7.3. For Convenience

## 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: John Neyens  
Klingner & Associates, P.C.  
907 East Ash Street  
Columbia, MO 65203  
Telephone: (573) 355-5988  
Email: [jjn@klingner.com](mailto:jjn@klingner.com)
  
- Construction Representative: Robert Rehagen  
Division of Facilities Management, Design and Construction  
709 Missouri Blvd (Upper Level)  
Jefferson City, MO 65109  
Telephone: (573) 522-0002  
Email: [Robert.Rehagen@oa.mo.gov](mailto:Robert.Rehagen@oa.mo.gov)
  
- Project Manager: Glenn Smith  
Division of Facilities Management, Design and Construction  
301 West High Street, Room 730  
Jefferson City, Missouri 65101  
Telephone: (573) 751-1367  
Email: [Glenn.Smith@oa.mo.gov](mailto:Glenn.Smith@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 4 complete sets of drawings and specifications at no charge.
- B. The Owner will furnish the Contractor with approximately 4 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.

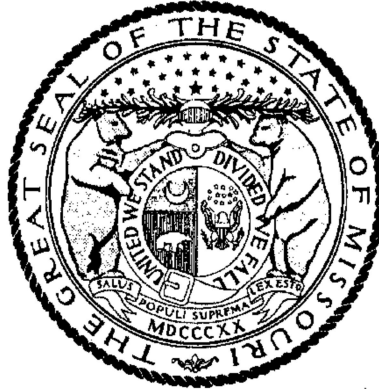
**5.0 SAFETY REQUIREMENTS**

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 026  
**COLE 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	\$53.18
Boilermaker	\$27.22*
Bricklayer	\$51.39
Carpenter	\$47.88
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$41.24
Plasterer	
Communications Technician	\$55.00
Electrician (Inside Wireman)	\$55.64
Electrician Outside Lineman	\$74.20
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$27.22*
Glazier	\$56.16
Ironworker	\$61.89
Laborer	\$41.21
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$27.22*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$60.02
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$39.08
Plumber	\$66.28
Pipe Fitter	
Roofer	\$51.92
Sheet Metal Worker	\$54.06
Sprinkler Fitter	\$62.10
Truck Driver	\$41.74
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  
COLE County

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$53.63
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$74.20
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$43.21
General Laborer	
Skilled Laborer	
Operating Engineer	\$58.94
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$45.80
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 HVAC improvements to the Missouri Supreme Court Building.
  - 1. Project Location: 207 W. High Street, Jefferson City, Missouri 65101.
  - 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 December 2, 2022 were prepared for the Project by Klingner & Associates, P.C, 907 East Ash, Columbia, Missouri.
- C. The Work consists of asbestos abatement, existing steam pipe and mechanical equipment demolition, new hot water and chilled water pipe installation, electrical duct heaters, dedicated outdoor air system installation, building automations system modifications, and historical interior finish repair.
- D. The Work will be constructed under a single prime contract.

#### **1.3 WORK SEQUENCE**

- A. The Work will be conducted in multiple phases in order to minimize disruption to facility operations
  - 1. Work in utility areas which are not typically occupied by building occupants (storage rooms, mechanical spaces, etc) can be completed throughout the duration of the construction process and/or in conjunction with other areas of work as determined by the Contractor. Work in utility areas shall be coordinated with the Owner and shall not interrupt facility operation without written approval from the Owner.
  - 2. Work areas have been identified on the Drawings. All work in a designated work area shall be completed in a continuous manner without interruption between the various trades to fully complete the work (abatement, demolition, proposed work, finishes, etc) in the designated work area prior to initiating work in a subsequent work area.
  - 3. It is not required to follow the numerical sequence of the work area listed in the Drawing. Contractor Construction Schedule shall identify the preferred sequence of the work areas for approval by the Owner.
  - 4. Concurrent work in multiple work areas will be considered by the Owner based on Contractor capacity.
  - 5. Work related to the proposed electric and hot water heating system components shall be completed and made operational prior to the initiation of abatement and demolition of steam heating system components within the building.
  - 6. It is preferred for abatement and work within the Library to occur during June, July, and, August.

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

- A. 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. 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 MISCELLANEOUS PROVISION**

- A. The State of Missouri has an existing contract with Walter Louis Fluid Technologies for water treatment services. The State of Missouri will utilize this existing contract to provide all chemicals needed for startup as well as all future chemicals needed to protect and maintain the equipment. The Contractor shall coordinate with Walter Louis Fluid Technologies to ensure that the water treatment system is compatible with new equipment.

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

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

**END OF SECTION 011000**



## **SECTION 012100 – ALLOWANCES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
  - 1. Facility No-Work Day allowances.
    - 1) Examples of Facility No-Work Days could include: Oral argument dates or other critical days where construction could disturb the fundamental activities occurring in the building
- C. Related Sections include the following:
  - 1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
  - 2. Division 1 Section "Unit Prices" for procedures for using unit prices.

#### **1.3 FACILITY NO-WORK DAY ALLOWANCE**

- A. Included within the completion period for this project are a specified number of “Facility No-Work” days (see Schedule of Allowances).
- B. The Contractor’s progress schedule shall clearly indicate the bad weather day allowance as an “activity” or “activities”. In the event weather conditions preclude performance of critical work activities for 50% or more of the Contractor’s scheduled workday, that day shall be declared unavailable for work due to weather (a “bad weather” day) and charged against the above allowance. Critical work activities will be determined by review of the Contractor’s current progress schedule.
- C. The Contractor’s Representative and the Construction Representative shall agree monthly on the number of “facility no-work” days to be charged against the allowance. This determination will be documented in writing and be signed by the Contractor and the Construction Representatives. If there is a failure to agree on all or part of the “facility no-work” days for a particular month, that disagreement shall be noted on this written document and signed by each party’s representative. Failure of the Contractor’s representative to sign the “facility no-work” day documentation after it is presented, with or without the notes of disagreement, shall constitute agreement with the “facility no-work” day determination contained in that document.
- D. There will be no modification to the time of contract performance due solely to the failure to deplete the “facility no-work” day allowance.
- E. Once this allowance is depleted, a no cost Change Order time extension will be executed for “facility no-work” days, as defined above, encountered during the remainder of the Project.

## 1.4 SOLE SOURCE ALLOWANCE

- A. Included within the Base Bid for this project is a specified amount for Controls Upgrades as noted in the design documents and in the C&C proposal. (See Schedule of Allowances.) The C&C Proposal is included at the end of this specification section. The C&C controls proposal includes but not limited to, the modification of the existing Schneider Electric DDC control system to incorporate the replacement of the fresh air unit, new hydronic coils, and new duct heaters. Various instrumentation and control devices including temperature sensors, control valves, and associated low voltage wiring and conduit will be provided within the allowance as more thoroughly described in the attached proposal.
- B. The Contractor's related costs are not part of this allowance
- C. The Contractors overhead and profit margins are not part of this allowance.

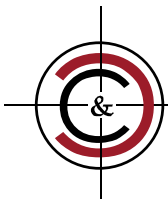
## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 SCHEDULE OF ALLOWANCES

- A. Facility No-Work Allowance: Included within the completion period for this Project (15) fifteen "Facility No-Work" days.
- B. Sole Source Allowance: Include in the Base Bid an allowance of **Two-Hundred Twenty Thousand Nine-Hundred Ten Dollars (\$220,910.00)** to provide Controls Upgrades where shown within the construction documents.

**END OF SECTION 012100**



Project: HVAC System Improvements – Missouri Supreme Court Building  
Location: Jefferson City, MO  
Date: 12/9/22

The enclosed proposal is to expand the existing Schneider Electric DDC control System to incorporate the new HVAC components as shown in the Plans and Specifications. Scope includes a turnkey installation consisting of the associated demolition, material, installation, and checkout as clarified below. At this point in time, we recognize a total of 0 Addendum issued on the project.

## **AHU-A**

- Provide analog control points for electric heaters serving two separate zones served by this AHU.
- Provide discharge air temperature sensor for each zone downstream of new heating coil.
- Provide return air humidity sensor to allow for a space humidity control sequence on this AHU.
- Upgrade AHU controller to accommodate additional control points.
- Provide new Space thermostats for two new duct heaters compatible with new controller.
- Program new sequence of operation per the Mechanical Control drawings.

## **AHU-B**

- Provide analog control points for electric heaters serving two separate zones served by this AHU.
- Provide discharge air temperature sensor for each zone downstream of new heating coil.
- Provide return air humidity sensor to allow for a space humidity control sequence on this AHU.
- Upgrade AHU controller to accommodate additional control points
- Provide new Space thermostats compatible with new controller
- Program new sequence of operation per the Mechanical Control drawings

## **AHU-F**

- Provide analog control points for electric heaters serving three separate zones served by this AHU.
- Provide discharge air temperature sensor for each zone downstream of new heating coil.
- Provide return air humidity sensor to allow for a space humidity control sequence on this AHU.
- Upgrade AHU controller to accommodate additional control points
- Provide new Space thermostats compatible with new controller
- Program new sequence of operation per the Mechanical Control drawings

## **AHU-G**

- Provide new proportional hot water valve and analog control point for new hydronic heating coil.
- Provide discharge air temperature sensor downstream of new heating coil.
- Provide return air humidity sensor to allow for a space humidity control sequence on this AHU.
- Upgrade AHU controller to accommodate additional control points
- Program new sequence of operation per the Mechanical Control drawings

## **AHU-H**

- Provide new proportional hot water valve and analog control point for new hydronic heating coil.
- Provide discharge air temperature sensor downstream of new heating coil.
- Provide return air humidity sensor to allow for a space humidity control sequence on this AHU.
- Upgrade AHU controller to accommodate additional control points
- Program new sequence of operation per the Mechanical Control drawings

#### **AHU-J**

- Provide new proportional hot water valve and analog control point for new hydronic heating coil.
- Provide discharge air temperature sensor downstream of new heating coil.
- Provide return air humidity sensor to allow for a space humidity control sequence on this AHU.
- Upgrade AHU controller to accommodate additional control points
- Program new sequence of operation per the Mechanical Control drawings

#### **AHU-K & L**

- Provide new proportional hot water valve and analog control point for new hydronic heating coil.
- Provide discharge air temperature sensor downstream of new heating coil.
- Upgrade AHU controller to accommodate additional control points
- Provide new Space thermostat compatible with new controller
- Program new sequence of operation per the Mechanical Control drawings

#### **AHU-1 & 2**

- Provide new proportional hot water valve and analog control point for new hydronic heating coil.
- Provide discharge air temperature sensor downstream of new heating coil.
- Provide return air humidity sensor to allow for a space humidity control sequence on this AHU.
- Upgrade AHU controller to accommodate additional control points
- Program new sequence of operation per the Mechanical Control drawings
- Add Start/Stop, Status and damper actuator points for RF-1 at AHU-1 controller and for RF-2 at AHU-2 controller. Actuator provided by C&C Group.

#### **AHU-4**

- Provide new proportional hot water valve and analog control point for new hydronic heating coil.
- Provide discharge air temperature sensor downstream of new heating coil.
- Upgrade AHU controller to accommodate additional control points
- Program new sequence of operation per the Mechanical Control drawings

#### **BC-1**

- Provide new proportional hot water valve and analog control point for new hydronic heating coil.
- Provide discharge air temperature sensor downstream of new heating coil.
- Upgrade AHU controller to accommodate additional control points
- Program new sequence of operation per the Mechanical Control drawings

#### **Existing FAU Being Removed**

- Disconnect existing Communication trunk and remove wiring back to previous controller.
- Verify existing communication trunk is continuous and functional

#### **New FAU**

- Provide and install new DDC Control Panel to meet the point capacity required for the new FAU.
- Provide power and communication to new Control Panel
- Provide control valves for the chilled water coil, Preheat coil, and runaround loop. Valves to be installed by the Mechanical Contractor.
- Provide and install all sensors and actuators as indicated on M801 to meet the Sequence of Operation. Wire all sensors back to the new Control Panel.

### **New Lobby Hydronic Radiator**

- Provide HHW control valve for new lobby radiator. Valve to be installed by the Mechanical Contractor.
- Provide and install wireless sensor in Lobby area for control of new HW valve.
- Wire valve and sensor transceiver back to existing control panel in AHU-C Mechanical Rm.

### **Misc**

- Wire Thermostat for Electric Cove heaters. Thermostat to be provided by Heater mfg.
- Provide new 1/3- 2/3 steam valves for Hot Water Heat Exchanger. Valves to be installed by Mechanical Contractor.
- Wire new HX valves to existing HX Control Panel
- Demolition of existing controls for Steam radiators is not part of this Scope. Existing radiator controls to be demolished by Mechanical Contractor.
- Upgraded controllers will be tied to a new Bacnet Ip communication trunk. Existing LON communication trunk will remain active for all equipment not impacted under this project. All components will be tied to the same front end graphical user interface throughout the entirety of the project.

Installed Price for Control Scope **\$220,910**

Thank you for the opportunity to submit this proposal. If you have any questions concerning this proposal, or if I may be of any further assistance, please don't hesitate to contact me at 573-632-4247 or [BSchepers@C-CGROUP.COM](mailto:BSchepers@C-CGROUP.COM).

Sincerely,

*Brian Schepers*  
C&C Group

## **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 012100 "Allowances" for procedural requirements for handling and processing Allowances.
  - 2. Division 1, Section 013115 "Project Management Communications" for administrative requirements for communications.
  - 3. Division 0, Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
  - 4. 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® 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® as provided by "e-Builder®" 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® 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® 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 – SCHEDULES – BAR CHART**

### **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 a Bar Chart Schedule for the project construction activities, schedule of submittals, and schedule for testing.

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

### **PART 3 - EXECUTION**

#### **3.1 SUBMITTAL PROCEDURES**

- A. The Contractor shall submit to the Designer, within ten (10) working days following the Notice to Proceed, a Progress Schedule including Schedule of Values showing the rate of progress the Contractor agrees to maintain and the order in which he proposed to carry out the various phases of Work. No payments shall be made to the Contractor until the Progress Schedule has been approved by the Owner.
  - 1. The Schedule of Values must have the following line items included with the value of the item as indicated below:
    - a. O&M's (Owner's Manual)
      - 1) \$1,000,000.00 (One million) and under – 2% of the total contract amount
      - 2) Over \$1,000,000.00 (One million) – 1% of the total contract amount
    - b. Close Out Documents
      - 1) \$1,000,000.00 (One million) and under – 2% of the total contract amount
      - 2) Over \$1,000,000.00 (One million) – 1% of the total contract amount
    - c. General Conditions
      - 1) No more than 10%
- B. The Contractor shall submit an updated Schedule for presentation at each Monthly Progress Meeting. The Schedule shall be updated by the Contractor as necessary to reflect the current Schedule and its relationship to the original Schedule. The updated Schedule shall reflect any changes in the logic, sequence, durations, or completion date. Payments to the Contractor shall be suspended if the Progress Schedule is not adequately updated to reflect actual conditions.

- C. The Contractor shall submit Progress Schedules to Subcontractors to permit coordinating their Progress Schedules to the general construction Work. The Contractor shall coordinate preparation and processing of Schedules and reports with performance of other construction activities.

### 3.2 CONSTRUCTION PROGRESS SCHEDULE – BAR CHART SCHEDULE

- A. Bar-Chart Schedule: The Contractor shall prepare a comprehensive, fully developed, horizontal bar chart-type Contractor’s Construction Schedule. The Contractor for general construction shall prepare the Construction Schedule for the entire Project. The Schedule shall show the percentage of work to be completed at any time, anticipated monthly payments by Owner, as well as significant dates (such as completion of excavation, concrete foundation work, underground lines, superstructure, rough-ins, enclosure, hanging of fixtures, etc.) which shall serve as check points to determine compliance with the approved Schedule. The Schedule shall also include an activity for the number of “bad” weather days specified in Section 012100 – Allowances.
  - 1. The Contractor shall provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.
    - a. If practical, use the same Schedule of Values breakdown for schedule time bars.
  - 2. The Contractor shall provide a base activity time bar showing duration for each construction activity. Each bar is to indicate start and completion dates for the activity. The Contractor is to place a contrasting bar below each original schedule activity time for indicating actual progress and planned remaining duration for the activity.
  - 3. The Contractor shall prepare the Schedule on a minimal number of separate sheets to readily show the data for the entire construction period.
  - 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on schedule with other construction activities. Include minor elements involved in the overall sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
  - 5. Coordinate the Contractor’s Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other required schedules and reports.
  - 6. Indicate the Intent to Award and the Contract Substantial Completion dates on the schedule.
- B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by the following:
  - 1. Requirement for Phased completion
  - 2. Work by separate Contractors
  - 3. Work by the Owner
  - 4. Pre-purchased materials
  - 5. Coordination with existing construction
  - 6. Limitations of continued occupancies



7. Un-interruptible services
  8. Partial Occupancy prior to Substantial Completion
  9. Site restrictions
  10. Provisions for future construction
  11. Seasonal variations
  12. Environmental control
- C. Work Stages: Use crosshatched bars to indicate important stages of construction for each major portion of the Work. Such stages include, but are not necessarily limited to, the following:
1. Subcontract awards
  2. Submittals
  3. Purchases
  4. Mockups
  5. Fabrication
  6. Sample testing
  7. Deliveries
  8. Installation
  9. Testing
  10. Adjusting
  11. Curing
  12. Startup and placement into final use and operation
- D. Area Separations: Provide a separate time bar to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a “major area” is a story of construction, a separate building, or a similar significant construction element.
1. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    - a. Structural completion.
    - b. Permanent space enclosure
    - c. Completion of mechanical installation
    - d. Completion of the electrical portion of the Work
    - e. Substantial Completion

### **3.3 SCHEDULE OF SUBMITTALS**

- A. Upon acceptance of the 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.
- B. 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
- C. 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.
- D. 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.

### **3.4 SCHEDULE OF INSPECTIONS AND TESTS**

- A. Prepare a schedule of inspections, tests, and similar services required by the Contract Documents. Submit the schedule with (15) days of the date established for commencement of the Contract Work. The Contractor is to notify the testing agency at least (5) working days in advance of the required tests unless otherwise specified.
- B. Form: This 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, Architect, and each party involved in performance of portions of the Work where inspections and tests are required.

**END OF SECTION 013200**

## **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.

SPEC SECTION	TITLE	CATEGORY
013100	Coordination	Certification
013100	Coordination	Shop Drawings
013200	Schedules	Construction Schedule
013200	Schedules	Schedule of Values
013513	Site Security and Health Requirements	Product Data
013513	Site Security and Health Requirements	Certification
013513	Site Security and Health Requirements	Construction Schedule
013591	Historic Treatment Procedures	Shop Drawings
024119	Selective Structure Demolition	Shop Drawings
024119	Selective Structure Demolition	Shop Drawings
024119	Selective Structure Demolition	Certification
024296	Historic Removal and Dismantling	Shop Drawings
028213	Asbestos Abatement	Certification
028213	Asbestos Abatement	Test Report
057000	Decorative Metal	Product Data
057000	Decorative Metal	Shop Drawings
057000	Decorative Metal	Sample
060312	Historic Wood Repair	Product Data
060312	Historic Wood Repair	Shop Drawings
060312	Historic Wood Repair	Sample
060312	Historic Wood Repair	Test Report
079200	Joint Sealants	Product Data
090190	Maintenance of Painting and Coating	Product Data
090320	Historic Treatment of Plaster	Product Data
090320	Historic Treatment of Plaster	Test Report
090391	Historic Treatment of Plain Painting	Product Data

090391	Historic Treatment of Plain Painting	Sample
090391	Historic Treatment of Plain Painting	Test Report
090391	Historic Treatment of Plain Painting	Test Report
092116	Gypsum Board Assemblies	Product Data
092226.23	Metal Suspension Systems	Product Data
092226.23	Metal Suspension Systems	Shop Drawings
230519	Meters and Gages for HVAC Piping	Product Data
230519	Meters and Gages for HVAC Piping	Operation / Maintenance Manual
230523	General Duty Valves for HVAC Piping	Product Data
230529	Hangers and Supports for HVAC Piping and Equipment	Product Data
230529	Hangers and Supports for HVAC Piping and Equipment	Shop Drawings
230529	Hangers and Supports for HVAC Piping and Equipment	Certification
230548	Vibration Controls for HVAC Piping and Equipment	Product Data
230553	Identification for HVAC Piping and Equipment	Product Data
230593	Testing, Adjusting, and Balancing for HVAC	Test Report
230593	Testing, Adjusting, and Balancing for HVAC	Certification
230700	HVAC Insulation	Product Data
232113	Hydronic Piping	Product Data
232113	Hydronic Piping	Shop Drawings
232113	Hydronic Piping	Test Report
232113	Hydronic Piping	Operation / Maintenance Manual
232213	Steam and Condensate Heating Piping	Product Data
232213	Steam and Condensate Heating Piping	Test Report
232213	Steam and Condensate Heating Piping	Operation / Maintenance Manual
233113	Metal Ducts	Shop Drawings
233300	Air Duct Accessories	Product Data
233300	Air Duct Accessories	Operation / Maintenance Manual
233423	HVAC Power Ventilators	Product Data
233423	HVAC Power Ventilators	Operation / Maintenance Manual
233713	Diffusers, Registers, and Grilles	Product Data
237300	Indoor Central-Station Air-Handling Units	Shop Drawings
237300	Indoor Central-Station Air-Handling Units	Product Data
238216	Air Coils	Product Data
238216	Air Coils	Operation / Maintenance Manual
238323	Radiant Heating Electric Panels	Product Data
238323	Radiant Heating Electric Panels	Operation / Maintenance Manual
239100	Louvered Penthouses	Product Data
260526	Grounding and Bonding for Electrical Devices	Product Data



260526	Grounding and Bonding for Electrical Devices	Test Report
260533	Raceways and Boxes for Electrical Systems	Product Data
262416	Panelboards	Product Data
262416	Panelboards	Shop Drawings
262726	Wiring Devices	Product Data
262816	Enclosed Switches and Circuit Breakers	Product Data

**END OF SECTION 013300**

## **SECTION 013513.28 – SITE SECURITY AND HEALTH REQUIREMENTS**

### **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 SECURITY CLEARANCES AND RESTRICTIONS**

#### **A. FMDC REQUIRED FINGERPRINTING FOR CRIMINAL BACKGROUND AND WARRANTS CHECK**

- 1. All employees of the Contractor are required to submit fingerprints to the Missouri State Highway Patrol to enable the Office of Administration, Division of Facilities Management, Design and Construction (FMDC) to receive state and national criminal background checks on such employees. FMDC reserves the right to prohibit any employee of the Contractor from performing work in or on the premises of any facility owned, operated, or utilized by the State of Missouri for any reason.
- 2. The Contractor shall ensure all of its employees submit fingerprints to the Missouri State Highway Patrol and pay for the cost of such background checks. The Contractor shall submit to FMDC via email to [FMDCSecurity@oa.mo.gov](mailto:FMDCSecurity@oa.mo.gov) a list of the names of the Contractor's employees who will be fingerprinted and a signed Missouri Applicant Fingerprint Privacy Notice, Applicant Privacy Rights and Privacy Act Statement for each employee. All employees of the Contractor approved by FMDC to work at a State facility must obtain a contractor ID badge from FMDC prior to beginning work on-site, unless the Director of FMDC, at the Director's discretion, waives the requirement for a contractor ID badge. The

Contractor and its employees must comply with the process for background checks and <https://oa.mo.gov/fmdc-contractor-id-badges>.

3. Pursuant to section 43.540, RSMo, FMDC participates in the Missouri Rap Back and National Rap Back programs as of August 28, 2018. This means that the Missouri State Highway Patrol, Central Records Repository, and the Federal Bureau of Investigation will retain the fingerprints submitted by each of the Contractor's employees, and those fingerprints will be searched against other fingerprints on file, including latent fingerprints. While retained, an employee's fingerprints may continue to be compared against other fingerprints submitted or retained by the Federal Bureau of Investigation, including latent fingerprints.
4. As part of the Missouri and National Rap Back programs, FMDC will receive notification if a new arrest is reported for an employee whose fingerprints have been submitted for FMDC after August 28, 2018. If the employee is performing work on a State contract at the time of the arrest notification, FMDC will request and receive the employee's updated criminal history records. If the employee is no longer performing work on a State contract, FMDC will not obtain updated criminal records.
5. Pursuant to section 43.540, RSMo, the Missouri State Highway Patrol will provide the results of the employee's background check directly to FMDC. FMDC may NOT release the results of a background check to the Contractor or provide the Contractor any information obtained from a background check, either verbally or in writing. FMDC will notify the Contractor only whether an employee is approved to work on State property.
6. Each employee who submits fingerprints to the Missouri State Highway Patrol has a right to obtain a copy of the results of his or her background check. The employee may challenge the accuracy and completeness of the information contained in a background check report and obtain a determination from the Missouri State Highway Patrol and/or the FBI regarding the validity of such challenge prior to FMDC making a final decision about his or her eligibility to perform work under a State contract.
7. The Contractor shall notify FMDC via email to [FMDCSecurity@oa.mo.gov](mailto:FMDCSecurity@oa.mo.gov) if an employee is terminated or resigns from employment with the Contractor. If the Contractor does not anticipate performing work on a State contract in the future, the Contractor may request that FMDC remove its employees from the Rap Back programs. However, if removed from the Rap Back programs, employees will be required to submit new fingerprints should the contractor be awarded another State contract.
8. Upon award of a Contract, the Contractor should contact FMDC at [FMDCSecurity@oa.mo.gov](mailto:FMDCSecurity@oa.mo.gov) to determine if its employees need to provide a new background check. If a Contractor's employee has previously submitted a fingerprint background check to FMDC as part of the Missouri and National Rap Back programs, the employee may not need to submit another fingerprint search for a period of three to six years, depending upon the circumstances. The Contractor understands and agrees that FMDC may require more frequent background checks without providing any explanation to the Contractor. The fact that an additional background check is requested by FMDC does not indicate that the employee has a criminal record.

### **3.4 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 013513.28**

## **SECTION 013591 - HISTORIC TREATMENT PROCEDURES**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes general protection and treatment procedures for the Project.

#### **1.2 DEFINITIONS**

- A. Consolidate: To strengthen loose or deteriorated materials in place.
- B. Dismantle: To disassemble or detach a historic item from a surface, or a nonhistoric item from a historic surface, using gentle methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- C. Historic: Spaces, areas, rooms, surfaces, materials, finishes, and overall appearance that are important to the successful preservation of the building.
- D. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Designer.
- E. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
- F. Remove: To take down or detach a non-historic item located within a historic space, area, or room, using methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- G. Repair: To correct damage and defects, retaining existing materials, features, and finishes while employing as little new material as possible. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
- H. Replace: To remove and reinstall entire item with new material.
- I. Restore: To consolidate, replicate, reproduce, repair, and refinish as required to achieve the indicated results.
- J. Retain: To keep existing items that are not to be removed or dismantled.
- K. Reversible: New construction work, treatments, or processes that can be removed or undone in the future without damaging historic materials unless otherwise indicated.
- L. Salvage: To protect removed or dismantled items and deliver them to Owner.
- M. Stabilize: To provide structural reinforcement of unsafe or deteriorated items while maintaining the essential form as it exists at present; also, to reestablish a weather-resistant enclosure.

### **1.3 COORDINATION**

- A. Schedule construction operations in sequence required to obtain best historic treatment results.
- B. Coordinate sequence of historic treatment work activities to accommodate the following:
  - 1. Owner's continuing occupancy of portions of existing building.
  - 2. Other known work in progress.

### **1.4 MATERIALS OWNERSHIP**

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.
  - 1. Carefully dismantle and salvage each item or object and protect it from damage, then promptly deliver it to Owner where directed.
  - 2. Coordinate with Owner's representative, who will establish special procedures for dismantling and salvaging.

### **1.5 INFORMATIONAL SUBMITTALS**

- A. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by Contractor's historic treatment operations.

### **1.6 QUALITY ASSURANCE**

- A. All work is to comply with the Secretary of the Interior's Standards for Rehabilitation and all relevant National Park Service Preservation Briefs.

### **1.7 STORAGE AND HANDLING OF HISTORIC MATERIALS**

- A. Existing Historic Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Designer, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after historic treatment and construction work in the vicinity is complete.

### **1.8 FIELD CONDITIONS**

- A. Size Limitations in Historic Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.

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

## **PART 3 EXECUTION**

### **3.1 PROTECTION, GENERAL**

- A. Protect persons and surrounding surfaces of building from harm resulting from historic treatment procedures.
  - 1. Use only proven protection methods, appropriate to each area and surface being protected.
  - 2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where historic treatment work is being performed.
  - 3. Erect temporary barriers to form and maintain fire-egress routes if required.
  - 4. Contain dust and debris generated by historic treatment work, and prevent it from reaching the public or adjacent surfaces.
  - 5. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
- B. Temporary Protection of Historic Materials:
  - 1. Protect existing historic materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
  - 2. Do not attach temporary protection to historic surfaces except as indicated as part of the historic treatment program and approved by Designer.
- C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials and components.
- D. Utility and Communications Services:
  - 1. Notify Owner, Designer, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by historic treatment work before commencing operations.
  - 2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for historic treatment work.
  - 3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

### **3.2 PROTECTION FROM FIRE**

- A. General: Follow fire-prevention plan and the following:
  - 1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled "Owner's Responsibility for Fire Protection."
  - 2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
  - 3. Prohibit smoking by all persons within Project work and staging areas.



4. Provide fire extinguishers for area cut off from existing fire extinguishers by temporary protection.

### **3.3 GENERAL HISTORIC TREATMENT**

- A. Have historic treatment work performed only by qualified historic treatment specialists.
- B. Ensure that supervisory personnel are present when historic treatment work begins and during its progress.
- C. Perform surveys of Project Site as the Work progresses to detect hazards resulting from historic treatment procedures.
- D. Follow the procedures in subparagraphs below unless otherwise indicated:
  1. Retain as much existing material as possible; repair and consolidate rather than replace.
  2. Use additional material or structure to reinforce, strengthen, prop, tie, and support existing material or structure.
  3. Use reversible processes wherever possible.
- E. Notify Designer of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
  1. Do not proceed with the work in question until directed by Designer.

**END OF SECTION 013591**

## **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. Ventilation
  - 4. Sanitary facilities, including drinking water
- C. Support facilities include, but are not limited to, the following:
  - 1. Field offices and storage sheds
  - 2. Temporary enclosures
  - 3. Temporary project identification signs and bulletin boards
  - 4. Waste disposal services
  - 5. 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. Environmental protection
  - 4. Existing surface protection

#### **1.3 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.

#### **1.4 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 signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.
  2. 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. 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.
- A. 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.
- B. Temporary Electric Power Service: The Owner will provide electric power for construction lighting and power tools. Contractors using such services shall pay all costs of temporary services, circuits, outlet, extensions, etc.
- C. Temporary Toilets: Use of the Owner's existing toilet facilities will be permitted, so long as facilities are cleaned and maintained in a condition acceptable to the Owner. All construction personnel will be allowed access only to those specific facilities designed by the Construction Representative. At substantial completion, restore these facilities to the condition prevalent at the time of initial use.
- D. Wash Facilities: The Owner will provide wash facilities within the building. All construction personnel will be allowed access only to those specific facilities designated by the Construction Representative.

### **3.2 SUPPORT FACILITIES INSTALLATION**

- A. Storage Facilities: The Owner will provide storage onsite as designated by the Facility Representative or the Construction Representative. Areas for use by the Contractor for storage will be identified at the Pre-Construction Meeting.
- B. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.
- C. 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. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- D. 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.
- E. Existing Furniture, Fixtures, and Equipment: Contractor is responsible for moving, storing, and reinstalling existing furniture, fixtures, and equipment (FF&E) as required to facilitate the work described in the Project Documents with the exception of wall-hung portraits and artwork. Removal, storage, and reinstallation of wall hung portraits and other artwork shall be the responsibility of the Owner.

### **3.3 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. 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.
- F. 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.
- G. Existing Surface Protection: Provide temporary wall, floor, ceiling, roof and other surface protection to prevent damage to existing surfaces during construction. Temporary surface protection materials and methods shall be selected based on the substrate surface protected and the construction activities performed. Contractor shall be responsible for the repair of any surfaces damaged during construction to their pre-project condition.

### **3.4 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. 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 017329 - CUTTING AND PATCHING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes procedural requirements for cutting and patching.

#### **1.2 QUALITY ASSURANCE**

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Owner's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

#### **1.3 WARRANTY**

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

### **PART 2 PRODUCTS**

#### **2.1 MATERIALS**

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.



## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

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

### **3.2 PREPARATION**

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

### **3.3 PERFORMANCE**

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
    - a. Historically Significant Finished Surfaces: Exercise caution and take action as required to prevent damage to historically significant surfaces. Use the least intrusive and least impactful method possible.

3. Concrete/Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  5. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
- E. Hazardous Materials: If suspected hazardous materials are encountered, stop work immediately and notify Owner.

**END OF SECTION 017329**

## **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 once 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. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.
- D. 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 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. Preinstruction 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 022000 - EXISTING CONDITIONS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This section describes existing conditions at the site as they relate to asbestos containing building materials and use of data resulting from those investigations.

#### **1.2 ASBESTOS INSPECTION REPORT**

- A. General:
  - 1. An Asbestos Inspection Report has been prepared for the building by the engineer/architect selected by the Owner.
- B. Use of Data:
  - 1. Information on the asbestos containing building materials previously identified at the site contained in the *Asbestos Inspection Report*, has been provided for bidder's information and shall not be construed as a guarantee of the conditions.
  - 2. The Contractor should visit the site and shall be responsible for determining to his/her satisfaction, prior to bidding, the actual site conditions.
  - 3. A copy of the Asbestos Inspection Report, prepared by Klingner & Associates, P.C., is attached at the end of the specifications, solely for the Contractor's information.
  - 4. Asbestos containing building materials exist within the structure. The Contractor shall be responsible for reviewing the report and either avoid disturbing the identified asbestos containing building materials or properly abate in accordance with all applicable regulations and replace with in-kind materials to facilitate proper construction.

**END OF SECTION 022000**

# Asbestos Inspection Report

Missouri Supreme Court Building  
207 West High Street  
Jefferson City, MO

March 22, 2022



*Prepared for:*

## MISSOURI SUPREME COURT BUILDING

207 W High St  
Jefferson City, Missouri

*Prepared by:*

## KLINGNER & ASSOCIATES, P.C.

907 E. Ash St.  
Columbia, Missouri 65201

Project No. 19-5034

Quincy, IL 217-223-3670	Galesburg, IL 309-343-1268	Pella, IA 515-612-7402	Burlington, IA 319-752-3603	Davenport, IA 563-359-1348	Hannibal, MO 573-221-0020	Columbia, MO 573-355-5988
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## TABLE OF CONTENTS

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1.0	INTRODUCTION.....	3
2.0	SITE DESCRIPTION.....	3
3.0	ASBESTOS INSPECTION.....	3
3.1	Introduction.....	3
3.2	Regulations.....	3
3.3	Inspection Results.....	4
3.4	Recommendations.....	5
4.0	CERTIFICATION.....	6

### EXHIBITS:

EXHIBIT A – ASBESTOS SAMPLE RESULTS SUMMARY

EXHIBIT B – PHOTOGRAPHS

EXHIBIT C – SAMPLE LOCATION MAP

EXHIBIT D – LABORATORY REPORT

EXHIBIT E – ASBESTOS LOCATION MAP

EXHIBIT F – THERMAL SYSTEM INSULATION APPROXIMATE QUANTITIES

EXHIBIT G – MISSOURI ASBESTOS INSPECTOR LICENSE

## 1.0 INTRODUCTION

---

The asbestos inspection was requested due to two upcoming projects at the courthouse: an HVAC upgrade and a fire system upgrade. The purpose of the inspection was to examine previous inspections, from 1999 and 2003, determine what materials will potentially be disturbed, and sample what previously was not sampled or not adequately sampled. Also, to quantify remaining asbestos containing TSI above basement ceiling.

## 2.0 SITE DESCRIPTION

---

Property Address: 207 West High Street, Jefferson City, Missouri.

The structure was built in 1907. It is a three-story brick building with a stone and concrete foundation. Most of the original building materials are still in place.

The inspection included sampling visible suspect asbestos containing building materials located on the interior of the structure.

## 3.0 ASBESTOS INSPECTION

---

### 3.1 Introduction

Asbestos is a naturally occurring mineral. There are essentially 6 types of asbestos minerals, only 3 of which were used commercially. These are: 1) Chrysotile - the most commonly used type of asbestos and accounts for approximately 95% of the asbestos found in buildings in the United States, 2) Amosite - the second most likely type to be found in buildings, and 3) Crocidolite - was used in high temperature insulation applications.

