



# PROJECT MANUAL

## VOLUME 1

*Replace HVAC, Structural Repairs  
& Replace Roof*

*George Washington Carver State  
Office Building*

*Jefferson City, Missouri*

Designed By: Klingner & Associates, P.C.  
3622 Endeavor Avenue, Suite 117  
Columbia, MO 65201

Date Issued: June 14, 2024

Project No.: O2440-01

STATE *of* MISSOURI

---

OFFICE *of* ADMINISTRATION  
Facilities Management, Design & Construction

---

**SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS**

**PROJECT NUMBER:** O2440-01 Volume 1

**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:**



**Matthew H. Bridges, Engineer**  
PE-2021031578  
Project Manual Division 00, 01, 02, 22, 23,  
and 26



**Bryan C. Bross, Engineer**  
PE-030244  
Asbestos Project Designer –  
711801124MOPDR7176  
Project Manual Section 02



**H. Michael Carter, Architect**  
AIA-006846  
Project Manual Division 04, 06, 07, 08, and 09



**Jeremy T. Steenhoek, Engineer**  
PE-2018008710



**TABLE OF CONTENTS**

<b>SECTION</b>	<b>TITLE</b>	<b>NUMBER OF PAGES</b>
<b><u>VOLUME 1</u></b>		
<b>DIVISION 00 – PROCUREMENT AND CONTRACTING INFORMATION</b>		
<b>000000 INTRODUCTORY INFORMATION</b>		
000101	Project Manual Cover	1
000107	Professional Seals and Certifications	1
000110	Table of Contents	5
000115	List of Drawings	3
<b>001116</b>	<b>INVITATION FOR BID (IFB) plus Missouri Buys instructions</b>	<b>2</b>
<b>002113</b>	<b>INSTRUCTIONS TO BIDDERS (Includes MBE/WBE/SDVE Information)</b>	<b>8</b>
<b>003000 AVAILABLE INFORMATION</b>		
003126	Existing Hazardous Material Information	1
003144	MBE/WBE/SDVE Directory	1
<b>**The following documents may be found on MissouriBUYS at <a href="https://missouribuys.mo.gov/**">https://missouribuys.mo.gov/**</a></b>		
<b>004000 PROCUREMENT FORMS &amp; SUPPLEMENTS</b>		
004113	Bid Form	*
004322	Unit Prices Form (Volume 2)	*
004323	Supplement A - Cost Breakdown	*
004336	Proposed Subcontractors Form	*
004337	MBE/WBE/SDVE Compliance Evaluation Form	*
004338	MBE/WBE/SDVE Eligibility Determination Form for Joint Ventures	*
004339	MBE/WBE/SDVE Good Faith Effort (GFE) Determination Forms	*
004340	SDVE Business Form	*
004541	Affidavit of Work Authorization	*
004545	Anti-Discrimination Against Israel Act Certification form	*
<b>005000 CONTRACTING FORMS AND SUPPLEMENTS</b>		
005213	Construction Contract	4
005414	Affidavit for Affirmative Action	1
<b>006000 PROJECT FORMS</b>		
006113	Performance and Payment Bond	2
006325	Product Substitution Request	2
006519.16	Final Receipt of Payment and Release Form	1
006519.18	MBE/WBE/SDVE Progress Report	1
006519.21	Affidavit of Compliance with Prevailing Wage Law	1
<b>007000 CONDITIONS OF THE CONTRACT</b>		
007213	General Conditions	20
007300	Supplementary Conditions	1
007346	Wage Rate	4
<b>DIVISION 1 - GENERAL REQUIREMENTS</b>		
011000	Summary of Work	3
012100	Allowances	2
012600	Contract Modification Procedures	2
013100	Coordination	4
013115	Project Management Communications	3
013200	Schedules	4
013300	Submittals	7
013513.10	Site Security and Health Requirements (OA)	3

015000	Construction Facilities and Temporary Controls	7
017400	Cleaning	3
017900	Demonstration and Training	4
<b>DIVISION 02 – EXISTING CONDITIONS</b>		
024100	Demolition	1
024126	Selective Mechanical and Electrical Demolition	2
028213	Asbestos Abatement	29
<b>DIVISION 04 – MASONRY</b>		
040000	Masonry	5
<b>DIVISION 05 – METALS</b>		
055000	Metal Fabrications	4
<b>DIVISION 06 – WOOD, PLASTICS, &amp; COMPOSITES</b>		
061000	Rough Carpentry	2
061600	Sheathing	3
<b>DIVISION 07 – THERMAL &amp; MOISTURE PROTECTION</b>		
072100	Thermal Insulation	4
079200	Joint Sealants	9
<b>DIVISION 08 – OPENINGS</b>		
081113	Hollow Metal Frames	6
<b>DIVISION 09 – FINISHES</b>		
090561	Common Work Results for Flooring Preparation	4
092216	Non-Structural Metal Framing	5
092900	Gypsum Board	6
096500	Resilient Flooring	4
099000	Painting and Coating	5
<b>DIVISION 10 – SPECIALTIES</b>		
102600	Wall Protection	3
<b>DIVISION 22 – PLUMBING</b>		
221116	Domestic Water Piping	4
223100	Domestic Water Softeners	4
223400	Fuel Fired Domestic Water Heaters	4
<b>DIVISION 23 – HEATING, VENTILATION, &amp; COOLING</b>		
230519	Meters and Gages for HVAC Piping	4
230523	General Duty Valves for HVAC Piping	6
230529	Hangers and Supports for HVAC Piping and Equipment	7
230553	Identification for HVAC Piping and Equipment	4
230593	Testing, Adjusting and Balancing for HVAC	9
230700	HVAC Insulation	9
230900	Instrumentation and Control for HVAC	8
231123	Facility Natural Gas Piping	10
232113	Hydronic Piping	11
232123	Hydronic Pumps	4
233113	Metal Ducts	4
233300	Air Duct Accessories	5
233413	Axial HVAC Fans	2
233713	Diffusers, Registers and Grilles	2
235216	Condensing Boilers	5
235700	Heat Exchangers for HVAC	3
236423	Scroll Water Chillers	6
236533	Liquid Coolers	3
237300	Indoor Central-Station Air-Handling Units	5

238126	Split System Air Conditioners	2
238219	Fan Coil Units	4
239100	Louvers	3
<b>DIVISION 26 – ELECTRICAL</b>		
260500	Common Work Results for Electrical	3
260519	Low Voltage Electrical Power Conductors and Cables	3
260529	Hangers and Supports for Electrical Systems	3
260533	Raceway and Boxes for Electrical Systems	3
260553	Identification for Electrical Systems	3
262816	Enclosed Switches and Circuit Breakers	3
262923	Variable Frequency Motor Controllers	5
<b>APPENDICES</b>		
APPENDIX A – ASBESTOS REPORT		1
	Limited Asbestos Inspection Report	5
	Exhibit A – Asbestos Sample Results Summary	2
	Exhibit B – Photographs	13
	Exhibit C – Sample Location Map	5
	Exhibit D – Laboratory Report	11
	Exhibit E – Asbestos Location Map	2
	Exhibit F – Missouri Asbestos Inspector License	2
APPENDIX B – LEAD REPORT		1
	Lead Inspection Report	5
	Exhibit A – Sample Location Map	2
	Exhibit B – Photographs	3
	Exhibit C – Laboratory Report	7



**TABLE OF CONTENTS**

<b>SECTION</b>	<b>TITLE</b>	<b>NUMBER OF PAGES</b>
----------------	--------------	------------------------

**VOLUME 2**

**DIVISION 00 – PROCUREMENT AND CONTRACTING INFORMATION**

**000000 INTRODUCTORY INFORMATION**

000101	Project Manual Cover	1
000107	Professional Seals and Certifications	1
000110	Table of Contents	5
000115	List of Drawings	1