All materials containing greater than 1% asbestos are considered to be ACM (asbestos containing material) in the State of Missouri by the Missouri Department of Natural Resources and the Occupational Safety and Health Administration (OSHA).

### 3.2 Regulations

The primary federal regulations include:

- ASHARA (Asbestos School Hazard Abatement Reauthorization Act), which applies to both public and commercial buildings;
- OSHA - 29 CFR 1926.1101(Occupational Safety and Health Administration's), which applies to employees of employers in the workforce;
- NESHAP - 40 CFR 61(National Emission Standards for Hazardous Air Pollutants), which applies to exposure or potential exposure to the general public (NESHAP includes public, commercial, and some residential buildings being demolished or renovated).

Certain types of asbestos are regulated differently under NESHAP regulations. Specifically, regulated ACM is: 1) friable ACM; 2) Category I nonfriable ACM that is in poor condition or has become friable; 3) Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting or abrading, or 4) Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder in the course of demolition or renovation operations. Category I nonfriable ACM consists of any asbestos-containing packing, gasket, resilient floor covering, or asphalt roofing product that contains more than 1 percent asbestos as determined using Polarized Light Microscopy (PLM) analysis. Category II nonfriable ACM consists of any material except for Category I nonfriable ACM that contains more than one percent asbestos as determined using PLM and that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

### 3.3 Inspection Results

Michelle M. Beck, Licensed Asbestos Inspector – Missouri license number 7118011422MOIR12300 (see Exhibit G – Missouri Asbestos Inspector License) of Klingner & Associates, P.C. performed an asbestos inspection on the structure located at 207 West High Street, Jefferson City, Missouri on March 4 and 10, 2022. The inspection included a visual assessment for possible asbestos containing building materials (ACBM) in the structure that may be disturbed as part of two system upgrade projects. Also, previous inspections conducted on the building were utilized. One from 1999 by a company called PSI, and another conducted in 2009 by Tt for a flooring upgrade in the Attorney General's portion of the courthouse. Demolition to access suspect materials behind walls, above fixed ceilings, or in chase ways was not conducted. Samples were collected from observed suspect materials that would be affected by the proposed work. Samples were shipped under chain of custody to EMSL Analytical, Inc. in Chicago, Illinois. EPA Method 600/R-93/116 for Polarized Light Microscopy (PLM) was used to determine the presence or absence of asbestos and the percentage content in each sample collected. Documentation of the inspection is included in the Exhibits as follows:

- Exhibit A – Asbestos Sample Results Summary: A summary of the sampling results.
- Exhibit B – Photographs: Photographs of the material sampled.
- Exhibit C – Sample Location Map
- Exhibit D – Laboratory Report
- Exhibit E – Asbestos Location Map



- Exhibit F – Thermal System Insulation Approximate Quantities
- Exhibit G – Missouri Asbestos Inspector License

During the inspection, seventeen (17) homogeneous areas were identified on 3/4/22 and fifty-five (55) samples were collected; and two (2) more homogeneous areas were identified on 3/10/22 and six (6) samples were collected. Seven (7) plaster samples were taken due to the square footage of the surfacing material. Three samples were collected from drywall, drywall mud and tape, ceiling tile, firebrick, grout, floor tile and mastic, and insulation wrap. Analytical results indicated two (2) homogeneous area contained greater than 1% asbestos. A summary of the identified asbestos containing materials is included in the table below and in Exhibit A. Photographs of the materials are included as Exhibit B. Maps showing the location of the asbestos containing materials are included in Exhibit E.

**TABLE 1 – ASBESTOS CONTAINING BUILDING MATERIALS**

Sample ID	Location	Percent & Type	Sample Description	Category I, Category II, or Friable	Condition (Good, Fair, or Poor)	Quantity
C-1, C-2	3 <sup>rd</sup> Floor; Vertical Wall Chases	2% Chrysotile	Drywall Mud	Friable	Good	unknown
A-1, 2, 3 Mastic	Basement, Under Floor Tile Around Shower to be Removed	4% Chrysotile	Mastic	Category II	Good	~35 SF
Prev Insp. 1	Basement	20% Chrysotile	TSI; Pipe Insulation	Friable	Good	~585 LF <sup>1</sup>
Prev. Insp. 4	Basement	20% Chrysotile	TSI; Mud Joint Packing	Friable	Good	~87 <sup>1</sup>
Prev Insp 39,40,41	Basement (Found in Room B-12 & Possibly B-13)	<1% Chrysotile	Ceiling Tile Glue	Category II	Good	~12 SF

Notes: <sup>1</sup> See Exhibit F for quantities observed

### 3.4 Recommendations

The chases located on the third floor include asbestos containing drywall mud and are proposed to be removed as part of the HVAC project. The drywall mud should be properly removed by an asbestos abatement contractor. According to maintenance personnel, the 3<sup>rd</sup> floor chases and soffits in various rooms were put in at the same time as the current HVAC system. If proposed work is located on the soffits on the 3<sup>rd</sup> floor, care should be taken to not disturb the drywall mud

during the HVAC or fire alarm upgrade projects. If the drywall mud is going to be disturbed, the drywall mud should be properly removed by an asbestos abatement contractor.

Any additional drywall mud located on the first, second, and third floor should be assumed to contain asbestos.

The floor tile mastic located in the basement under the floor tile around the shower appears to be a remnant from previous tile and is covered with yellow mastic and floor tile. It may or may not be exposed due to the removal of the shower. Care should be taken to not disturb the floor tile mastic around the shower during removal.

The 1999 inspection performed by others indicates ceiling mastic "pucks" as ACM; however, lab results from that inspection indicate this material contains less than <1% asbestos. If this material is going to be disturbed, it is recommended the material be resampled and a point count analysis be performed.

The thermal system insulation (TSI) (pipe insulation & mud joint packing) in the basement is currently proposed to be abated as part of these projects. Exhibit E shows the general location of observed asbestos containing TSI in the basement. The approximate quantities of TSI are included in F.

## 4.0 CERTIFICATION

---

I, Michelle M Beck, certify that this asbestos inspection was performed in compliance with Missouri Rules and Regulations and the National Emission Standards for Hazardous Air Pollutants for asbestos. In general, three (3) samples were collected from each identified suspect asbestos containing building material (unless specifically excluded as described in Section 3.3 – Inspection Results).



Michelle M Beck  
Missouri Asbestos Inspector License # 7118011422MOIR12300

March 22, 2022

Date

# EXHIBIT A

---

## ASBESTOS SAMPLE RESULTS SUMMARY

## ASBESTOS SAMPLE RESULTS SUMMARY

Missouri Supreme Court House  
207 West High St  
Jefferson City, MO

Inspection Date: 4-Mar-22

Klingner & Associates, P.C. Project Number 19-5034

Sample ID	Location	ASBESTOS		Sample Description	Category I, Category II, or Friable	Condition (Good, Fair, or Poor)	Quantity
		Percent	Type				
A-1	northeast chimney	ND		Fire Brick	NA	GOOD	NA
A-2	northeast chimney	ND					
A-3	northwest chimney	ND					
B-1	northeast chimney	ND		Grout for Fire Brick	NA	GOOD	NA
B-2	northeast chimney	ND					
B-3	northwest chimney	ND					
C-1	CORR 3-356	2%	Chrysotile	Drywall Mud & tape	Category II	GOOD	Unknown
C-2	CORR 3-306	2%	Chrysotile	Drywall Mud & tape	Category II	GOOD	
C-3	1-115B	ND		Drywall Mud & tape	Category II	GOOD	
C-4	BASMT B-11	ND		Basement - Drywall mud & tape	NA	GOOD	NA
C-5	BASMT B-12	ND					
C-6	BASMT B-02	ND					
D-1	CORR 3-356	ND		Sheetrock	NA	GOOD	NA
D-2	CORR 3-306	ND					
D-3	1-115B	ND					
D-4	BASMT B-11	ND		Basement - Sheetrock	NA	GOOD	NA
D-5	BASMT B-12	ND					
D-6	BASMT B-02	ND					
E-1	CORR 1-132	ND		Ceiling Tile - 2x2; 4-square pattern (trimmed edges)	NA	GOOD	NA
E-2	1-105	ND					
E-3	CORR 1-132	ND					
F-1	SAMPLED FROM	ND		Ceiling Tile - 2x2; narrow line pattern (trimmed edges)	NA	GOOD	NA
F-2	VARIOUS BOXES OF	ND					
F-3	EXTRA TILE IN STOR.	ND					
G-1	SAMPLED FROM	ND		Ceiling Tile - 2x2; one large square pattern (trimmed edges)	NA	GOOD	NA
G-2	VARIOUS BOXES OF	ND					
G-3	EXTRA TILE IN STOR.	ND					
H-1	SAMPLED FROM	ND		Ceiling Tile - 2x2; small fissures and drill holes (trimmed edges)	NA	GOOD	NA
H-2	VARIOUS BOXES OF	ND					
H-3	EXTRA TILE IN STOR.	ND					
J-1	CORR B-56	ND		Ceiling Tile - 2x4; small fissures and drill holes	NA	GOOD	NA
J-2	CORR B-55	ND					
J-3	CORR B-20	ND					
K-1	B-02B	ND		Ceiling Tile - 2x4; slight texture with drill holes	NA	GOOD	NA
K-2	STOR. OFF B-02A	ND					
K-3	B-02A	ND					
L-1	CORR B-26	ND		Ceiling Tile - 2x2; very rough open fissures	NA	GOOD	NA
L-2	CORR B-26	ND					
L-3	VEST. B-07A	ND					
M-1	CORR B-09	ND		Ceiling Tile - 2x4; rough texture w/ defined fissures and drill holes	NA	GOOD	NA
M-2	CORR B-09	ND					
M-3	B-11	ND					
N-1	B-04	ND		Ceiling Tile - 2x2; smooth with drill and pin holes	NA	GOOD	NA
N-2	B-10	ND					
N-3	CORR B-65	ND					
O-1	VEST. B-59	ND		Ceiling Tile - 2x4 medium fissures and drill holes	NA	GOOD	NA
O-2	STOR B-06A	ND					
O-3	STOR B-06A	ND					
P-1	MAINT 3-349	ND		Plaster	NA	GOOD	NA
P-2	MAINT 3-309	ND					
P-3	CORR 2-211	ND					
P-4	LIBRARY 2-201	ND					
P-5	CHASE 1-105B	ND					
P-6	B-11	ND					
P-7	CORR B-26	ND					
Notes: ND = None Detected NA = Not Applicable							

## ASBESTOS SAMPLE RESULTS SUMMARY

Missouri Supreme Court House  
207 West High St  
Jefferson City, MO

Inspection Date: 10-Mar-22

Klingner & Associates, P.C. Project Number 19-5034

Sample ID	Location	ASBESTOS		Sample Description	Category I, Category II, or Friable	Condition (Good, Fair, or Poor)	Quantity
		Percent	Type				
A-1 Tile	Toilet B-53	ND	NA	Floor Tile	NA	NA	~35 sf
A-2 Tile							
A-3 Tile							
A-1 Mastic	Toilet B-53	4%	Chrysotile	Mastic	Category II	GOOD	~35 sf
A-2 Mastic		4%	Chrysotile				
A-3 Mastic		2%	Chrysotile				
TSI - 1A	clos B-50A	ND	NA	Pipe wrap (over fiberglass)	NA	NA	~34 lf
TSI - 1B							
TSI - 1C							
Notes: ND = None Detected NA = Not Applicable							

## Exhibit B

---

# PHOTOGRAPHS





<b>1</b> Date 03/04/2022	<b>Description</b>	General Photograph of Structure
	<b>Site Name</b>	Jefferson City, Missouri
	<b>K&amp;A Project #</b>	19-5034/32



<b>2</b> Date 03/04/2022	<b>Description</b>	General Photograph of Structure
	<b>Site Name</b>	Jefferson City, Missouri
	<b>K&amp;A Project #</b>	19-5034/32

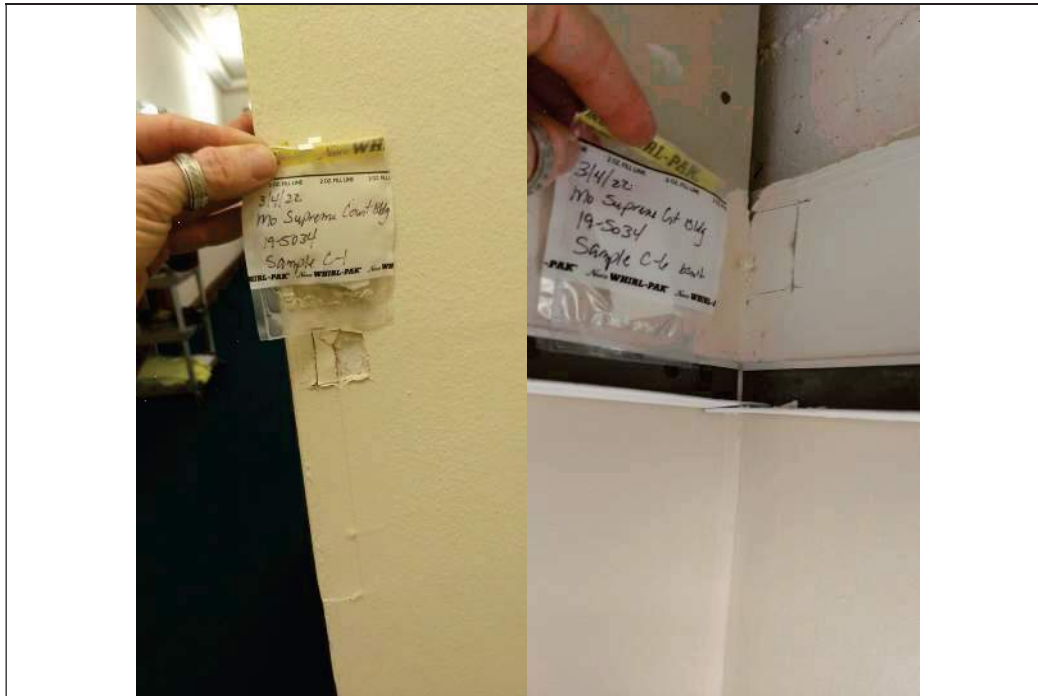


<b>3</b> Date 03/04/22	<b>Description</b>	Sample A – Fire Brick	<b>Percent Asbestos ND</b>
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	

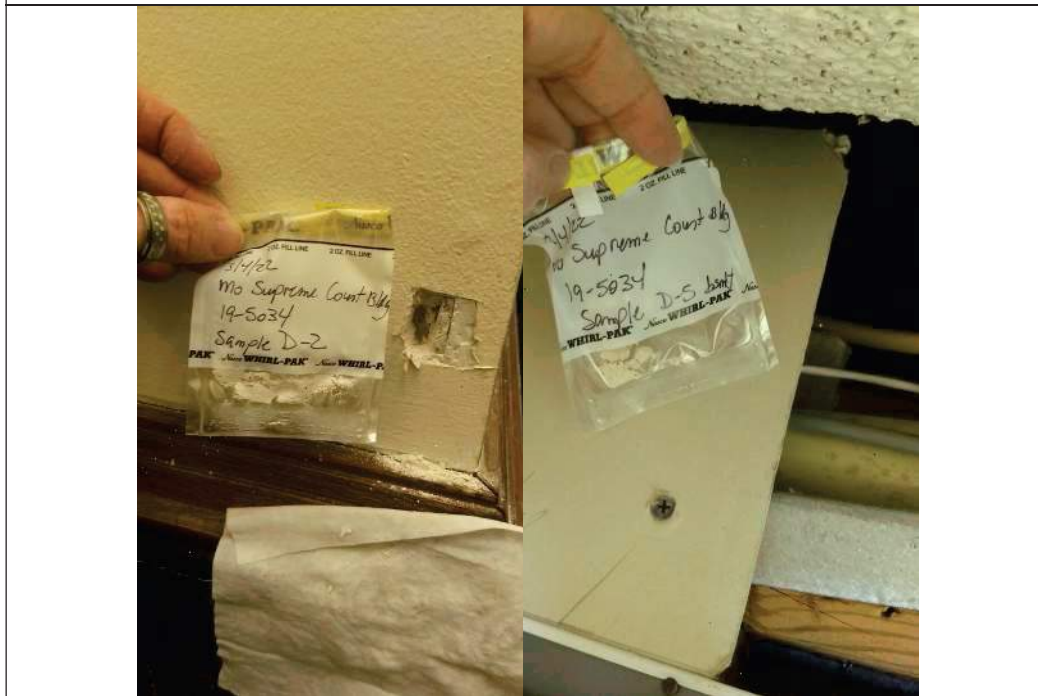


<b>4</b> Date 03/04/22	<b>Description</b>	Sample B – grout for A	<b>Percent Asbestos ND</b>
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	





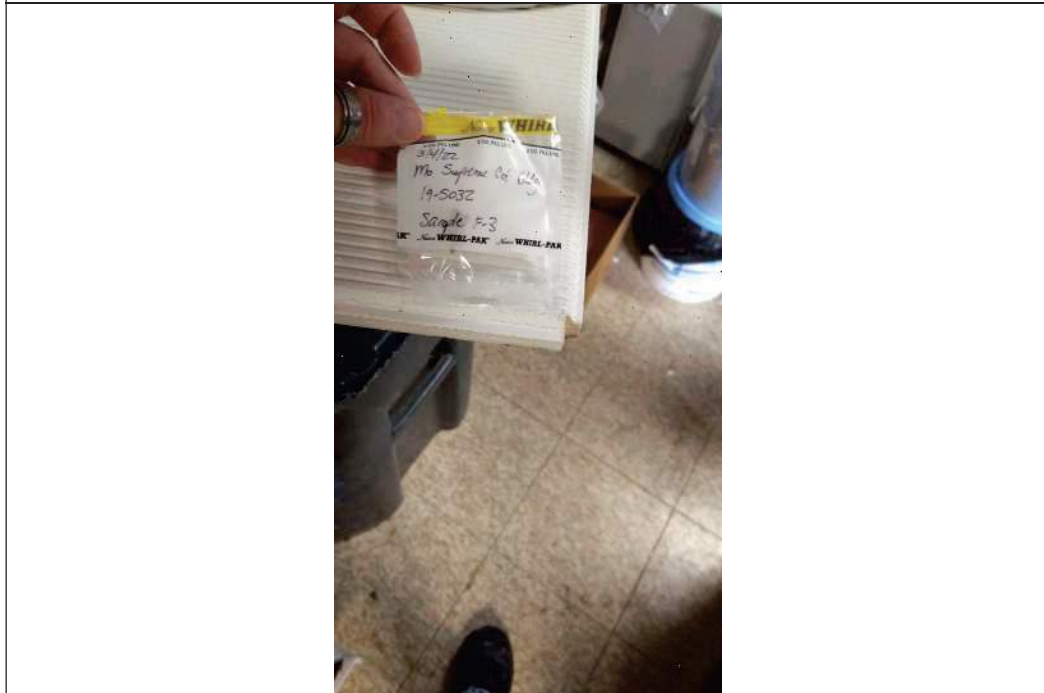
<b>5</b> Date 03/04/22	<b>Description</b>	Sample C – drywall mud & tape	<b>Percent Asbestos</b> <b>Mud 2%</b> Tape ND
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	



<b>6</b> Date 03/04/22	<b>Description</b>	Samples D - sheetrock	<b>Percent Asbestos</b> ND
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	



<b>7</b> Date 03/04/22	<b>Description</b>	Sample E – ceiling tile; 2x2 w/ 4-square pattern	<b>Percent Asbestos</b>  ND
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	



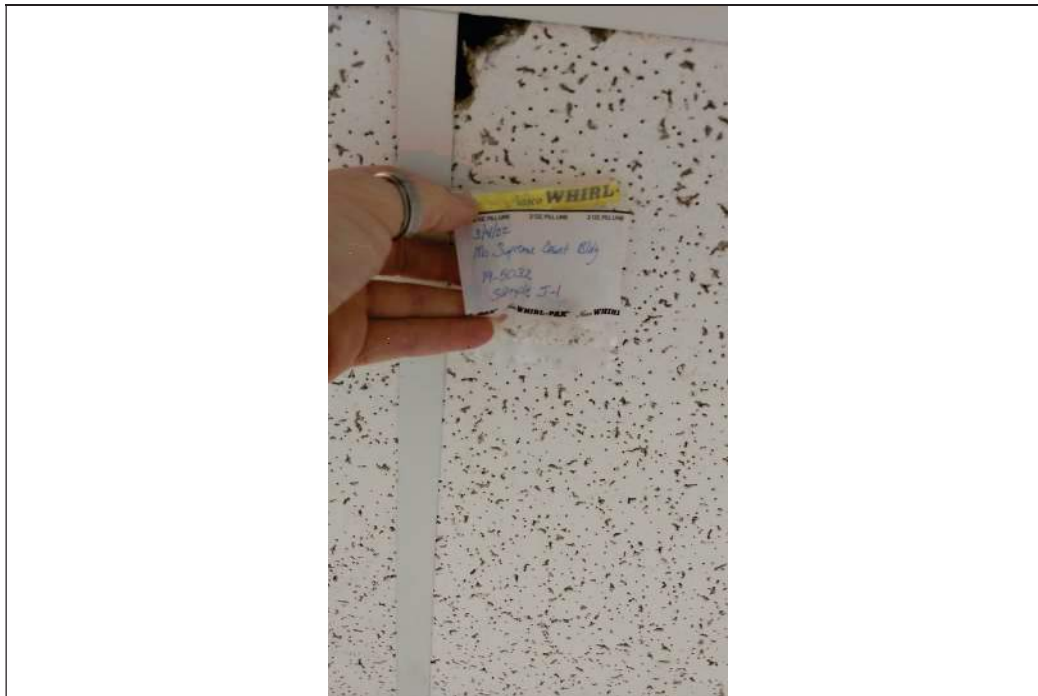
<b>8</b> Date 03/04/22	<b>Description</b>	Samples F – ceiling tile; 2x2 w/ lined pattern	<b>Percent Asbestos</b>  ND
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	



<b>9</b> Date 03/04/22	<b>Description</b>	Sample G – ceiling tile; 2x2 w/ 1 large square pattern	<b>Percent Asbestos</b>
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	ND



<b>10</b> Date 03/04/22	<b>Description</b>	Samples H – ceiling tile; 2x2 w/ small fissures & drill holes	<b>Percent Asbestos</b>
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	ND



<b>11</b> Date 03/04/22	<b>Description</b>	Sample J – ceiling tile; 2x4 w/ small fissures and pin holes	<b>Percent Asbestos</b>
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	ND

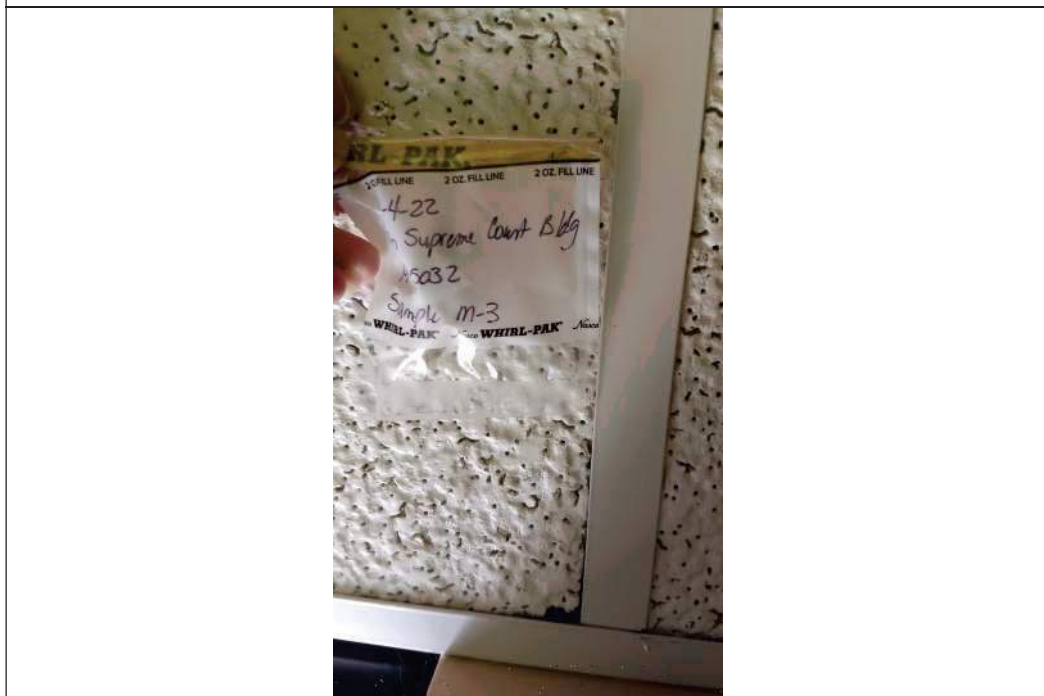


<b>12</b> Date 03/04/22	<b>Description</b>	Samples K – 2x4; slight texture w/ drill holes	<b>Percent Asbestos</b>
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	ND

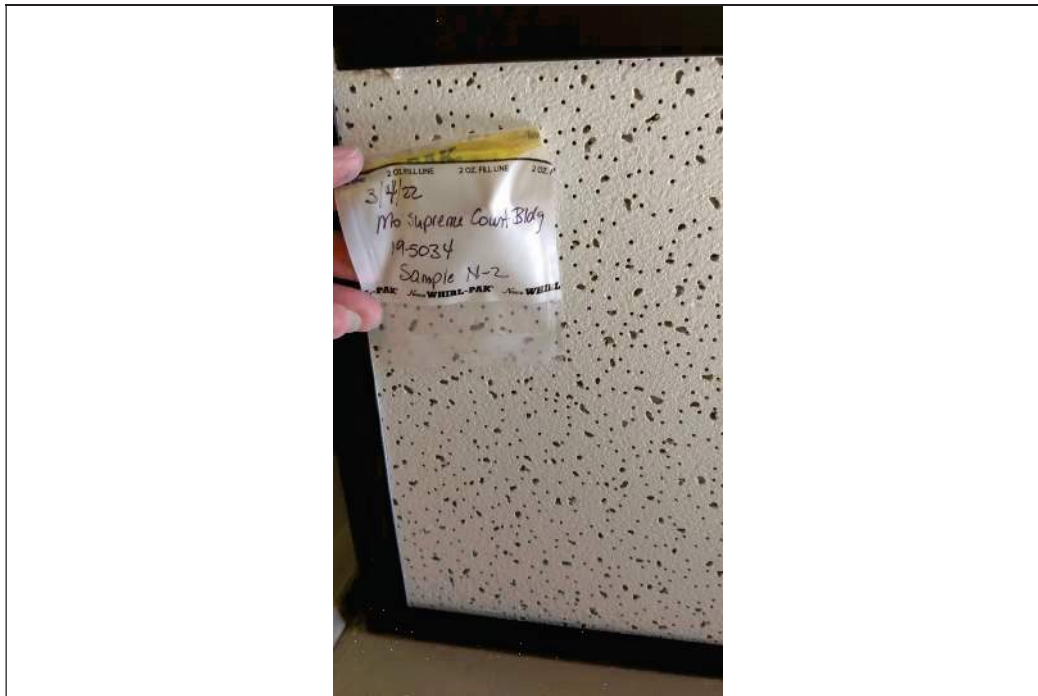




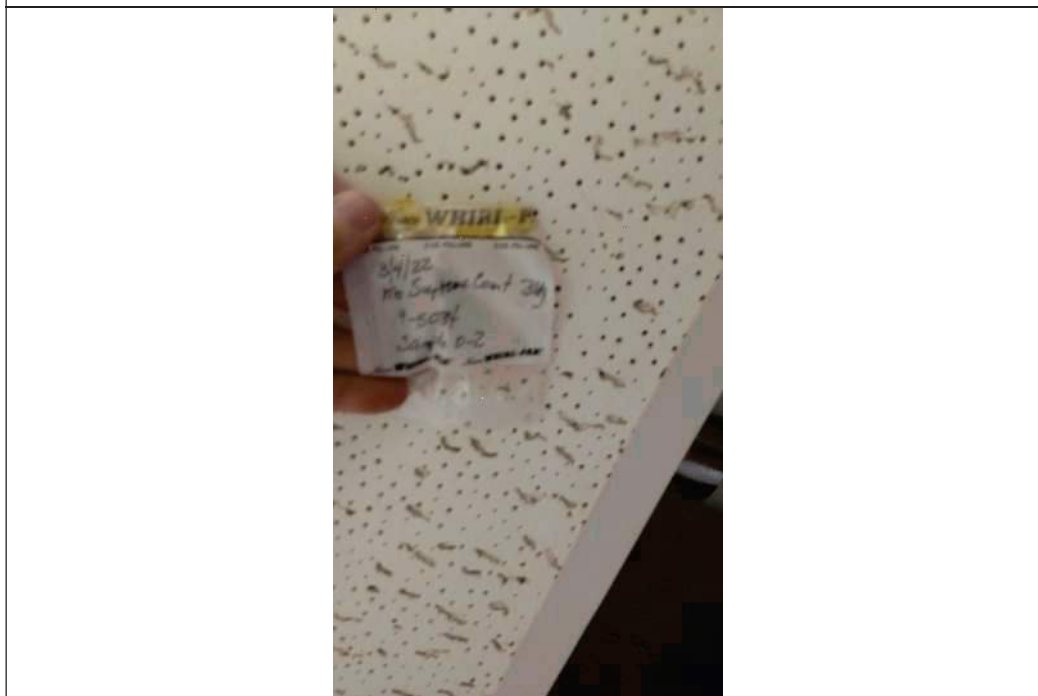
<b>13</b> Date 03/04/22	<b>Description</b>	Sample L – ceiling tile; 2x2 w/ very rough pattern & open fissures	<b>Percent Asbestos</b>
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	ND



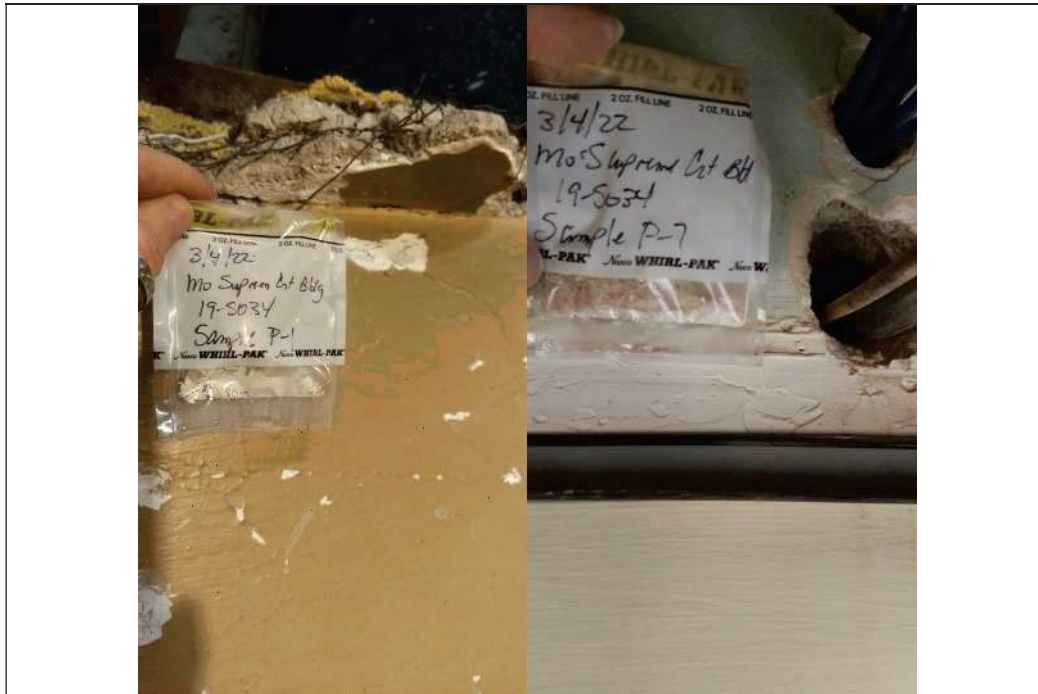
<b>14</b> Date 03/04/22	<b>Description</b>	Samples M – ceiling tile; 2x4 w/ rough texture and defined fissures & drill holes	<b>Percent Asbestos</b>
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	ND



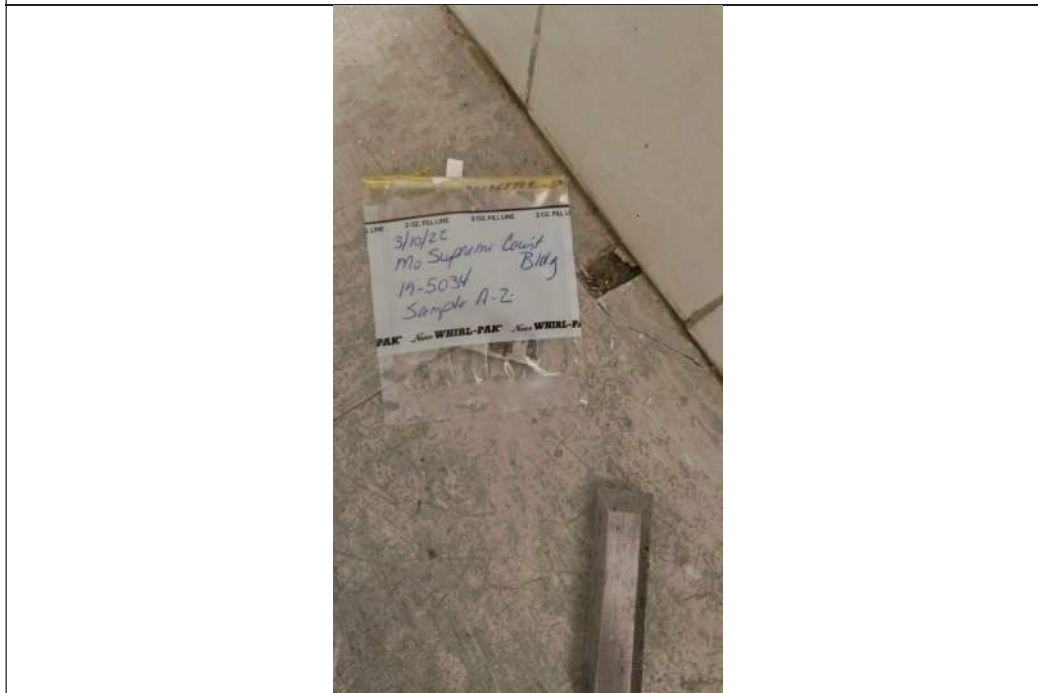
<b>15</b> Date 03/04/22	<b>Description</b>	Sample N – ceiling tile; 2x2 smooth w/ drill holes	<b>Percent Asbestos</b>
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	ND



<b>16</b> Date 03/04/22	<b>Description</b>	Samples O – ceiling tile; 2x2 w/ medium fissures and drill holes	<b>Percent Asbestos</b>
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	ND



<b>17</b> Date 03/04/22	<b>Description</b>	Sample P – Plaster	<b>Percent Asbestos</b> ND
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	



<b>18</b> Date 03/10/2022	<b>Description</b>	Sample A (3/10/22) – floor tile & mastic	<b>Percent Asbestos</b> FT – ND <b>Mastic 4%</b>
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	