**DIVISION 01 - GENERAL REQUIREMENTS**

011000	Summary of Work	3
012200	Unit Prices	2
013300	Submittals	2

**DIVISION 02 – EXISTING CONDITIONS**

020700	Selective Demolition	4
--------	----------------------	---

**DIVISION 03 - CONCRETE**

031000	Concrete Forming and Accessories	5
032000	Concrete Reinforcing	4
032500	Fiber Reinforced Polymer Reinforcing	18
033000	Cast-In-Place Concrete	41

**DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

078123	Intumescent Fire Protection	4
--------	-----------------------------	---

**DIVISION 09 - FINISHES**

099600	High-Performance Coatings	3
--------	---------------------------	---

## TABLE OF CONTENTS

<b>SECTION</b>	<b>TITLE</b>	<b>NUMBER OF PAGES</b>
----------------	--------------	------------------------

### VOLUME 3

#### **DIVISION 00 – PROCUREMENT AND CONTRACTING INFORMATION**

<b>000000</b>	<b>INTRODUCTORY INFORMATION</b>	
000101	Project Manual Cover	1
000107	Professional Seals and Certifications	1
000110	Table of Contents	5
000115	List of Drawings	1

#### **DIVISION 01 - GENERAL REQUIREMENTS**

011000	Summary of Work	3
013300	Submittals	1

#### **DIVISION 02 – EXISTING CONDITIONS**

024119	Selective Demolition	2
--------	----------------------	---

#### **DIVISION 05 – METALS**

055133	Metal Ladders	2
--------	---------------	---

#### **DIVISION 06 – WOOD, PLASTIC, AND COMPOSITE PRODUCTS**

061053	Miscellaneous Rough Carpentry	2
--------	-------------------------------	---

#### **DIVISION 07 – THERMAL AND MOISTURE PROTECTION**

075423	Thermoplastic Polyofelin (TPO) Membrane Roofing	5
076200	Sheet Metal Flashing and Trim	2
079200	Joint Sealants	2

#### **APPENDICES**

APPENDIX 1: Asbestos Test Results	4
-----------------------------------	---

APPENDIX 2: Roofing Installer's Warranty	2
--	---

## 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	06/14/24	G001
2.	INDEX SHEET	G002	06/14/24	G002
3.	FIRST FLOOR ASBESTOS ABATEMENT PLAN	AB110	06/14/24	AB110
4.	ASBESTOS ABATEMENT DETAILS	AB501	06/14/24	AB501
5.	BASEMENT DEMOLITION FLOOR PLAN	AD101	06/14/24	AD101
6.	1 <sup>ST</sup> FLOOR DEMOLITION FLOOR PLAN	AD102	06/14/24	AD102
7.	2 <sup>ND</sup> FLOOR DEMOLITION FLOOR PLAN	AD103	06/14/24	AD103
8.	3 <sup>RD</sup> FLOOR DEMOLITION FLOOR PLAN	AD104	06/14/24	AD104
9.	BASEMENT FLOOR PLAN	A101	06/14/24	A101
10.	1 <sup>ST</sup> FLOOR PLAN	A102	06/14/24	A102
11.	2 <sup>ND</sup> FLOOR PLAN	A103	06/14/24	A103
12.	3 <sup>RD</sup> FLOOR PLAN	A104	06/14/24	A104
13.	WALL SECTIONS	A310	06/14/24	A310
14.	ENLARGED PLANS AND ELEVATIONS	A401	06/14/24	A401



15.	MEP SYMOBLS LIST	MEP001	06/14/24	MEP001
16.	BASEMENT DEMOLITION FLOOR PLAN	D101	06/14/24	D101
17.	1 <sup>ST</sup> FLOOR DEMOLITION FLOOR PLAN	D102	06/14/24	D102
18.	2 <sup>ND</sup> FLOOR DEMOLITION FLOOR PLAN	D103	06/14/24	D103
19.	3 <sup>RD</sup> FLOOR DEMOLITION FLOOR PLAN	D104	06/14/24	D104
20.	ELECTRICAL DEMOLITION ONE-LINE	D601	06/14/24	D601
21.	BASEMENT HYDRONIC FLOOR PLAN	M101	06/14/24	M101
22.	1 <sup>ST</sup> FLOOR HYDRONIC FLOOR PLAN	M102	06/14/24	M102
23.	2 <sup>ND</sup> FLOOR HYDRONIC FLOOR PLAN	M103	06/14/24	M103
24.	3 <sup>RD</sup> FLOOR HYDRONIC FLOOR PLAN	M104	06/14/24	M104
25.	BASEMENT DUCTWORK FLOOR PLAN	M105	06/14/24	M105
26.	1 <sup>ST</sup> FLOOR DUCTWORK FLOOR PLAN	M106	06/14/24	M106
27.	2 <sup>ND</sup> FLOOR DUCTWORK FLOOR PLAN	M107	06/14/24	M107
28.	3 <sup>RD</sup> FLOOR DUCTWORK FLOOR PLAN	M108	06/14/24	M108
29.	BASEMENT MECHANICAL ROOM ISOMETRIC	M201	06/14/24	M201
30.	BASEMENT MECHANICAL ROOM ISOMETRIC	M202	06/14/24	M202
31.	BASEMENT MECHANICAL ROOM ISOMETRIC	M203	06/14/24	M203
32.	MECHANICAL DETAILS	M501	06/14/24	M501
33.	MECHANICAL DETAILS	M502	06/14/24	M502
34.	MECHANICAL DETAILS	M503	06/14/24	M503
35.	EQUIPMENT SCHEDULES	M601	06/14/24	M601

36.	EQUIPMENT SCHEDULES	M602	06/14/24	M602
37.	EQUIPMENT SCHEDULES	M603	06/14/24	M603
38.	CONTROLS SCHEMATICS	M701	06/14/24	M701
39.	CONTROLS SCHEMATICS	M702	06/14/24	M702
40.	CONTROLS SCHEMATICS	M703	06/14/24	M703
41.	HYDRONIC PIPING SCHEMATIC-CONTROLS	M704	06/14/24	M704
42.	BASEMENT ELECTRICAL FLOOR PLAN	E101	06/14/24	E101
43.	1 <sup>ST</sup> FLOOR ELECTRICAL FLOOR PLAN	E102	06/14/24	E102
44.	2 <sup>ND</sup> FLOOR ELECTRICAL FLOOR PLAN	E103	06/14/24	E103
45.	3 <sup>RD</sup> FLOOR ELECTRICAL FLOOR PLAN	E104	06/14/24	E104
46.	ELECTRICAL DETAILS	E601	06/14/24	E601

**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. **Replace HVAC, Structural Repairs & Replace Roof**  
George Washington Carver State Office Building  
1616 Missouri Boulevard  
Jefferson City, Missouri  
**Project No.: O2440-01**

### 3.0 BIDS WILL BE RECEIVED:

- A. Until: 1:30 PM, September 19, 2024
- B. **Only electronic bids on MissouriBUYS shall be accepted: <https://missouribuys.mo.gov>. Bidder must be registered to bid.**

### 4.0 DESCRIPTION:

- A. Scope: Volume 1: The project includes complete replacement of the HVAC system including removal and replacement of hydronic pumps, chillers, boilers, basement air handling unit, ductless split systems, and hydronic fan coil units.
- Volume 2: The project includes the addition of reinforcing elements at concrete slabs and at slab-to column interfaces.
- Volume 3: The project includes removing the existing roof system down to the roof deck, removing existing gutters and downspouts, coordinating with the installation of roof structural reinforcement (Volume 2) work, installing new roof system, installing new gutters and downspouts, and installing new cage ladder.
- 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.**