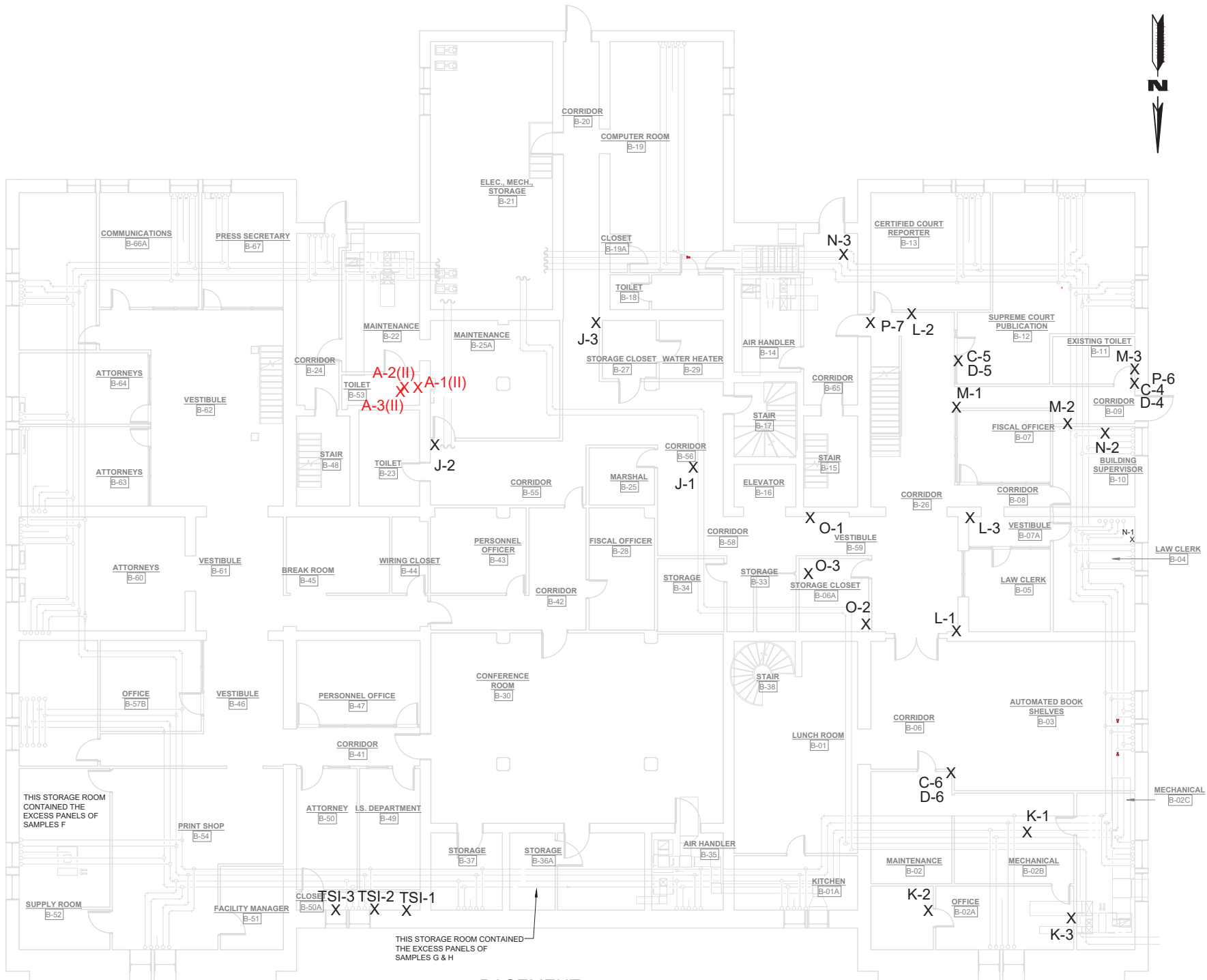
<b>19</b> Date 03/10/2022	<b>Description</b>	Sample TSI – 1 (3/10/22)	<b>Percent Asbestos</b> ND
	<b>Site Name</b>	Jefferson City, Missouri	
	<b>K&amp;A Project #</b>	19-5034/32	



## Exhibit C

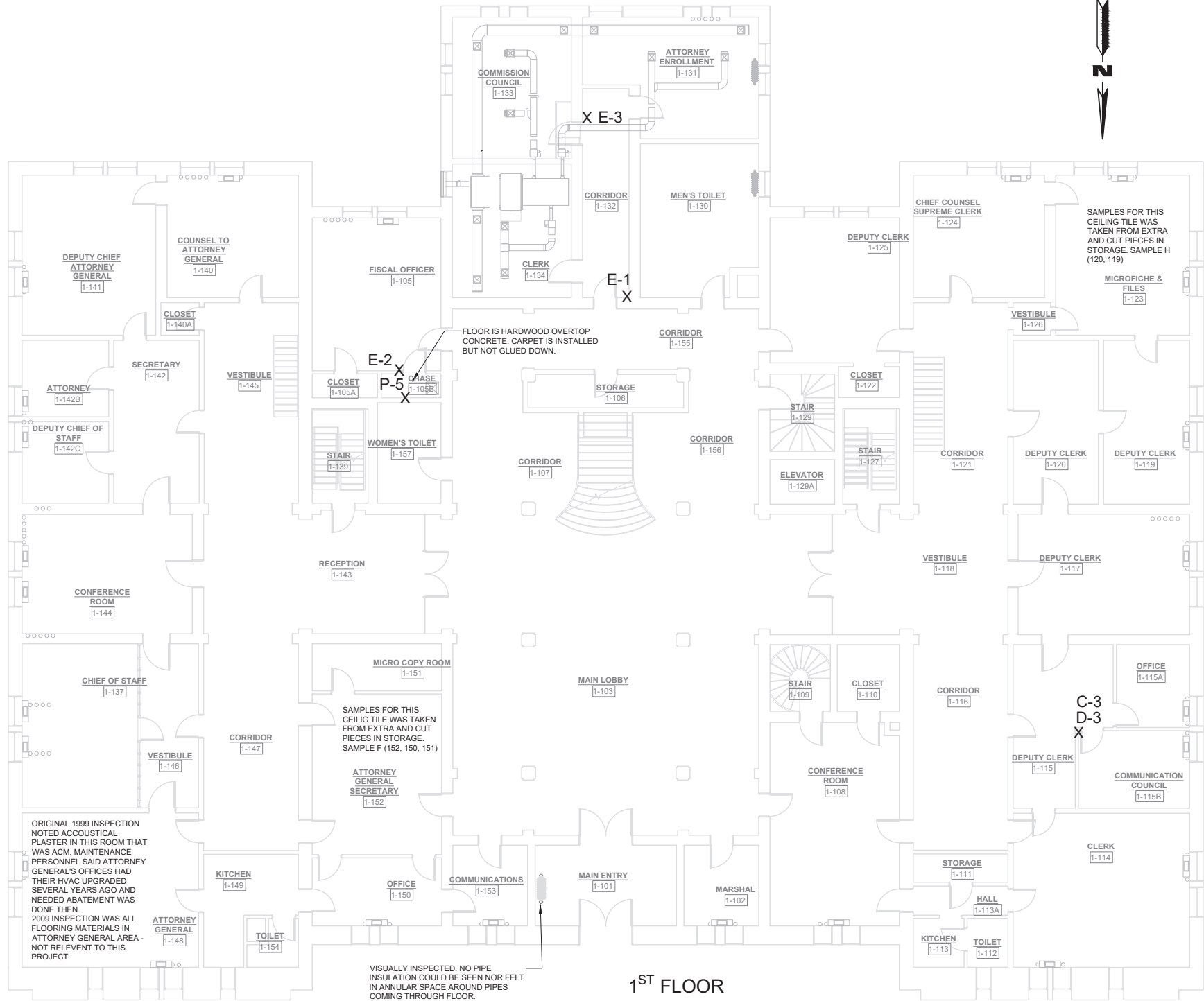
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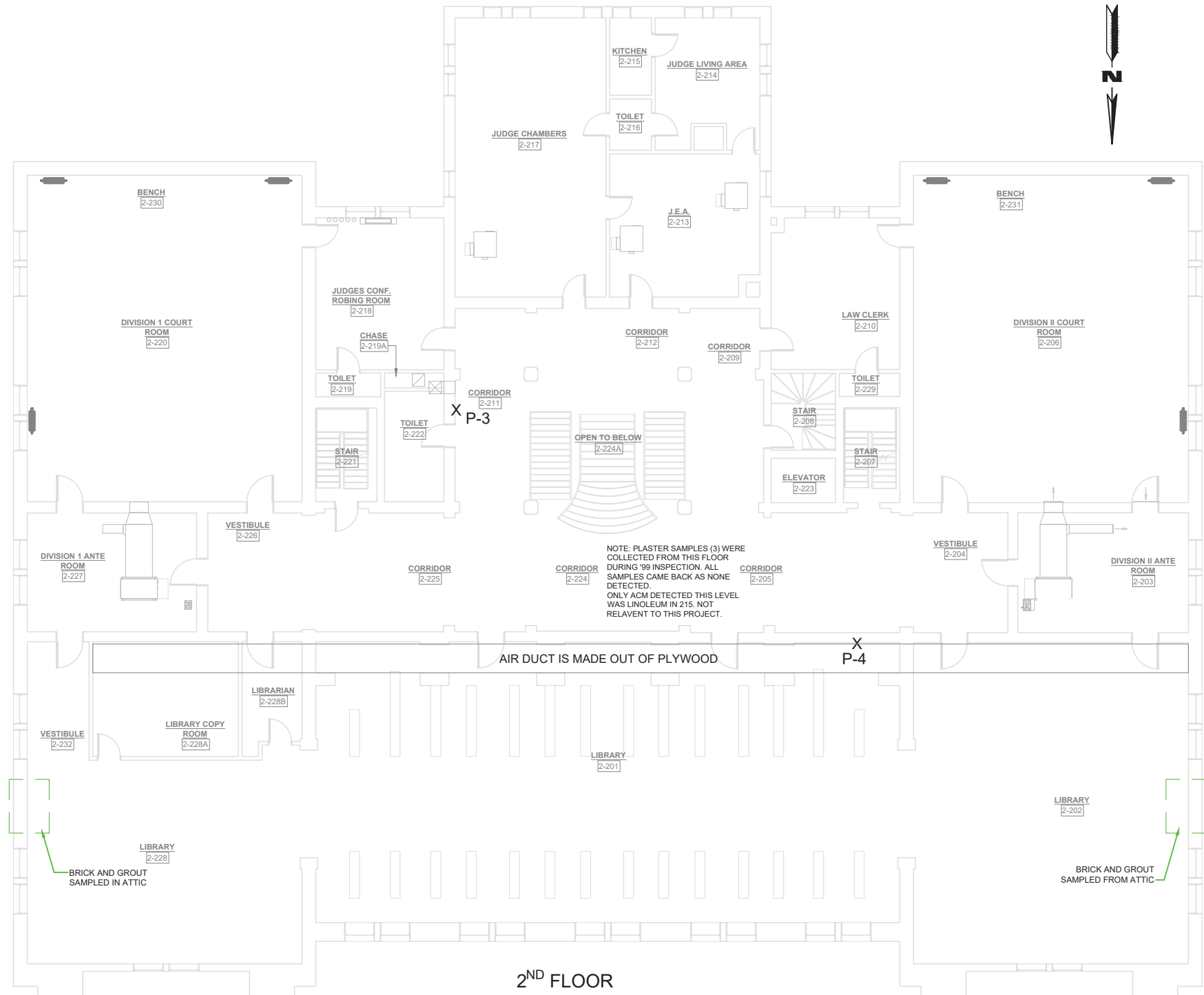
# **SAMPLE LOCATION MAP**

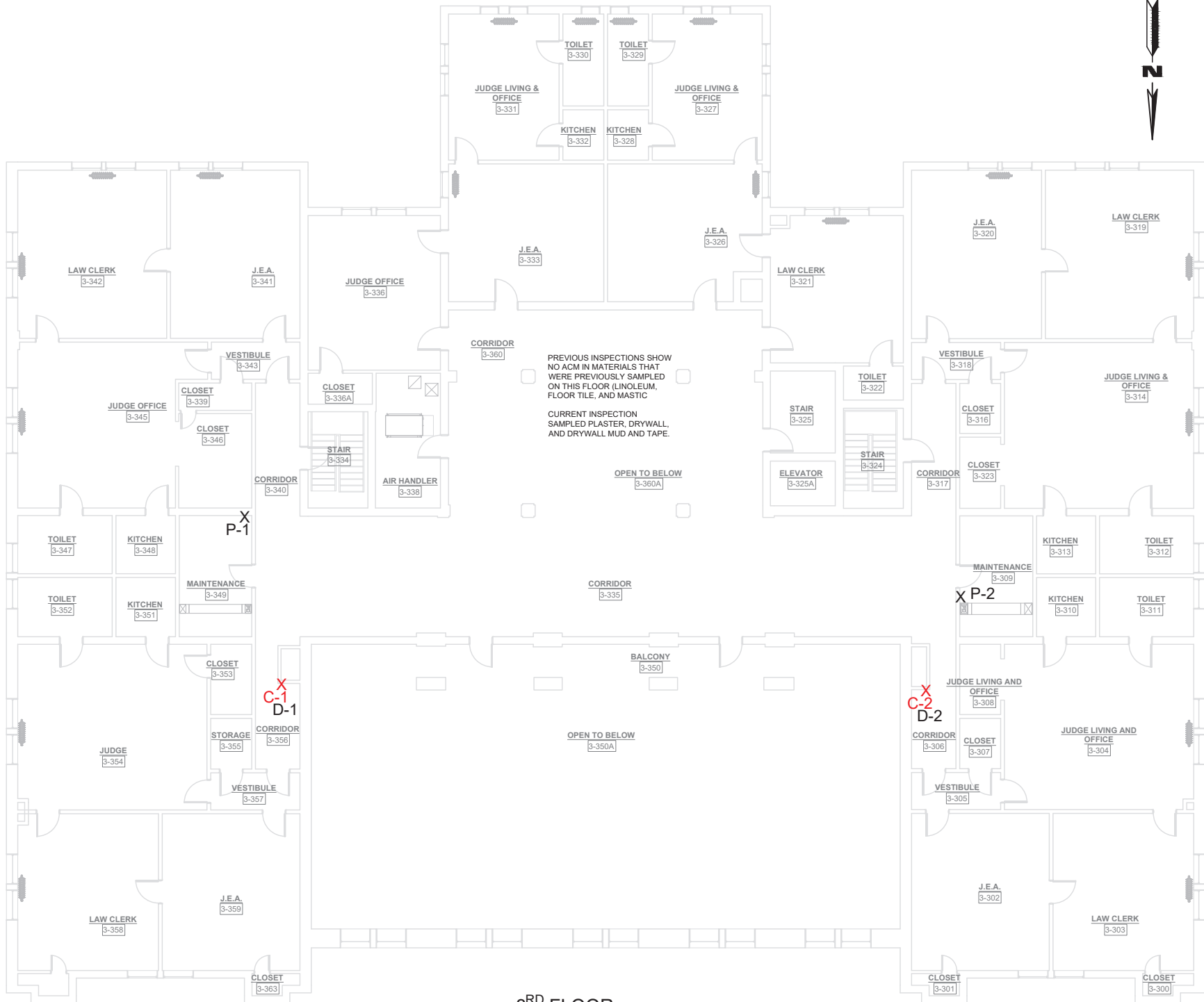


THIS STORAGE ROOM CONTAINED THE EXCESS PANELS OF SAMPLES G & H

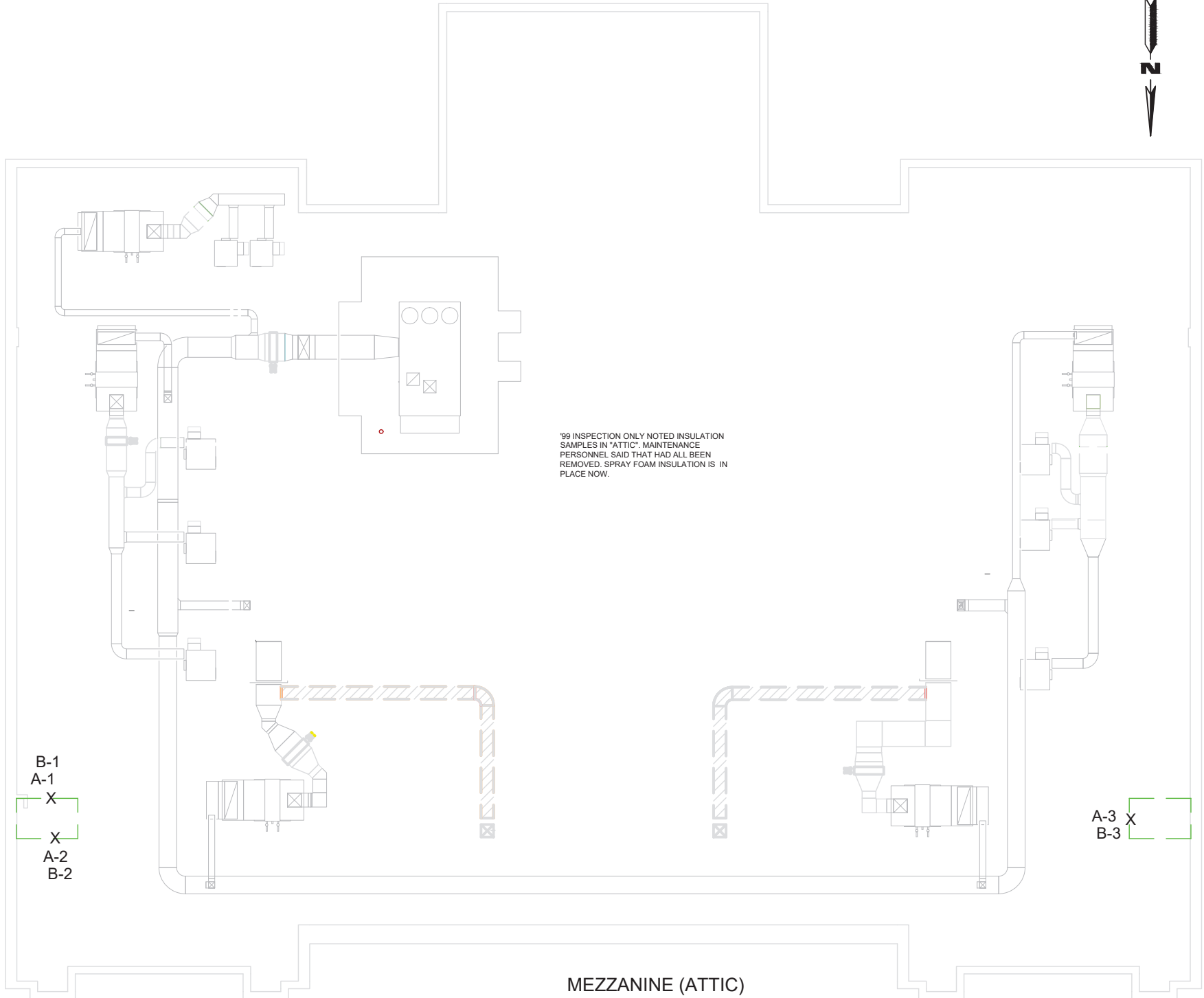
**BASEMENT**







3<sup>RD</sup> FLOOR



B-1  
A-1  
X  
X  
A-2  
B-2

A-3 X  
B-3

MEZZANINE (ATTIC)

Exhibit D

---

# LABORATORY REPORT



# EMSL Analytical, Inc.

4140 Litt Drive Hillside, IL 60162  
Tel/Fax: (773) 313-0099 / (773) 313-0139  
<http://www.EMSL.com> / [chicagolab@emsl.com](mailto:chicagolab@emsl.com)

**EMSL Order:** 262201666  
**Customer ID:** KLIN63  
**Customer PO:**  
**Project ID:**

**Attention:** Michelle M. Beck  
Klingner & Associates  
4510 Paris Gravel Road  
Hannibal, MO 63401

**Phone:** (573) 221-0020  
**Fax:** (573) 221-0012  
**Received Date:** 03/08/2022 9:15 AM  
**Analysis Date:** 03/15/2022  
**Collected Date:** 03/04/2022

**Project:** Mo Supreme Court House

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
A-1 262201666-0001	Attic - Firebrick	Red Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
A-2 262201666-0002	Attic - Firebrick	Red Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
A-3 262201666-0003	Attic - Firebrick	Red Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
B-1 262201666-0004	Attic - grout for firebrick	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
B-2 262201666-0005	Attic - grout for firebrick	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
B-3 262201666-0006	Attic - grout for firebrick	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
C-1-Mud 262201666-0007	1&2 3rd Floor 3-1st Floor - drywall mud & tape	White Non-Fibrous Homogeneous		98% Non-fibrous (Other)	2% Chrysotile
C-1-Tape 262201666-0007A	1&2 3rd Floor 3-1st Floor - drywall mud & tape	White Fibrous Homogeneous	98% Cellulose	2% Non-fibrous (Other)	None Detected
C-2-Mud 262201666-0008	1&2 3rd Floor 3-1st Floor - drywall mud & tape	White Non-Fibrous Homogeneous		98% Non-fibrous (Other)	2% Chrysotile
C-2-Tape 262201666-0008A	1&2 3rd Floor 3-1st Floor - drywall mud & tape				Layer Not Present
C-3-Mud 262201666-0009	1&2 3rd Floor 3-1st Floor - drywall mud & tape	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
C-3-Tape 262201666-0009A	1&2 3rd Floor 3-1st Floor - drywall mud & tape	White Non-Fibrous Homogeneous	98% Cellulose	2% Non-fibrous (Other)	None Detected
D-1 262201666-0010	1&2 3rd Floor 3-1st Floor - sheet rock	Brown/White Non-Fibrous Homogeneous	10% Cellulose	90% Non-fibrous (Other)	None Detected
D-2 262201666-0011	1&2 3rd Floor 3-1st Floor - sheet rock	Brown/White Non-Fibrous Homogeneous	10% Cellulose	90% Non-fibrous (Other)	None Detected
D-3 262201666-0012	1&2 3rd Floor 3-1st Floor - sheet rock	Brown/White Non-Fibrous Homogeneous	10% Cellulose	90% Non-fibrous (Other)	None Detected
C-4-Mud 262201666-0013	Basement - drywall mud & tape	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 03/15/2022 16:08:22





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Tel/Fax: (773) 313-0099 / (773) 313-0139  
<http://www.EMSL.com> / [chicagolab@emsl.com](mailto:chicagolab@emsl.com)

**EMSL Order:** 262201666  
**Customer ID:** KLIN63  
**Customer PO:**  
**Project ID:**

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
C-4-Tape 262201666-0013A	Basement - drywall mud & tape	White Fibrous Homogeneous	98% Cellulose	2% Non-fibrous (Other)	None Detected
C-5-Mud 262201666-0014	Basement - drywall mud & tape	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
C-5-Tape 262201666-0014A	Basement - drywall mud & tape	White Fibrous Homogeneous	98% Cellulose	2% Non-fibrous (Other)	None Detected
C-6-Mud 262201666-0015	Basement - drywall mud & tape	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
C-6-Tape 262201666-0015A	Basement - drywall mud & tape	White Fibrous Homogeneous	98% Cellulose	2% Non-fibrous (Other)	None Detected
D-4 262201666-0016	Basement - sheet rock	Brown/White Non-Fibrous Homogeneous	10% Cellulose 3% Glass	87% Non-fibrous (Other)	None Detected
D-5 262201666-0017	Basement - sheet rock	Brown/White Non-Fibrous Homogeneous	10% Cellulose 3% Glass	87% Non-fibrous (Other)	None Detected
D-6 262201666-0018	Basement - sheet rock	Brown/White Non-Fibrous Homogeneous	10% Cellulose 3% Glass	87% Non-fibrous (Other)	None Detected
E-1 262201666-0019	1st Floor - 2x2 clg tile-4 squ pattern	Gray/White Fibrous Homogeneous	40% Cellulose 20% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
E-2 262201666-0020	1st Floor - 2x2 clg tile-4 squ pattern	Gray/White Fibrous Homogeneous	40% Cellulose 20% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
E-3 262201666-0021	1st Floor - 2x2 clg tile-4 squ pattern	Gray/White Non-Fibrous Homogeneous	40% Cellulose 20% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
F-1 262201666-0022	Storage - 2x2 clg tile-lined pattern	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
F-2 262201666-0023	Storage - 2x2 clg tile-lined pattern	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
F-3 262201666-0024	Storage - 2x2 clg tile-lined pattern	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
G-1 262201666-0025	Storage - 2x2 clg tile-single squ pattern	Gray/White Fibrous Homogeneous	20% Cellulose 40% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
G-2 262201666-0026	Storage - 2x2 clg tile-single squ pattern	Gray/White Fibrous Homogeneous	20% Cellulose 40% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
G-3 262201666-0027	Storage - 2x2 clg tile-single squ pattern	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
H-1 262201666-0028	Storage - 2x2 clg tile-sm fissures & pinholes	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
H-2 262201666-0029	Storage - 2x2 clg tile-sm fissures & pinholes	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected

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**EMSL Order:** 262201666  
**Customer ID:** KLIN63  
**Customer PO:**  
**Project ID:**

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
H-3 262201666-0030	Storage - 2x2 clg tile-sm fissures & pinholes	Gray/White Fibrous Homogeneous	40% Cellulose 20% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
J-1 262201666-0031	Basement - 2x4 clg tile-sm fissures & pinholes	Gray/White Fibrous Homogeneous	40% Cellulose 20% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
J-2 262201666-0032	Basement - 2x4 clg tile-sm fissures & pinholes	Tan/White Fibrous Homogeneous	40% Cellulose 20% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
J-3 262201666-0033	Basement - 2x4 clg tile-sm fissures & pinholes	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
K-1 262201666-0034	Basement - 2x4 clg tile-slight txtr w/ drill holes	Gray/White Fibrous Homogeneous	40% Cellulose 20% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
K-2 262201666-0035	Basement - 2x4 clg tile-slight txtr w/ drill holes	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
K-3 262201666-0036	Basement - 2x4 clg tile-slight txtr w/ drill holes	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
L-1 262201666-0037	Basement - 2x2 clg tile-very rough w/ open fissures	Gray/White Fibrous Homogeneous	20% Cellulose 60% Min. Wool	10% Perlite 10% Non-fibrous (Other)	None Detected
L-2 262201666-0038	Basement - 2x2 clg tile-very rough w/ open fissures	Gray/White Fibrous Homogeneous	20% Cellulose 60% Min. Wool	10% Perlite 10% Non-fibrous (Other)	None Detected
L-3 262201666-0039	Basement - 2x2 clg tile-very rough w/ open fissures	Gray/White Fibrous Homogeneous	20% Cellulose 40% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
M-1 262201666-0040	Basement - 2x4 clg tile-rough w/ fissures & drillholes	Gray/White Fibrous Homogeneous	40% Cellulose 20% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
M-2 262201666-0041	Basement - 2x4 clg tile-rough w/ fissures & drillholes	Gray/White Fibrous Homogeneous	40% Cellulose 20% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
M-3 262201666-0042	Basement - 2x4 clg tile-rough w/ fissures & drillholes	Gray/White Fibrous Homogeneous	40% Cellulose 20% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
N-1 262201666-0043	Basement - 2x2 clg tile-smooth w/ drill & pin holes	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
N-2 262201666-0044	Basement - 2x2 clg tile-smooth w/ drill & pin holes	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
N-3 262201666-0045	Basement - 2x2 clg tile-smooth w/ drill & pin holes	Gray/White Fibrous Homogeneous	40% Cellulose 20% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
O-1 262201666-0046	Basement - 2x4 clg tile-med. Fissures & drill holes	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
O-2 262201666-0047	Basement - 2x4 clg tile-med. Fissures & drill holes	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected
O-3 262201666-0048	Basement - 2x4 clg tile-med. Fissures & drill holes	Gray/White Fibrous Homogeneous	30% Cellulose 30% Min. Wool	30% Perlite 10% Non-fibrous (Other)	None Detected

Initial report from: 03/15/2022 16:08:22



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<http://www.EMSL.com / chicagolab@emsl.com>

**EMSL Order:** 262201666  
**Customer ID:** KLIN63  
**Customer PO:**  
**Project ID:**

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
P-1 262201666-0049	Entire building - plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
P-2-Skim Coat 262201666-0050	Entire building - plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
P-2-Base Coat 262201666-0050A	Entire building - plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
P-3-Skim Coat 262201666-0051	Entire building - plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
P-3-Base Coat 262201666-0051A	Entire building - plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
P-4-Skim Coat 262201666-0052	Entire building - plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
P-4-Base Coat 262201666-0052A	Entire building - plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
P-5-Skim Coat 262201666-0053	Entire building - plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
P-5-Base Coat 262201666-0053A	Entire building - plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
P-6-Skim Coat 262201666-0054	Entire building - plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
P-6-Base Coat 262201666-0054A	Entire building - plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
P-7-Skim Coat 262201666-0055	Entire building - plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
P-7-Base Coat 262201666-0055A	Entire building - plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Analyst(s) \_\_\_\_\_

Lisa Odeshoo (24)  
Lauren Swain (42)

James Hahn, Laboratory Manager  
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Hillside, IL NVLAP Lab Code 200399-0

Initial report from: 03/15/2022 16:08:22



# EMSL Analytical, Inc.

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Tel/Fax: (773) 313-0099 / (773) 313-0139  
<http://www.EMSL.com> / [chicagolab@emsl.com](mailto:chicagolab@emsl.com)

**EMSL Order:** 262201778  
**Customer ID:** KLIN63  
**Customer PO:**  
**Project ID:**

**Attention:** Michelle M. Beck  
Klingner & Associates  
4510 Paris Gravel Road  
Hannibal, MO 63401

**Phone:** (573) 221-0020  
**Fax:** (573) 221-0012  
**Received Date:** 03/14/2022 9:00 AM  
**Analysis Date:** 03/16/2022 - 03/17/2022  
**Collected Date:**

**Project:** 19-5034

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
A-1-Floor Tile <small>262201778-0001</small>	Toilet B-53 - floor tile (and mastic)	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
A-1-Mastic <small>262201778-0001A</small>	Toilet B-53 - floor tile (and mastic)	Black/Yellow Non-Fibrous Homogeneous		96% Non-fibrous (Other)	4% Chrysotile
A-2-Floor Tile <small>262201778-0002</small>	Toilet B-53 - floor tile (and mastic)	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
A-2-Mastic <small>262201778-0002A</small>	Toilet B-53 - floor tile (and mastic)	Black/Yellow Non-Fibrous Homogeneous		96% Non-fibrous (Other)	4% Chrysotile
A-3-Floor Tile <small>262201778-0003</small>	Toilet B-53 - floor tile (and mastic)	Beige Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
A-3-Mastic <small>262201778-0003A</small>	Toilet B-53 - floor tile (and mastic)	Black/Yellow Non-Fibrous Heterogeneous		98% Non-fibrous (Other)	2% Chrysotile
TSI-A-Insulation <small>262201778-0004</small>	Closet B-50A - covering wrap on fiberglass insul.	Yellow Fibrous Homogeneous	3% Cellulose 95% Glass	2% Non-fibrous (Other)	None Detected
TSI-A-Wrap <small>262201778-0004A</small>	Closet B-50A - covering wrap on fiberglass insul.	Tan/Silver Fibrous Homogeneous	50% Cellulose 35% Glass	15% Non-fibrous (Other)	None Detected
TSI-B-Insulation <small>262201778-0005</small>	Closet B-50A - covering wrap on fiberglass insul.	Yellow Fibrous Homogeneous	3% Cellulose 95% Glass	2% Non-fibrous (Other)	None Detected
TSI-B-Wrap <small>262201778-0005A</small>	Closet B-50A - covering wrap on fiberglass insul.	Tan/Silver Fibrous Homogeneous	50% Cellulose 35% Glass	15% Non-fibrous (Other)	None Detected
TSI-C-Insulation <small>262201778-0006</small>	Closet B-50A - covering wrap on fiberglass insul.				Layer Not Present
TSI-C-Wrap <small>262201778-0006A</small>	Closet B-50A - covering wrap on fiberglass insul.	White/Silver Non-Fibrous Homogeneous	50% Cellulose 10% Glass	40% Non-fibrous (Other)	None Detected

Initial report from: 03/17/2022 10:14:35



# EMSL Analytical, Inc.

4140 Litt Drive Hillside, IL 60162  
Tel/Fax: (773) 313-0099 / (773) 313-0139  
<http://www.EMSL.com> / [chicagolab@emsl.com](mailto:chicagolab@emsl.com)

**EMSL Order:** 262201778  
**Customer ID:** KLIN63  
**Customer PO:**  
**Project ID:**

Analyst(s)

Cristian Nunez (8)  
Lisa Odeshoo (3)

James Hahn, Laboratory Manager  
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

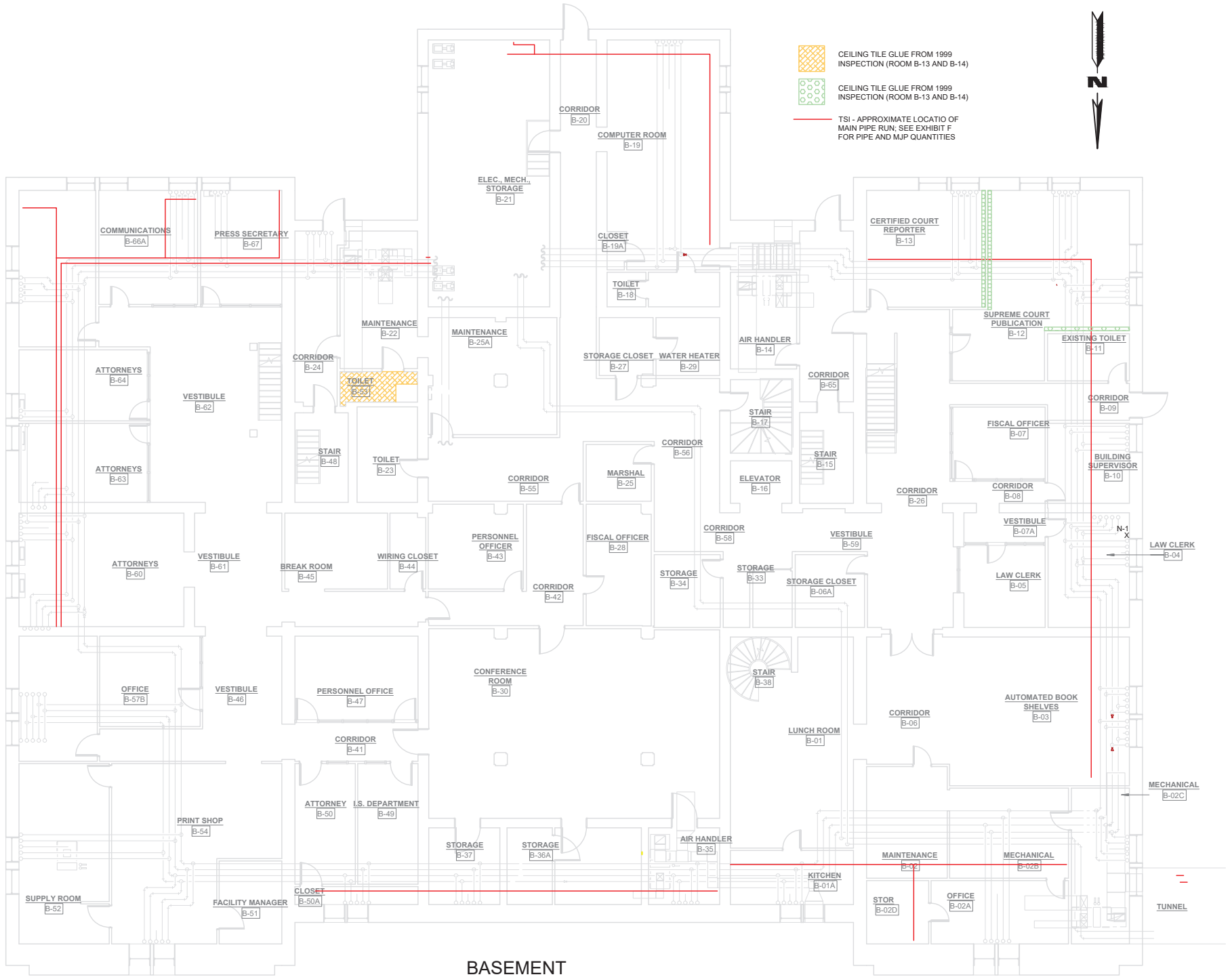
Samples analyzed by EMSL Analytical, Inc. Hillside, IL NVLAP Lab Code 200399-0

Initial report from: 03/17/2022 10:14:35

## Exhibit E

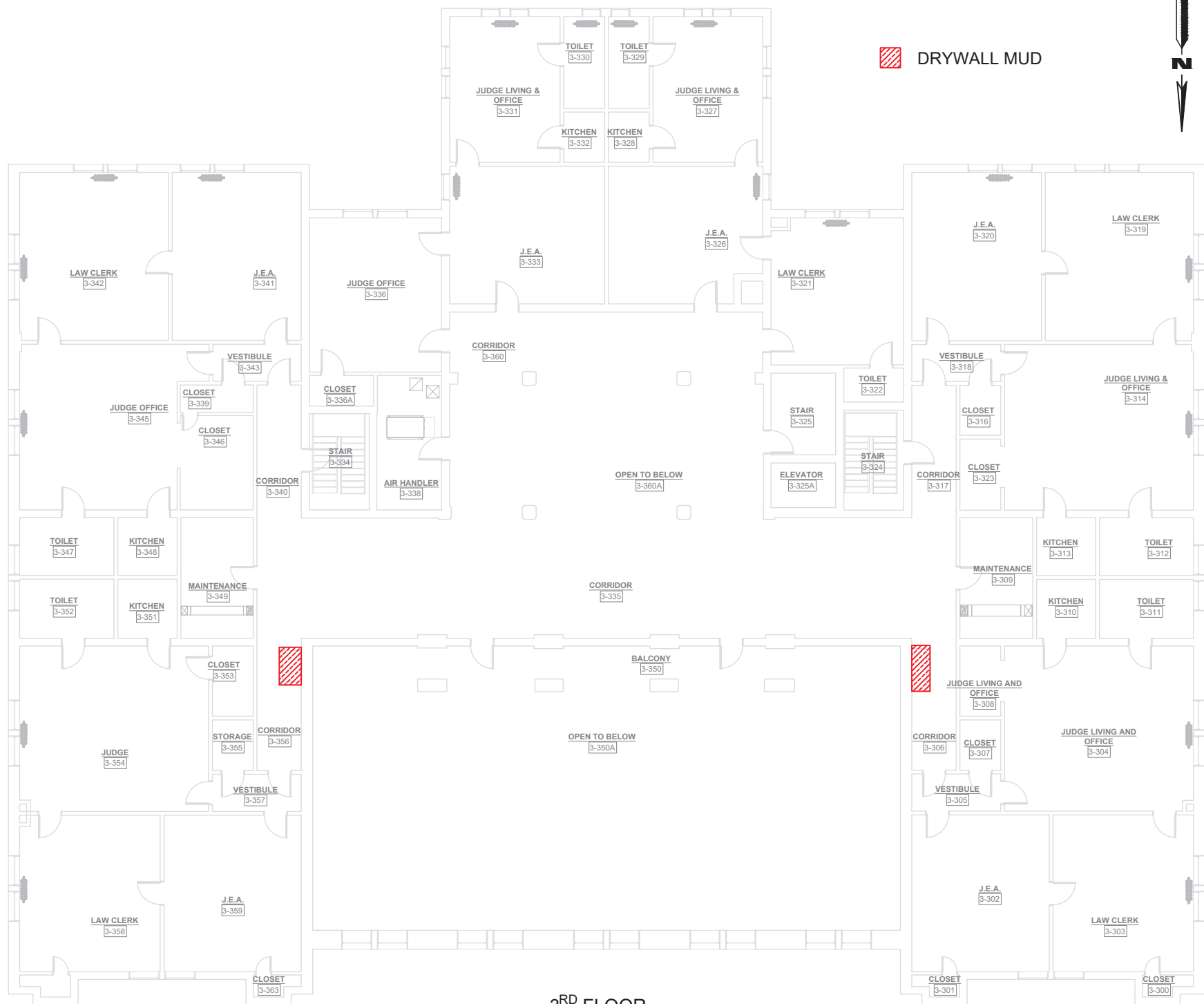
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# ASBESTOS LOCATION MAP





 DRYWALL MUD



3<sup>RD</sup> FLOOR



# EXHIBIT F

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## **THERMAL SYSTEM INSULATION APPROXIMATE QUANTITIES**

TSI - Approximate Quantities Observed											
ROOM #	4" INSUL	4" MJP	6" INSUL	6" MJP	8" INSUL	8" MJP	12" INSUL	12" MJP	2" INSUL	2" MJP	NOTES
Tunnel											2 pcs 12" Diam. 8" long - under pipe hangers
Mech AHU-B											None Observed
B-02B					17.5						2 pcs 12" Diam. 8" long - under pipe hangers
B-02A											None Observed
B-02D			8	1							
B-02	6	6	11								
B-01A			17	2							
B-01											None Observed
B-35	3.5	1			9						
B-36	4	4	18	1	7	6					
B-36A											
B-30					27						
B-37	1				7	1					
B-50A	3	5			13.5	1					
B-51											None Observed
B-52											None Observed
B-66B	45	6							21	3	
B-64	25.5	2									
B-63	20										
B-60	16	2									
B-57A											None Observed
B-57B											None Observed
B-66A	40	7									
B-67	30	2									
B-24	6	1									
B-22	10	1									
B-21	2		10	5							appeared that ~1' of 4" insul comes through east wall (2 pipes)
B-20	6										
B-19	12	4	30	3							insul appears to end at north end of comp room where newer plumbing is
B-14											None Observed
B-65											None Observed
B-13	24	2	23	4							
B-12					32	5					
B-11			7								
B-09	7	3	6								
B-10			12								
B-04					15	1					
B-03	11	4			22	4					
<b>Totals</b>	<b>272</b>	<b>50</b>	<b>142</b>	<b>16</b>	<b>150</b>	<b>18</b>			<b>21</b>	<b>3</b>	

# EXHIBIT G

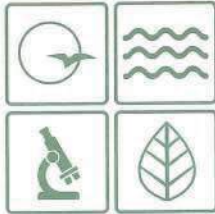
---

## MISSOURI ASBESTOS INSPECTOR LICENSE

RECEIVED

JAN 28

KLINGNER & ASSOC., P.C.  
dnr.mo.gov



# Missouri Department of NATURAL RESOURCES

Michael L. Parson, Governor

Dru Buntin, Director

January 25, 2022

Michelle M Beck  
4510 Paris Gravel Rd  
Hannibal, MO 63401

## RE: Missouri Asbestos Occupation Certification Card

Enclosed is your certification card for Asbestos Inspector, as issued by the Asbestos Unit of the Missouri Department of Natural Resources' Air Pollution Control Program.

Missouri Certification Number: 7118011422MOIR12300

Course Training Date: January 14, 2022

Missouri Certification Approval Date: January 26, 2022

Missouri Certification Expiration Date: January 26, 2023

### Note:

- All Missouri-certified asbestos personnel must comply with the following statutes and regulations:
  - Sections 643.225 to 643.250, RSMo;
  - 10 CSR 10-6.241 *Asbestos Projects-Registration, Abatement, Notification, Inspection, Demolition, and Perfi*
  - 10 CSR 10-6.250 *Asb Requirements.*

- To keep your occupation ce and submit a renewal applic

CERTIFICATION NUMBER:  
**7118011422MOIR12300**

THIS CERTIFIES  
**Michelle M Beck**

HAS COMPLETED THE CERTIFICATION

REQUIREMENTS FOR  
**Inspector**



Business Exemption

1 refresher course

1 refresher

APPROVED: **01/26/2022**

TRAINING DATE: **01/14/2022**

EXPIRES: **01/26/2023**

*Stephen M. Hall*  
Director of Air Pollution Control Program

## **SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Demolition and removal of selected portions of building or structure.

#### **1.2 SUBMITTALS**

- A. Pre-demolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.
- B. Asbestos Containing Material Remediation Plan: If necessary provide plan of ACM management, removal and disposal
- C. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

#### **1.3 QUALITY ASSURANCE**

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

#### **1.4 DEFINITIONS**

- A. Demolish: Completely remove and legally dispose of off-site.
- B. Recycle: Recovery of demotion waste for subsequent processing at a recycling facility.
- C. Salvage: Carefully detach and remove from existing construction, in a manner to prevent damage and deliver to Owner at a specified location. Include fasteners or brackets needed for reattachment elsewhere as applicable.

#### **1.5 PROJECT CONDITIONS**

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Coordinate with Owner's representative regarding the schedule of days on which selective demolition may occur.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

- C. Hazardous Materials: Asbestos sampling and associated reports have been completed and are included in this Project Manual. Asbestos is present within the building. Contractor shall review entire report and avoid disturbance of asbestos containing materials not indicated to be abated. Coordinate with asbestos abatement plans and specifications.
  - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Owner.
- D. Utility Service: Maintain existing utilities to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

## **1.6 WARRANTY**

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

## **PART 2 PRODUCTS (NOT USED)**

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict.

### **3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS**

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
- C. Demolish existing exposed conduit where indicated on the Drawings.

### **3.3 PREPARATION**

- A. Coordinate and verify that any asbestos, special waste or hazardous waste materials have been remediated in areas of demolition before proceeding.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with other adjacent occupied and used facilities.

- C. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain. Contractor is responsible for not only installing temporary protection and dust barriers, but also checking it every day to ensure the protection is in place and containing the spread of dust. Maintenance of the protection is the responsibility of the Contractor. All temporary protection shall be installed in a manner that does not damage any historic surfaces.

### **3.4 SELECTIVE DEMOLITION**

- A. General: Demolish and remove existing construction only to the extent required by new construction. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Perform all demolition work in accordance with the Secretary of the Interior's Standards for Rehabilitation and any relevant National Park Service Preservation Briefs. Exercise caution during all selective demolition and minimize damage to substrates. If damage occurs, repair and/or repaint as described elsewhere in these specifications.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 4. Do not use cutting torches.
  - 5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 6. Dispose of demolished items and materials promptly.
- B. Existing Items to Remain: Protect construction to remain against damage and soiling during selective demolition.

### **3.5 DISPOSAL OF DEMOLISHED MATERIALS**

- A. General: Remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
- B. Burning: Do not burn demolished materials.

### **3.6 CLEANING**

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

**END OF SECTION 024119**

## **SECTION 024296 - HISTORIC REMOVAL AND DISMANTLING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes historic treatment procedures in the form of special types of selective demolition work for designated historic spaces, areas, rooms, and surfaces and the following specific work:
  - 1. Removal and dismantling of indicated portions of building or structure and debris hauling.
  - 2. Removal and dismantling of indicated site elements and debris hauling.
- B. Related Requirements:
  - 1. Section 013591 "Historic Treatment Procedures" for general historic treatment requirements.

#### **1.2 DEFINITIONS**

- A. Dismantle: To disassemble or detach a historic item from a surface, or a non-historic item from a historic surface, using gentle methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- B. Existing to Remain: Existing items that are not to be removed or dismantled, except to the degree indicated for performing required Work.
- C. Remove: To take down or detach a non-historic item located within a historic space, area, or room, using methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- D. Retain: To keep existing items that are not to be removed or dismantled.
- E. Salvage: To protect removed or dismantled items and deliver them to Owner.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by Contractor's removal and dismantling operations. Submit before work begins.

#### **1.4 QUALITY ASSURANCE**

- A. Removal and Dismantling Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for removal and dismantling work, including protection of surrounding and substrate materials and Project site.



- B. Regulatory Requirements: Comply with notification regulations of authorities having jurisdiction before beginning removal and dismantling work. Comply with hauling and disposal regulations of authorities having jurisdiction.

## **1.5 FIELD CONDITIONS**

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Designer of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.
- C. Hazardous Materials: Asbestos sampling and associated reports have been completed and are included in this Project Manual. Asbestos is present within the building. Contractor shall review entire report and avoid disturbance of asbestos containing materials not indicated to be abated. Coordinate with asbestos abatement plans and specifications.
  - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Designer and Owner.
- D. Storage or sale of removed or dismantled items on-site is not permitted unless otherwise indicated.

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

## **PART 3 EXECUTION**

### **3.1 HISTORIC REMOVAL AND DISMANTLING EQUIPMENT**

- A. Removal Equipment: Use only hand-held tools, except as follows or unless otherwise approved by Designer on a case-by-case basis.
- B. Dismantling Equipment: Use manual, hand-held tools, except as follows or otherwise approved by Designer on a case-by-case basis.

### **3.2 EXAMINATION**

- A. Preparation for Removal and Dismantling: Examine construction to be removed or dismantled to determine best methods to safely and effectively perform removal and dismantling work. Examine adjacent work to determine what protective measures are necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed or dismantled and location of utilities and services to remain that may be hidden by construction that is to be removed or dismantled.
- B. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

- C. Perform surveys as the Work progresses to detect hazards resulting from historic removal and dismantling procedures.

### **3.3 HISTORIC REMOVAL AND DISMANTLING**

- A. General: Have removal and dismantling work performed by a qualified historic removal and dismantling specialist. Ensure that historic removal and dismantling specialist's field supervisors are present when removal and dismantling work begins and during its progress.
- B. Perform work according to the Secretary of the Interior's Standards for Rehabilitation and any relevant National Park Service Preservation Briefs.
  - 1. Perform removal and dismantling to the limits indicated.
  - 2. Provide supports or reinforcement for existing construction that becomes temporarily weakened by removal and dismantling work, until the Project Work is completed unless otherwise indicated.
  - 3. Perform cutting by hand or with small power tools wherever possible. Cut holes and slots neatly to size required, with minimum disturbance of adjacent work.
  - 4. Do not operate air compressors inside building unless approved by Designer in each case.
  - 5. Do not drill or cut columns, beams, joints, girders, structural slabs, or other structural supporting elements, without having Contractor's professional engineer's written approval for each location before such work is begun.
  - 6. Dispose of removed and dismantled items off-site unless indicated to be salvaged or reinstalled.
- C. Water-Mist Sprinkling: Use water-mist sprinkling and other wet methods to control dust only with adequate, approved procedures and equipment to ensure that such water does not create a hazard or adversely affect other building areas or materials.
- D. Unacceptable Equipment: Keep equipment that is not permitted for historic removal or dismantling work away from the vicinity where such work is being performed.
- E. Removing and Dismantling Items on or Near Historic Surfaces:
  - 1. Use only dismantling equipment and procedures within 12 inches of historic surface. Do not use pry bars. Protect historic surface from contact with or damage by tools.
  - 2. Unfasten items in the opposite order from which they were installed.
  - 3. Support each item as it becomes loosened to prevent stress and damage to the historic surface.
  - 4. Dismantle anchorages.
- F. Anchorages:
  - 1. Remove anchorages associated with removed items.
  - 2. Dismantle anchorages associated with dismantled items.
  - 3. In nonhistoric surfaces, patch holes created by anchorage removal or dismantling according to the requirements for new work.

4. In historic surfaces, patch or repair holes created by anchorage removal or dismantling according to Section that is specific to the historic surface being patched.

**END OF SECTION 024296**

# SECTION 028213 - ASBESTOS ABATEMENT

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Perform all operations in connection with asbestos abatement and related work as shown on drawings and/or specified herein.
- B. Description of Work:
1. Removal: All asbestos containing building materials identified to be removed on the drawings and/or specified herein. The EPA NESHAP and OSHA regulations as adopted by the Missouri Department of Natural Resources as well as Missouri Air Conservation Law Sections 643.225 – 643.250 and Missouri State Regulations 10 CSR 10-6.241 and 10-6.250 shall govern these asbestos abatement activities. The work includes all coordination efforts with the Missouri Supreme Court and other contractors to complete this portion of the project.
  2. Asbestos removal work includes the following:
    - a. Base Bid

Proper removal and disposal of the identified asbestos containing pipe insulation, drywall joint compound, floor tile mastic, and ceiling tile mastic in the Missouri Supreme Court Building. Identified asbestos containing building materials and approximate quantities are described below and are shown on Drawings.

<u>ACBM Description</u>	<u>Location</u>	<u>Approximate Quantity</u>
Drywall Joint Compound	3 <sup>rd</sup> Floor Corridor & Judge Living Area	250 Square Feet
Mastic for Floor Tile	3 <sup>rd</sup> Floor Toilet Room	35 Square Feet
Mastic for Ceiling Tile	Basement (Rooms B-12 & B-13)	25 Square Feet
Pipe Run Insulation	Basement	*630 Linear Feet
Pipe Fitting Insulation	Basement	88 Fittings

Note: \* = Total Quantity Listed of 585 Linear Feet includes: 21 LF of 2" insulation; 272 LF 4" insulation; 142 LF 6" insulation; and 195 LF 8" insulation.

- C. Special Precautions:
1. Coordinate with the Owners Project Representative for the shutdown and isolation of all electrical circuits and air movement systems within the regulated area from that of the rest of the facility to prevent any inconvenience to building occupants and contamination outside of the regulated area.
  2. Significant coordination efforts are expected between the Asbestos Abatement Contractor, Missouri Supreme Court, and other contractors. The lump sum cost shall include all costs associated with any coordination efforts necessary between contractors to complete the entire project.
  3. The building will be occupied during the asbestos abatement activities. Special precautions shall be utilized to coordinate with the Missouri Supreme Court occupants to minimize disruption.
  4. The work is proposed to be completed in phases. The anticipated phasing description is included in Section 011000 Summary of Work.

- D. Restoration: Asbestos Abatement Contractor is responsible for restoring all existing finish surfaces to their original state, which were damaged as a result of removal activities. Replacement of removed building materials is not part of the asbestos abatement work.

## 1.2 REFERENCES

### A. General Reference:

1. All work under this contract shall be done in strict accordance with all applicable Federal, State, and Local regulations, standards and codes governing asbestos abatement and any other trade work done in conjunction with the abatement.
2. The most recent edition of any relevant regulation in force at the time of bid opening shall be in effect. Where conflict among the laws, rules, and regulations or with these specifications exists, the most stringent requirements shall be utilized.
3. The Contractor shall make available, in the clean change area of the worker decontamination system, copies of this specification and all standards, regulations, and codes listed hereinafter as necessary.

### B. Specific Reference:

1. Occupational Safety and Health Administration (OSHA):
  - a. Title 29 Code of Federal Regulations (CFR), Section 1910
    - 1) .20 - Access to Employee Exposure and Medical Records.
    - 2) .134 - Respiratory Protection (see also ANSI Z88.2 (1980)).
    - 3) .1001 - Occupational Exposure to Asbestos - General Industry.
    - 4) .1200 - Hazard Communication.
    - 5) Subpart D - Walking - Working Surfaces.
    - 6) Subpart S - Electrical.
  - b. Title 29 Code of Federal Regulations (CFR), Section 1926.1101 - Construction Industry, including the mandatory appendices:
    - 1) Appendix A - OSHA Reference Method.
    - 2) Appendix C - Qualitative and Quantitative Fit Testing Procedures.
    - 3) Appendix D - Medical Questionnaires.
    - 4) Appendix E - Interpretation and Classification of Chest Roentgenograms.
    - 5) Non-mandatory appendices:
    - 6) Appendix B - Detailed Procedures for Asbestos, Tremolite, Anthrophyllite, and Actinolite Sampling and Analysis.
    - 7) Appendix F - Work Practices and Engineering Controls for Major Asbestos Removal, Renovation, and Demolition Operations.
    - 8) Appendix G - Work Practices and Engineering Controls for Small Scale, Short Duration Asbestos Renovation and Maintenance Activities.
    - 9) Appendix H - Substance Technical Information for Asbestos.
    - 10) Appendix I - Medical Surveillance Guidelines for Asbestos, Tremolite, Anthrophyllite, and Actinolite.
  - c. Title 29 Code of Federal Regulations (CFR), Section 1926.59 - Hazard Communication Standard, requires employers to inform their workers of the hazards of any chemicals used on the project and to train their employees in proper safeguards.
    - 1) Subpart L - Scaffolds.
    - 2) Subpart X - Stairways and Ladders.
2. Environmental Protection Agency (EPA): Title 40 Code of Federal Regulations (CFR) Part 763 Subpart G - Asbestos Abatement Projects; Worker Protection

3. Environmental Protection Agency (EPA) Title 40 Code of Federal Regulations (CFR) Part 61 - National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision.
  - a. Subpart A - General Provisions.
  - b. Subpart B - National Emission Standard for Asbestos
  - c. Subpart M - National Emissions Standard for Asbestos, Asbestos Stripping Work Practices and Disposal of Asbestos Waste.
4. Missouri Department of Natural Resources (MDNR), State of Missouri, Missouri Air Conservation Law Sections 643.225 – 643.250
5. State of Missouri, Missouri State Regulations 10 CSR 10-6.241 and 10-6.250.

### **1.3 QUALIFICATIONS**

- A. The prospective Asbestos Abatement Contractor who is proposed to actually perform the asbestos abatement work, shall submit, if requested, to the Owner the data hereinafter requested within ten (10) days after Bid Opening.
- B. The proposed Asbestos Abatement Contractor shall, if requested:
  1. Demonstrate prior experience on asbestos abatement projects of similar nature and scope of that being bid, through the submission of letters of reference from building owners including the name, address, and telephone numbers of the contact persons who are specifically familiar with the referenced projects. At least three (3) previous users of this service shall be submitted. Include descriptions of projects and records of all air monitoring data that was generated during the projects.
  2. Submit a list of names, work responsibilities and evidence of certification for all employees that will be assigned to the asbestos abatement portion of this project: At least one firm principal, the firm's "competent person" and any other personnel performing supervisory duties must be certified by the Missouri Department of Natural Resources (MDNR) as an Asbestos Supervisor.
- C. Contractor's employees who perform asbestos abatement activities must hold a valid Asbestos Worker License certified by the MDNR.

### **1.4 DEFINITIONS**

- A. See 29 CFR 1926.1101(b), 40 CFR 763 Subpart E Section 763.83 and 40 CFR 61 Subpart M Section 61.141.

### **1.5 SUBMITTALS AND NOTICES**

- A. If necessary, prior to commencement of work, Asbestos Abatement Contractor shall:
  1. Submit the following items to the Missouri Department of Natural Resources (MDNR) postmarked or facsimile dated at least 10 working days (or less if waived) prior to the commencement of an asbestos abatement project.
    - a. The Asbestos NESHAP Notification of Demolition and Renovation provided by the MDNR shall be completed and submitted by the contractor for all abatement projects. The completed form shall contain only correct and accurate information. The Architect/Engineer shall be copied on all correspondence and notifications.

2. The contractor shall notify the MDNR in writing on the form provided by the Department prior to any change in start date, completion date and scope of the project.
3. Five (5) days prior to commencement of work, the contractor shall submit the following items to the project manager assigned by the Engineer/Architect. These items shall be up-to-date and shall be maintained by the project manager.
  - a. Documentation of arrangements for the transport and disposal of asbestos-containing or contaminated materials and supplies and the name and location of the disposal site.
  - b. Documentation that each asbestos worker and supervisor is licensed.
  - c. Drawings for layout and construction of decontamination enclosure systems and barriers for isolation of the work area.
  - d. When rental equipment is to be used in removal areas or to transport waste materials, a copy of the written notification to inform the rental company of the nature of use of the rented equipment.
  - e. Copies of initial and current accreditation certificates of all licensed persons and the original license.
  - f. Documentation that all employees or agents who may be exposed to airborne asbestos in excess of the OSHA action level have been medically determined to be physically capable of working while wearing the respirator required without suffering adverse health effects.
4. During abatement activities the contractor shall submit on a bi-weekly basis the following items to the Architect/Engineer:
  - a. Job progress reports detailing abatement activities, including a review of progress with respect to previously established schedules, problems and actions taken, injury reports, and equipment breakdowns.
  - b. Copies of all transport manifests, trip tickets and disposal receipts for all asbestos waste materials removed from the work area during the abatement process shall be submitted to the Architect/Engineer within 10 days after the completion of the project.
  - c. Copies of worksite entry log books with information on worker and visitor access.
  - d. Logs documenting filter changes on respirators, HEPA vacuums, negative pressure ventilation units, and other engineering controls.
  - e. Logs documenting that each asbestos worker present and in the abatement area was licensed as such by the MDNR.
  - f. Any revisions to the start date, completion date or scope of the project.
  - g. Results of bulk material analysis and air sampling data collected during the course of the abatement including OSHA compliance air monitoring results.

## **1.6 SITE SECURITY**

- A. Asbestos Abatement Contractor shall be responsible for the security of the regulated area(s) during abatement operations in order to protect work efforts and equipment.
- B. The regulated area shall be restricted to only authorized, trained, and protected personnel. These may include the Contractor's employees, employees of subcontractors, state representatives, Owner's representative(s), and any other designated individuals.

- C. A log book shall be maintained in the clean room area of the decontamination system. Anyone who enters the regulated area must record name, affiliation, time in, and time out for each entry.
- D. Provide protection for personnel and building in accordance with 40 CFR 763 Subpart G – Worker Protection, 29 CFR 1910.134, and 29 CFR 1926.1101 Appendix F & Appendix G.
- E. Access to the regulated areas under containment shall be through air locks. All other means of access (doors, windows, hallways, etc.) shall be blocked or locked so as to prevent entry to or exit from the regulated area. The only exceptions to this rule are the waste pass-out air lock which shall be sealed, except during the removal of containerized asbestos waste from the regulated area, and emergency exits in case of fire or accident. Emergency exits shall not be locked from the inside; however, they shall be sealed with polyethylene sheeting and tape until needed.

## **1.7 MULTI-EMPLOYER WORKSITES**

- A. The project is being conducted at a multi-employer worksite.
- B. On multi-employer worksites, an Asbestos Abatement Contractor performing work requiring the establishment of a regulated area shall inform other employers on the site of the nature of the Asbestos Abatement Contractor's work with asbestos, of the existence of and requirements pertaining to regulated areas, and the measures taken to ensure that employees of such other employers are not exposed to asbestos.
- C. Asbestos hazards at a multi-employer work site shall be abated by the contractor who created or controls the source of asbestos contamination. For example, if there is a significant breach of an enclosure containing Class I work, the employer responsible for erecting the enclosure shall repair the breach immediately.
- D. In addition, all employers of employees exposed to asbestos hazards shall comply with applicable protective provisions to protect their employees. For example, if employees working immediately adjacent to a Class I asbestos job are exposed to asbestos due to the inadequate containment of such job, their employer shall either remove the employees from the area until the enclosure breach is repaired; or perform an initial exposure assessment.
- E. The Asbestos Abatement Contractor shall take steps on a daily basis to ascertain the integrity of the enclosure and/or the effectiveness of the control method relied on by the Asbestos Abatement Contractor to assure that asbestos fibers do not migrate from regulated areas to adjacent areas.
- F. All general contractors on a construction project which includes work covered by 29 CFR 1926.1101 shall be deemed to exercise general supervisory authority over the work covered by 29 CFR 1926.1101, even though the general contractor is not qualified to serve as the asbestos "competent person". As supervisor of the entire project, the general contractor shall ascertain whether the Asbestos Abatement Contractor is in compliance with 29 CFR 1926.1101, and shall require such contractor to come into compliance with the standard when necessary.

## **1.8 PRECONSTRUCTION MEETING**

- A. The Contractor shall attend a pre-construction meeting to be conducted at a time and place designated by the Owners Project Representative. All parties (or designated person) having an active role in asbestos abatement shall be in attendance.



- B. The Contractor, Contractor's competent person and other supervisory personnel who will provide on-site direction of the abatement activities must attend.
- C. At this meeting the Contractor shall provide all pre-construction documentation as required by Article entitled: "Submittals and Notices," herein.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Polyethylene sheeting for containments shall be a minimum of six (6) mil thick. Sheeting shall be used in widths selected to minimize the frequency of joints.
- B. Polyethylene sheeting utilized for decontamination enclosure shall be opaque white or black in color.
- C. The contractor performing asbestos abatement shall furnish all labor, materials, and equipment necessary for completion of the project.
  - 1. All materials subject to damage shall be stored off the ground, away from wet or damp surfaces, and under protective cover to prevent damage or contamination. Replacement materials shall be stored outside of the work area until abatement is completed.
  - 2. Damaged and deteriorating materials shall not be used and shall be removed from the premises.
  - 3. Plastic (polyethylene) sheeting, in sizes to minimize the frequency of joints, shall be furnished.
  - 4. Duct tape shall be used for sealing joints of adjacent sheets of plastic and facilitating attachment of plastic sheets to finished or unfinished surfaces.
  - 5. Spray adhesive shall be capable of providing additional sealing of joints and facilitating attachment of plastic sheeting to finished or unfinished surfaces where needed.
  - 6. The surfactant used to produce amended water shall be a product that is nontoxic, noncarcinogenic, and is not an eye, nose, or skin irritant.
  - 7. Airtight and watertight containers shall be provided to receive and retain any asbestos-containing or contaminated materials for storage until disposal at a landfill. The containers shall be labeled in accordance with OSHA regulation 29 CFR 1926.1101(k)(8).
  - 8. Plastic asbestos disposal bags shall be a minimum of six (6) mil or equivalent in thickness and be marked with caution labels in accordance with OSHA regulation 29 CFR 1926.1101(k)(8).
  - 9. Enclosure materials shall be impact resistant and assembled to be airtight. Gypsum panels taped at the seams, tongue and groove boards, and boards with spline joints all meet this requirement. Joints between walls and ceilings shall be caulked.
  - 10. An encapsulant shall adhere to the fibrous substrate with sufficient penetration to prevent separation of the sealant from the asbestos-containing materials.
  - 11. Hardboard or plywood, minimum 1/4 inch thick shall be furnished to protect finished floor surfaces such as carpet or hardwood floors to prevent damage from scaffolds, lifts, or falling objects in the portion of the building to remain. Such protection shall also be provided for polyethylene sheeting under the scaffold area if the material being removed has sharp projections which could readily puncture the enclosure material.
  - 12. Disposal drums for transporting disposal bags shall be metal or fiberboard with locking ring tops.

13. Bridging type encapsulant (for sealing masonry and concrete walls, barrier surfaces during cleanup phase and asbestos containing surfaces to remain in place) shall be capable of being applied with airless spray equipment, able to withstand light impact or abrasion without releasing fibers, and water insoluble when cured.
14. Penetrating type encapsulant (for sealing scratch coat plaster, wood grounds and wood blocking which have been in contact with asbestos containing material and also exposed ends of pipe insulation) shall not be noxious or toxic to applicator or subsequent occupants, shall have high flame retardance and low toxic fume and smoke emission ratings, shall have some permeability to water vapor to prevent condensation accumulation.

## **2.2 EQUIPMENT**

- A. Negative Pressure Ventilation Units:
  1. Negative air pressure equipment shall be in compliance with ANSI Z9.2 (1991), Local Exhaust Ventilation.
  2. Negative air pressure systems shall be operated in accordance with "Specifications and Operating Procedures for the Use of Negative Pressure Systems for Asbestos Abatement," Guidance for Controlling Friable Asbestos-Containing Materials in Buildings, EPA Report Number 560/5-85-024 (1985).

## **PART 3 - EXECUTION**

### **3.1 GENERAL CONDITIONS**

- A. Building protection, commencement of asbestos abatement work, preparation of regulated area(s), worker decontamination enclosure systems, remote decontamination enclosure systems, equipment decontamination enclosure systems, separation barriers, maintenance of decontamination enclosure systems and workplace barriers, workplace entry and exit procedures, removal procedures, cleanup procedures, disposal procedures, and reestablishment of the work area shall all be carried out in accordance with all applicable federal, state, and local regulations and as described herein.

### **3.2 ADDITIONAL CONDITIONS**

- A. Plans for construction, including materials and layout of the worker decontamination enclosure system, shall be submitted to the Architect/Engineer prior to work initiation. Plans must include floor plan with dimensions, materials, size, thickness, plumbing and electrical utilities.
- B. REMOVAL OF ASBESTOS CONTAINING DRYWALL JOINT COMPOUND
  1. Removal of the asbestos containing drywall joint compound located on the third floor of the Missouri Supreme Court shall be conducted in accordance with the methods of compliance for Class I Work set forth in 29 CFR 1926.1101(g). All drywall shall be removed along with the drywall joint compound and shall be properly disposed of as asbestos containing material. A full containment with negative pressure shall be erected around the materials to be abated. Such containment may require construction of temporary walls for installation of enclosure system.

2. HVAC systems shall be isolated in the regulated areas by sealing with a double layer of 6 mil plastic or the equivalent.
3. Removal shall be conducted within a Negative Pressure Enclosure (NPE) system consisting of at least one (1) layer of 6 mil plastic. The NPE shall maintain at least four (4) air changes per hour. A minimum of -0.02 column inches of water pressure differential, relative to outside pressure, shall be maintained within the NPE as evidenced by manometric measurements. The NPE shall be kept under negative pressure throughout the period of its use. Air movement shall be directed away from employees performing asbestos work within the enclosure, and toward a HEPA filtration or a collection device.
4. Electrical circuits in the enclosure shall be deactivated, unless equipped with ground-fault circuit interrupters.
5. Removal shall be conducted utilizing wet methods.
6. All asbestos containing material removed shall be placed into leak-tight containers for proper disposal.

#### C. REMOVAL OF ASBESTOS CEILING TILE MASTIC

1. Removal of the asbestos ceiling tile mastic located in the basement of the Missouri Supreme Court shall be conducted in accordance with the methods of compliance for Class II Work set forth in 29 CFR 1926.1101(g). Critical barriers shall be placed over all openings to the regulated area. Impermeable dropcloths shall be placed on surfaces beneath all removal activity.
2. HVAC systems shall be isolated in the regulated areas by sealing with a double layer of 6 mil plastic or the equivalent.
3. Electrical circuits in the enclosure shall be deactivated, unless equipped with ground-fault circuit interrupters.
4. Removal shall be conducted utilizing wet methods.
5. All asbestos containing material removed shall be placed into leak-tight containers for proper disposal.

#### D. GLOVEBAG PROCEDURES

1. Glovebag systems may be used to remove asbestos containing pipe insulation located throughout the Missouri Supreme Court with the following specifications and work practices set forth in 29 CFR 1926.1101(g)(5)(ii):
  - a. Glovebags shall be, at a minimum, made of six (6) mil thick plastic and shall be seamless at the bottom.
  - b. Glovebags used on elbows and other connections must be designed for that purpose and used without modifications.
  - c. Each glovebag shall be installed so that it completely covers the circumference of pipe or other structure where the work is to be done.

- d. Glovebags shall be smoke-tested for leaks and any leaks sealed prior to use.
  - e. Glovebags may be used only once and may not be moved.
  - f. Glovebags shall not be used on surfaces whose temperature exceeds 150 °F.
  - g. Prior to disposal, glovebags shall be collapsed by removing air within them using a HEPA vacuum.
  - h. Before beginning the operation, loose and friable material adjacent to the glovebag operation shall be wrapped and sealed in two (2) layers of six (6) mil plastic or otherwise rendered intact.
  - i. Where system uses attached waste bag, such bag shall be connected to collection bag using hose or other material which shall withstand pressure of ACM waste and water without losing its integrity.
  - j. Sliding valve or other device shall separate waste bag from hose to ensure no exposure when waste bag is disconnected.
  - k. At least two (2) persons shall perform Class I glovebag removal operations.
  - l. Negative pressure glove bag systems may be used to remove ACM from piping.
  - m. In addition to specifications for glovebag systems above, negative pressure glovebag systems shall attach HEPA vacuum systems or other devices to bag to prevent collapse during removal.
  - n. The HEPA vacuum cleaner or other device used to prevent collapse of bag during removal shall run continually during the operation until it is completed at which time the bag shall be collapsed prior to removal of the bag from the pipe.
  - o. Where a separate waste bag is used along with a collection bag and discarded after one use, the collection bag may be reused if rinsed clean with amended water before reuse.
2. Glovebag procedures for the removal of pipe insulation shall be conducted in a regulated area properly demarcated in accordance with 29 CFR 1926.1101(e)(2). For the purpose of this project, Critical Barriers will be required within the regulated area where glovebag procedures are being performed.
  3. If glovebags are not utilized for removal of asbestos containing pipe insulation, the removal activities shall take place within a Negative Pressure Enclosure constructed in accordance with OSHA Regulation 1926.1101(g)(6).

#### E. WRAP AND CUT – THERMAL SYSTEM INSULATION GLOVEBAG PROCEDURES

1. The area must be pre-cleaned within ten (10) feet of the component being removed.
2. A wrap and cut method may be used when an entire component will be removed. If the piping in which the asbestos containing thermal system insulation is located on is not scheduled to remain, the Asbestos Abatement Contractor may utilize a wrap and cut method where appropriate.

3. Glovebag systems (described above) may be used to remove asbestos containing pipe insulation located at areas designated to be cut as part of the wrap and cut method. The ends of the thermal system insulation designated to be wrapped and removed shall be encapsulated.
4. Wet the asbestos containing thermal system insulation thoroughly.
5. The component must then be wrapped in 2 layers of 6-mil polyethylene sheeting.
6. The sheeting must be sealed with tape to provide an airtight seal around the component.
7. Once the component is sealed in poly, it may be cut from its original position and removed, provided the areas that are being cut are free from asbestos.
8. During removal, the component must be supported. The component then must be lowered to the ground or floor and not dropped or thrown.
9. The component must be labelled with the appropriate asbestos warning labels.
10. The component must then be properly removed from the building and disposed as asbestos waste.

#### F. FLOORING SYSTEM REMOVAL

1. Where appropriate, asbestos containing floor tile and mastic may be removed utilizing non-friable methods.
2. Abatement contractor shall remove all non-asbestos containing floor coverings over asbestos containing floor tile, prior to beginning removal process, if non-asbestos containing floor covering can be removed without disturbance of asbestos containing flooring.
3. For removal of floor tile that may be considered friable, only wet removal techniques will be allowed. Remove and dispose of all non-asbestos containing floor coverings, prior to containment construction of the work area. All curtains or draperies shall be removed from the work area prior to beginning removal activities. Prepare work area with barriers as specified herein.
  - a. Provide decontamination enclosures and differential air pressure as specified herein.
  - b. Collect the material that has been removed and place in sealable plastic bags (6 mil thick minimum) or drums. Each bag/drum shall be cleaned, wet wiped, evacuated, and removed from the work area. All plastic bags and containers must be imprinted with required warnings and/or labels. The preferred method is for the material to be placed directly into previously described containers.
  - c. Clean the external surfaces of the containers thoroughly in the work area. Next, move the containers into the Equipment Decontamination Enclosures.
  - d. After all visible gross material has been properly bagged and removed; wet clean and HEPA vacuum, as appropriate, the containment area.
4. The preferred method for removing asbestos containing mastic or adhesives is by solvents. If the area of removal is not already utilizing a negative pressure enclosure system, the work shall be conducted in a manner to exhaust odors generated from the process to the exterior of the

building. This may be conducted by utilizing a construction barrier similar to critical barriers and negative air exhaust to the exterior of the building. The solvent shall be required to conform to a minimum of the following conditions:

- a. Flash point (open or closed cup) > 200 degrees Fahrenheit.
- b. Auto Ignition Temperature > 600 degrees Fahrenheit.
- c. Slight odor, pH neutral, aromatic vapors < 100 ppm, and will not react violently with water.