### 5.0 PRE-BID MEETING:

- A. Place/Time: 11:00 AM, September 4, 2024, at George Washington Carver State Office Building - 3rd Floor Conference Room, 1616 Missouri Blvd., 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:
- Volume 1: Klingner & Associates, P.C., Matthew Bridges, (573) 355-5988, email: [mbridges@klingner.com](mailto:mbridges@klingner.com)
- Volume 2: Martin/Martin Inc., Andrew Lack, (816) 830-3361, email: [alack@martinmartin.com](mailto:alack@martinmartin.com)
- Volume 3: FMDC, Brad Schaefer, (573) 526-0136, email: [brad.schaefer@oa.mo.gov](mailto:brad.schaefer@oa.mo.gov)
- B. Project Manager: Tracie Siebeneck, (573) 508-9480, email: [tracie.siebeneck@oa.mo.gov](mailto:tracie.siebeneck@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."
  10. Ensure receipt of notifications including current e-mail address are enabled within vendor profile.
- D. Any time a bidder wants to modify the bid, he or she will have to retract, make revisions, and then submit again. Please ensure that "draft" status is not shown. FMDC will open the last response the bidder submits. The bidder may revise and submit the bid up to the close of the solicitation (bid date and time). Be sure to allow for uploading time so that the bid is successfully uploaded prior to the 1:30 PM deadline; we can only accept the bid if it is uploaded before the deadline.
- E. If you want to verify that you are uploading documents correctly, please contact Paul Girouard: 573-751-4797, [paul.girouard@oa.mo.gov](mailto:paul.girouard@oa.mo.gov) ; April Howser: 573-751-0053, [April.Howser@oa.mo.gov](mailto:April.Howser@oa.mo.gov) ; or Mandy Roberson: 573-522-0074, [Mandy.Roberson@oa.mo.gov](mailto:Mandy.Roberson@oa.mo.gov).
- F. If you are experiencing login issues, please contact Web Procure Support (Proactis) at 866-889-8533 anytime from 7:00 AM to 7:00 PM Central Time, Monday through Friday. If you try using a userid or password several times that is incorrect, the system will lock you out. Web Procure Support is the only option to unlock you! If you forget your userid or password, Web Procure Support will provide a temporary userid or password. Also, if it has been a while since your last successful login and you receive an "inactive" message, contact Web Procure (Proactis). If you are having a registration issue, you may contact Office of Administration Division of Accounting at 573-751-2971 and ask for the MissouriBUYS vendor team.

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

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

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

### **2.0 - BID DOCUMENTS**

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

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

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

### **4.0 - INTERPRETATIONS**

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

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

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

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

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

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

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

## **6.0 - SIGNING OF BIDS**

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

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

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

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

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

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

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

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

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

## **SECTION 003126 – EXISTING HAZARDOUS MATERIAL INFORMATION**

### **PART 1 - GENERAL**

#### **1.1 EXISTING HAZARDOUS MATERIAL INFORMATION**

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
- B. An existing asbestos report for Project, prepared by Klingner & Associates PC, dated September 26, 2022, is available for viewing as appended to this Document.
- C. An existing lead report for Project, prepared by Klingner & Associates PC, dated September 26, 2022, is available for viewing as appended to this Document.
- D. Related Requirements:
  - 1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.

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

### **PART 3 - EXECUTION (NOT APPLICABLE)**

**END OF DOCUMENT 003126**

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

---

---

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://oeo.mo.gov/sdve-certification-program/>

<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:**                    **Replace HVAC, Structural Repairs & Replace Roof  
George Washington Carver State Office Building**

**Project Number:**            **O2440-01**

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 completion date is **July 1, 2026**. Onsite Construction may not begin until **August 1, 2025**. 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)**

**UNIT PRICES:** The Owner accepts the following Unit Prices:

For changing specified quantities of work from those indicated by the contract drawings and specifications, upon written instructions of Owner, the following unit prices shall prevail. The unit prices include all labor, overhead and profit, materials, equipment, appliances, bailing, shoring, shoring removal, etc., to cover the finished work of the several kinds of work called for. Only a single unit price shall be given and it shall apply for either MORE or LESS work than that shown on the drawings and called for in the specifications or included in the Base Bid. In the event of more or less units than so indicated or included, change orders may be issued for the increased or decreased 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
------

--

**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**

---

---

---

---

---

---

---

---

---

---

**REASON FOR SUBSTITUTION**

---

---

---

---

---

---

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

YES       NO

IF YES, EXPLAIN

---

---

---

---

---

---

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

YES       NO

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

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

BIDDER/CONTRACTOR

DATE

**REVIEW AND ACTION**

Resubmit Substitution Request with the following additional information:

---

Substitution is accepted.

Substitution is accepted with the following comments:

---

Substitution is not accepted.

ARCHITECT/ENGINEER

DATE



STATE OF MISSOURI  
 OFFICE OF ADMINISTRATION  
 DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION  
**FINAL RECEIPT OF PAYMENT AND RELEASE**

PROJECT NUMBER

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 checked="" type="checkbox"/> <b>FINAL</b>	DATE

PROJECT TITLE

PROJECT LOCATION

FIRM

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

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

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

SELECT MBE, WBE, SDVE	ORIGINAL CONTRACT PARTICIPATION AMOUNT	PARTICIPATION AMOUNT PAID-TO-DATE (includes approved contract changes)	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	\$	\$	



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

**USE RUBBER STAMP IN CLEAR AREA BELOW**

NOTARY PUBLIC SIGNATURE

MY COMMISSION EXPIRES

NOTARY PUBLIC NAME (TYPED OR PRINTED)

# 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
- 3.7. Subcontracts

**4. Changes in the Work**

- 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, acting by and through the Office of Administration, Division of Facilities Management, Design and Construction.
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"**: All supervision, labor, materials, tool, supplies, equipment, and any incidental operations and/or activities required by or reasonably inferable from the Contract Documents necessary to construct the Project and to produce the results intended by the Contract Documents in a safe, expeditious, orderly, and workmanlike manner, and 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 subject to the following limits: (a) the percentage mark-up for the Contractor shall be limited to the Contractor's fee; (b) fifteen percent (15%) maximum for Work directly performed by employees of a subcontractor, or sub-subcontractor; (c) five percent (5%) maximum for the Work performed or passed through to the Owner by the Contractor; (d) five percent (5%) maximum subcontractor's mark-up for Work performed by a sub-subcontractor and

passed through to the Owner by the subcontractor and Contractor; and (e) in no case shall the total overhead and profit paid by the Owner on any Contract Changes exceed twenty-five percent (25%) 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 Contractor's payment and performance bonding, builder's risk insurance, and general liability insurance to their cost of work. The above listed 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(s) 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 the same as those for additive Contract Changes provided above.
- 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 Volume 1: Matthew Bridges  
Klingner & Associates, P.C.  
3622 Endeavor Avenue, Suite 117  
Columbia, MO 65201  
Telephone: (573) 355-5988  
Email: [mbridges@klingner.com](mailto:mbridges@klingner.com)

Designer Volume 2: Andrew Lack  
Martin/Martin Inc.  
31 West 31<sup>st</sup> Street  
Kansas City, Missouri 64108  
Telephone: (816) 830-3361  
Email: [alack@martinmartin.com](mailto:alack@martinmartin.com)

Designer Volume 3: Brad Schaefer  
Division of Facilities Management, Design and Construction  
301 West High Street, Room 780  
Jefferson City, MO 65101  
Telephone: (573) 526-0136  
Email: [brad.schaefer@oa.mo.gov](mailto:brad.schaefer@oa.mo.gov)

Construction Representative: John Gentges  
Division of Facilities Management, Design and Construction  
301 W High Street, Room 730  
Jefferson City, MO 65101  
Telephone: (573) 526-5768  
Email: [john.gentges@oa.mo.gov](mailto:john.gentges@oa.mo.gov)