G. WATER COLLECTION AND DISPOSAL

1. All excess water resulting from work activities shall be collected and placed in sealed containers for disposal as contaminated material.
2. Water from the decontamination shower shall be collected in a holding tank and filtered to remove particles of 0.5 microns or larger size before draining water into sanitary sewer system. The drainage and filtering system shall consist of the following:
  - a. A centrifugal pump capable of pumping at least 25 gallons/minute.
  - b. Two (2) filter cartridge housings, one (1) serving as a pre-filter, utilizing at least 6 cylindrical 100 micron filters (reusable type) and the other serving as final filter with 6 cylindrical 0.5 micron filters.
  - c. Maintain two (2) sets (6 cylinders per set) of 100 micron filters, to allow one set to be cleaned while the other set is in use.
  - d. A common garden hose may be connected to final filter housing to drain water to sanitary sewer system.

H. AIR MONITORING

1. The Asbestos Abatement Contractor shall take steps on a daily basis to ascertain the integrity of the enclosure and/or the effectiveness of the control method relied on by the Asbestos Abatement Contractor to assure that asbestos fibers do not migrate from regulated areas to adjacent areas.
2. Air monitoring may or may not be performed by an independent air sampling professional (ASP) employed by the Architect/Engineer to verify work procedures are not causing elevated airborne concentrations of asbestos fibers in the interior of the structure adjacent to the work area. However, if air sampling is conducted by an independent ASP, such air sampling shall not take the place of the required air sampling to be conducted by the Asbestos Abatement Contractor.

I. Daily Personal Air Monitoring (OSHA Compliance) (To be Conducted by Contractor):

- a. Daily determination of employee exposure shall be made by collecting one or more breathing zone samples that are representative of the 8-hour TWA, full-shift exposure for each employee in each regulated area; and one or more breathing zone air samples that are representative of 30-minute exposures associated with operations that are most likely to produce exposures above the excursion limit for employees in each regulated area.
- b. Daily personal air monitoring testing may be eliminated if employees are equipped with supplied-air respirators operated in a positive-pressure mode while performing abatement work.

J. CLEARANCE TESTING - PHASE CONTRAST MICROSCOPY (PCM) (To be Conducted by Owner's Representative)

1. Clearance sampling and analysis will be performed on select containments only after the asbestos abatement work area has been completely cleaned and visually inspected.

2. Air sampling for final clearance shall be conducted using collection procedures in accordance with NIOSH Standard Analytical Method 7400.
3. The specific locations where samples shall be taken and the number of samples shall be established by the Owner's Air Sampling Professional.
4. Aggressive sampling shall be performed with portable fans circulating air in the work area to simulate actual use conditions.
5. Air samples shall be analyzed by Phase Contrast Microscopy.
6. All samples analyzed shall indicate concentrations of airborne fibers less than 0.01 f/cc, or less than the average of the fiber count established by Baseline Test for outside containment air, whichever is greater. Areas exceeding this level shall require the area to be recleaned and retested until satisfactory levels are obtained. Only when tests meet the acceptable level, can the protective barriers of the regulated area be removed.
7. Owner will pay for initial clearance testing. The cost of any retesting, necessitated as a result of failure to meet requirements for clearance, shall be borne by the Asbestos Abatement Contractor.

**END OF SECTION 028213**

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

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 00 and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Structural shapes.
  - 2. Angles.
  - 3. Structural plates and bars.
  - 4. Bolts, connectors, and anchors.
  - 5. Grout.

#### **1.3 REFERENCE STANDARDS**

- A. American Institute of Steel Construction:
  - 1. AISC 303 - Code of Standard Practice for Structural Steel Buildings and Bridges.
  - 2. AISC 360 - Specification for Structural Steel Buildings.
- B. American Welding Society:
  - 1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
  - 2. AWS D1.1 - Structural Welding Code - Steel.
- C. ASTM International:
  - 1. ASTM A36 - Standard Specification for Carbon Structural Steel.
  - 2. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
  - 3. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
  - 4. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
  - 5. ASTM A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
  - 6. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  - 7. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
  - 8. ASTM A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
  - 9. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
  - 10. ASTM A786 - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.



11. ASTM A913 - Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process.
12. ASTM A992 - Standard Specification for Structural Steel Shapes.
13. ASTM E94 - Standard Guide for Radiographic Examination.
14. ASTM F436 - Standard Specification for Hardened Steel Washers.
15. 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.

D. Research Council on Structural Connections:

1. RCSC - Specification for Structural Joints Using High Strength Bolts.

#### **1.4 COORDINATION**

- A. Coordinate Work of this Section with related Divisions 02 through 33.

#### **1.5 SUBMITTALS**

- A. Notify the Architect/Engineer with the shop drawing schedule 14 calendar days prior to submitting structural steel shop drawings. Increase the allowed time for review by three business days for each 100 sheets of structural steel shop drawings and calculations exceeding 100 sheets.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and bolts.
2. Connections; all connection designs that have been modified from those shown on the design drawings shall be clouded on the shop drawings.
3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
4. Coordinate shop drawings with Architectural, Mechanical and Electrical design drawings.

- C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

- D. Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis.

- E. Source Quality-Control Submittals: Indicate results of shop and factory tests and inspections.

- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

- G. Perform Work according to State and local standards.

#### **1.6 QUALIFICATIONS**

- A. Fabricator: Company specializing in fabricating products specified in this Section with minimum 5 years experience:

- B. Erector: Company specializing in performing Work of this Section with minimum five years experience.
- C. Welders and Welding Procedures: AWS D1.1 qualified within previous 12 months.

## **PART 2 - PRODUCTS**

### **2.1 STRUCTURAL STEEL**

- A. Structural W-Shapes: ASTM A992; Grade 50.
- B. Channels and Angles: ASTM A36 or ASTM A572; Grade 50.
- C. Structural Plates and Bars: ASTM A36 or ASTM A572; Grade 50.
- D. Furnish materials according to State and local standards.

### **2.2 BOLTS, CONNECTORS, AND ANCHORS**

- A. Bolts: Heavy-hex, structural type.
  - 1. ASTM F3125 grade A325; Type 1, plain
- B. Nuts: ASTM A563; heavy-hex type.
  - 1. Finish: Plain
- C. Washers:
  - 1. ASTM F436.
  - 2. Type 1, circular
  - 3. Furnish clipped washers where space limitations require.
  - 4. Finish: Plain
  - 5. Plate Washers: ASTM A36.
- D. Threaded Rods:
  - 1. ASTM A36.
  - 2. Finish: Unfinished

### **2.3 WELDING MATERIALS**

- A. Welding Materials:
  - 1. AWS D1.1.
  - 2. Type required for materials being welded.

### **2.4 FABRICATION**

- A. Fabricate connections for bolt, nut, and washer connectors.

## **2.5 FINISHES**

- A. Structural Steel shall be cleaned and primed.

## **2.6 ACCESSORIES**

- A. Grout:
  - 1. ASTM C1107 Non-metallic, Non-shrink type; premixed compound consisting of nonmetallic aggregate, cement, water-reducing, and plasticizing additives.
  - 2. Capable of developing minimum compressive strength of 7,000 psi at 28 days.
- B. Shop Primer: SSPC Paint 15, Type 1, red oxide.
- C. Touchup Primer: Match shop primer.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that bearing surfaces are at correct elevation.

### **3.2 PREPARATION**

- A. Furnish templates for installation of treaded rods in masonry work.

### **3.3 ERECTION**

- A. Allow for erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.
- B. Field-connect members with threaded fasteners; torque to required resistance, tighten joints to snug-tighten for bearing-type connections.
- C. Do not field-cut or alter structural members without approval of Architect/Engineer.

### **3.4 GROUT INSTALLATION**

- A. Fill void with grout; install and pack grout to remove air pockets.
- B. Moist-cure grout.
- C. Remove forms after grout is set.

### **3.5 TOLERANCES**

- A. Maximum Variation from Plumb: 1/4 inch per story, noncumulative.
- B. Maximum Offset from Alignment: 1/4 inch.

### **3.6 FIELD QUALITY CONTROL**

- A. **Owner** shall engage a qualified testing and inspecting agency to perform field Special Inspections and testing in accordance with the applicable International Building Code and AISC 360 Chapter N. The testing and inspection agency is to submit reports.
- B. The Erector shall perform quality control inspection tasks as described in AISC 360 Chapter N prior to Special Inspections (Quality Assurance Inspections).
- C. The Contractor shall provide a minimum of 48 hours notification to the Special Inspector prior to needing an inspection. The Contractor shall provide access to the work so the Special Inspections can be completed. The Contractor shall verify all Special Inspections have been completed and discrepancies corrected prior to covering the work.
- D. Bolted Connections: Inspect according to AISC 303 and AISC 360 Chapter N.
  - 1. Visually inspect all bolted connections.
- E. Correct defective bolted connections.

**END OF SECTION 051200**

## **SECTION 057000 - DECORATIVE METAL**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes custom ornamental metal items.

#### **1.2 SUBMITTALS**

- A. Product Data: For each product indicated.
- B. Shop Drawings: Show details of fabrication and installation. Indicate materials, finishes, fasteners, anchorages, and accessory items.
- C. Samples: For each type of exposed finish required.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ornamental Mechanical Grilles:
    - a. Architectural Grille; Div. of Giumenta Corporation.
    - b. Harrington & King Perforating Co.
    - c. Reggio Registers Co., Inc.
    - d. Or approved equal.

#### **2.2 METALS**

- A. Steel and Iron:
  - 1. Steel Sheet, Cold Rolled: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, exposed, 22 ga.

#### **2.3 MISCELLANEOUS MATERIALS**

- A. Fasteners: Same basic metal as fastened metal; concealed, unless otherwise indicated, with Phillips flat-head screws for exposed fasteners.

- B. Anchors: Fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined per ASTM E 488.

**2.4 FINISHES**

A. Steel and Iron Finishes:

- 1. Powder-Coat Finish: Prepare, treat, and coat ferrous metal to comply with resin manufacturer's written instructions.
  - a. Preparation of Uncoated Ferrous Metal: Comply with SSPC-SP 6, "Commercial Blast Cleaning."
  - b. Preparation of Galvanized Metal: Thoroughly removing grease, dirt, oil, flux, and other foreign matter.
  - c. Treat prepared metal with metallic-phosphate pretreatment, rinse, and seal surfaces.
  - d. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils.
  - e. Color: Match sample below.

SHERWIN-WILLIAMS 5380      06/11/19  
 860-621-5396      Order# 0095366

INTERIOR      ARCHITECTURAL  
 COLOR TO GO      LATEX  
 SATIN      IFC 7012NP


MATCH  
 CUSTOM SHER-COLOR MATCH

CCE#COLORANT	OZ	32	64	128
W1-White	-	29	-	1
B1-Black	-	25	1	-
G2-New Green	-	15	1	-
Y3-Deep Gold	-	9	1	1

QUART      DEEP  
 A91W00453      650955958

Non Returnable Tinted Color

CAUTION: To assure consistent color, always order enough paint to complete the job and intermix all containers of the same color before application. Mixed colors may vary slightly from color strip or color chip.



0095366-002

21625

**2.5 PERFORATION PATTERN**

A. Basis of Design:

- 1. 0.125" diameter holes, staggered, 5/32" centers.
- 2. Minimum openness: 50%.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Provide anchorage devices and fasteners where necessary for securing to in-place construction.
- B. Set products accurately in location, alignment, and elevation. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers.
- C. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- D. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.
- E. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work.

**END OF SECTION 057000**

## **SECTION 060312 - HISTORIC WOOD REPAIR**

### **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 historic treatment of wood in the form of repairing wood features as follows:
  - 1. Repairing and reinstalling wood trim.
- B. Related Requirements:
  - 1. Section 013591 "Historic Treatment Procedures" for general historic treatment requirements.
  - 2. Section 024296 "Historic Removal and Dismantling" for historic removal and dismantling work.

#### **1.3 SEQUENCING AND SCHEDULING**

- A. Perform historic wood repair in the following sequence, which includes work specified in this and other Sections:
  - 1. Before removing wood components for on-site or off-site repair, tag each component with location-identification numbers. Indicate on tags and building plans the locations of each component, such as "Baseboard on North Side of Room 101."
  - 2. In the shop, label each repaired component and whole or partial replacement with permanent location-identification number in inconspicuous location and remove site-applied tags.
  - 3. Sort units by condition, separating those that need extensive repair.
  - 4. Clean surfaces.
  - 5. General Wood-Repair Sequence:
    - a. Remove paint to bare wood.
    - b. Repair wood by consolidation, replacement, partial replacement, and patching, if required.
    - c. Sand, prime, fill, sand again, and prime surfaces again for refinishing.
  - 6. Reinstall components.
  - 7. Apply finish coats.



## **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.
- B. Shop Drawings:
  - 1. Include plans, elevations, and sections showing locations and extent of repair and replacement work, with enlarged details of replacement parts indicating materials, profiles, joinery, reinforcing, method of splicing or attaching wood members to other surfaces, accessory items, and finishes.
  - 2. Include field-verified dimensions and the following:
    - a. Full-size shapes and profiles with complete dimensions for replacement components and their jointing, showing relationship of existing components to new components.
    - b. Identification of each new unit and its corresponding location in the building on annotated plans and elevations.
- C. Samples for Verification: For the following products in manufacturer's standard sizes unless otherwise indicated, finished as required for use in the Work:
  - 1. Replacement Wood: 12-inch- long, full-size molding sections with applied finish.
  - 2. Repaired Wood: Prepare Samples using existing wood removed from site, repaired, and prepared for refinishing.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Wood Historic Treatment Program: Submit before work begins.

## **1.6 QUALITY ASSURANCE**

- A. Historic Treatment Specialist Qualifications: A qualified historic wood-repair specialist, experienced in repairing, refinishing, and replacing wood in whole and in part. Experience only in fabricating and installing new woodwork is insufficient experience for wood historic treatment work.
- B. Wood Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for historic treatment work, including protection of surrounding materials and Project site.
  - 1. If materials and methods other than those indicated are proposed for any phase of historic treatment work, add a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Pack, deliver, and store products in suitable packs, heavy-duty cartons, or wooden crates; surround with sufficient packing material to ensure that products will not be deformed, broken, or otherwise damaged.
- B. Until installed, store products inside a well-ventilated area and protect from weather, moisture, soiling, abrasion, extreme temperatures, and humidity, and where environmental conditions comply with manufacturer's requirements.

## **1.8 FIELD CONDITIONS**

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

## **PART 2 PRODUCTS**

### **2.1 HISTORIC WOOD REPAIR, GENERAL**

- A. Quality Standard: Comply with applicable requirements in Section 12, "Historic Restoration Work," and related requirements in AWI/AWMAC/WI's "Architectural Woodwork Standards" for construction, finishes, grade rules, and other requirements unless otherwise indicated.
  - 1. Exception: Industry practices cited in Section 12, Article 1.5, "Industry Practices," of the Architectural Woodwork Standards do not apply to the work of this Section.

### **2.2 REPLICATED WOOD ITEMS**

- A. Scope: Replication of Wood Trim is only required if trim related to the scope of work is discovered to be missing or severely damaged or deteriorated. Trim which is intact and in excellent, good, or repairable condition is to be temporarily removed if required by new work and reinstalled rather than replicated.
- B. Replicated Wood Trim: Custom-fabricated replacement wood units and components.
  - 1. Joint Construction: Joints matching existing joints.
  - 2. Wood Species: Match species of existing wood.
  - 3. Wood Cut: Match cut of existing wood.
  - 4. Wood Member and Trim Profiles: Match profiles and detail of existing.
  - 5. Date Identification: Emboss on a concealed surface of each replaced item, in easily read characters, "MADE ." Manufacturer's name may also be embossed.

## 2.3 WOOD-REPLACEMENT MATERIALS

- A. Wood, General: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.
- B. Interior Trim: Match existing species.

## 2.4 WOOD-REPAIR MATERIALS

- A. Scope: Repair of Wood Trim is only required if trim related to the scope of work is discovered to be deteriorated and in need of repair. Trim which is intact and in excellent or good condition is to be temporarily removed if required by new work and reinstalled without repair.
- B. Source Limitations: Obtain wood consolidant and wood-patching compound from single source from single manufacturer.
- C. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated due to weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.
- D. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be designed for filling voids in damaged wood materials that have deteriorated due to weathering and decay. Compound shall be capable of filling deep holes and spreading to featheredge.

## 2.5 MISCELLANEOUS MATERIALS

- A. Cleaning Materials:
  - 1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
  - 2. Mildewcide: Commercial, proprietary mildewcide or a solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.
- B. Adhesives: Wood adhesives with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair and exposure condition.
- C. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.
  - 1. Match existing fasteners in material and type of fastener unless otherwise indicated.
  - 2. Use concealed fasteners for interconnecting wood components.
  - 3. Use concealed fasteners for attaching items to other work unless exposed fasteners are the existing fastening method].

4. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.

## **2.6 WOOD FINISHES**

- A. Unfinished Replacement Units: Provide exposed interior wood surfaces of replacement units unfinished; smooth, filled, and suitably prepared for on-site priming and finishing.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Protect adjacent materials from damage by historic wood repair.
- B. Clean wood of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.
- C. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

### **3.2 HISTORIC WOOD REPAIR, GENERAL**

- A. Historic Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Architect from 10 feet away for interior work.
- B. General: In treating historic items, disturb them as minimally as possible and as follows:
  1. Stabilize and repair wood to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
  2. Remove coatings before repair. Remove coatings according to Section 090391 "Historic Treatment of Plain Painting" unless otherwise indicated.
  3. Repair items in place where possible.
  4. Refinish historic wood according to Section 090391 "Historic Treatment of Plain Painting" unless otherwise indicated.
- C. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods, such as sanding, wire brushing, or power tools, except as indicated as part of the historic treatment program and as approved by Architect.
- D. Repair Wood: Match existing materials and features, retaining as much original material as possible to perform repairs.

1. Where existing materials are not in excellent or good condition, repair wood by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
  2. Where damage cannot be repaired by consolidating and patching, repair wood by limited replacement matching existing material.
- E. Replace Wood: Where existing materials are beyond repair, duplicate and replace units with units made from salvaged, sound, original wood or with new wood matching existing wood. Use surviving prototypes to create patterns for duplicate replacements.
1. Do not use substitute materials unless otherwise indicated.
- F. Identify removed items with numbering system corresponding to item locations, to ensure reinstallation in same location. Key items to Drawings showing location of each removed unit. Permanently label units in a location that will be concealed after reinstallation.

### **3.3 WOOD PATCH-TYPE REPAIR**

- A. General: Patch wood that exhibits depressions, holes, or similar voids, and that has limited amounts of rotted or decayed wood.
1. Verify that surfaces are sufficiently clean and free of paint residue prior to patching.
  2. Treat wood with wood consolidant prior to application of patching compound. Coat wood surfaces by brushing, applying multiple coats until wood is saturated and refuses to absorb more. Allow treatment to harden before filling void with patching compound.
  3. Remove rotted or decayed wood down to sound wood.
- B. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.
1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
  2. Mix only as much patching compound as can be applied according to manufacturer's written instructions.
  3. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
  4. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.
  5. Clean spilled compound from adjacent materials immediately.

### **3.4 WOOD-REPLACEMENT REPAIR**

- A. General: Replace parts of or entire wood items at locations where damage is too extensive to patch.
1. Remove surface-attached items from wood surface before performing wood-replacement repairs unless otherwise indicated.
  2. Verify that surfaces are sufficiently clean and free of paint residue prior to repair.
  3. Remove broken, rotted, and decayed wood down to sound wood.

4. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member.
  5. Secure new wood using finger joints, multiple dowels, or splines with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding sound wood.
- B. Repair remaining depressions, holes, or similar voids with patch-type repairs.
  - C. Clean spilled materials from adjacent surfaces immediately.
  - D. Reinstall items removed for repair into original locations.

### **3.5 CLEANING AND PROTECTION**

- A. Clean exposed surfaces immediately after historic wood repair. Avoid damage to coatings and finishes. Remove excess sealants, patching materials, dirt, and other substances.

**END OF SECTION 060312**

## **SECTION 061000 - ROUGH CARPENTRY**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Nonstructural dimension lumber framing.
- B. Miscellaneous framing and sheathing.

#### **1.2 REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings 2018.
- C. PS 20 - American Softwood Lumber Standard 2021.
- D. SPIB (GR) - Grading Rules 2014.

#### **1.3 DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
  - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at [www.alsc.org](http://www.alsc.org), and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

#### **2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS**

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Stud Framing (2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm )):
  - 1. Species: Allowed under referenced grading rules.
  - 2. Grade: No. 2.
- E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 2 or Standard Grade.
  - 2. Boards: Standard or No. 3.

## **2.3 ACCESSORIES**

- A. Fasteners and Anchors:
  - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
  - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length to achieve full penetration of sheathing substrate.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION - GENERAL**

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

### **3.2 FRAMING INSTALLATION**

- A. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.

### **3.3 BLOCKING, NAILERS, AND SUPPORTS**

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.



- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

### **3.4 TOLERANCES**

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

### **3.5 CLEANING**

- A. Waste Disposal: See Section 017400 - Cleaning.
  - 1. Comply with applicable regulations.
  - 2. Do not burn scrap on project site.
  - 3. Do not burn scraps that have been pressure treated.
  - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

**END OF SECTION 061000**

## **SECTION 079200 - JOINT SEALANTS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Joint backings and accessories.

#### **1.2 REFERENCE STANDARDS**

- A. ASTM C834 - Standard Specification for Latex Sealants 2017.
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- E. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.
- F. SCAQMD 1168 - Adhesive and Sealant Applications 1989, with Amendment (2017).

#### **1.3 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements 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. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
- 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.

#### **1.4 QUALITY ASSURANCE**

- A. Maintain one copy of each referenced document covering installation requirements on site.

## 1.5 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a one 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.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
  - 1. Master Builders Solutions: [www.master-builders-solutions.com/en-us/#sle](http://www.master-builders-solutions.com/en-us/#sle).
  - 2. Pecora Corporation: [www.pecora.com/#sle](http://www.pecora.com/#sle).
  - 3. Sika Corporation: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
  - 4. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).

### 2.2 JOINT SEALANT APPLICATIONS

- A. Scope:
  - 1. 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. In sound-rated wall and ceiling assemblies, 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.
    - b. Other joints indicated below.
  - 2. Do not seal the following types of joints.
    - a. Joints between suspended panel ceilings/grid and walls.
- B. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
  - 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
  - 2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
  - 3. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
- C. Interior Wet Areas: Bathrooms, restrooms, and kitchens; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

### 2.3 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

- B. Colors: To match adjacent surfaces, subject to approval by Owner and Designer.

## 2.4 NONSAG JOINT SEALANTS

- A. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
1. Color: Match adjacent finished surfaces.
  2. Manufacturers:
    - a. Master Builders Solutions; MasterSeal NP1: [www.master-builders-solutions.com/en-us/#sle](http://www.master-builders-solutions.com/en-us/#sle).
    - b. Sika Corporation; Sikaflex-1a: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Tremco Commercial Sealants & Waterproofing; Vulkem 116: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - d. Or approved equal.
- B. 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. Color: Match adjacent finished surfaces.
  2. Manufacturers:
    - a. Sika Corporation; Sikaflex-1a: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - b. Sika Corporation; Sikaflex-2c NS: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Or approved equal.
- C. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: Match adjacent finished surfaces.
  2. Manufacturers:
    - a. Master Builders Solutions; MasterSeal NP 520: [www.master-builders-solutions.com/en-us/#sle](http://www.master-builders-solutions.com/en-us/#sle).
    - b. Pecora Corporation; AC-20 +Silicone: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - c. Tremco Commercial Sealants & Waterproofing; Tremflex 834: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - d. Or approved equal.
- D. Acrylic Emulsion Latex: Fire and smoke rated.
1. Color: Match adjacent finish surfaces.
  2. Manufacturers:
    - a. Hilti, Inc; CP 506 Smoke and Acoustical Sealant: [www.ushilti.com#sle](http://www.ushilti.com#sle).

## 2.5 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 C - Closed Cell Polyethylene.
  2. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
  3. Manufacturers:
    - a. Sonneborn, Sonolastic Soft Backer-Rod.
    - b. C.R. Laurence "Sof Rod."
    - c. Or approved equal.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. 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.

### **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.
- 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. Tool joints smooth.
- H. 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.
- I. Nonsag Sealants: Tool surface to match existing profile, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

**END OF SECTION 079200**

## **SECTION 090190 - MAINTENANCE OF PAINTING AND COATING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Surface preparation for painting of interior historic items and surfaces.
  - 2. Patching of minor damage to surfaces of historic items to be painted.

#### **1.2 SUBMITTALS**

- A. Product Data: For each paint system indicated.

#### **1.3 EXTRA MATERIALS**

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
  - 1. Quantity: Furnish Owner with an additional 3 percent, but not less than 1 gal. or 1 case, as appropriate, of each material and color applied.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in Section 090931.

#### **2.2 PATCHING MATERIALS**

- A. Interior Cementitious Patching Compound Materials: Provide cementitious patching compounds and repair materials specifically manufactured for surface preparation and sanding prior to repainting.

#### **2.3 MISCELLANEOUS MATERIALS**

- A. Detergent Cleaning Solution: Mix 2 cups of tetrasodium polyphosphate, 1/2 cup of laundry detergent, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.

## **PART 3 EXECUTION**

### **3.1 SURFACE PREPARATION, GENERAL REQUIREMENTS**

- A. Prepare existing surfaces as follows:
  - 1. Clean existing surfaces to remove loose dirt and dust.
  - 2. Remove surface films that will prevent proper adhesion.
  - 3. Treat paint finishes with gloss sheen to dull the surface with de-glosser.
  - 4. Remove loose, blistered, or otherwise defective paint; smooth edges with sandpaper.
  - 5. Spackle and sand gypsum and plaster surfaces.
  - 6. Prime bare surfaces.
- B. If existing surfaces cannot be prepared to an acceptable condition for proper finishing by using specified surface-preparation methods, notify Designer in writing.
- C. Selection of surface-preparation tools and methods shall be the responsibility of the Contractor's painting restoration specialist, provided surface preparation complies with requirements specified for type of existing surface condition. Comply with the following general requirements for equipment:
  - 1. Do not use power tools including sanders, grinders, and power brushing tools.

### **3.2 SURFACE-PREPARATION METHODS**

- A. General: Use the cleaning methods specified in this article, using the gentlest appropriate method necessary to clean the surface.
- B. Wash surfaces by hand cleaning using clean rags, sponges, water, and detergent.
- C. Hand-Tool Cleaning: Use wet sanding and wet scraping methods only. Lightly mist substrate before sanding or scraping. Acceptable hand-tools include scrapers, wire brushes, sandpaper, steel wool, nonmetallic pads, and dusters. Because of varying substrates, selection of tools shall be the responsibility of Contractor. After hand-cleaning is attempted, power tool cleaning may be required to complete cleaning and surface preparation.

### **3.3 SURFACE PREPARATION FOR EXISTING PAINTED CEMENTITIOUS MATERIALS**

- A. New and Bare Plaster: Neutralize surface of plaster with mild acid solution as recommended by paint manufacturer. In lieu of acid neutralization, provide manufacturer's written recommendation for plaster primer over alkaline plaster surfaces.

### **3.4 SURFACE PREPARATION FOR EXISTING PAINTED PLASTER OR GYPSUM BOARD**

- A. Sound Existing Paint System: Wash all areas to be painted with a mild detergent solution; rinse with clean water until all detergent has been removed. Remove dirt and chalk from the surface without damaging the substrates or adjacent areas. Allow washed areas to dry thoroughly before painting.



### **3.5 APPLICATION, GENERAL**

- A. Comply with manufacturers' requirements for application methods and with other Division 09 painting Sections.
- B. In addition to the number of coats specified in schedules in other Division 09 painting Sections, provide additional coats as required to match adjacent surfaces.
- C. Blending: When painting new substrates patched into existing surfaces, furnish finishes specified for the specific substrate. Final finish coat shall be applied over entire surface from edge to edge and corner to corner.

### **3.6 CLEANING**

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
  - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

### **3.7 PROTECTION**

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Designer.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
  - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### **3.8 SURFACE-PREPARATION SCHEDULE**

- A. General: Prepare existing surfaces according to applicable requirements specified in this Schedule, which include descriptions of existing surface conditions before restoration painting begins.
- B. Surface-Preparation Class SP-1:
  - 1. Description: Existing paint film in good condition and tightly adhered.
  - 2. Surface Preparation: Detergent wash with specified cleaning methods. Roughen or degloss existing paint surfaces to ensure adhesion.
- C. Surface-Preparation Class SP-2:
  - 1. Description: Paint film cracked or broken but adhered.
  - 2. Surface Preparation: Following removal methods, detergent wash. Sand surfaces to smooth remaining paint film edges. Prepare bare cleaned surfaces to be repainted according to specified surface-preparation methods for substrate construction materials.

D. Surface-Preparation Class SP-3:

1. Description: Paint film loose, flaking, or peeling.
2. Surface Preparation: Following removal methods, detergent wash. Sand surfaces to smooth remaining paint film edges. Prepare bare cleaned surfaces to be repainted according to specified surface-preparation methods for substrate construction materials.

E. Surface-Preparation Class SP-5:

1. Description: Missing material, including small holes, openings, and deteriorated or corroded substrate.
2. Surface Preparation: Replace missing material by patching with compounds or splicing new material with old material. After patching, refinish new surface complying with surface preparation and painting specified for new construction materials. Provide surface preparation of adjacent existing materials to comply with surface-preparation class required for description of existing surface.

**END OF SECTION 090190**

## **SECTION 090320 - HISTORIC TREATMENT OF PLASTER**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Repair and replacement of historic interior lime plaster.
- B. Related Requirements:
  - 1. Section 013591 "Historic Treatment Procedures" for general historic treatment requirements.

#### **1.2 SEQUENCING AND SCHEDULING**

- A. Perform historic treatment of plaster in the following sequence, which includes work specified in this and other Sections:
  - 1. Dismantle existing surface-mounted objects and hardware that overlie plaster surfaces except items indicated to remain in place. Tag items with location identification and protect.
  - 2. Verify that temporary protections have been installed.
  - 3. Examine condition of plaster surfaces.
  - 4. Clean plaster surface and remove paint and other finishes to the extent required.
  - 5. Repair and replace existing plaster and supports to the degree required for a uniform, tightly adhered surface on which to paint or apply other finishes.
  - 6. Cure repaired surfaces and allow them to dry for proper finishing.
  - 7. Paint and apply other finishes.
  - 8. Reinstall dismantled surface-mounted objects and hardware unless otherwise indicated.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include recommendations for product application and use.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Plasterwork Historic Treatment Program: Submit before work begins.

#### **1.5 QUALITY ASSURANCE**

- A. Historic Treatment Specialist Qualifications: A qualified historic plastering specialist with expertise in matching and performing the types of historic plasterwork repairs required.

Experience only in installing and repairing new plasterwork, veneer plaster, or gypsum board is insufficient experience for historic treatment work.

- B. Plasterwork Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for historic treatment work and protection of surrounding materials and Project site.
  - 1. Include methods and procedures to protect plastered surfaces from damage caused by construction operations, including, but not limited to, exposure to moisture, vibration, mechanical damage, and soiling.
  - 2. If materials and methods other than those indicated are proposed for any phase of historic treatment work, add a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.

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

- A. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- B. Store materials on elevated platforms, under cover, and in a dry location with ambient temperatures continuously maintained at not less than 45 deg F.
- C. Store hydrated lime and factory-prepared lime putty in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- D. Store materials not in use in tightly covered containers.
- E. Store lime putty covered with water in sealed containers.
- F. Store sand where grading and other required characteristics can be maintained and contamination avoided.

## **1.7 FIELD CONDITIONS**

- A. Comply with plaster-material manufacturers' written instructions.
- B. Temperatures: Maintain temperatures in work areas at not less than 55 deg F or greater than 80 deg F for at least seven days before application of plaster, continuously during application, and for seven days after plaster has set or until plaster has dried.
- C. Avoid conditions that result in plaster drying out too quickly.
  - 1. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
  - 2. Maintain relative humidity levels for prevailing ambient temperature that produce normal drying conditions.
  - 3. Ventilate work areas in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

## **PART 2 PRODUCTS**

### **2.1 LIME-PLASTER MATERIALS**

- A. Hydrated Lime: ASTM C 206, Type S.
- B. Lime Putty: Slaked hydrated lime.
- C. Sand Aggregates: ASTM C 897.
  - 1. Finish-Coat Sand: Match size, texture, and gradation of existing sand as closely as possible. Blend several sands if necessary to achieve suitable match.

### **2.2 MISCELLANEOUS MATERIALS**

- A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Fasteners for Attaching Lath to Substrates:
  - 1. For Lime Plaster: ASTM C 1063.
  - 2. For Wood Lath: ASTM C 841 requirements for wood-floor-runner or wood-furring fasteners unless otherwise indicated on Drawings.
- C. Wire Ties: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.
- D. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
  - 1. Previous effectiveness in performing the work involved.
  - 2. Little possibility of damaging exposed surfaces.
  - 3. Consistency of each application.
  - 4. Uniformity of the resulting overall appearance.
  - 5. Do not use products or tools that could do the following:
    - a. Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
    - b. Leave an unintended residue on surfaces.

## **PART 3 EXECUTION**

### **3.1 HISTORIC TREATMENT OF PLASTER, GENERAL**

- A. Historic Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Designer from building interior at 10 feet away from surface.
- B. General: In treating historic plaster, disturb it as minimally as possible and as follows unless otherwise indicated:

1. Verify that substrate surface conditions are suitable for repairs.
  2. Provide lath, furring, and support systems for plaster to match and/or integrate with existing.
  3. Leave repaired plasterwork in proper condition for painting or applying other finishes as indicated.
  4. Install temporary protective measures to protect historic surfaces that shall be treated later.
- C. Illumination: Perform plastering work with adequate, uniform illumination that does not distort the flatness or curvature of surfaces.

### **3.2 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate and environmental conditions, installation tolerances, and other conditions affecting performance of the Work.
1. If existing substrates cannot be prepared to an acceptable condition for plastering work, notify Designer in writing.
  2. Notify Designer of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
- B. Begin historic plastering work only after unsatisfactory conditions have been corrected.

### **3.3 PREPARATION FOR PLASTERING**

- A. Substrates: Prepare according to plaster manufacturer's written instructions and as follows:
1. Clean surfaces to remove dust, loose particles, grease, oil, incompatible curing compounds, form-release agents, and other foreign matter and deposits that could impair bond with plaster.
  2. Remove ridges and protrusions greater than 1/8 inch and fill depressions greater than 1/4 inch with patching material. Allow to set and dry.

### **3.4 PLASTER REMOVAL AND REPLACEMENT, GENERAL**

- A. Maintain lath and supporting members in an undamaged condition so far as practicable. Dismantle damaged lath and supports that cannot be repaired or resecured and replace with new work of same type.
- B. Notify Designer of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
- C. Clean substrate surfaces to remove grease, waxes, oils, waterborne staining, debris, and other foreign matter and deposits that could impair bond with repair material.
- D. Wet wood lath and masonry bases before plaster application. Keep substrate damp to the touch but without visible water droplets.
- E. Wet remaining plaster abutting the replacement plaster before installing new plasterwork.

- F. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

### **3.5 FLAT LIME-PLASTER REMOVAL AND REPLACEMENT**

- A. Lime-Plaster Base Coats:
  - 1. Scratch Coat: 1 part lime putty, 2-1/2 parts base-coat sand.
  - 2. Brown Coat: 1 part lime putty, 3 parts base-coat sand.
- B. Lime-Plaster Finish Coats:
  - 1. Finish-Coat Mix for Smooth-Troweled Finish: 3 parts lime putty, 1 part finish-coat sand.
  - 2. Finish-Coat Mix for Smooth-Float Finish: 1 part lime putty, 1 part finish-coat sand.
  - 3. Finish-Coat Mix for Sandy Float Finish: 1 part lime putty, 3 parts finish-coat sand.
- C. Lime-Plaster Finishes: Blend to match finishes of adjacent surfaces.
- D. Hairline cracking within the plaster or plaster separation at edge of a replacement is unacceptable. Completely dismantle such work and reinstall or repair as a crack repair.