Project Manager: Tracie Siebeneck  
Division of Facilities Management, Design and Construction  
301 West High Street, Room 780  
Jefferson City, Missouri 65101  
Telephone: (573) 508-9480  
Email: [tracie.siebeneck@oa.mo.gov](mailto:tracie.siebeneck@oa.mo.gov)

Contract Specialist: Paul Girouard  
Division of Facilities Management, Design and Construction  
301 West High Street, Room 730  
Jefferson City, Missouri 65101  
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 5 complete sets of drawings and specifications at no charge.
- B. The Owner will furnish the Contractor with approximately 5 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. 31

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 8, 2024**

Last Date Objections May Be Filed: **April 8, 2024**

Prepared by Missouri Department of Labor and Industrial Relations

Building Construction Rates for  
COLE County

Section 026

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$62.47
Boilermaker	\$30.53*
Bricklayer-Stone Mason	\$54.17
Carpenter	\$50.84
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$43.74
Plasterer	
Communication Technician	\$57.89
Electrician (Inside Wireman)	\$58.31
Electrician Outside Lineman	\$30.53*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$30.53*
Glazier	\$56.48
Ironworker	\$68.93
Laborer	\$43.22
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$30.53*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$67.64
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$42.11
Plumber	\$70.54
Pipe Fitter	
Roofer	\$54.75
Sheet Metal Worker	\$57.54
Sprinkler Fitter	\$52.79
Truck Driver	\$30.53*
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 RSMo Section 290.210.

Heavy Construction Rates for  
COLE County

Section 026

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$55.19
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$80.11
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$48.42
General Laborer	
Skilled Laborer	
Operating Engineer	\$63.82
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$48.68
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. 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.

# 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 replacement, structural repairs, and roof replacement at the George Washington Carver State Office Building.
  - 1. Project Location: George Washington Carver State Office Building, 1616 Missouri Blvd, Jefferson City, MO 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 06/14/24 were prepared for the Project by the following designers:
  - 1. Volume 1: Klingner & Associates, P.C, 3622 Endeavor Avenue, Suite 117, Columbia, Missouri 65201.
  - 2. Volume 2: Martin/Martin, Inc., 31 West 31<sup>st</sup> Street, Kansas City, Missouri 64108.
  - 3. Volume 3: Office of Administration – Division of Facilities Management, Design, and Construction, 301 West High Street, Jefferson City, Missouri.
- C. The Work includes the following:
  - 1. Volume 1: The Work consists of modifications to the existing hydronic cooling and heating system, including the removal and replacement of hydronic pumps, chillers, boilers, basement air handling unit, ductless split systems, and hydronic fan coil units. This Work will be coordinated with the slab reinforcement work of Volume 2.
  - 2. Volume 2: The Work consists of the addition of reinforcing elements at concrete slabs and at slab-to-column interfaces. This Work will be coordinated with the HVAC work of Volume 1 and the roof replacement work of Volume 3.
  - 3. Volume 3: The Work consists of removing the existing roof system down to the roof deck, removing existing gutters and downspouts, disposing of debris, installing new roof system, installing new gutters and downspouts, and installing new cage ladder. This Work will be coordinated with roof structural reinforcement work of Volume 2.
- D. The Work will be constructed under a single prime contract.

#### **1.3 WORK SEQUENCE**

- A. The Work will be conducted in one phase. Construction at the site may not begin until August 1, 2025. The project shall be Substantially Complete by July 1, 2026.

#### **SUMMARY OF WORK**

O2440-01 – George Washington Carver State Office Building  
Replace HVAC, Structural Repairs, & Replace Roof

## **1.4 WORK UNDER OTHER CONTRACTS**

- A. Separate Contracts: The Owner will award separate contracts for performance of certain construction operations at the site. Those operations will be conducted in coordination with work under this contract. The Separate Contracts include, but are not limited to, the following:
  - 1. Remodel the first, second, and third floor men's and women's restrooms.
  - 2. Replace exterior windows and doors.
  - 3. Replace carpet, ceilings, and paint.
  - 4. Replace the fire alarm system.
  - 5. Replace the parking lot, sidewalks, and exterior lighting.
  - 6. Replace the camera and building access systems.
- B. Cooperate fully with separate contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

## **1.5 CONTRACTOR USE OF PREMISES**

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.
- B. Use of the Existing Building: Maintain the existing building in a weathertight condition throughout the construction period. Repair damage cause by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.

## **1.6 OCCUPANCY REQUIREMENTS**

- A. Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.
  - 1. The Designer will prepare a Certificate of Partial Occupancy for each specific portion of the Work to be occupied prior to substantial completion.
  - 2. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will operate and maintain mechanical and electrical systems serving occupied portions for the building.
  - 3. Upon occupancy, the Owner will assume responsibility for maintenance and custodial service for occupied portions for the building.

## **1.7 MISCELLANEOUS PROVISIONS**

- 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.

### **SUMMARY OF WORK**

O2440-01 – George Washington Carver State Office Building  
Replace HVAC, Structural Repairs, & Replace Roof

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

**PART 3 - EXECUTION**

**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. Weather allowances.
- C. Related Sections include the following:
  - 1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.

#### **1.3 WEATHER ALLOWANCE**

- A. Included within the completion period for this project are a specified number of “bad weather” 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 “bad weather” 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 “bad weather” 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 “bad weather” day documentation after it is presented, with or without the notes of disagreement, shall constitute agreement with the “bad weather” 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 “bad weather” day allowance.
- E. Once this allowance is depleted, a no cost Change Order time extension will be executed for “bad weather” days, as defined above, encountered during the remainder of the Project.

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

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

**3.2 PREPARATION**

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

**3.3 SCHEDULE OF ALLOWANCES**

- A. Weather Allowance: Included within the completion period for this Project 10 “bad weather” days.

**END OF SECTION 012100**

## **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 012200 "Unit Prices" for administrative requirements for using Unit Prices.
  - 3. Division 1, Section 013115 "Project Management Communications" for administrative requirements for communications.
  - 4. Division 0, Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
  - 5. 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**

---

<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 – SCHEDULE – 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	List of Subcontractors
013200	Schedules	Construction Schedule
013200	Schedules	Schedule of Values
013200	Schedules	Major Material Suppliers
017900	Demonstration and Training	Certification
028213	Asbestos Abatement	Certification
028213	Asbestos Abatement	Shop Drawings
028213	Asbestos Abatement	Construction Schedule
040000	Masonry	Product Data
050520	Post Installed Anchors	Certification
055000	Metal Fabrications	Shop Drawings
055000	Metal Fabrications	Certification
061000	Rough Carpentry	Product Data
061600	Sheathing	Product Data
072100	Thermal Insulation	Product Data
079200	Joint Sealants	Product Data
079200	Joint Sealants	Sample
081113	Hollow Metal Frames	Shop Drawings
081113	Hollow Metal Frames	Product Data
090561	Common Work Results for Flooring Preparation	Product Data
092216	Non-Structural Metal Framing	Product Data
092900	Gypsum Board	Product Data
096500	Resilient Flooring	Shop Drawings
096500	Resilient Flooring	Sample
096500	Resilient Flooring	Test Report
096500	Resilient Flooring	Certification
096500	Resilient Flooring	Operation / Maintenance Manual