### **3.6 REMOVING AND INSTALLING LATH AND ACCESSORIES**

- A. Notify Designer of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
- B. Wood Lath: Install wood lath in same orientation and spacing as remaining wood lath and with lath ends supported by furring or framing. Stagger ends of adjacent laths over different supports, not aligned, and secure with fasteners at each end and spaced a maximum of 24 inches o.c. into supports.
- C. Metal Lath: Install according to ASTM C 1063 for lime plaster.
  - 1. Partition Framing and Vertical Furring: Install flat diamond-mesh lath.
  - 2. Flat-Ceiling and Horizontal Framing: Install flat diamond-mesh lath.
  - 3. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.

### **3.7 PATCH-TYPE REPAIR**

- A. General: Patch voids in otherwise sound plaster where fire alarm devices are to be removed and not replaced.
  - 1. Notify Designer of undocumented detrimental conditions including cracks, bulges, loose backup, rotted wood, rusted metal, and other deteriorated items.
  - 2. Inspect for deterioration of supporting plaster and lath, and repair or replace deteriorated material as required for a sound substrate.
  - 3. Rake perimeter of hole to sound plaster, and slightly undercut existing plaster to enable replacement plaster to tuck behind existing plaster.
  - 4. Replace missing lath in kind. Bridge gaps in wood lath with expanded-metal lath, overlapping wood by 6 inches and fastening them together.

5. Clean hole to remove loose materials and other foreign matter and deposits that could impair bond with repair material. Where grease, waxes, oils, waterborne staining, or other foreign matter and deposits that could impair bond with repair material have penetrated into the plaster, enlarge the hole to remove these deposits.
  6. Wet substrate to damp condition, but without visible water droplets, then install patch material to original profiles.
  7. Maintain adjacent plasterwork in an undamaged condition so far as practicable.
- B. Lime-Plaster Mix: 1 part lime putty, 3 parts sand .
- C. Finishing: Finish flat surfaces flush and with same texture as adjacent existing plaster.
- D. Hairline cracking within the plaster or plaster separation at edge of a patch is unacceptable. Completely dismantle such work and reinstall or repair.

### **3.8 CLEANING AND PROTECTION**

- A. Protect work of other trades against damage. Promptly remove plaster from surfaces not indicated to be repaired or plastered. Do not scratch or damage finished surfaces.
- B. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.
- C. Correct damage to other historic surfaces and to new work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. Remove temporary protection and enclosure of other work.

**END OF SECTION 090320**



## **SECTION 090391 - HISTORIC TREATMENT OF PLAIN PAINTING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes historic treatment of plain painting as follows:
  - 1. Plain painting of historic surfaces.
- B. Related Requirements:
  - 1. Section 013591 "Historic Treatment Procedures" for general historic treatment requirements.

#### **1.2 DEFINITIONS**

- A. Modern Paint Materials: Paint materials not designed to match historic paint formulations but that may be required to match historic paint colors.
- B. Plain Painting: For historic treatment, this means painting that requires attention to historic treatment requirements, but no special, decorative or artistic painting skill.

#### **1.3 SEQUENCING AND SCHEDULING**

- A. Perform historic treatment of painting in the following sequence, which includes work specified in this and other Sections:
  - 1. Verify that temporary protections have been installed.
  - 2. Examine condition of surfaces to be painted.
  - 3. Remove existing paint to the degree required for each substrate and surface condition of existing paint.
  - 4. Apply paint system.
  - 5. Reinstall dismantled surface-mounted objects and hardware unless otherwise indicated.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.
- B. Samples: For each type of paint system and each pattern, color, and gloss; minimum 4 inches long in least dimension.
  - 1. Label each Sample for location and application.
- C. Product List: For each paint product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Plain Painting Historic Treatment Program: Submit before work begins.

## **1.6 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra paint materials, from the same production run, that match products applied and that are packaged with protective covering for storage and identified with labels describing contents, including material, finish, source, and location on building.
  1. Quantity: Furnish Owner with an additional 3 percent, but not less than 1 gal. or one case, as appropriate, of each material and color applied.

## **1.7 QUALITY ASSURANCE**

- A. Historic Treatment Specialist Qualifications: A qualified historic painting specialist with expertise in matching and touching up existing painting. Experience only in new painting work is insufficient experience for historic treatment work.
- B. Color Matching: Custom computer-match paint colors to match existing surfaces. See finish schedule on Drawings for additional information.
- C. Plain Painting Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for historic treatment work, including protection of surrounding materials and Project site and control of runoff during cleaning, paint removal, repainting, and other processes.
  1. If materials and methods other than those indicated are proposed for any phase of historic treatment work, add a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.

## **1.8 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 daily.

## **1.9 FIELD CONDITIONS**

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

- B. Concealed and undocumented historic items, murals, and similar objects encountered during historic treatment remain Owner's property. Carefully protect each item or object.

## **PART 2 PRODUCTS**

### **2.1 PREPARATORY CLEANING MATERIALS**

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F.
- C. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for every 5 gal. of solution required.

### **2.2 PAINT, GENERAL**

- A. Material Compatibility:
  - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. Colors: To match adjacent existing surfaces.

### **2.3 MODERN PAINT MATERIALS, GENERAL**

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.
  - 1. Flat Paints and Coatings: 50 g/L.
  - 2. Nonflat Paints and Coatings: 150 g/L.
  - 3. Primers, Sealers, and Undercoaters: 200 g/L.

### **2.4 MODERN PAINT MATERIAL MANUFACTURERS**

- A. Manufacturers:
  - 1. Sherwin Williams.
  - 2. PPG Industries.
  - 3. Diamond Vogel.
  - 4. Benjamin Moore.

## 2.5 MODERN PAINT MATERIALS

### A. Primers and Sealers:

1. Primer Sealer, Latex, Interior, for Gypsum Wall Board Substrates: MPI #50.
  - a. Basis-of-Design Product: Sherwin Williams ProMar 200 Zero VOC Lax Primer, B28 Series.
2. Primer Sealer for Plaster Substrates: MPI #3.
  - a. Basis-of-Design Product: Loxon Concrete & Masonry Primer LX02W0050.
3. Primer Sealer for Masonry Substrates: MPI #3.
  - a. Basis-of-Design Product: Loxon Concrete & Masonry Primer LX02W0050.

### B. Water-Based Paints:

1. Latex, Interior, Flat, (Gloss Level 1), for horizontal surfaces: MPI #53.
  - a. Basis-of-Design Product: ProMar 200 Zero VOC Flat, B30 Series.
2. Latex, Interior, (Gloss Level 2), for vertical surfaces: MPI #44.
  - a. Basis-of-Design Product: ProMar 200 Zero VOC Eg Shel, B41 Series.

## 2.6 PATCHING MATERIALS

- A. Cementitious Patching Compounds: Cementitious patching compounds and repair materials specifically manufactured for filling cementitious substrates and for sanding or tooling prior to repainting; formulation as recommended in writing by manufacturer for type of cementitious substrate indicated, exposure to weather and traffic, the detail of work, and site conditions.
- B. Gypsum-Plaster Patching Compound: Finish coat plaster and bonding compound according to ASTM C 842 and manufacturer's written instructions.

## PART 3 EXECUTION

### 3.1 PROTECTION

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
  1. Cover adjacent surfaces with materials that are proven to resist chemical solutions being used unless the solutions will not damage adjacent surfaces. Use protective materials that are UV resistant and waterproof. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
  2. Do not apply chemical solutions during winds of sufficient force to spread them to unprotected surfaces.
  3. Neutralize and collect alkaline and acid wastes before disposal.

### **3.2 HISTORIC TREATMENT OF PAINTING, GENERAL**

- A. Historic Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Designer from building interior at 10 feet away from painted surface.
- B. Execution of the Work: In treating historic items, disturb them as minimally as possible and as follows:
  - 1. Verify that substrate surface conditions are suitable for painting.
  - 2. Allow other trades to repair items in place and retain as much original material as possible before repainting.
  - 3. Install temporary protective measures to protect historic painted surfaces that shall be treated later.
- C. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use only the gentlest mechanical methods, such as scraping and lightly hand sanding, that will not abrade softer substrates, reducing clarity of detail. Do not use abrasive methods such as rotary sanding, rotary wire brushing, or power tools except as indicated as part of the historic treatment program and as approved by Designer.
- D. Heat Processes: Do not use torches, heat guns, or heat plates.

### **3.3 EXAMINATION**

- A. Examine substrates and conditions, with historic treatment specialist present, for compliance with requirements for maximum moisture content and other conditions affecting performance of painting work. Comply with paint manufacturer's written instructions for inspection.
- B. Maximum Moisture Content of Substrates: Do not begin application of coatings unless moisture content of exposed surface is below the maximum value recommended in writing by paint manufacturer and not greater than the following maximum values when measured with an electronic moisture meter appropriate to the substrate material:
  - 1. Gypsum Board: 12 percent.
  - 2. Plaster: 12 percent.
- C. Alkalinity: Do not begin application of coatings unless surface alkalinity is within range recommended in writing by paint manufacturer. Conduct alkali testing with litmus paper on exposed plaster, cementitious, and masonry surfaces.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
  - 1. If existing surfaces cannot be prepared to an acceptable condition for proper finishing by using specified surface-preparation methods, notify Designer in writing.
- E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
  - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

### **3.4 PREPARATORY CLEANING**

- A. General: Use only the gentlest, appropriate method necessary to clean surfaces in preparation for painting. Clean all surfaces, corners, contours, and interstices.
- B. Detergent Cleaning: Wash surfaces by hand using clean rags, sponges, and bristle brushes. Scrub surface with detergent solution and bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet. Rinse with water applied by clean rags or sponges.

### **3.5 SUBSTRATE REPAIR**

- A. General: Repair substrate surface defects that are inconsistent with the surface appearance of adjacent materials and finishes.
- B. Cementitious Material Substrate:
  - 1. General: Repair defects left after fire alarm device removal including dents and chips more than 1/4 inch in size and all holes and cracks by filling with cementitious patching compound and sanding smooth. Remove protruding fasteners. Repairs in portions of walls or ceilings not directly related to the removal of fire alarm devices are not required.
  - 2. New and Bare Plaster: Neutralize surface of plaster with mild acid solution as recommended in writing by paint manufacturer. In lieu of acid neutralization, follow manufacturer's written instruction for primer or transition coat over alkaline plaster surfaces.
- C. Gypsum-Plaster and Gypsum-Board Substrates:
  - 1. Repair defects left after fire alarm device removal including dents and chips more than 1/4 inch in size and all holes and cracks by filling with gypsum-plaster patching compound and sanding smooth. Remove protruding fasteners. Repairs in portions of walls or ceilings not directly related to the removal of fire alarm devices are not required.
  - 2. Rout out surface cracks to remove loose, unsound material; fill with patching compound and sand smooth.

### **3.6 PAINT APPLICATION, GENERAL**

- A. Comply with manufacturers' written instructions for application methods unless otherwise indicated in this Section.
- B. Blending Plain Painted Surfaces: When painting new substrates patched into existing surfaces or touching up missing or damaged finishes, apply coating system specified for the specific substrate. Apply final finish coat over entire surface from edge to edge and corner to corner.

### **3.7 CLEANING AND PROTECTION**

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Designer, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### **3.8 SURFACE-PREPARATION SCHEDULE**

- A. General: Before painting, prepare surfaces for painting according to applicable requirements specified in this schedule.
  - 1. Examine surfaces to evaluate each surface condition according to paragraphs below.
  - 2. Where existing degree of soiling prevents examination, preclean surface and allow it to dry before making an evaluation.
  - 3. Repair substrate defects according to "Substrate Repair" Article.
- B. Surface Preparation for MPI DSD 0 Degree of Surface Degradation:
  - 1. Surface Condition: Existing paint film in good condition and tightly adhered.
  - 2. Paint Removal: Not required.
  - 3. Preparation for Painting: Wash surface by detergent cleaning; use solvent cleaning where needed. Roughen or degloss cleaned surfaces to ensure paint adhesion according to paint manufacturer's written instructions.
- C. Surface Preparation for MPI DSD 1 Degree of Surface Degradation:
  - 1. Surface Condition: Paint film cracked or broken but adhered.
  - 2. Paint Removal: Scrape by hand-tool cleaning methods to remove loose paint until only tightly adhered paint remains.
  - 3. Preparation for Painting: Wash surface by detergent cleaning; use other cleaning methods for small areas of bare substrate if required. Roughen, degloss, and sand the cleaned surfaces to ensure paint adhesion and a smooth finish according to paint manufacturer's written instructions.

**END OF SECTION 090391**

## **SECTION 092116 - GYPSUM BOARD ASSEMBLIES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Gypsum wallboard.
- B. Joint treatment and accessories.

#### **1.2 REFERENCE STANDARDS**

- A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).
- B. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- C. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.
- D. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- E. GA-216 - Application and Finishing of Gypsum Panel Products 2021.

#### **1.3 SUBMITTALS**

- A. Product Data: Provide data on gypsum board, accessories, and joint finishing system.

### **PART 2 PRODUCTS**

#### **2.1 BOARD MATERIALS**

- A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place and as required to make repairs; ends square cut.
  - 1. Thickness: match existing.
  - 2. Paper-Faced Products:
    - a. American Gypsum Company; FireBloc Type X Gypsum Wallboard: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
    - b. CertainTeed Corporation; Type X Drywall: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - c. Georgia-Pacific Gypsum; ToughRock Fireguard X: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - d. USG Corporation; USG Sheetrock Brand Firecode X Panels: [www.usg.com/#sle](http://www.usg.com/#sle).

#### **2.2 GYPSUM WALLBOARD ACCESSORIES**

- A. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.



- B. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
- D. Finishing Compound: Surface coat and primer, takes the place of skim coating.

## **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 Sealant: Install in accordance with manufacturer's instructions.

### **3.3 BOARD INSTALLATION**

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Areas of repair are to be feathered and blended to match existing adjacent surfaces.

### **3.4 JOINT TREATMENT**

- A. Finish gypsum board to match existing adjacent surfaces.
- 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 092116**

## **SECTION 092226.23 - METAL SUSPENSION SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

#### **1.2 SUMMARY**

#### **1.3 SECTION INCLUDES:**

- 1. Suspension System Framing and Furring for Gypsum Board Assemblies
  - 2. Main runners, cross tees, framing angles, aluminum trims, steel trims, accessories, hanger wire, finishing trims and fasteners.
- B. Related Divisions:
    - 1. Division 23 00 00 - HVAC

#### **1.4 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
  - 2. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
  - 3. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability"
  - 4. ASTM D 610 Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces
  - 5. ASTM B 117 Standard Practice for Operating Salt Spray (Fog) Apparatus
  - 6. ASTM C 635 Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
  - 7. ASTM C 636 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
  - 8. ASTM C 1858 Standard Practice for Design, Construction, and Material Requirements for Direct Hung Suspended T-bar Type Ceiling Systems Intended to Receive Gypsum Panel Products in Areas Subject to Earthquake Ground Motions
  - 9. ASTM C 645 Standard Specification for Nonstructural Steel Framing Members
  - 10. ASTM C 754 Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

11. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
12. ASTM E 119 Standard Test Method for Fire Tests of Building Construction and Materials (if applicable).
13. ASTM E3118 Standard for Seismic Ceiling Testing
14. ESR-1289 ICC-ES Evaluation Report. (Pending, 2021 ESR Revision)

## **1.5 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical literature.
- B. Shop Drawings: Indicate layout of system and panels, including how the system coordinates with related HVAC ducting and diffusers.

## **1.6 QUALITY ASSURANCE**

- A. Single-Source Responsibility: To ensure proper interface, all drywall furring components shall be produced or supplied by a single manufacturer.
- B. All accessory components from other manufacturers shall conform to ASTM standards.
- C. Coordination of Work:
  1. Coordinate drywall furring work with installers of related work including, but not limited to gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.
  2. All work above the ceiling line should be completed prior to installing the drywall sheet goods. There should be no materials resting against or wrapped around the suspension system, hanger wires or ties.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

## **1.8 WARRANTY**

- A. Suspensions System: Submit a written limited warranty executed by the manufacturer, agreeing to repair or replace grid components that are supplied with a hot-dipped galvanized coating or aluminum base material. Failures include, but are not limited to:
  1. The occurrence of 50% red rust as defined by ASTM D 610 test procedures as a result of defects in materials or factory workmanship.
- B. Warranty Period:
  1. Grid: Ten years from date of installation.

- C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Suspension Systems:
1. Basis of Design: Armstrong World Industries, Inc.
  2. USG Corporation.
  3. Certainteed.
  4. Or approved equal.

### **2.2 SUSPENSION SYSTEMS**

- A. Structural Classification:
1. Main Beam shall be heavy duty per ASTM C 635.
  2. Classification can require wires to be closer together for additional loading when used to support double layer gypsum, verticals, slopes, circles, soffits, canopies, and step conditions which call for loading or unusual designs and shapes in drywall construction.
  3. Deflection of fastening suspension system supporting light fixtures, ceiling grilles, access doors, verticals and horizontal loads shall have a maximum deflection of 1/360 of the span.
- B. Components:
1. SimpleSoffit Main Beam: Shall be double-web construction (minimum 0.0179 inch prior to protective coating, ASTM C645), hot dipped galvanized (per ASTM A653).
    - a. SSB: Box Soffit, 1-1/4 inch web height, 1-1/2 inch flange, custom length, custom routes (up to 6 routes).
    - b. Exact components as recommended by manufacturer and as required to achieve desired configuration.
  2. Drywall Grid Cross Tees: Shall be double-web steel construction (minimum 0.0179 inch prior to protective coating, ASTM C645), hot dipped galvanized (minimum G40 or G90 per ASTM A653)
    - a. Exact components as recommended by manufacturer and as required to achieve desired configuration.
  3. Wall Molding:
    - a. KAM21025: 10 foot Knurled Angle molding, 2 inch x 2 inch, knurled surface, pre-punched holes in top flange 4" O.C., 18 mil. (25 ga.)
    - b. LAM-12: 12 foot Locking Angle Molding, 1-1/4 inch x 1-1/4 inch with pre-engineered locking tabs punched 8 inches on center, knurled surface, screw stop hem, pre-punched holes in top flange, 4" O.C., 18 mil. (25ga.)

- c. Exact components as recommended by manufacturer and as required to achieve desired configuration.
- 4. Support Hanger
  - a. Exact components as recommended by manufacturer and as required to achieve desired configuration.
- 5. Clips and Accessories
  - a. DW90C: 90 Degree Drywall Angle Clip
  - b. Exact components as recommended by manufacturer and as required to achieve desired configuration.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION - GENERAL**

- A. Install suspension system and panels in accordance with the manufacturer's instructions, in compliance with ASTM installation standard, and with applicable codes as required by the authorities having jurisdiction.
- B. To secure to metal clips, concrete inserts, steel bar joist or steel deck, use power actuated fastener, or insert. Coordinate placement for hanger wire spaced as required for expected ceiling loads and layout.
- C. Install hanger wire as required with necessary on center spacing to support expected ceiling load requirements, following local practices, codes and regulations. Provide additional wires at light fixtures, grilles, and access doors where necessary. A pigtail knot shall be used with three tight wraps at top and bottom fastening locations.
- D. Add additional wire as needed when using compatible clips and accessories.
- E. Control Joints: Roll formed zinc alloy, aluminum, or plastic as required for expansion and contraction as shown on drawings.
- F. Main beams shall be suspended from the overhead construction with hanger wire, spaced as required for expected ceiling loads, along the length of the main beams.
- G. Install cross tees at on center spacing as specified by the drywall manufacturer. Typical drywall cross tee spacing:
  - 1. 16 inches on center with 5/8 or 1/2 inch gypsum board
  - 2. 24 inches on center with 5/8 inch gypsum board
- H. Use channel molding or angle molding to interface with Drywall Grid System to provide perimeter attachment or to obtain drop soffits, verticals, slopes, etc.
- I. To suspend a second ceiling beneath a new or existing drywall ceiling, without breaching the integrity of the upper ceiling, use the Drywall Clip. To form a transition from a drywall ceiling to an acoustical ceiling, use the Drywall Transition Clips spaced as required for expected loads.

- J. Single cross tees in a route hole to be secured by 7/16 inch framing screw or alternative methods.

**END OF SECTION 092226**

## **SECTION 095100 - ACOUSTICAL CEILINGS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Acoustical units.

#### **1.2 REFERENCE STANDARDS**

- A. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.

#### **1.3 FIELD CONDITIONS**

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Acoustic Tiles/Panels:
  - 1. Match existing to best ability.

#### **2.2 ACOUSTICAL UNITS**

- A. Acoustical Panels ACT-1, ACT-5: Painted mineral fiber, with the following characteristics:
  - 1. Classification: ASTM E1264 Type III.
  - 2. Size: 24" x 24".
  - 3. Thickness: Match existing.
  - 4. Panel Edge: Match existing.
  - 5. Color: Match existing.
  - 6. Suspension System: Exposed grid.
- B. Acoustical Panels, Type ACT-2, ACT-4: Painted mineral fiber, with the following characteristics:
  - 1. Classification: ASTM E1264 Type III.
  - 2. Size: 24 by 48 inch (610 by 1219 mm).
  - 3. Thickness: Match existing.
  - 4. Panel Edge: Match existing.
  - 5. Suspension System: Exposed grid.

C. Raised Panel Ceiling, Type ACT-3: Mineral fiber.

1. Match existing product: Armstrong Raised Panel Ceiling, model 1201.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify existing conditions before starting work.

### **3.2 PREPARATION**

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

### **3.3 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
  1. Make field cut edges of same profile as factory edges.

**END OF SECTION 095100**



## **SECTION 230500 - COMMON WORK RESULTS FOR HVAC**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Sleeves.
  - 5. Escutcheons.
  - 6. Grout.
  - 7. HVAC demolition.
  - 8. Equipment installation requirements common to equipment sections.
  - 9. Concrete bases.
  - 10. Supports and anchorages.

#### **1.2 SUBMITTALS**

- A. Welding certificates.
- B. Submit product information for all materials used for the various mechanical systems.

#### **1.3 REFERENCES**

- A. Standards:
  - 1. ASME American Society of Mechanical Engineers.
  - 2. AWWA American Water Works Association.
  - 3. UL Underwriters Laboratories, Inc.
  - 4. MCA Mechanical Contractors Association.
  - 5. IBR Institute of Boiler and Radiators Manufacturers AISE Association of Iron & Steel Engineers.
  - 6. SAE Society of Automotive Engineers.
  - 7. NEMA National Electric Manufacturers Association ASTM American Society for Testing and Materials.
  - 8. ANSI American National Standard Institute.
  - 9. AWS American Welding Society.

#### **1.4 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

## **1.5 QUALITY ASSURANCE**

- A. All equipment and materials shall be new and of first quality. Manufactured products shall be Manufacturer's standard product with specified options but shall not be field or factory modified unless specified. All materials and equipment shall bear the Manufacturer's nameplate or marking with type, size, catalog numbers and ratings as appropriate.
- B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- D. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

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

- A. Acceptance (at site): Take delivery of all items delivered to site. Be responsible for inspection of materials and equipment to detect transit damage.
- B. Protection (prior to application or installation):
  - 1. Materials shall be stored inside building. Piping may be stored outside.
  - 2. Be responsible for all damage to materials stored on site.

## **1.7 PROJECT CONDITIONS**

- A. When existing conditions prohibit the proper installation as shown on the Drawings or as specified herein, the Contractor shall notify the Engineer/Architect, in writing, requesting a solution.
- B. Contractor is responsible for the verification of new and existing conditions on the site before that particular phase of installation begins.

## **1.8 WARRANTY**

- A. Contractors and manufacturers warranty shall be 1 year after substantial completion.

## **PART 2 - PRODUCTS**

### **2.1 PIPE, TUBE, AND FITTINGS**

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### **2.2 JOINING MATERIALS**

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
  - 1. CPVC Piping: ASTM F 493.
  - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

### **2.3 DIELECTRIC FITTINGS**

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

## **2.4 MECHANICAL SLEEVE SEALS**

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## **2.5 SLEEVES**

- A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.
- D. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- E. PVC Pipe: ASTM D 1785, Schedule 40.
- F. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

## **2.6 ESCUTCHEONS**

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated Rough brass Polished chrome-plated and rough brass.

## **2.7 GROUT**

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## **PART 3 - EXECUTION**

### **3.1 HVAC DEMOLITION**

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### **3.2 PIPING SYSTEMS - COMMON REQUIREMENTS**

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. "Street fittings" shall not be used.
- L. Select system components with pressure rating equal to or greater than system operating pressure.
- M. Install escutcheons for penetrations of walls, ceilings, and floors.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- O. Where pipe passes through building walls and floors cuts shall be square or round and ground smooth.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
  - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### **3.3 PIPING JOINT CONSTRUCTION**

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. 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.
- E. 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.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 3. 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.
  - 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.
- N. Bending of pipe will not be permitted, only ells shall be utilized for a change in direction.

### **3.4 PIPING CONNECTIONS**

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### **3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS**

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### **3.6 CONCRETE BASES**

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.



4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

### **3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES**

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

### **3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES**

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

### **3.9 GROUTING**

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

### **3.10 TESTING OF PIPING SYSTEMS**

- A. Piping Systems:

1. Contractor shall subject all piping and equipment to a test of 125 psi for a period of 8 hours and all leaks developed shall be repaired and the test repeated until the system is absolutely tight.
2. Disconnect all traps and devices not rated for operation at test pressures.
3. All instruments and equipment required for testing shall be furnished by the Contractor and tests shall, if so requested, be made in the presence of the Engineer/Architect.

### **3.11 ADJUST AND CLEAN**

#### **A. Protection of Completed Work:**

1. When work is completed, it shall, when it is subject to damage by ongoing construction, be protected from this damage.
2. As work is being installed, equipment and piping shall be protected from other ongoing construction or from its own construction. Exposed piping ends should not be temporarily covered; hanger shall be supplied in sufficient number to prevent warping or bending of pipe.

**END OF SECTION 230500**

## **SECTION 230519 - METERS AND GAGES FOR HVAC PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Thermometers.
  - 2. Gages.
  - 3. Flowmeters.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

### **PART 2 - PRODUCTS**

#### **2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Palmer - Wahl Instruments Inc.
  - 2. Trerice, H. O. Co.
  - 3. Weiss Instruments, Inc.
  - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Case: Die-cast aluminum or brass, 9 inches long.
- C. Tube: Red or blue reading, mercury or organic-liquid filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

## **2.2 DUCT-TYPE, LIQUID-IN-GLASS THERMOMETERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Miljoco Corp.
  - 2. Palmer - Wahl Instruments Inc.
  - 3. Trerice, H. O. Co.
  - 4. Weiss Instruments, Inc.
- B. Case: Die-cast aluminum, 7 inches long.
- C. Tube: Red or blue reading, mercury or organic filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass or plastic.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Metal, for installation in mounting bracket and of length to suit installation.
- H. Mounting Bracket: Flanged fitting for attachment to duct and made to hold thermometer stem.
- I. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

## **2.3 BIMETALLIC-ACTUATED DIAL THERMOMETERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
  - 2. Ernst Gage Co.
  - 3. Eugene Ernst Products Co.
  - 4. Marsh Bellofram.
  - 5. Miljoco Corp.
  - 6. NANMAC Corporation.
  - 7. Noshok, Inc.
  - 8. Palmer - Wahl Instruments Inc.
  - 9. REO TEMP Instrument Corporation.
  - 10. Tel-Tru Manufacturing Company.
  - 11. Trerice, H. O. Co.
  - 12. Weiss Instruments, Inc.
  - 13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
  - 14. WIKA Instrument Corporation.
  - 15. Winters Instruments.
- B. Description: Direct-mounting, bimetallic-actuated dial thermometers complying with ASME B40.3.
- C. Case: Liquid-filled type, stainless steel with 5-inch diameter.

- D. Element: Bimetal coil.
- E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- F. Pointer: Red metal.
- G. Window: Glass.
- H. Ring: Stainless steel.
- I. Connector: Adjustable angle type.
- J. Stem: Metal, for thermowell installation and of length to suit installation.
- K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

## **2.4 THERMOWELLS**

- A. Manufacturers: Same as manufacturer of thermometer being used.
- B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

## **2.5 PRESSURE GAGES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. AMETEK, Inc.; U.S. Gauge Div.
  2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
  3. Ernst Gage Co.
  4. Eugene Ernst Products Co.
  5. KOBOLD Instruments, Inc.
  6. Marsh Bellofram.
  7. Miljoco Corp.
  8. Noshok, Inc.
  9. Palmer - Wahl Instruments Inc.
  10. REO TEMP Instrument Corporation.
  11. Trerice, H. O. Co.
  12. Weiss Instruments, Inc.
  13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
  14. WIKA Instrument Corporation.
  15. Winters Instruments.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
  1. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch diameter.
  2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
  3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
  4. Movement: Mechanical, with link to pressure element and connection to pointer.

5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red metal.
7. Window: Glass.
8. Ring: Stainless steel.
9. Accuracy: Grade B, plus or minus 2 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.
2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

## **PART 3 - EXECUTION**

### **3.1 THERMOMETER APPLICATIONS**

A. Install liquid-in-glass thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler and chiller.
3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
4. Inlet and outlet of each hydronic heat exchanger.
5. Inlet and outlet of each hydronic heat-recovery unit.
6. Inlet and outlet of each thermal storage tank.
7. Outside-air, return-air, and mixed-air ducts.

B. Install bimetallic-actuated dial thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler and chiller.
3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
4. Inlet and outlet of each hydronic heat exchanger.
5. Inlet and outlet of each hydronic heat-recovery unit.
6. Inlet and outlet of each thermal storage tank.

C. Install liquid-filled-case-type, bimetallic-actuated dial thermometers at suction and discharge of each pump.

D. Provide the following temperature ranges for thermometers:

1. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
2. Condenser Water: 30 to 240 deg F, with 2-degree scale divisions.
3. Chilled Water: 0 to 160 deg F, with 2-degree scale divisions.
4. Steam and Condensate: 50 to 400 deg F, with 5-degree scale divisions.
5. Air Ducts: 30 to 240 deg F, with 2-degree scale divisions.

### **3.2 GAGE APPLICATIONS**

A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.

- B. Install liquid-filled-case-type pressure gages at chilled- and condenser-water inlets and outlets of chillers.
- C. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

### **3.3 INSTALLATIONS**

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.
- D. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- E. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).
- F. Install needle-valve and syphon fitting in piping for each pressure gage for steam.
- G. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.
- H. Install flowmeter elements in accessible positions in piping systems.
- I. Install differential-pressure-type flowmeter elements with at least minimum straight lengths of pipe upstream and downstream from element as prescribed by manufacturer's written instructions.
- J. Install connection fittings for attachment to portable indicators in accessible locations.
- K. Install flowmeters at discharge of hydronic system pumps and at inlet of hydronic air coils.

### **3.4 CONNECTIONS**

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.
- B. Connect flowmeter-system elements to meters.

### **3.5 ADJUSTING**

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.

**END OF SECTION 230519**

## **SECTION 230523 - GENERAL DUTY VALVES FOR HVAC PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Brass ball valves.
  - 2. Bronze ball valves.
  - 3. Iron, single-flange butterfly valves.
  - 4. Bronze swing check valves.
  - 5. Iron swing check valves.
  - 6. Bronze globe valves.
  - 7. Iron globe valves.
  
- B. Related Sections:
  - 1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
  - 2. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of valve indicated.

#### **1.3 QUALITY ASSURANCE**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
  
- B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL REQUIREMENTS FOR VALVES**

- A. Refer to HVAC valve schedule articles for applications of valves.
  
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
  
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
  
- D. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
  - 2. Handwheel: For valves other than quarter-turn types.
  - 3. Handlever: For quarter-turn valves NPS 6 and smaller.
  
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:



1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

## 2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
  - d. Hammond Valve.
  - e. Jamesbury; a subsidiary of Metso Automation.
  - f. Kitz Corporation.
  - g. Marwin Valve; a division of Richards Industries.
  - h. Milwaukee Valve Company.
  - i. RuB Inc.
2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece.
  - e. Body Material: Forged brass.
  - f. Ends: Flanged, solder joint, or threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Stainless steel.
  - i. Ball: Stainless steel, vented.
  - j. Port: Full.

## 2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.; Apollo Valves.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Hammond Valve.
  - d. Lance Valves; a division of Advanced Thermal Systems, Inc.
  - e. Milwaukee Valve Company.
  - f. NIBCO INC.
  - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.

- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Flanged, solder joint, or threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

## 2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

### A. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
  - b. Bray Controls; a division of Bray International.
  - c. Conbraco Industries, Inc.; Apollo Valves.
  - d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
  - e. Crane Co.; Crane Valve Group; Jenkins Valves.
  - f. Crane Co.; Crane Valve Group; Stockham Division.
  - g. DeZurik Water Controls.
  - h. Hammond Valve.
  - i. Kitz Corporation.
  - j. Milwaukee Valve Company.
  - k. Mueller Steam Specialty; a division of SPX Corporation.
  - l. NIBCO INC.
  - m. Norriseal; a Dover Corporation company.
  - n. Red-White Valve Corporation.
  - o. Spence Strainers International; a division of CIRCOR International.
  - p. Sure Flow Equipment Inc.
  - q. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-67, Type I.
  - b. CWP Rating: 150 psig.
  - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
  - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
  - e. Seat: NBR.
  - f. Stem: One- or two-piece stainless steel.
  - g. Disc: Stainless steel.

### B. Class 300, Single-Flange, High-Performance Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
  - b. Bray Controls; a division of Bray International.
  - c. Cooper Cameron Valves; a division of Cooper Cameron Corp.
  - d. Crane Co.; Crane Valve Group; Flowseal.
  - e. Crane Co.; Crane Valve Group; Stockham Division.
  - f. DeZurik Water Controls.
  - g. Hammond Valve.
  - h. Jamesbury; a subsidiary of Metso Automation.
  - i. Milwaukee Valve Company.
  - j. NIBCO INC.
  - k. Process Development & Control, Inc.

- l. Tyco Valves & Controls; a unit of Tyco Flow Control.
- m. Xomox Corporation.
- 2. Description:
  - a. Standard: MSS SP-68.
  - b. CWP Rating: 720 psig at 100 deg F.
  - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
  - d. Body Material: Carbon steel, cast iron, or ductile iron.
  - e. Seat: Reinforced PTFE or metal.
  - f. Stem: Stainless steel; offset from seat plane.
  - g. Disc: Carbon steel.
  - h. Service: Bidirectional.

## 2.5 BRONZE SWING CHECK VALVES

- A. Class 150, Bronze Swing Check Valves with Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Valve, Inc.
    - b. Crane Co.; Crane Valve Group; Crane Valves.
    - c. Crane Co.; Crane Valve Group; Jenkins Valves.
    - d. Crane Co.; Crane Valve Group; Stockham Division.
    - e. Kitz Corporation.
    - f. Milwaukee Valve Company.
    - g. NIBCO INC.
    - h. Red-White Valve Corporation.
    - i. Zy-Tech Global Industries, Inc.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 300 psig.
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: Bronze.

## 2.6 IRON SWING CHECK VALVES

- A. Class 250, Iron Swing Check Valves with Metal Seats:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Division.
    - d. Hammond Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO INC.
    - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
    - c. NPS 14 to NPS 24, CWP Rating: 300 psig.
    - d. Body Design: Clear or full waterway.
    - e. Body Material: ASTM A 126, gray iron with bolted bonnet.

- f. Ends: Flanged.
- g. Trim: Bronze.
- h. Gasket: Asbestos free.

## 2.7 BRONZE GLOBE VALVES

- A. Class 150, Bronze Globe Valves with Nonmetallic Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
    - c. Kitz Corporation.
    - d. Milwaukee Valve Company.
    - e. NIBCO INC.
    - f. Powell Valves.
    - g. Red-White Valve Corporation.
    - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - i. Zy-Tech Global Industries, Inc.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 2.
    - b. CWP Rating: 300 psig.
    - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
    - d. Ends: Threaded.
    - e. Stem: Bronze.
    - f. Disc: PTFE or TFE.
    - g. Packing: Asbestos free.
    - h. Handwheel: Malleable iron.

## 2.8 IRON GLOBE VALVES

- A. Class 250, Iron Globe Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Division.
    - d. Hammond Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO INC.
    - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-85, Type I.
    - b. CWP Rating: 500 psig.
    - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - d. Ends: Flanged.
    - e. Trim: Bronze.
    - f. Packing and Gasket: Asbestos free.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### **3.2 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

### **3.3 ADJUSTING**

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### **3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball valves.
  - 2. Throttling Service, Except Steam: Globe or ball valves.
  - 3. Throttling Service, Steam: Globe valves.
  - 4. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
    - b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

- C. Select valves, except wafer types, with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
  4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  6. For Steel Piping, NPS 5 and Larger: Flanged ends.