099000	Painting and Coating	Sample
102600	Wall Protection	Product Data
102600	Wall Protection	Sample
102600	Wall Protection	Operation / Maintenance Manual
223100	Domestic Water Softeners	Product Data
223100	Domestic Water Softeners	Operation / Maintenance Manual
223400	Fuel Fired Domestic Water Heaters	Product Data
223400	Fuel Fired Domestic Water Heaters	Operation / Maintenance Manual
230519	Meters and Gages for HVAC Piping	Product Data
230523	General Duty Valves for HVAC Piping	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
230900	Instrumentation and Control for HVAC	Product Data
230900	Instrumentation and Control for HVAC	Operation / Maintenance Manual
231123	Facility Natural Gas Piping	Product Data
232113	Hydronic Piping	Product Data
232113	Hydronic Piping	Operation / Maintenance Manual
232123	Hydronic Pumps	Product Data
232123	Hydronic Pumps	Operation / Maintenance Manual
232123	Hydronic Pumps	Warranty
233300	Air Duct Accessories	Product Data
233413	Axial HVAC Fans	Product Data
233413	Axial HVAC Fans	Operation / Maintenance Manual
235216	Condensing Boilers	Product Data
235216	Condensing Boilers	Test Report
235216	Condensing Boilers	Operation / Maintenance Manual
235216	Condensing Boilers	Warranty
235700	Heat Exchangers for HVAC	Product Data
235700	Heat Exchangers for HVAC	Operation / Maintenance Manual
235700	Heat Exchangers for HVAC	Warranty
236423	Scroll Water Chillers	Product Data
236423	Scroll Water Chillers	Test Report
236423	Scroll Water Chillers	Operation / Maintenance Manual
236423	Scroll Water Chillers	Warranty
236533	Liquid Coolers	Product Data
236533	Liquid Coolers	Operation / Maintenance Manual
236533	Liquid Coolers	Warranty
237300	Indoor Central-Station Air-Handling Units	Shop Drawings
237300	Indoor Central-Station Air-Handling Units	Product Data
237300	Indoor Central-Station Air-Handling Units	Operation / Maintenance Manual
238126	Split-System Air-Conditioners	Product Data



238126	Split-System Air-Conditioners	Operation / Maintenance Manual
238219	Fan Coil Units	Product Data
238219	Fan Coil Units	Operation / Maintenance Manual
239100	Louvers	Product Data
260519	Low Voltage Electrical Power Conductors and Cables	Product Data
260553	Identification for Electrical Systems	Product Data
262816	Enclosed Switches and Circuit Breakers	Product Data
262923	Variable Frequency Motor Controllers	Product Data
262923	Variable Frequency Motor Controllers	Operation / Maintenance Manual
262923	Variable Frequency Motor Controllers	Warranty

**END OF SECTION 013300**

## **SECTION 013513.10 – SITE SECURITY AND HEALTH REQUIREMENTS (OA)**

### **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 CONTRACTOR BACKGROUND AND ID BADGE PROCESS**

1. All employees of an OA/FMDC contractor (or subcontractor performing work under an OA/FMDC contract) are required to submit a fingerprint check through the Missouri State Highway Patrol (MSHP) and the FBI enabling OA/FMDC to obtain state and national criminal background checks on the employees, unless stated otherwise in the Contractor's contract.
2. 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.
3. 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 OA/FMDC Authorization for Release of Information Confidentiality Oath 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 contractor ID badges found on FMDC's website at: <https://oa.mo.gov/facilities/facilities-operations/security-information/fmdc-contractor-background-and-id-badge>

4. Fingerprints and Authorization for Release of Information Confidentiality Oath form are valid for one (1) year and must be renewed annually. Changing or adding locations may result in additional required documentation. Certain employees may be required to be fingerprinted more frequently. OA/FMDC reserves the right to request additional background checks at any time for any reason.
5. The Contractor shall notify FMDC via email to [FMDCSecurity@oa.mo.gov](mailto:FMDCSecurity@oa.mo.gov) within 48 hours of anyone severing employment with their company.

### **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 013513.10**

## **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. Sanitary facilities, including drinking water
- C. Support facilities include, but are not limited to, the following:
  - 1. Field offices and storage sheds
  - 2. Hoists and temporary elevator use
  - 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. Barricades, warning signs, and lights
  - 2. Sidewalk bridge or enclosure fence for the site
  - 3. Environmental 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 job-built temporary office, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
  - 2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.
  - 3. For fences and vision barriers, provide minimum 3/9" (9.5mm) thick exterior plywood.
  - 4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8" (16mm) thick exterior plywood.
- C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.
- D. Paint: Comply with requirements of Division 9 Section "Painting".
  - 1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.
  - 2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
  - 3. For interior walls of temporary offices, provide two (2) quarts interior latex-flat wall paint.
- E. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of (15) or less. For temporary enclosures, provide translucent, nylon-reinforced laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
- F. Water: Provide potable water approved by local health authorities.

- G. Open-Mesh Fencing: Provide 0.120" (3mm) thick, galvanized 2" (50mm) chainlink fabric fencing 6' (2m) high with galvanized steel pipe posts, 1½" (38mm) ID for line posts and 2½" (64mm) ID for corner posts.

## 2.2 EQUIPMENT

- A. General: Provide new equipment. If acceptable to the Designer, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Water Hoses: Provide ¾" (19mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100' (30m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110 to 120V plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage rating.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixture where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.
- H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated re-circulation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers, or a combination of extinguishers of NFPA-recommended classes for the exposures.
  - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each Facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### **3.2 TEMPORARY UTILITY INSTALLATION**

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
  - 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
  - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
  - 3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
  - 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Change Order.
- B. Temporary Water Service: 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.
- C. 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.
- D. Temporary Heating: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
  - 1. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP gas or fuel-oil heaters with individual space thermostatic control.
  - 2. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.
- E. Temporary Toilets: Install self-contained toilet units. Use of pit-type privies will not be permitted. Comply with regulations and health codes for the type, number, location,



operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.

1. Shield toilets to ensure privacy.
  2. Provide separate facilities for male and female personnel.
  3. Provide toilet tissue materials for each facility.
- F. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a health and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
1. Provide paper towels or similar disposable materials for each facility.
  2. Provide covered waste containers for used material.
  3. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
- G. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.
1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45°F to 55°F (7°C to 13°C).

### **3.3 SUPPORT FACILITIES INSTALLATION**

- A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip office as follows:
- C. Storage facilities: Install storage sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere onsite.
- D. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.
- E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and materials drying or curing requirements to avoid dangerous conditions and effects.
  2. Install tarpaulins securely with incombustible wood framing and other materials. Close openings of 25SqFt (2.3SqM) or less with plywood or similar materials.

3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
  4. Where temporary wood or plywood enclosure exceeds 100SqFt (9.2SqM) in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.
- F. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.
- G. Temporary Elevator Use: The Owner will allow use of elevators within the building. All construction personnel will be allowed access only to those specific elevators designated by the Construction Representative.
- H. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.
1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
  2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- I. 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.

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

- A. 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. 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.
- C. 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.
- D. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment

that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near the site.

### **3.5 OPERATION, TERMINATION AND REMOVAL**

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  - 2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines.
- 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.

**END OF SECTION 015000**

## **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.

#### **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 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.

## **1.5 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 Engineer.

## **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.

**END OF SECTION 017900**

## **SECTION 024100 - DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Work includes demolition inside existing building as shown on demolition drawings and as required to permit new general construction, plumbing, HVA/C and electrical work within the existing building.
- B. Any fixtures, cabinetry, windows, doors/frames, plumbing fixtures, HVA/C equipment or electrical fixtures not designated for reuse in the renovated building or addition shall be offered to the Owner for salvage and storage. Items not retained by Owner shall be removed from site by Contractor. Owner will remove from site for storage any selected items. Note that certain electrical fixtures/devices are to be removed and reused by the Electrical Contractor. Electrical Contractor to confirm specifically which of these items are to be reused.

### **PART 2 - EXECUTION**

#### **2.1 JOB CONDITIONS AND WORKMANSHIP**

- A. Contractor is advised that demolition will be an on-going procedure with portions of the work required at various times as general construction work progresses.
- B. Exercise care in removal of material to prevent damage to floors, walls and/or equipment/contents which will remain. Portions of partitions removed shall be cleanly cut vertically and cut at ceiling and floor line to minimize damage to surfaces remaining.
- C. Keep material wetted to minimize dust. Exercise care that wetting procedures do not damage existing building structure/contents to remain intact.
- D. Contractor shall be responsible for removal and disposal of all debris promptly as work progresses; retaining and temporarily storing on site only that material designated, as noted above, for reuse and for Owner's salvage.

#### **2.2 EXISTING CONDITIONS/INSPECTION**

- A. During demolition procedures, this contractor shall take all precautions to protect against personal and public injuries. Erect safety walkways where necessary. Provide dust protection barriers to prevent dust infiltration into occupied areas of existing building.
- B. Obtain all necessary demolition permits, land fill disposal permits, etc. necessary for proper and authorized execution of the work.

### **END OF SECTION 024100**

# **SECTION 024126 - SELECTIVE MECHANICAL AND ELECTRICAL DEMOLITION**

## **PART 1 - GENERAL**

### **1.1 SUMMARY**

A. Section Includes:

1. Removal of existing mechanical and electrical equipment, wiring, and conduit in areas noted on Drawings.

### **1.2 SEQUENCING**

- A. Demolition activities shall be indicated on the construction schedule and shall not commence until approved in writing by the Owner or Engineer.
- B. Contractor is advised that demolition will be an on-going procedure with portions of the work required at various times as construction work progresses.
- C. Exercise care in removal of equipment and material to prevent damage to roofs, floors, walls and/or equipment/contents which will remain.
- D. Contractor shall be responsible for removal and disposal of all debris promptly as work progresses; retaining and temporarily storing on site only that material designated, as noted above, for reuse.

### **1.3 COORDINATION**

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.
- C. Obtain all necessary demolition permits, land fill disposal permits, etc. necessary for proper and authorized execution of the work.

### **1.4 WORKMANSHIP**

- A. Exercise care in removal of equipment and material to prevent damage to roofs, floors, walls and/or equipment/contents which will remain.
- B. During demolition procedures, all roof opening shall be kept weathertight to prevent infiltration of air or water through the roof openings.

### **1.5 HAZARDOUS MATERIALS**

- A. Refrigerant within existing HVAC equipment shall be recovered and recycled per EPA regulations (40 CFR Part 82, Subpart F). Requirements include but are not limited to:
  1. Equipment shall be evacuated to EPA required levels with equipment certified by an EPA testing organization for this purpose.

2. Recovered refrigerant shall be sent to an EPA certified reclaimer.

## **PART 2 - PRODUCTS**

Not Used

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.
- B. Verify termination points for demolished services.

### **3.2 PREPARATION**

- A. Erect, and maintain temporary safeguards, for protection of the public, Owner, Contractor's employees, and existing improvements to remain.

### **3.3 DEMOLITION**

- A. Demolition Drawings are based on casual field observation. Report discrepancies impacting demolition activities to Architect/Engineer before disturbing existing installation.
- B. Remove pipe, conduit, wire, boxes, fastening devices, and other ancillary components scheduled for removal to avoid any interference with new installation.
- C. Install temporary wiring and connections to maintain required existing systems in service during construction.
- D. Repair adjacent construction and finishes damaged during demolition and extension work.
- E. Protect and retain services to existing active equipment remaining.

### **3.4 CLEANING**

- A. Remove demolished materials as work progresses. Legally dispose.
- B. Keep workplace neat.

**END OF SECTION 024126**

## SECTION 028213 – ASBESTOS ABATEMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Perform all operations in connection with asbestos abatement, encapsulation, removal and related work as shown on drawings and/or specified herein.
- B. Description of Work:
  - 1. Removal: All asbestos containing building materials identified in the appendix and any materials not previously discovered.
  - 2. Encapsulation: NONE.
  - 3. Enclosure: NONE.
  - 4. Approved Disposal Site: LANDFILL PERMITTED TO RECEIVE ASBESTOS WASTE.
- C. Special Precautions:
  - 1. Coordinate with the Owner's 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. Refer to Article entitled: "Preparation of Regulated area," of this section relative to shutdown of mechanical and electrical systems.
  - 2. Equipment that must remain in operation while abatement work is in progress consists of the following: NONE.
- D. Special Circumstances: NONE.
- E. Restoration: Contractor is responsible for restoring all existing finish surfaces to their original state, which were damaged as a result of abatement activities.
- F. Related work specified elsewhere: NONE.

#### 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.
  - 4. The Contractor is responsible for the methods used for creating the proper work environment. If he (she) uses a method to reduce pressure and filtration which has been the subject of a court case (Natale U.S. Patent No. 4,604,111), it will be his (her) responsibility

to have a license for the above patent or a provision in the performance bond covering any patent claims.

B. Specific Reference:

1. Occupational Safety and Health Administration (OSHA):
  - a. Title 29 Code of Federal Regulations, 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, 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, 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 (effective March 27, 1987).
3. Environmental Protection Agency (EPA) Title 40 Code of Federal Regulations (CFR) Part 61 - National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision; Final Rule effective November 20, 1990.
  - 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. Compressed Gas Association, Inc., New York, Pamphlet G-7, "Compressed Air for Human Respiration", and Specification G-7.1 "Commodity Specification for Air" (1966). See also ANSI 86.1-1973.
5. ASTM E1368-90; "Cleaning Standard".
6. American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2 (1991).
7. National Institute of Occupational Safety and Health, Manual of Analytical Methods (Method 7400 - 1984).
8. Title 49, Code of Federal Regulations, Part 171 & 172, "Hazardous Material Shipping", U.S. Department of Transportation.
9. MO Chapter 643.225 to 643.250 – “Rules for Asbestos Abatement Projects, ...”, Missouri Department of Natural Resources
10. Missouri State Regulations 10 CSR 10-6.241 “Asbestos Projects – Registration, Notification and Performance Requirements”
11. Missouri State Regulations 10 CSR 10-6.250 “Asbestos Abatement Projects – Certification, Accreditation and Business Exemption Requirements”

### 1.3 QUALIFICATIONS

- A. The prospective Contractor who is proposed to actually perform the asbestos abatement work, shall submit to the Architect/Engineer the data hereinafter requested within ten (10) days after Bid Opening. The proposed asbestos abatement Contractor will be awarded a Contract, only if data submitted is determined to be favorable in all instances, by the Architect/Engineer, and the prospective Contractor further meets the qualifications requirements specified in the Instructions to Bidders.
- 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 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 description of all major Asbestos Abatement Equipment owned by the prospective Contractor which is available for use on this project such as:
    - a. Respiratory protection equipment.
    - b. HEPA vacuum equipment.
    - c. Negative air pressure equipment.
    - d. Spray equipment for amended water.
    - e. Equipment used for shower facilities in decontamination enclosure system.
  3. Submit a list of names, work responsibilities and evidence of certification for all employees that will be assigned to 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 having successfully completed a comprehensive 4-day course for Asbestos Abatement Contractors and Supervisors in conformance with MDNR rules and regulations incorporated by reference herein.
- C. Contractor's employees who perform asbestos abatement activities must be certified by the MDNR as having successfully completed a comprehensive 3-day course for Asbestos Abatement Workers in conformance with MDNR rules and regulations incorporated by reference herein.