### **3.5 VALVE SCHEDULE**

- A. Pipe NPS 3 and Smaller:
1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
  2. Bronze Angle Valves: Class 150, bronze disc.
  3. Ball Valves: Two piece, full regular reduced port, brass or bronze with stainless-steel trim.
  4. Bronze Swing Check Valves: Class 150, bronze disc.
  5. Bronze Globe Valves: Class 150, bronze disc.
  - 6.
  - 7.
- B. Pipe NPS 4 and Larger:
1. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24: 150 CWP, NBR seat, stainless-steel disc.
  2. High-Performance Butterfly Valves: Class 300, single flange.
  3. Iron Swing Check Valves: Class 250, metal seats.
  4. Iron Globe Valves: Class 250.

**END OF SECTION 230523**

# SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Equipment supports.

### 1.2 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

### 1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.
  - 3. Powder-actuated fastener systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze pipe hangers. Include Product Data for components.
  - 2. Metal framing systems. Include Product Data for components.
  - 3. Equipment supports.
- C. Welding certificates.

### 1.4 QUALITY ASSURANCE

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

4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."

## **PART 2 - PRODUCTS**

### **2.1 STEEL PIPE HANGERS AND SUPPORTS**

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
- B. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.
- C. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### **2.2 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

### **2.3 METAL FRAMING SYSTEMS**

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

### **2.4 THERMAL-HANGER SHIELD INSERTS**

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.
- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. 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 zinc-coated steel, 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-steel shapes.

## **2.7 MISCELLANEOUS MATERIALS**

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Non-staining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

# **PART 3 - EXECUTION**

## **3.1 HANGER AND SUPPORT APPLICATIONS**

- A. Specific hanger and support requirements are specified 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 padded hangers for piping that is subject to scratching.
- F. 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.
- G. 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 20.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. 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.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  11. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb .
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- J. 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.

- K. 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. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
  4. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
  5. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
  6. 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.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

### **3.2 HANGER AND SUPPORT INSTALLATION**

- A. Steel 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 building structure.
- B. 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 above for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- 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 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 in building areas constructed to meet the FEMA 361 standards.
- 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 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 so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
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 according to ASME B31.1 for power piping and 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 4: 12 inches long and 0.048 inch thick.
5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### **3.3 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 smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports in building areas constructed to meet the FEMA 361 standards.

### **3.4 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 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 contours of welded surfaces match adjacent contours.

### **3.5 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.

### **3.6 PAINTING**

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION 230529**

# SECTION 230548 - VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Spring hangers.
4. Pipe riser resilient supports.
5. Resilient pipe guides.

### 1.2 SUBMITTALS

A. Product Data: For each product indicated.

## PART 2 - PRODUCTS

### 2.1 VIBRATION ISOLATORS

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

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- D. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. 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.
  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. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
  7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- E. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch-thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.
- F. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch-thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

## **PART 3 - EXECUTION**

### **3.1 VIBRATION-CONTROL DEVICE INSTALLATION**

- A. Equipment Restraints:
1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
- B. Piping Restraints:
1. Comply with requirements in MSS SP-127.
- C. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- D. 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.
- E. 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. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

### **3.2 ADJUSTING**

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust active height of spring isolators.
- C. Adjust restraints to permit free movement of equipment within normal mode of operation.

**END OF SECTION 230548**

# SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
1. Equipment labels.
  2. Warning signs and labels.
  3. Pipe labels.
  4. Duct labels.

### 1.2 SUBMITTAL

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

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
1. Material and Thickness: Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  4. Fasteners: Stainless-steel rivets or self-tapping screws.
  5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
  2. Letter Color: Black Blue Red White Yellow Insert color.
  3. Background Color: White.
  4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  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-fourths 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.

- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus 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), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## **2.2 WARNING SIGNS AND LABELS**

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Yellow Insert color.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

## **2.3 PIPE LABELS**

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, 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: At least 1-1/2 inches high.

## **2.4 DUCT LABELS**

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
  - 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. Lettering Size: At least 1-1/2 inches high.

## **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 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### **3.3 PIPE LABEL INSTALLATION**

- A. 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 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.

B. Pipe Label Color Schedule:

1. Chilled-Water Piping:
  - a. Background Color: Blue.
  - b. Letter Color: White.
2. Condensate Water Piping:
  - a. Background Color: Yellow.
  - b. Letter Color: Black.
3. Heating Water Piping:
  - a. Background Color: White.
  - b. Letter Color: Red.
4. Low-Pressure Steam Piping:
  - a. Background Color: White.
  - b. Letter Color: Yellow.
5. High-Pressure Steam Piping:
  - a. Background Color: Yellow.
  - b. Letter Color: White.
6. Steam Condensate Piping:
  - a. Background Color: Black.
  - b. Letter Color: White.

### 3.4 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
  1. Blue: For cold-air supply ducts.
  2. Yellow: For hot-air supply ducts.
  3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
  4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

**END OF SECTION 230553**

## **SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes TAB to produce design objectives for the following:
  - 1. Air Systems:
    - a. Constant-volume air systems.
  - 2. Verifying that automatic control devices are functioning properly.
  - 3. Reporting results of activities and procedures specified in this Section.

#### **1.2 SUBMITTALS**

- A. Qualification Data: Within 45 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. TAB plan that includes strategies and step-by-step procedures.
- C. Sample Report Forms: Submit two sets of sample TAB report forms.
- D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

#### **1.3 QUALITY ASSURANCE**

- A. TAB Firm Qualifications: (TAB firm must meet all of the qualifications listed)
  - 1. Certified by AABC, NEBB, TABB, or balancer must have completed 40 hours (minimum) of TAB training.
  - 2. Work performed under the direct supervision of a Licensed Professional Engineer.
  - 3. Minimum TAB experience of 5 years.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard forms from TAB firm's forms approved by Architect.
- D. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

- E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
  - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

#### **1.4 PROJECT 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.

#### **1.5 COORDINATION**

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

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

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
  - 1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
  - 2. Verify that balancing devices are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine equipment performance data including fan curves.
- D. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- E. Examine system and equipment test reports.
- F. Examine HVAC system and equipment installations to verify that indicated balancing devices are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- G. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.



- H. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- J. Examine equipment for installation and for properly operating safety interlocks and controls.
- K. Examine automatic temperature system components to verify the following:
  - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
  - 2. Dampers and valves are in the position indicated by the controller.
  - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
  - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
  - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
  - 6. Sensors are located to sense only the intended conditions.
  - 7. Sequence of operation for control modes is according to the Contract Documents.
  - 8. Controller set points are set at indicated values.
  - 9. Interlocked systems are operating.
  - 10. Changeover from heating to cooling mode occurs according to indicated values.
- L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### **3.2 PREPARATION**

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
  - 1. Permanent electrical power wiring is complete.
  - 2. Automatic temperature-control systems are operational.
  - 3. Equipment and duct access doors are securely closed.
  - 4. Balance, smoke, and fire dampers are open.
  - 5. Isolating and balancing valves are open and control valves are operational.
  - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

### **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 Testing and Balancing Heating, Ventilating, and Air Conditioning Systems", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's TABB "HVAC Systems - Testing, Adjusting, and Balancing" and this Section.

- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### **3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS**

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- 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 outside-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. Check for proper sealing of air duct system.

### **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 the total supply airflow at the unit using a pitot-tube traverse.
  - 2. Measure fan static pressures to determine actual static pressure as follows:
    - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.

- c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
  - 4. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
  - 5. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
  - 6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
  - 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
  - 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
    - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  - 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
  - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
  - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### **3.6 PROCEDURES FOR MOTORS**

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  - 1. Manufacturer, model, and serial numbers.
  - 2. Motor horsepower rating.
  - 3. Motor rpm.
  - 4. Efficiency rating.
  - 5. Nameplate and measured voltage, each phase.
  - 6. Nameplate and measured amperage, each phase.
  - 7. Starter thermal-protection-element rating.

### **3.7 PROCEDURES FOR HEAT-TRANSFER COILS**

- A. Hydronic Coils: Measure the following data for each coil:
  - 1. Dry-bulb temperature of entering and leaving air.
  - 2. Wet-bulb temperature of entering and leaving air.
  - 3. Airflow.
  - 4. Air pressure drop.
  - 5. Entering water temperature.
  - 6. Leaving water temperature.

### **3.8 PROCEDURES FOR TEMPERATURE MEASUREMENTS**

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure outside-air, wet- and dry-bulb temperatures.

### **3.9 TEMPERATURE-CONTROL VERIFICATION**

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Check main control supply-air pressure and observe compressor and dryer operations.

- J. Note operation of electric actuators using spring return for proper fail-safe operations.

### **3.10 TOLERANCES**

- A. Set HVAC system airflow and water flow rates within the following tolerances:
  - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
  - 2. Air Outlets and Inlets: 0 to minus 10 percent.
  - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
  - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

### **3.11 FINAL REPORT**

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
  - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
  - 1. Pump curves.
  - 2. Fan curves.
  - 3. Manufacturers' test data.
  - 4. Field test reports prepared by system and equipment installers.
  - 5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
  - 1. Title page.
  - 2. Name and address of TAB firm.
  - 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 firm 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, type size, and fittings.

14. Notes to explain why certain final data in the body of reports varies from indicated values.
  15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outside-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.
- E. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data: Include the following:
    - 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. Sheave dimensions, center-to-center, and amount of adjustments in inches.
    - j. Number of belts, make, and size.
    - k. Number of filters, type, and size.
  2. Motor Data:
    - a. 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. Sheave dimensions, center-to-center, and amount of adjustments in inches.
  3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm (measured at unit discharge)
    - b. Total airflow rate in cfm (summation of air terminals)
    - c. Total system static pressure in inches wg.
    - d. Fan rpm.
    - e. Discharge static pressure in inches wg .
    - f. Filter static-pressure differential in inches wg.
    - g. Preheat coil static-pressure differential in inches wg.
    - h. Cooling coil static-pressure differential in inches wg.
    - i. Heating coil static-pressure differential in inches wg.
    - j. Outside airflow in cfm.
    - k. Return airflow in cfm.
    - l. Outside-air damper position.
    - m. Return-air damper position.
    - n. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch o.c.
- f. Make and model number.
- g. Face area in sq. ft..
- h. Tube size in NPS.
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outside-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Refrigerant expansion valve and refrigerant types.
- i. Refrigerant suction pressure in psig.
- j. Refrigerant suction temperature in deg F.

G. 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.

H. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Test apparatus used.
- d. Area served.
- e. Air-terminal-device make.
- f. Air-terminal-device number from system diagram.
- g. Air-terminal-device type and model number.

- h. Air-terminal-device size.
- 2. Test Data (Indicated and Actual Values):
  - a. Airflow rate in cfm.
  - b. Preliminary airflow rate as needed in cfm.
  - c. Final airflow rate in cfm.
- 3. If fans are an integral part of the unit, include the following for each fan:
  - a. Make and type.
  - b. Arrangement and size.
  - c. Sheave make, size in inches, and bore.
  - d. Sheave dimensions, center-to-center, and amount of adjustments in inches.
- I. Instrument Calibration Reports:
  - 1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

**END OF SECTION 230593**



## **SECTION 230700 - HVAC INSULATION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Insulation Materials:
    - a. Flexible elastomeric.
    - b. Mineral fiber.
  - 2. Fire-rated insulation systems.
  - 3. Adhesives.
  - 4. Mastics.
  - 5. Sealants.
  - 6. Factory-applied jackets.
  - 7. Field-applied jackets.
  - 8. Tapes.
  - 9. Securements.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

#### **1.3 QUALITY ASSURANCE**

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting 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.

#### **1.4 COORDINATION**

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## **PART 2 - PRODUCTS**

### **2.1 INSULATION MATERIALS**

- A. Comply with requirements in Part 3 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: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
- 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.
- 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.
- I. Mineral-Fiber, Preformed Pipe Insulation: Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

### **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 Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- E. PVC Jacket Adhesive: Compatible with PVC jacket.

## **2.3 MASTICS**

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  - 1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  - 4. Color: White.

## **2.4 SEALANTS**

- A. PVC Jacket Flashing Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Fire- and water-resistant, flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 4. Color: White.

## **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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## **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. Adhesive: As recommended by jacket material manufacturer.
  - 2. Color: White
  - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

1. Finish and thickness are indicated in field-applied jacket schedules.

## 2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  1. Width: 3 inches.
  2. Thickness: 11.5 mils.
  3. Adhesion: 90 ounces force/inch in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch in width.
  6. 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. Width: 3 inches.
  2. Thickness: 6.5 mils.
  3. Adhesion: 90 ounces force/inch in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch in width.
  6. 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. Width: 2 inches.
  2. Thickness: 6 mils.
  3. Adhesion: 64 ounces force/inch in width.
  4. Elongation: 500 percent.
  5. Tensile Strength: 18 lbf/inch in width.

## 2.8 SECUREMENTS

- A. Insulation Pins and Hangers:
  1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch or 0.135-inch diameter shank, length to suit depth of insulation indicated.
  2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch or 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, galvanized-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. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

4. 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.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

### **3.3 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe 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. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.

- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. 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. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 2. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  2. 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: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistant joint sealers.
- E. Insulation Installation at Floor Penetrations:
1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
  2. Pipe: Install insulation continuously through floor penetrations.
  3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

### **3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION**

- 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.
- B. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### **3.6 MINERAL-FIBER INSULATION INSTALLATION**

- 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 16 inches and smaller, no pins required.
  - b. On duct sides with dimensions larger than 16 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. 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.
5. 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 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 16 inches and smaller, no pins required.
  - b. On duct sides with dimensions larger than 16 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. 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.
5. 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 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.
  
- B. 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.

### **3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION**

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
  
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
  
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

### **3.9 INDOOR DUCT INSULATION SCHEDULE**

- A. Supply Air, round, duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2-1/8 inches thick and 0.75-lb/cu. ft. nominal density.
  
- B. Supply Air, rectangular, duct insulation shall be the following:
  - 1. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
  
- C. Outdoor Air, rectangular, duct insulation shall be the following:
  - 1. Mineral-Fiber Board: 2-inches thick and 3-lb/cu. ft. nominal density.
  
- D. Return Air, round and rectangular, duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

### **3.10 OUTDOOR DUCT INSULATION SCHEDULE**

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
  
- B. Exposed, rectangular, duct insulation shall be the following:
  - 1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.
  - 2. Field applied white PVC jacket, 30-mils thick.

### **3.11 PIPING INSULATION SCHEDULE, GENERAL**

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

### **3.12 PIPING INSULATION SCHEDULE**

- A. Chilled Water Piping: Insulation shall be one of the following:
  - 1. Pipe Size 1-1/4 inch and smaller: 1/2 inch thick elastomeric.
  - 2. Pipe Sizes 1-1/2 inch and greater: 1 inch thick elastomeric.
- B. Heating Water Piping: Insulation shall be one of the following:
  - 1. Pipe Size 1 inch and smaller: 1 inch thick mineral fiber.
  - 2. Pipe Sizes 1-1/4 inch and greater: 1-1/2 inch thick mineral fiber.
- C. Low Pressure Steam and Condensate Piping:
  - 1. Pipe Size 4 inch and smaller: 2-1/2 inch thick mineral fiber.

**END OF SECTION 230700**

## **SECTION 232113 - HYDRONIC PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
  - 1. Hot-water heating piping.
  - 2. Chilled-water piping.
  - 3. Air-vent piping.
  - 4. Safety-valve-inlet and -outlet piping.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of the following:
  - 1. Pressure-seal fittings.
  - 2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
  - 3. Air control devices.
  - 4. Chemical treatment.
- B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
  - 1. Hot-Water Heating Piping: 125 psig at 200 deg F Inset temperature.
  - 2. Chilled-Water Piping: 125 psig at 200 deg F.
  - 3. Air-Vent Piping: 200 deg F Inset temperature.
  - 4. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

#### **1.4 QUALITY ASSURANCE**

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

## **PART 2 - PRODUCTS**

### **2.1 COPPER TUBE AND FITTINGS**

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Fittings: ASME B16.22.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Anvil International, Inc.
    - b. S. P. Fittings; a division of Star Pipe Products.
    - c. Victaulic Company of America.
  - 2. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
  - 3. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.
- E. Wrought-Copper Unions: ASME B16.22.

### **2.2 STEEL PIPE AND FITTINGS**

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.
- F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.

G. Grooved Mechanical-Joint Fittings and Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Anvil International, Inc.
  - b. Central Sprinkler Company; a division of Tyco Fire & Building Products.
  - c. National Fittings, Inc.
  - d. S. P. Fittings; a division of Star Pipe Products.
  - e. Victaulic Company of America.
2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

## 2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- E. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

## 2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Capitol Manufacturing Company.
  - b. Central Plastics Company.
  - c. Hart Industries International, Inc.
  - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.
2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Calpico, Inc.
  - b. Lochinvar Corporation.
2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

## 2.5 VALVES

A. Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Bronze, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Armstrong Pumps, Inc.
  - b. Bell & Gossett Domestic Pump; a division of ITT Industries.
  - c. Flow Design Inc.
  - d. Gerand Engineering Co.
  - e. Griswold Controls.
  - f. Tour & Andersson; available through Victaulic Company of America
2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

C. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. Armstrong Pumps, Inc.
  - b. Bell & Gossett Domestic Pump; a division of ITT Industries.
  - c. Flow Design Inc.
  - d. Gerand Engineering Co.
  - e. Griswold Controls.
4. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
5. Ball: Brass or stainless steel.
6. Stem Seals: EPDM O-rings.
7. Disc: Glass and carbon-filled PTFE.
8. Seat: PTFE.
9. End Connections: Flanged or grooved.
10. Pressure Gage Connections: Integral seals for portable differential pressure meter.
11. Handle Style: Lever, with memory stop to retain set position.
12. CWP Rating: Minimum 125 psig.
13. Maximum Operating Temperature: 250 deg F.

D. Automatic Flow-Control Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. Flow Design Inc.
  - b. Griswold Controls.
4. Body: Brass or ferrous metal.
5. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
6. Combination Assemblies: Include bronze or brass-alloy ball valve.
7. Identification Tag: Marked with zone identification, valve number, and flow rate.
8. Size: Same as pipe in which installed.
9. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
10. Minimum CWP Rating: 175 psig.
11. Maximum Operating Temperature: 200 deg F.

## 2.6 AIR CONTROL DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

## 2.7 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and pressure-seal joints.
2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be any of the following:



1. Type L, drawn-temper copper tubing, wrought-copper fittings, and pressure-seal joints.
  2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
  2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- E. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- F. Air-Vent Piping:
1. Inlet: Same as service.
  2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- G. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

### **3.2 VALVE APPLICATIONS**

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install throttling-duty valves at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

### **3.3 PIPING INSTALLATIONS**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- T. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

### **3.4 HANGERS AND SUPPORTS**

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
  1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.

3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  4. Spring hangers to support vertical runs.
  5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
  6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
  7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### 3.5 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. 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.
- E. 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.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
- I. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

### **3.6 HYDRONIC SPECIALTIES INSTALLATION**

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

### **3.7 TERMINAL EQUIPMENT CONNECTIONS**

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

### **3.8 CHEMICAL TREATMENT**

- A. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

### **3.9 FIELD QUALITY CONTROL**

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment.
7. Verify lubrication of motors and bearings.

**END OF SECTION 232113**

## **SECTION 232213 - STEAM AND CONDENSATE HEATING PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following for LP steam (less than 15 psig) and condensate piping:
  - 1. Pipe and fittings.
  - 2. Strainers.
  - 3. Safety valves.
  - 4. Pressure-reducing valves.
  - 5. Steam traps.
  - 6. Thermostatic air vents and vacuum breakers.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of the following:
  - 1. Pressure-reducing and safety valve.
  - 2. Steam trap.
  - 3. Air vent and vacuum breaker.
- B. Operation and maintenance data.

#### **1.3 QUALITY ASSURANCE**

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.

### **PART 2 - PRODUCTS**

#### **2.1 STEEL PIPE AND FITTINGS**

- A. Steel Pipe: ASTM A 53/A 53M, black steel, plain ends, Type, Grade, and Schedule as indicated in Part 3 piping applications articles.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300 as indicated in Part 3 piping applications articles.
- C. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in Part 3 piping applications articles.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 piping applications articles.
- E. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated in Part 3 piping applications articles; raised ground face, and bolt holes spot faced.

## 2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

## 2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Hart Industries, International Inc.
    - d. Watts Water Technologies, Inc.
    - e. Zurn Plumbing Products Group.
  - 2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

## 2.4 VALVES

- A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."
- B. Stop-Check Valves:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Crane Co.
    - b. Jenkins Valves; a Crane Company.
    - c. Lunkenheimer Valves.
    - d. A.Y. McDonald Mfg. Co.
  - 2. Body and Bonnet: Malleable iron.
  - 3. End Connections: Flanged.

4. Disc: Cylindrical with removable liner and machined seat.
5. Stem: Brass alloy.
6. Operator: Outside screw and yoke with cast-iron handwheel.
7. Packing: Polytetrafluoroethylene-impregnated packing with two-piece packing gland assembly.
8. Pressure Class: 250.

## 2.5 STRAINERS

### A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 20 mesh strainer, and perforated stainless-steel basket with 50 percent free area.
4. Tapped blowoff plug.
5. CWP Rating: 250-psig working steam pressure.

## 2.6 SAFETY VALVES

### A. Bronze Safety Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Armstrong International, Inc.
  - b. Kunkle Valve; a Tyco International Ltd. Company.
  - c. Spirax Sarco, Inc.
  - d. Watts Water Technologies, Inc.
2. Disc Material: Forged copper alloy.
3. End Connections: Threaded inlet and outlet.
4. Spring: Fully enclosed steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
5. Pressure Class: 250.
6. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
7. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

### B. Cast-Iron Safety Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Armstrong International, Inc.
  - b. Kunkle Valve; a Tyco International Ltd. Company.
  - c. Spirax Sarco, Inc.
  - d. Watts Water Technologies, Inc.



2. Disc Material: Forged copper alloy with bronze nozzle.
3. End Connections: Raised-face flanged inlet and threaded or flanged outlet connections.
4. Spring: Fully enclosed cadmium-plated steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
5. Pressure Class: 250.
6. Drip-Pan Elbow: Cast iron and having threaded inlet, outlet, and drain, with threads complying with ASME B1.20.1.
7. Exhaust Head: Cast iron and having threaded inlet and drain, with threads complying with ASME B1.20.1.
8. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

## **2.7 PRESSURE-REDUCING VALVES**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Armstrong International, Inc.
  2. Hoffman Specialty; Division of ITT Industries.
  3. Leslie Controls, Inc.
  4. Spence Engineering Company, Inc.
  5. Spirax Sarco, Inc.
- B. Size, Capacity, and Pressure Rating: Factory set for inlet and outlet pressures indicated.
- C. Description: Pilot-actuated, diaphragm type, with adjustable pressure range and positive shutoff.
- D. Body: Cast iron.
- E. End Connections: Threaded connections for valves NPS 2 and smaller and flanged connections for valves NPS 2-1/2 and larger.
- F. Trim: Hardened stainless steel.
- G. Head and Seat: Replaceable, main head stem guide fitted with flushing and pressure-arresting device cover over pilot diaphragm.
- H. Gaskets: Non-asbestos materials.

## **2.8 STEAM TRAPS**

- A. Thermostatic Traps:
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Armstrong International, Inc.
    - b. Barnes & Jones, Inc.
    - c. Dunham-Bush, Inc.
    - d. Hoffman Specialty; Division of ITT Industries.
    - e. Spirax Sarco, Inc.

- f. Sterling.
  - 2. Body: Bronze angle-pattern body with integral union tailpiece and screw-in cap.
  - 3. Trap Type: Balanced-pressure.
  - 4. Bellows: Stainless steel or monel.
  - 5. Head and Seat: Replaceable, hardened stainless steel.
  - 6. Pressure Class: 125.
- B. Float and Thermostatic Traps:
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Armstrong International, Inc.
    - b. Barnes & Jones, Inc.
    - c. Dunham-Bush, Inc.
    - d. Hoffman Specialty; Division of ITT Industries.
    - e. Spirax Sarco, Inc.
    - f. Sterling.
  - 2. Body and Bolted Cap: ASTM A 126, cast iron.
  - 3. End Connections: Threaded.
  - 4. Float Mechanism: Replaceable, stainless steel.
  - 5. Head and Seat: Hardened stainless steel.
  - 6. Trap Type: Balanced pressure.
  - 7. Thermostatic Bellows: Stainless steel or monel.
  - 8. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.
  - 9. Vacuum Breaker: Thermostatic with phosphor bronze bellows and stainless steel cage, valve, and seat.
  - 10. Maximum Operating Pressure: 125 psig.

### **PART 3 - EXECUTION**

#### **3.1 LP STEAM PIPING APPLICATIONS**

- A. LP Steam Piping: Schedule 40, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
- B. Condensate Piping above Grade: Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

#### **3.2 ANCILLARY PIPING APPLICATIONS**

- A. Air-Vent Piping:
  - 1. Inlet: Same as service where installed.
- B. Vacuum-Breaker Piping: Outlet, same as service where installed.

- C. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

### **3.3 VALVE APPLICATIONS**

- A. Install shutoff duty valves at branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.
- B. Install safety valves on pressure-reducing stations and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

### **3.4 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Use indicated piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- K. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- L. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.
- M. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.

- N. Reduce pipe sizes using eccentric reducer fitting installed with level side down.
- O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to top of main pipe.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."
- U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

### **3.5 STEAM-TRAP INSTALLATION**

- A. Install steam traps in accessible locations as close as possible to connected equipment.
- B. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.

### **3.6 PRESSURE-REDUCING VALVE INSTALLATION**

- A. Install pressure-reducing valves in accessible location for maintenance and inspection.
- B. Install bypass piping around pressure-reducing valves, with globe valve equal in size to area of pressure-reducing valve seat ring, unless otherwise indicated.
- C. Install gate valves on both sides of pressure-reducing valves.
- D. Install unions or flanges on both sides of pressure-reducing valves having threaded- or flanged-end connections respectively.
- E. Install pressure gages on low-pressure side of pressure-reducing valves after the bypass connection according to Division 23 Section "Meters and Gages for HVAC Piping."
- F. Install strainers upstream for pressure-reducing valve.
- G. Install safety valve downstream from pressure-reducing valve station.

### **3.7 SAFETY VALVE INSTALLATION**

- A. Install safety valves according to ASME B31.9, "Building Services Piping."

- B. Pipe safety-valve discharge without valves to atmosphere outside the building.
- C. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.
- D. Install exhaust head with drain to waste, on vents equal to or larger than NPS 2-1/2.

### 3.8 HANGERS AND SUPPORTS

- A. Install hangers and supports according to Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with requirements below for maximum spacing.
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
- C. Install hangers with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 9 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 9 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/2: Maximum span, 12 feet; minimum rod size, 3/8 inch.
  - 4. NPS 2: Maximum span, 13 feet; minimum rod size, 3/8 inch.
  - 5. NPS 2-1/2: Maximum span, 14 feet; minimum rod size, 3/8 inch.
  - 6. NPS 3: Maximum span, 15 feet; minimum rod size, 3/8 inch.
  - 7. NPS 4: Maximum span, 17 feet; minimum rod size, 1/2 inch.
- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2: Maximum span, 4 feet; minimum rod size, 1/4 inch.
  - 2. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - 7. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### 3.9 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### **3.10 TERMINAL EQUIPMENT CONNECTIONS**

- A. Size for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install traps and control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install vacuum breakers downstream from control valve, close to coil inlet connection.
- E. Install a drip leg at coil outlet.

### **3.11 FIELD QUALITY CONTROL**

- A. Prepare steam and condensate piping according to ASME B31.9, "Building Services Piping," and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush system with clean water. Clean strainers.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- B. Perform the following tests on steam and condensate piping:
  - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  - 2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
  - 3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components and repeat hydrostatic test until there are no leaks.

- C. Prepare written report of testing.

**END OF SECTION 232213**

## **SECTION 233113 - METAL DUCTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

**A. Section Includes:**

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

**B. Related Sections:**

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### **1.2 PERFORMANCE REQUIREMENTS**

**A. Delegated Duct Design:** Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated.

**1. Static-Pressure Classes:**

- a. Supply Ducts (except in Mechanical Rooms): 1-inch wg.
- b. Return Ducts (Negative Pressure): 1-inch wg.
- c. Exhaust Ducts (Negative Pressure): 1-inch wg.

**2. Leakage Class:**

- a. Round Supply-Air Duct: 3 cfm/100 sq. ft. at 1-inch wg.
- b. Rectangular Supply-Air Duct: 6 cfm/100 sq. ft. at 1-inch wg .

**B. 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".

#### **1.3 SUBMITTALS**

**A. 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.
5. Design Calculations: Calculations for selecting hangers and supports.

#### **1.4 QUALITY ASSURANCE**

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 – “Systems and Equipment” and Section 7 – “Construction and System Start-up.”
- B. 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 1-4, "Transverse (Girth) 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 1-5, "Longitudinal Seams - Rectangular Ducts," 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 2, "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. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," 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."
  1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," 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."
  - 1. Fabricate round ducts larger than 90 in diameter with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "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 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.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

### **2.4 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.
- 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. 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.

## **2.5 HANGERS AND SUPPORTS**

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- D. 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.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. 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 Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

### **3.2 SEAM AND JOINT SEALING**

- A. Seal duct seams and joints for duct static-pressure and leakage classes specified in "Performance Requirements" Article, according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements," unless otherwise indicated.

### **3.3 HANGER AND SUPPORT INSTALLATION**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
  - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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.

- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. 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.
- F. 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.

### 3.4 DUCT SCHEDULE

#### A. Elbow Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
  - a. Velocity 1000 fpm or Lower:
    - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
  - b. Velocity 1000 to 1500 fpm:
    - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
    - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
    - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
  - c. Velocity 1500 fpm or Higher:
    - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
- 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
  - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
    - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
    - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

- 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
  - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
  - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- B. Branch Configuration:
- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
    - a. Rectangular Main to Rectangular Branch: 45-degree entry.
    - b. Rectangular Main to Round Branch: High efficiency takeoff with gasket.
  - 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals."
    - a. Velocity 1000 fpm or Lower: 90-degree tap.
    - b. Velocity 1000 fpm or Higher: 45-degree lateral.

**END OF SECTION 233113**

## **SECTION 233300 - AIR DUCT ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
1. Manual volume dampers.
  2. Control dampers.
  3. Flange connectors.
  4. Turning vanes.
  5. Duct-mounted access doors.
  6. Flexible connectors.
  7. Flexible ducts.
  8. Duct accessory hardware.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

#### **1.3 QUALITY ASSURANCE**

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G90.
  2. Exposed-Surface Finish: Mill phosphatized.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.2 MANUAL VOLUME DAMPERS

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

- a. Air Balance Inc.; a division of Mestek, Inc.
- b. American Warming and Ventilating; a division of Mestek, Inc.
- c. Flexmaster U.S.A., Inc.
- d. McGill AirFlow LLC.
- e. METALAIRE, Inc.
- f. Nailor Industries Inc.
- g. Pottorff; a division of PCI Industries, Inc.
- h. Ruskin Company.
- i. Trox USA Inc.
- j. Vent Products Company, Inc.

B. Standard, Steel, Manual Volume Dampers:

1. Standard leakage rating.
2. Suitable for horizontal or vertical applications.
3. Frames:
  - a. Hat-shaped, galvanized steel channels, 0.064-inch minimum thickness.
  - b. Mitered and welded corners.
  - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
4. 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.
5. Blade Axles: Galvanized steel.
6. Bearings:
  - a. 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.
7. Tie Bars and Brackets: Galvanized steel.

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.

## 2.3 CONTROL DAMPERS

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



1. American Warming and Ventilating; a division of Mestek, Inc.
  2. Greenheck Fan Corporation.
  3. Nailor Industries Inc.
  4. NCA Manufacturing, Inc.
  5. Ruskin Company.
  6. Vent Products Company, Inc.
- B. Low-leakage rating and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Frames:
1. Hat shaped.
  2. Galvanized-steel channels, 0.064 inch thick.
  3. Mitered and welded corners.
- D. Blades:
1. Multiple blade with maximum blade width of 8 inches.
  2. Opposed-blade design.
  3. Galvanized steel.
  4. 0.064 inch thick.
  5. Blade Edging: Closed-cell neoprene edging.
  6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- E. 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.
- F. Bearings:
1. Synthetic.
  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.

## 2.4 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
  2. Nexus PDQ; Division of Shilco Holdings Inc.
  3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

## 2.5 TURNING VANES

- A. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
  - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- 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 2-3, "Vaness and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

## 2.6 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - 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: Two hinges and two sash locks.
    - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
    - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

## 2.7 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
- D. 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.

## **2.8 FLEXIBLE DUCTS**

- A. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene 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.
- B. Flexible Duct Connectors:
  1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.

## **2.9 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 backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. 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.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. At maximum 50-foot spacing.
  2. Upstream of turning vanes.
  3. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.
- I. Access Door Sizes: (install the largest size below based on the ductwork size)
1. Hand Access: 6 by 10 inches.
  2. Head and Hand Access: 12 by 12 inches.
  3. Head and Shoulders Access: 18 by 18 inches.
- J. Install flexible connectors to connect ducts to equipment with an airflow over 2000 cfm.
- K. Connect diffusers to low-pressure ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- L. Install duct test holes where required for testing and balancing purposes.

**END OF SECTION 233300**

## **SECTION 233423 - HVAC POWER VENTILATORS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Inline Fans.

#### **1.2 SUBMITTALS**

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and 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. Fan speed controllers.
- B. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

#### **1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

## **1.5 COORDINATION**

- A. Coordinate size and location of structural-steel support members.

## **PART 2 - PRODUCTS**

### **2.1 CENTRIFUGAL SQUARE INLINE FANS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Acme Engineering & Mfg. Corp.
  - 2. Carnes Company HVAC.
  - 3. Greenheck.
  - 4. Loren Cook Company.
- B. Product Description: V-belt drive with galvanized steel housing integral inlet cone, removable access doors on 3 sides, inlet and outlet duct collar, gravity backdraft damper in discharge, horizontal hanging brackets.
- C. Fan Wheel: Backward inclined centrifugal type, aluminum construction.
- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- E. Motor and Drive Mounting: Out of air stream.
- F. Motor: Open drip proof.
- G. Bearings: ABMA 9 life at 200,000 hours.
- H. Accessories:
  - 1. Belt guard.
  - 2. Motor cover.
  - 3. Inlet safety screen.
  - 4. Outlet safety screen.
  - 5. Flexible duct connector.
  - 6. Disconnect Switch: NEMA 250 Type 1 enclosure.
  - 7. Fan speed controller.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install power ventilators level and plumb.
- B. Install units with clearances for service and maintenance.
- C. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

### **3.2 CONNECTIONS**

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### **3.3 ADJUSTING**

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

**END OF SECTION 233423**

## **SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
  - 1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### **1.2 SUBMITTALS**

- A. Product Data: For each 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.

### **PART 2 - PRODUCTS**

#### **2.1 GRILLES AND REGISTERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Krueger HVAC.
  - 2. Nailor Industries of Texas Inc.
  - 3. Price Industries.
  - 4. Titus.

#### **2.2 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 practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- 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 233713**

## **SECTION 237300 - INDOOR CENTRAL-STATION AIR-HANDLING UNITS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes modular factory fabricated air-handling units and accessories that can be disassembled at the project site and installed through a 4 foot wide by 6 foot tall access door in the attic.

#### **1.2 SUBMITTALS**

- A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- B. Product Data, Submit the following:
  - 1. Published Literature: Indicate capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
  - 2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
  - 3. Fans: Performance and fan curves with specified operating point plotted, power, RPM.
  - 4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
  - 5. Dampers: Include leakage, pressure drop, and sample calibration curves. Indicate materials, construction, dimensions, and installation details.
  - 6. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring. Indicate factory installed and field installed wiring.

#### **1.3 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: Submit instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.
- B. Protect units from weather and construction traffic by storing in dry, roofed location.

#### **1.5 WARRANTY**

- A. Manufacturer shall provide a limited “parts only” warranty for a period of 12 months from the date of equipment start up or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for installation, operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and air filters.

## **PART 2 - PRODUCTS**

### **2.1 AIR HANDLING UNITS**

- A. Manufacturers:
  - 1. Aeon.
  - 2. Trane.
  - 3. Daikin.
  
- B. Configuration:
  - 1. Filter Section.
  - 2. Hydronic Preheat Coil (runaround coil #1).
  - 3. Cooling Coil.
  - 4. Hydronic Reheat Coil (runaround coil #2).
  - 5. Supply fan.
  - 6. Electric Reheat Coil.
  