## 1.4 DEFINITIONS

- A. Abatement: The procedure to control fiber release from asbestos containing building materials. Activities include removal, encapsulation, and enclosure.
- B. ACGIH: American Conference of Governmental Industrial Hygienists.
- C. Action Level: Means an airborne concentration of asbestos of 0.1 fiber per cubic centimeter (f/cc) of air, calculated as an eight (8) - hour time - weighted average.
- D. AIHA: American Industrial Hygiene Association.
- E. Air Lock: A system for permitting ingress and egress with minimum air movement between a contaminated area and an uncontaminated area.
- F. Air Monitoring: The process of measuring the fiber content of a known volume of air collected during a specific period of time shall conform with Appendix A to OSHA 29 CFR 1926.1101. The procedure normally utilized for asbestos follows the NIOSH Standard Analytical Method 7400 for Asbestos in Air. For clearance air monitoring, electron microscopy methods may be utilized for lower detectability limit and specific fiber identification.
- G. Air Sampling Professional: The Professional contacted or employed by the Owner to supervise and conduct air monitoring and analysis schemes. This individual shall not be affiliated in any way other than through this contact with the Contractor performing the abatement work.
- H. Amended Water: Water to which a surfactant has been added to decrease the surface tension to 29 dynes per square centimeter or less when tested in accordance with ASTM D 1331.
- I. Area Sampling: Sampling of asbestos fiber concentrations within the asbestos control area (regulated area or containment) and outside the asbestos control area which approximates the concentrations of asbestos fibers in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.
- J. ANSI: American National standards Institute.
- K. Asbestos: Means the asbestiform varieties of chrysotile (serpentine); crocidolite (riebeckite); amosite (cummingtonite-grunerite); tremolite; anthrophyllite, and actinolite. Any suspect material identified in the plans or specifications as ACM.
- L. Asbestos Containing Material (ACM): Material composed of asbestos of any type and in an amount greater than 1% by area, either alone or mixed with other fibrous or non-fibrous materials.
- M. Asbestos Containing Waste Material: Asbestos containing material or asbestos contaminated objects requiring disposal.
- N. ASTM: American Society for Testing and Materials.
- O. Authorized Visitor: The Building Owner (and designated representatives) and any representative of a regulatory agency having jurisdiction over the project.
- P. Background Concentration: Ambient air samples collected by the Owner or his (her) representatives prior to commencement of any work in the project area to record the levels of fiber concentrations before abatement. These samples shall be analyzed using the same methodology that will be used for project clearance.

- Q. Barrier: Any surface that seals off the work area to inhibit the movement of fibers.
- R. Breathing Zone: A hemisphere forward of the shoulders of a person with radius of approximately six to nine inches.
- S. Certified Industrial Hygienist (CIH): An industrial hygienist certified in Comprehensive Practice by the American Board of Industrial Hygiene.
- T. Ceiling System: References to ceiling or ceiling system either written or on the plans shall be construed to mean ceiling system and shall include all layers of and any combination of layers of ceiling materials including but not limited to tiles, panels, gypsum board, mastics, plasters, supporting accessories and debris between the ceiling structure visible from the room and the underside of the facility roof structure.
- U. Clean Room: An uncontaminated area or room which is part of the worker decontamination enclosure with provisions for storage of worker's street clothes and protective equipment.
- V. Competent Person: Means one who is capable of identifying existing asbestos hazards in the workplace and who has the authority to take prompt corrective measures to eliminate them.
- W. Containment: An air-tight physical barrier used to isolate the work area from non-contaminated areas. The purpose of which is to contain the air and particulates within the work area.
- X. Controlled Area: The area of the project site identified by barrier tape or within twenty feet of posted warning signs demarcating an abatement area.
- Y. Curtained Doorway: A device to allow ingress and egress from one room to another while permitting minimal air movement between the rooms, typically constructed by placing three overlapping sheets of plastic over an existing or temporarily framed doorway, securing the vertical edge of one sheet along one vertical side of the doorway, securing the vertical edge of the second sheet along the opposite vertical side of the doorway, and securing the vertical edge of third sheet along the starting vertical side of the doorway.
- Z. Decontamination Enclosure System: A decontamination system consisting of a clean room, a shower room, and an equipment room separated from each other and from the regulated area by airlocks. This system is used for all workers to enter and exit the regulated area and may also serve as equipment and waste pass out on small jobs.
- AA. Differential Air Pressure Equipment: A portable local exhaust system equipped with HEPA filtration and capable of maintaining a constant, low velocity air flow into uncontaminated areas from adjacent contaminated areas.
- BB. Encapsulant: A liquid material which can be applied to asbestos containing materials (and cleaned surfaces from which asbestos containing materials have been removed) and which controls the possible release of asbestos fibers from the material either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding/disintegrating its components together (penetrating/removal encapsulant). (Also sealant).
- CC. Encapsulation: The application of a bridging or penetrating liquid material to asbestos containing materials to control the release of asbestos fibers into the air. The bridging liquid material creates a membrane over the surface and the penetrating liquid material seeps through the surface and binds all components together.

- DD. Enclosure: The construction of an airtight, impermeable, permanent barrier around asbestos containing material to control the release of asbestos fibers into the air.
- EE. Equipment Decontamination Enclosure: That portion of a decontamination enclosure system designed for controlled transfer of materials and equipment, typically consisting of a washroom (shower) and a holding area.
- FF. Equipment Room: A contaminated area or room which is part of the worker decontamination enclosure with provisions for storage of contaminated clothing and equipment.
- GG. EPA: U. S. Environmental Protection Agency.
- HH. Final Clearance: Air sampling taken after final visual inspection and prior to removal of final layer of plastic barriers. Analysis is by Phase Contrast Microscopy (PCM) or Transmission Electron Microscopy (TEM). Results for PCM shall be below 0.01 f/cc or background concentration (whichever is greater). TEM results must be below 70 s/mm<sup>2</sup> to allow removal of final barriers.
- II. Floor Systems: References to floor, flooring or floor system either written or on the plans shall be construed to mean floor system and shall include all layers and any combination of layers of floor materials including but not limited to carpets, tiles, mastics, leveling compounds, linoleum, felts, baseboard, water proof membranes and other materials placed upon the facility's floor structure.
- JJ. Glovebag Technique: A method with limited applications for removing small amounts of friable asbestos-containing material from HVAC ducts, short piping runs, valves, joints, elbows, and other non-planar surfaces in a non-contained (plasticized) regulated area. The glovebag is constructed and installed in such a manner (typically with 6 mil transparent regulite or polyethylene plastic) that it surrounds the object or material to be removed and contains all asbestos fibers released during the process.
- KK. HEPA Filter: A high efficiency particulate air filter capable of trapping and retaining particles 0.3 microns in mass median aerodynamic equivalent diameter with 99.97% efficiency.
- LL. HEPA Vacuum: A vacuum system equipped with HEPA filtration.
- MM. Holding Area: A chamber in the equipment decontamination enclosure located between the washroom (shower) and an uncontaminated area. The holding area comprises an airlock.
- NN. HVAC: Heating, ventilation, and air conditioning system.
- OO. Log Book: A notebook or other book containing essential project data, daily project information, and a daily project diary. This book shall be kept up to date and on the project at all times.
- PP. Missouri Department of Natural Resources (MDNR): A Missouri state agency that regulates asbestos abatement projects in schools and commercial/public buildings.
- QQ. NIOSH: The National Institute for Occupational Safety and Health.
- RR. Negative Pressure Respirator: A respirator in which the air pressure inside the respiratory-inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere.
- SS. OSHA: The Occupational Safety and Health Administration.