- C. Fabrication: Conform to AHRI 430.

### **2.2 CASING**

- A. Assemble sections with gaskets and bolts.
  
- B. Unit shall be factory assembled and tested including leak testing of the coils and run testing of the supply fans and factory wired system. Run test report shall be supplied with the unit in the control compartment's literature packet, and also available electronically after the unit ships.
  
- C. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel and prevents exterior condensation on the panel.
  
- D. Unit insulation shall have a minimum thermal resistance R-value of 6.25. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.
  
- E. Finish: Manufacturers standard paint on exterior.
  
- F. Inspection Doors: galvanized steel for flush mounting, with gasket, latch, and handle assembly.
  
- G. Drain Pans: Double-sloped 304 stainless steel drain pan that extends a minimum of 24" downstream from each coil with 1-inch NPT connection.
  - 1. Drain pans required on the hydronic pre-heat coil and the cooling coil.
  - 2. Drain pans not required on the hydronic post heat coil or the electric heating coil.
  
- H. Strength: Furnish structure to brace casings for suction pressure of 2.5-inch w.g, with maximum deflection of 1 in 200.

## 2.3 FANS

- A. Unit shall include direct drive, unhooded, backward curved, plenum supply fans.
- B. Blower and motor assembly shall be dynamically balanced.
- C. Motor shall be a high efficiency electronically commutated motor (ECM).
- D. Motor shall be an IE5 efficiency permanent magnet totally enclosed motor.
- E. Blower and motor assembly shall utilize neoprene gasket.
- F. ECM driven supply fan shall include a factory installed potentiometer within the control compartment for cfm setpoint. The factory provided terminal block shall include a jumper wire that can be removed when wired to field provided 0-10 VDC control signal.
- G. Access to supply fan shall be through an access door with removable pin hinges and lockable quarter turn handles.
- H. Access to supply fan shall be through removable bolted access panels on the top and bottom of the unit.

## 2.4 MOTORS

- A. High efficiency EC motors.

## 2.5 COILS

- A. Casing with access to both sides of coils. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel.
- B. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.
- C. Fabrication:
  - 1. Tubes: Seamless copper expanded into fins, brazed joints.
  - 2. Fins: Aluminum.
  - 3. Casing: Die formed channel frame of galvanized steel.
  - 4. Rows: Maximum of 6.
  - 5. Fins Per Inch: Maximum of 12.
- D. Water Heating Coils:
  - 1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
  - 2. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.
- E. Water Cooling Coils:
  - 1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
  - 2. Configuration: Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.

F. Electric Coils:

1. Assembly: UL 1096 listed and labeled, with terminal control box and hinged cover, splice box, coil, casing, and controls.
2. Controls: Fully modulating SCR control with 0-10VDC signal. Automatic reset thermal cutout, built-in magnetic contactors, manual reset thermal cutout, air flow proving device, fused disconnect.
- 3.

**2.6 FILTERS**

- A. Filter Box: Section with filter guides, access doors from both sides, for side loading with gaskets and blank-off plates.
- B. Flat: 2 inches deep disposable panel filters.

**2.7 CONTROLS**

- A. Controls: Field provided and installed by by owner's preferred controls vendor.

**2.8 ELECTRICAL CHARACTERISTICS AND COMPONENTS**

- A. Electrical Characteristics: In accordance with Section 260503 and the following:
- B. Disconnect Switch: Factory mount on equipment.
- C. Factory installed smoke detector on the supply side.
- D. Factory installed condensate high level switch.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install in accordance with ARI 430.
- B. Install flexible connections between unit and inlet and discharge ductwork. Install metal bands of connectors parallel with minimum **1 inch** flex between ductwork and fan while running. Refer to Section 233300.
- C. Install assembled units with vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as required. Adjust snubbers to prevent tension in flexible connectors when fan is operating.
- D. Provide fixed sheaves required for final air balance.
- E. Insulate coil headers located outside airflow as specified for piping.
- F. Install condensate piping with trap and route from drain pan to nearest floor drain.

### **3.2 INSTALLATION CHILLED WATER COOLING COIL**

- A. Make connections to coils with unions or flanges.
- B. Connect water supply to leaving airside of coil (counter flow arrangement).
- C. Locate water supply at bottom of supply header and return water connection at top.
- D. Install water coils to allow draining and install drain connection at low points.
- E. Install valves and piping specialties in accordance with details as indicated on Drawings.
- F. Install manual air vents at high points complete with shutoff valve.

### **3.3 INSTALLATION HOT WATER HEATING COIL**

- A. Make connections to coils with unions or flanges.
- B. Connect water supply to leaving airside of coil (counter flow arrangement).
- C. Locate water supply at bottom of supply header and return water connection at top.
- D. Install water coils to allow draining and install drain connection at low points.
- E. Install valves and piping specialties in accordance with details as indicated on Drawings.
- F. Install manual air vents at high points complete with shutoff valve.

### **3.4 MANUFACTURER'S FIELD SERVICES**

- A. Furnish services of factory trained representative for minimum of one days to leak test, refrigerant pressure test, evacuate, dehydrate, charge, start-up, calibrate controls, and instruct Owner on operation and maintenance.

### **3.5 CLEANING**

- A. Vacuum clean coils and inside of unit cabinet.
- B. Install new throwaway filters in units at Substantial Completion.

### **3.6 DEMONSTRATION**

- A. Refer to section 017900 – Demonstration and Training.
- B. Demonstrate unit operation and maintenance.

**END OF SECTION 237300**

## **SECTION 238216 - AIR COILS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes hot-water and electric air coils that are not an integral part of air-handling units.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each air coil. Include rated capacity and pressure drop for each air coil.
- B. Operation and maintenance data.

#### **1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

### **PART 2 - PRODUCTS**

#### **2.1 WATER COILS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Aerofin Corporation.
  - 2. Carrier Corporation.
  - 3. Coil Company, LLC.
  - 4. Dunham-Bush, Inc.
  - 5. Heatcraft Refrigeration Products LLC; Heat Transfer Division.
  - 6. Super Radiator Coils.
  - 7. Trane.
  - 8. USA Coil & Air.
- B. Performance Ratings: Tested and rated according to ARI 410 and ASHRAE 33.
- C. Minimum Working-Pressure/Temperature Ratings: 200 psig, 325 deg F.
- D. Source Quality Control: Factory tested to 300 psig.
- E. Tubes: copper, minimum 0.035 inch thick.
- F. Fins: Aluminum, minimum 0.006 inch thick.

- G. Headers: Seamless copper tube with brazed joints, prime coated.
- H. Frames: Galvanized-steel channel frame, minimum 0.064 inch thick for flanged mounting.
- I. Hot-Water Coil Capacities and Characteristics:
  - 1. Minimum Fin Spacing: maximum 10 fins per inch.
  - 2. Number of Rows: maximum of 2 rows.
  - 3. Mounting: Flanged.
  - 4. Coating: Baked phenolic.

## 2.2 ELECTRIC COILS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Brasch Manufacturing Co., Inc.
  - 2. Chromalox, Inc., Wiegand Industrial Division; Emerson Electric Company.
  - 3. Dunham-Bush, Inc.
  - 4. INDEECO.
  - 5. Trane.
- B. Coil Assembly: Comply with UL 1995.
- C. Heating Elements: Open-coil resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, and fastened to supporting brackets.
- D. High-Temperature Coil Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box without removing heater from duct or casing.
  - 1. Secondary Protection: Load-carrying, manually reset or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
- E. Frames: Galvanized-steel channel frame, minimum 0.064 inch thick for flanged mounting.
- F. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:
  - 1. Magnetic contactor.
  - 2. Mercury contactor.
  - 3. Toggle switches; one per step.
  - 4. Step controller.
  - 5. Time-delay relay.
  - 6. Pilot lights; one per step.
  - 7. Airflow proving switch.
- G. Thermostats: Duct-mounted thermostats, with temperature range from 50 to 90 deg F, and 2.5 deg F throttling range.



## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install coils level and plumb.
- B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
- C. Straighten bent fins on air coils.
- D. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.
- E. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- F. Install piping adjacent to coils to allow service and maintenance.
- G. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Control valves are specified in Division 23 Section "Instrumentation and Control for HVAC" and other piping specialties are specified in Division 23 Section "Hydronic Piping."
- H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### **3.2 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, operate electric coils to confirm proper unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

**END OF SECTION 238216**

## **SECTION 238323 - RADIANT HEATING ELECTRIC PANELS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes prefabricated radiant-heating electric panels.

#### **1.2 SUBMITTALS**

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
- B. Operation and maintenance data.

#### **1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

### **PART 2 - PRODUCTS**

#### **2.1 PREFABRICATED RADIANT-HEATING ELECTRIC PANELS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Berko Electric Heating; a division of Marley Engineered Products.
  - 2. Markel Products; a division of TPI Corporation.
  - 3. QMark Electric Heating; a division of Marley Engineered Products.
- B. Description: Electric radiant cove heater with cULus listing. Unit shall be of extruded aluminum, coated with high temperature rated textured powder coat paint.
  - 1. Panel: Minimum 24-gauge, plated steel sheet back panel that shall spring into place without hardware. The heater shall be open at the top and the bottom to allow maximum convection.
  - 2. Heating Element: The heating element shall consist of high resistance nickel-chrome alloy wire, embedded in high purity magnesium oxide and encased in a metal sheath.
  - 3. Electrical Connections: Non-heating, high-temperature, insulated-copper leads, factory connected to heating element.
  - 4. Exposed-Side Panel Finish: Baked-enamel finish in manufacturer's standard custom paint color as selected by Architect.
  - 5. Mounting Hardware: Mounting brackets for wall installation.

- C. Wall Thermostat: Bimetal, sensing elements calibrated from 55 to 90 deg F; with contacts suitable for line-voltage circuit, and manually operated on-off switch with contactors, relays, and control transformers.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install radiant-heating panels level and plumb.
- B. Verify locations of thermostats with Drawings and room details before installation. Install devices 60 inches above finished floor.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

#### **3.2 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field tests and inspections and prepare test reports:
  - 1. Operate electric heating elements through each stage to verify proper operation and electrical connections.
  - 2. Test and adjust controls and safeties.
- B. Remove and replace malfunctioning units and retest as specified above.

**END OF SECTION 238323**

## **SECTION 239100 – LOUVERED PENTHOUSES**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Extruded Aluminum for Formed Galvanized Steel Stationary Blade Boxed Penthouse.

#### **1.2 SUBMITTALS**

- A. Product Data: For each product to be used, include:
  - 1. Manufacturer's product data including performance data.

#### **1.3 QUALITY ASSURANCE**

- A. Product Qualifications:
  - 1. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finishes during handling and installation to prevent damage.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

#### **1.5 PROJECT CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

#### **1.6 WARRANTY**

- A. Manufacturer shall provide standard limited warranty for louver systems for a period of five (5) years (60 months) from date of installation, no more than 60 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the Owner.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

#### **A. Acceptable Manufacturers:**

1. Air Balance Inc.; A Division of Mestek Inc.
2. Air Flow Company Inc.
3. Airolite Company, LLC
4. All-Lite Architectural Products
5. American Warming and Ventilating
6. Arrow United Industries
7. Larnes Company
8. Cesco Products; A Division of Mestek, Inc.
9. Construction Specialties, Inc.
10. Dams Incorporated; D. Architectural Metal Solutions Incorporated
11. Greenheck Fan Corporation
12. Industrial Louvers Inc.
13. Louvers & Dampers, Inc.
14. Metal Form Manufacturing
15. NCA Manufacturing Inc.
16. Nystrom, Inc.
17. Pottorff
18. Reliable Products, Inc.
19. Ruskin Company
20. Safe-Air Dowco Products
21. United Enertech

### **2.2 STATIONARY BLAD BOXED CORNER PENTHOUSE**

#### **A. Fabrication:**

1. Roof
  - a. With aluminum louvers: Aluminum 0.63 inch (1.6mm)
2. Frame Structural Support:
  - a. With aluminum Louvers: Extruded Aluminum, 1½ x 4 x 1½ inches (38 x 102 x 38mm).
3. Blades:
  - a. Style: Any style except thinline models
  - b. Wall Thickness: 0.081 inch (2.1 mm), nominal.
  - c. Material: Extruded aluminum, Alloy 6063-T6.
4. Boxed Corner Flashing:
  - a. With extruded aluminum louvers.080 (3) thick formed aluminum, mechanically fastened to louver frames.
5. Sill:

- a. .125" (3) thick formed aluminum, extends approximately 6 ½" (165) beyond rear of louver Units 32 " x 32 (813 x 813) and small will extend roughly 3 ½" (89).

## **2.3 ACCESSORIES**

### **A. Bird Screen:**

1. Aluminum: Aluminum, 5/8 inches by 0.040 inch (16 mm by 1 mm), expanded and flattened.
2. Frame: Removable. Re-wireable.

### **B. Extended Sills:**

1. Extruded Aluminum, Allow 6063-T6. Minimum nominal thickness 0.060 inch (1.5mm).
2. Formed Aluminum, Allow 3003. Minimum nominal thickness 0.081 inch (2.1mm).

### **C. Visible Mullions: Manufacturer's standard horizontal or vertical visible mullions for architectural accent as indicated on drawings.**

## **2.4 FINISHES**

### **A. Finish: Mill finish.**

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.
- B. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.2 PREPARATION**

- A. Clean opening 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. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.
- B. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.
- C. The supporting structure shall be designed to accommodate the point loads transferred by the louvers when subject to the design wind loads.

- D. Install joint sealants as specified in Section 079 000 Joint Sealants.

### **3.4 CLEANING**

- A. Clean louver surfaces in accordance with manufacturer's instructions.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION 239100**

## **SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The Contractor for this work is referred to the Drawings, Bidding Requirements, General Conditions, Special Conditions, Temporary Services and other pertinent Sections of these Specifications. These sections describe work which is a part of this Contract. The following General Provisions amplify and supplement these Sections of Specifications. In cases of conflicting requirements, the stipulations set forth in Division 1 supersede and must be satisfied by the Contractor.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Electrical equipment coordination and installation.
  - 2. Common electrical installation requirements.

#### **1.3 COORDINATION**

- A. Contractor must read the entire Specifications covering other branches of Work. Contractor is responsible for coordination of his (her) work with work performed by other trades.
- B. Consult all Contract Documents which may affect the location of any equipment or apparatus furnished under this Work and make minor adjustments in location as necessary to secure coordination.
- C. System layout is schematic and exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be arbitrarily changed. The equipment layout is to fit into the building as constructed and to coordinate with equipment included under other Divisions of Work.
- D. Contractor shall contact the Owner's Representative immediately if he (she) notices any discrepancies or omissions in either the Drawings or Specifications, or if there are any questions regarding the meaning or intent thereof.
- E. Submit all changes, other than minor adjustments, to the Engineer/Architect for approval before proceeding with the work.
- F. The Contractor is required to visit the site and fully familiarize himself or herself concerning all conditions affecting the scope of work. Failure to visit the site shall not relieve the Contractor from any responsibility in the performance of his or her Work.
- G. All workmanship to be of the highest quality in accordance with the best practices of the trade by craftsmen/ craftswomen skilled in this particular work.
- H. Coordinate arrangement, mounting, and support of electrical equipment:



1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  3. To allow right of way for piping and conduit installed at required slope.
  4. To ensure connecting raceways, cables, wireways, cable trays, and busways are clear of obstructions and of the working and access space of other equipment.
- I. Coordinate installation of electrical boxes that are recessed in pre cast wall with precast wall manufacturer. This may require that the electrician be present at the precast wall manufacturer location during the forming of the panels. All costs associated with this coordination shall be included within the bid and no additional time or charges will be allowed to facilitate this coordination.
  - J. All field holes in precast wall assemblies shall be core drilled holes made in accordance with precast wall manufacturer directions.
  - K. All buried conduits passing from below the proposed building to the exterior shall pass below the proposed structural footing.
  - L. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.
  - M. Coordinate sleeve selection and application with selection and application of firestopping.
  - N. Where thermostat locations are shown, the electrical contractor shall provide a recessed wall box with conduit to an accessible location. In areas where surface mounted boxes are required, a surface mounted box and conduit to 10' AFF shall be provided (or to the equipment location, whichever is closer). Thermostat installation and the corresponding low voltage thermostat wiring shall be by the mechanical contractor.

#### **1.4 PERMITS, INSPECTIONS AND CODES**

- A. File all drawings, pay all fees, and obtain permits and certificate of inspection relative to this Work.
- B. Complete installation shall conform with all applicable Federal, State and Local laws, Codes and Ordinances including, but not limited to the latest approved editions of the following:
  1. State Building Codes.
  2. Specific Construction Safety Requirements, State Industrial Commission.
  3. National Electrical Code (NFPA-70).
  4. Life Safety Code, NFPA-101.
  5. Occupational Safety and Health Act (OSHA) of 1971 and all amendments thereto.
- C. Nothing contained in the drawings and specifications shall be construed to conflict with these laws, codes, and ordinances and they are hereby included in these specifications.

#### **1.5 RECORD DRAWINGS**

- A. Record all deviations from the Drawings, on a set of prints and deliver them to the Owner and Owner's Representative upon completion of the work. Special attention to record the location of concealed boxes, service runs shall be made at the point of installation to maintain accuracy.

1. Sufficient dimensional tie points to permanent building features shall be provided for all buried conduits to facilitate future location.

## **1.6 INSPECTION**

- A. Contractor shall arrange for and include in his (her) bid, inspection of this work by the appropriate stator or local code authority having jurisdiction.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Furnish new, undeteriorated materials of a quality not less than what is specified.
- B. Contractor to furnish and install only those brands of equipment mentioned specifically or accepted as substitutes.

### **2.2 EQUIPMENT SELECTION AND APPROVAL**

- A. The selection of materials and equipment to be furnished shall be governed by the following:
  1. Where trade names, brands of manufacturer of equipment or materials are listed in the specification, the exact equipment listed shall be used in the bid or the contractor shall submit the necessary literature to show the alternative product meets the performance characteristics of that which has been called for. Where more than one name is listed, Contractor may select any one of the various brands specified.

### **2.3 SUBSTITUTIONS**

- A. Contractor must base his (her) bid on furnishing the brands of material and equipment listed in the Specifications or their approved equals.
- B. The Contractor is entitled to bid on any other equal or similar brands of material and equipment he (she) may desire to substitute. In order to be considered, the Contractor must request approval to bid the substitution in writing no later than ten (10) days prior to the Bid Date. If permitted the substitutes will be approved by addendum.

## **PART 3 - EXECUTION**

### **3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION**

- A. Furnish all materials, labor, tools, transportation, incidentals, and appurtenances to complete in every detail and leave in working order all items of work called for herein or shown on the accompanying Drawings.
- B. Include any minor items of work necessary to provide a complete and fully operative electrical system which meets all required codes.
- C. Comply with NECA 1.

- D. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- E. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- F. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- G. Right of Way: Give to piping systems installed at a required slope.

### **3.2 PROTECTION AND CLEANING**

- A. Protect all fixtures and equipment against damage from leaks or abuse and pay the cost of repair or replacement of fixtures or equipment made necessary by failure to provide suitable safeguards or protection.
- B. After all fixtures and equipment have been set, thoroughly clean all fixtures and equipment with manufacturers recommended cleaning agents, removing stickers and other foreign matter and leave every part in acceptable condition, clean and ready for use.
- C. Repair all dents and scratches in factory prime or finish coats on all electrical equipment. If damage is excessive, replacement may be required.

**END OF SECTION 260500**

# SECTION 260526 - GROUNDING AND BONDING 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 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.
- B. Grounding system shall be in compliance with all requirements of the National Electrical Code.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field Quality Report
  - 1. Photo Report
  - 2. Dimensioned as-built locations of grounding features

### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

## **2.2 BONDING TERMINATIONS**

- A. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.
- B. Intersystem Bonding Termination:
  1. Lay-in connection clamp sized for connected grounding electrode conductor
  2. Minimum of (5) bonding conductor terminals (#14 AWG- #4 AWG)
  3. UV stabilized base and housing with stainless steel mounting hardware
  4. UL listed as an intersystem bonding termination

## **2.3 CONNECTORS**

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
  1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

## **2.4 GROUNDING ELECTRODES**

- A. Ground Rods: Copper-clad steel; 5/8 inch in diameter by 10 feet or as noted on the Drawings.
- B. Segmented Ground Rods: Copper-clad steel; 5/8 inch in diameter by 10 feet in length, capable of being threaded together to form a continuous vertical grounding electrode as noted on the drawings.

## **PART 3 - EXECUTION**

### **3.1 APPLICATIONS**

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned copper conductor. Bury at least 24 inches below grade.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Exothermically welded connections except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

### 3.2 EQUIPMENT GROUNDING

- A. A separate equipment grounding conductor, minimum size per NEC, shall be installed in each feeder, branch circuit, and control circuit conduit. Conductor insulation shall be green. DO NOT use conduit as a means for grounding of receptacles or any other such devices.
- B. Conduit system shall be electrically continuous. All enclosures and non-current carrying metals to be grounded. All locknuts must cut through enameled or painted surfaces on enclosures. Where enclosures and non-current carrying metals are isolated from the conduit system, use bonding jumpers with approved clamps.
- C. All new receptacles shall be bonded to a ground conductor using a #12 AEG min. bonding jumper between receptacle terminal and ground conductor. Metal-to-metal contact between the device yoke and the outlet box is not acceptable for either surface mounted boxes or flush type boxes.
- D. Junction boxes and pull boxes shall be bonded by the use of UL listed ground screws or lugs.
- E. Lighting fixtures shall be grounded by the use of a pigtail fastened on bare metal that is free of paint.
- F. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- G. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- H. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
  2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- I. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

### 3.4 FIELD QUALITY CONTROL

- A. Provide a photo report consisting of labeled pictures of all of the following grounding features:
  - 1. Ground rods
  - 2. Intersystem bonding termination
  - 3. Grounding arrangements and connections for separately derived systems
  - 4. Grounding connection to rebar in footing/floor
  - 5. Grounding connection to building steel

6. Grounding connection to metallic water pipe
- B. Dimensioned as-built plans showing the locations of the key grounding features contained in the photo report shall be submitted concurrently with the photo report.

**END OF SECTION 260526**



## **SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes:
  - 1. Hangers and supports for electrical equipment and systems.

#### **1.2 PERFORMANCE REQUIREMENTS**

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

#### **1.3 QUALITY ASSURANCE**

- A. Comply with NFPA 70.

### **PART 2 - PRODUCTS**

#### **2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS**

- A. Aluminum Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
  - 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 2. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
  - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
  - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  - 5. Toggle Bolts: All-steel springhead type.
  - 6. Hanger Rods: Threaded steel.

## **2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES**

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### **3.2 SUPPORT INSTALLATION**

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Retain first subparagraph below if powder-actuated devices are allowed. Consider deleting if Project contains both lightweight and standard-weight concrete or more than one thickness of concrete slab.
  - 6. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 7. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  - 8. To Light Steel: Sheet metal screws.
  - 9. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### **3.3 INSTALLATION OF FABRICATED METAL SUPPORTS**

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

### **3.4 PAINTING**

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION 260529**

## **SECTION 260533 - RACEWAY AND BOXES 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 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

#### **1.3 SUBMITTALS**

- A. Product Data: For surface raceways.

#### **1.4 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

### **PART 2 - PRODUCTS**

#### **2.1 METAL CONDUIT AND TUBING**

- A. Rigid Steel Conduit: ANSI C80.1.
- B. PVC Coated Rigid Steel Conduit: UL 6, NEMA RN 1
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all types and flexible and liquid-tight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
  - 1. Fittings for EMT: Steel, set-screw or compression type. Die cast fittings are not acceptable.

- G. LFMC: Flexible steel conduit with PVC jacket. Made from a continuous length of galvanized cold rolled steel strip, spirally wound. Adjacent strips shall have locked typed construction with all the edges turned in. With an extruded PVC jacket.

## **2.2 NONMETALLIC CONDUIT AND TUBING**

- A. PVC conduit shall be heavy wall, Schedule 40 ultra-violet resistant, UL listed under Standard 651. Conduit shall be suitable for use with 90°C insulated wire. Conduit fittings and cement shall be of the same manufacturer.
- B. Fittings for Schedule 40 PVC: Match to conduit or tubing type and material.

## **2.3 METAL WIREWAYS**

- A. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Wireway Covers: Screw-cover type.
- D. Finish: Manufacturer's standard enamel finish.

## **2.4 BOXES AND ENCLOSURES**

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1,
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

## **2.5 SLEEVES FOR RACEWAYS**

- A. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

# **PART 3 - EXECUTION**

## **3.1 RACEWAY APPLICATION**

- A. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
  2. All other exposed areas: RMC.
  3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC
  5. Damp or Wet Locations: RMC.
  6. Raceways for Optical Fiber or Communications Cable: EMT.
  7. Boxes and Enclosures: NEMA 250, Type 1, except as noted on the Drawings.
- B. Minimum Raceway Size: 3/4-inch trade size Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

### 3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. In finished areas, conduit must be concealed above accessible ceilings, within the building structure, or within chases. Exposed conduits to be run tight to wall or ceiling and installed in a neat workmanlike manner, ready for painting.
- C. Install conduit parallel or perpendicular to building lines (except where run in or below floor slabs). Keep conduit runs as closed to underside of structure as possible.
- D. Exercise necessary precautions to prevent accumulation of water, dirt, or concrete in conduits during execution of electrical work. Conduit in which water or foreign material has been permitted to accumulate shall be thoroughly cleaned or replaced where such accumulations cannot be removed.
- E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Complete raceway installation before starting conductor installation.
- G. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- H. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- I. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- J. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- L. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 240-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

- M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where otherwise required by NFPA 70.
- N. Covers for all junction boxes containing emergency circuits shall be red and labeled according to "260553 Identification for Electrical Systems."
- O. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
  - 1. Wall boxes in tile, marble, brick or other finished masonry wall shall be of welded construction and designed for installation within masonry.
- Q. Set metal floor boxes level and flush with finished floor surface.
- R. Metal boxes cast in concrete shall be designed for concrete installation.
- S. Weather-proof boxes shall be die-cast aluminum.
- T. Boxes for exposed work in finished area to be Type FS with threaded hubs and rigid conduit risers.
- U. Install expansion fittings at all locations where conduits cross building expansion joints.
- V. Secure rigid conduit at cabinets and boxes using insulated throat type grounding and bonding bushings. Locknuts shall be tightened to cut through painted surfaces.
- W. Where a number of conduits are to be run exposed and parallel, one with another, they shall be grouped and supported by trapeze hangers or unistrut racks tight to the building structure.
- X. Mount junction and pull boxes securely to building structure in a location that meets the requirements of the National Electrical Code for accessibility and work space clearance. Coordinate exact locations of work with other trades. Unless noted otherwise, mounting heights shall be (all measurements are to the top of the box):

Switches, receptacles, or telephone/data shown above a countertop	12" above countertop
Dedicated receptacles (i.e. refrigerator, microwave, etc.)	To suit equipment (see equipment/cabinetry elevation drawings where applicable)
Other interior receptacles	16" AFF
Exterior receptacles	20" above finished grade
Other switches	48" AFF
Telephone/data shown next to a doorway	56" AFF
Other telephone/data	16" AFF



### **3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- B. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- C. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials.
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

### **3.4 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

**END OF SECTION 260533**

## **SECTION 260553 - IDENTIFICATION 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 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Identification for conductors and communication and control cable.
  - 2. Data/Telephone outlet labels
  - 3. Receptacle labels
  - 4. Underground-line warning tape.
  - 5. Warning labels and signs.
  - 6. Instruction signs.
  - 7. Equipment identification labels.
  - 8. Miscellaneous identification products.

#### **1.3 QUALITY ASSURANCE**

- A. Comply with NFPA 70.
- B. Comply with 29 CFR 1910.145.

#### **1.4 COORDINATION**

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

### **PART 2 - PRODUCTS**

#### **2.1 CONDUCTOR, COMMUNICATION, AND CONTROL CABLE IDENTIFICATION MATERIALS**

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tape: Vinyl or vinyl -cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

## 2.2 DATA/TELEPHONE OUTLET LABELS

- A. Machine printed paper insert with black filled lettering located under clear label cover on face of plate and durable wire markers on inside of outlet box.

## 2.3 RECEPTACLE LABELS

- A. Hot stamped or engraved machine printing with black filled lettering under clear label on face of plate and durable wire markers on inside of outlet box.

## 2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Color Scheme
  - 1. Emergency Warning labels: White background with red letters
  - 2. All other warning labels: Yellow background with black letters
- D. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
  - 3. Service Equipment emergency sources warning: "CAUTION – TWO SOURCES OF SUPPLY- EMERGENCY POWER SOURCE LOCATED IN GENERATOR ROOM 207 ON NORTH SIDE OF BUILDING."
  - 4. Generator Warning Label: "EMERGENCY GENERATOR"
  - 5. Automatic Transfer Switch Warning Label: "EMERGENCY TRANSFER SWITCH"
  - 6. Emergency Panel Warning Label: "EMERGENCY PANEL"
  - 7. Junction boxes containing emergency circuits: "EMERGENCY CIRCUITS- PANEL *insert name*"
  - 8. As noted on drawings.

## 2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
  - 1. Engraved legend with black letters on white face. (White letters on red background for emergency information)

2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## **2.6 EQUIPMENT IDENTIFICATION LABELS**

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for fasteners, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- B. Fasteners for Labels: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## **2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS**

- A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
- B. Covers for all junction boxes containing emergency circuits shall be red.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. Auxiliary Electrical Systems Conductor and Cable Identification: Use marker tape to identify field-installed alarm, control, signal, sound, intercommunications, voice, and data wiring connections.
  1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and cable pull points. Identify by system and circuit designation.
  2. Use system of designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
- B. Data/Telephone Outlet Identification: Use outlet labels to identify each outlet connection. Use system of designation that is uniform and consistent with cable identification. Label face of plate and wire markers inside of box,
- C. Receptacle Identification: Use labels to identify panelboard and circuit number from which served. Label face of plate and wire markers inside of box,
- D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- E. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
  1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.

- b. Controls with external control power connections.
  - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- F. Instruction Signs:
- 1. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for emergency shut down of generator or remote operation of main switch.
- G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
- 1. Labeling Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment.
    - c. Elevated Components: Increase sizes of labels and legend to those appropriate for viewing from the floor.
  - 2. Equipment to Be Labeled:
    - a. Panelboards, electrical cabinets, and enclosures.
    - b. Electrical switchgear and switchboards.
    - c. Transformers.
    - d. Generators
    - e. Disconnect switches.
    - f. Power transfer equipment.
    - g. Contactors.
    - h. Timeclocks
    - i. Fire alarm control panel and annunciators
    - j. Motor control switches including Hand/Off/Auto switches

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

- E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
  
- F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied or for sizes larger than No. 10 AWG field applied
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  - 4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
  
- G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

**END OF SECTION 260553**

## **SECTION 262416 - PANELBOARDS**

### **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. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail bus configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 5. Retain first subparagraph below if series rating of overcurrent protective devices is used.
  - 6. Include evidence of NRTL listing for series rating of installed devices.
  - 7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 8. Include wiring diagrams for power, signal, and control wiring.
  - 9. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

#### **1.4 QUALITY ASSURANCE**

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories 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.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

## 1.5 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and surface-mounted cabinets.
  - 1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean 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. Or as noted on the plans
  - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
  - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
  - 4. Finishes:
    - a. Panels and Trim: Steel and galvanized steel factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Galvanized steel.
  - 5. Directory Card: Provide typewritten circuit directory card inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses:
  - 1. Hard-drawn copper, 98 percent conductivity.
  - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
  - 2. Main and Neutral Lugs: Mechanical type.
  - 3. Ground Lugs and Bus Configured Terminators: Mechanical type.
  - 4. Feed-Through Lugs (When required): Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.



5. Subfeed (Double) Lugs (When required): Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- E. Service Equipment Label (When applicable): NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

## **2.2 DISTRIBUTION PANELBOARDS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- D. Mains: Circuit breaker or main lugs only as noted on Drawings.
- E. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

## **2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or main lugs only as noted on Drawings
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
  3. AFCI Circuit Breakers: Single pole configurations for 15A and 20A circuits per NFPA 70 Article. 210.12.
  4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - c. Shunt Trip (When indicated): 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    - d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    - e. Handle Padlocking Device (When indicated): Fixed attachment, for locking circuit-breaker handle in on or off position.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 90 inches Insert height above finished floor unless otherwise required keep the distance from the floor to top most circuit breaker within the height limitation contained in the NEC.
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

- D. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
- E. Install filler plates in unused spaces.
- F. Recessed panels: Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- H. Comply with NECA 1.

### **3.2 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

**END OF SECTION 262416**

## **SECTION 262726 - WIRING DEVICES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Twist-locking receptacles.
  - 3. Snap switches.
  - 4. Pendant cord-connector devices.
  - 5. Cord and plug sets.
  - 6. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.
  - 7. Cord reels

#### **1.3 SUBMITTALS**

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

#### **1.4 QUALITY ASSURANCE**

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

#### **1.5 COORDINATION**

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
  2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  3. Leviton Mfg. Company Inc. (Leviton).
  4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

### **2.2 STRAIGHT BLADE RECEPTACLES**

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 5351 (single), CR5362 (duplex).
    - b. Hubbell; HBL5351 (single), CR5352 (duplex).
    - c. Leviton; 5891 (single), 5352 (duplex).
    - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; TRBR20.
    - b. Hubbell; BR20TR.
    - c. Leviton; TCR20

### **2.3 GFCI RECEPTACLES**

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; GF20.
    - b. Pass & Seymour; 2084.

## **2.4 TWIST-LOCKING RECEPTACLES**

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; L520R.
    - b. Hubbell; HBL2310.
    - c. Leviton; 2310.
    - d. Pass & Seymour; L520-R.

## **2.5 PENDANT CORD-CONNECTOR DEVICES**

- A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
  - 1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
  - 2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

## **2.6 CORD AND PLUG SETS**

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
  - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
  - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## **2.7 SNAP SWITCHES**

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
    - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
    - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

- C. Double-throw, Center-Off Switches (3-Position): 120/277 V, 20 A, HP Rating 1HP- 120V, 2HP-277V
- D. Key-Operated Switches, 120/277 V, 20 A:

## **2.8 WALL PLATES**

- A. Single and combination types to match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting
  - 3. Material for Unfinished Spaces: Galvanized steel.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

## **2.9 FLOOR SERVICE FITTINGS**

- A. Type: Modular, flush-type
- B. Service Plate: Round, solid brass with satin finish.
- C. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

## **2.10 CORD REELS**

- A. Comply with UL 365
- B. Ceiling mount industrial power cord reel.
  - 1. Corrosion resistant finish (white)
  - 2. 12/3 SJEO retractable cord (20' min).
  - 3. Black duplex outlet box
  - 4. 5' cord and plug connection
  - 5. Positive latch mechanism to maintain desired cord length
- C. Basis of Design
  - 1. Hubbell HBL45123R20WM1

## **2.11 FINISHES**

- A. Color: Coordinate with Architect and Owner
  - 1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Wiring Devices Connected to Emergency Power System: Red.

## **PART 3 - EXECUTION**

### **3.1 RECEPTACLE APPLICATION**

- A. In all areas accessible to students: Tamper Resistant receptacles
- B. In areas not accessible to students: Standard receptacles
- C. Where required by the most recent version of the NEC and as indicated on the plan sheets: GFCI receptacles

### **3.2 INSTALLATION**

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
  - 1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  - 4. Existing Conductors:
    - a. Cut back and pigtail or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
  - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.



2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### **3.3 IDENTIFICATION**

- A. Comply with Division 26 Section "Identification for Electrical Systems."
1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### **END OF SECTION 262726**

## **SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
  - 1. Fusible switches.
  - 2. Non-fusible switches.
  - 3. Enclosures.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current rating.

#### **1.4 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

#### **1.5 COORDINATION**

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.2 FUSIBLE AND NONFUSIBLE SWITCHES**

- A. Manufacturers:
  - 1. Eaton Corporation; Cutler-Hammer Products.
  - 2. General Electric Co.; Electrical Distribution & Control Division.
  - 3. Square D/Group Schneider.
- B. Fusible Switch, 600 A and Smaller: NEMA KS 1, 208/120V Type Heavy Duty three pole, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks interlocked with cover in closed position.
- C. Non-fusible Switch, 600 A and Smaller: NEMA KS 1, 208/120V Type Heavy Duty three pole lockable handle with capability to accept two padlocks interlocked with cover in closed position.
- D. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; and labeled for copper and aluminum neutral conductors.

### **2.3 ENCLOSURES**

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  - 1. As noted in the drawings.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

### **3.2 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

### **3.3 CLEANING**

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

**END OF SECTION 262816**