- TT. Outside Air: The air outside the work area that is used as make up air.
- UU. Permissible Exposure Limits (PELs): No personnel associated with asbestos abatement work shall be exposed to an airborne concentration of asbestos in excess of the following limits, as determined by the method prescribed in Appendix A to OSHA 29 CFR 1926.1101, or by an equivalent method:
1. P.E.L. is 0.1 fiber per cubic centimeter (f/cc) of air as an eight (8) - hour time-weighted average.
  2. Excursion Limit (EL) 1.0 fiber per cubic centimeter of air as averaged over a sampling period of thirty (30) minutes.
- VV. Plasticize: To cover floors and walls with plastic sheeting as herein specified.
- WW. Powered Air Purifying Respirator (PAPR): A respirator in which the air pressure inside the respiratory-inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere.
- XX. Regulated Area: An area identified by specific boundaries where airborne concentrations of asbestos exceed, or can reasonably be expected to exceed the P.E.L. and/or Excursion Limit. The regulated area may take the form of:
1. A temporary negative-pressure enclosure.
  2. An area specifically identified and segregated in any manner that minimizes the number of employees exposed to asbestos.
- YY. Removal: All herein specified procedures necessary to remove asbestos containing building materials from the designated areas in an appropriate manner consistent with applicable regulations and state of the art industry work practices, and to dispose of these materials at an acceptable and approved landfill.
- ZZ. Shower Room: A room between the clean room and the equipment room in the worker decontamination enclosure with hot and cold or warm running water and suitably arranged for complete and thorough showering during decontamination.
- AAA. Surfactant: A chemical wetting agent added to water to improve penetration.
- BBB. Visible Emissions: Any emissions containing particulate asbestos material that is visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.
- CCC. Wall System: References to siding, panels, paneling, siding system, panel system, wall, wallboard, or wall systems either written or on the plans shall be construed to mean wall system and shall include all layers of and any combination of layers of siding/panel materials including but not limited to panels, cement board, cement-asbestos board, gypsum board, mastics, plasters, lathing, base plate, supporting accessories, fasteners and debris between the wall surface visible from the room and the interstitial frame space of the facility wall structure such as materials located on both sides of the wall or beneath the base plate including the studs and accessories.
- DDD. Wash Room: A room between the work area and the holding area in the equipment decontamination enclosure system. The washroom comprises an airlock.

EEE. Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning utensils which have been dampened with water and afterwards thoroughly decontaminated or disposed of as asbestos contaminated waste.

FFF. Wiping: Final cleanup stage performed after gross removal where all surfaces are wet cleaned.

GGG. Work Area: Designated rooms, spaces, or areas of the project in which asbestos abatement actions are to be undertaken or which may become contaminated as a result of such abatement actions. A contained work area is a work area which has been sealed, plasticized, and equipped with a decontamination enclosure system. A non-contained work area is an isolated controlled access work area which has not been plasticized nor equipped with a decontamination enclosure system.

HHH. Wrap and Cut: The method of wrapping a TSI covered piping section with plastic, cutting, and removing the piping and insulation in a fully contained unit. Preceding measure required include the glovebag technique at each location where the wrapping and cutting will take place. This method may only be used where the systems can be removed prior to demolition activities.

## 1.5 SUBMITTALS AND NOTICES

A. Prior to Commencement of Work, Contractor shall:

1. File a Notice with the MDNR according to the requirements specified on the form. A copy of the partially completed form is appended to this section for reproducing number of copies required. The Architect/Engineer shall be carbon copied on all correspondence and notifications.

B. Submit the following documentation to the Owners Project Representative:

1. Required permits, site location and arrangements for transport and disposal of asbestos containing waste materials.
2. Documentation that all employees or agents who may be exposed to airborne asbestos in excess of action level have been medically determined to be physically capable of working while wearing the respirator required without suffering adverse health effects.
3. A fully completed and signed copy of the "Certificate of Worker's Release" form for each employee of the Contractor that will be on the project site. A copy of the form is appended to this section for reproducing number of copies required.
4. Shop drawings for layout and construction of decontamination enclosure systems and barriers for isolation of the regulated area as detailed in this specification and required by applicable regulations. If work is to be phased, a phasing schedule shall also be submitted.
5. Manufacturer's certification that HEPA vacuums, negative pressure ventilation units and other local exhaust ventilation equipment conform to ANSI Z9.2-79. Also, submit manufacturer's information on water filtration unit(s) to be used.
6. Written notification of rental equipment to be used in abatement areas or to transport asbestos contaminated waste must be provided to the rental agency with a copy submitted to the Construction Representative.
7. Document NIOSH approvals for all respiratory protective devices utilized on site. Include manufacturer certification of HEPA filtration capabilities for all cartridges and filters.
8. Documentation of respirator fit-testing for all Contractor employees and agents who must enter the regulated area. This fit-testing shall be in accordance with procedures as detailed in Title 29 CFR 1926.1101, Appendix C, Qualitative and Quantitative Fit Testing procedures.

9. A written hazard communication program indicating how the contractor plans to meet the requirements of OSHA 29 CFR 1926.59 relative to labeling, handling of material safety data sheets and training of employees.
10. Written emergency plan - (See details on following page).
11. All approved documents will be on file with the Owners Project Representative.

C. During Abatement Activities, Contractor shall submit to the Owners Project Representative:

1. Weekly (or as required) job progress reports detailing abatement activities. Include review of major problems and action taken, injury reports, equipment breakdown.
2. Copies of all completed "Transportation and Disposal Manifest" forms for all asbestos waste materials removed from the regulated area during the abatement process.
3. Copies of daily work site entry log books with information on worker and visitor access.
4. Logs documenting filter changes on respirators, HEPA vacuums, negative pressure ventilation units, local exhaust ventilation systems, and other engineering controls.
5. Results of bulk material analysis and air sampling data collected during the course of the abatement including OSHA compliance air monitoring results.
6. Results of materials testing conducted during the abatement for purposes of utilization during abatement activities (e. g., testing of encapsulant for depth of penetration, testing of materials for adherence to encapsulated surfaces).
7. Any new asbestos abatement employee hired, who has not been previously reported, and complete data must be submitted, consisting of: experience, certification, assigned job responsibilities, respirator test fitting, physician's determination of employee's ability to work while wearing respirator and evidence of medical monitoring.
8. Contractor shall post at the entrance to the regulated area a list containing the names, addresses, and telephone numbers of the Contractor, Fire Department and any other personnel who may be required to be contracted during abatement activities.

## 1.6 SITE SECURITY

- A. 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, and any other designated individuals. A list of authorized personnel shall be established prior to job start and posted in the clean room of the decontamination facility.
- C. Contractor shall immediately decontaminate (if required) and evict any unauthorized individual entering the regulated area and notify the Construction Representative of action taken and identity of the unauthorized individual.
- D. 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.
- E. Access to the regulated area shall be through a single decontamination system located where shown on approved Shop Drawings. 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 EMERGENCY PLANNING**

- A. Written emergency plan shall be submitted through the Owners Project Representative and approved by the Architect/Engineer prior to the initiation of abatement activities.
- B. Emergency procedures shall be in written form and prominently posted in the clean change area and equipment room of the worker decontamination area. Everyone prior to entering the regulated area must read and sign these procedures to acknowledge receipt and understanding of work site layout, location of emergency exits and emergency procedures.
- C. Emergency planning shall include notification of police, fire and emergency medical personnel of planned abatement activities, work schedule and layout of regulated area, particularly barriers that may affect response capabilities.
- D. Emergency planning shall include considerations of fire, explosion, toxic atmospheres, electrical hazards, slips, trips and falls, confined spaces and heat related injury. Written procedures shall be developed and employee training in procedures shall be provided.
- E. Employees shall be trained in evacuation procedures in the event of workplace emergencies under the following conditions:
- F. For non-life-threatening situations, employees injured or otherwise incapacitated shall decontaminate following normal procedures with assistance from fellow workers if necessary, before exiting the workplace to obtain proper medical treatment.
- G. For life-threatening injury or illness, worker decontamination shall take least priority, after measures to stabilize the injured worker, remove the worker from the workplace and secure proper medical treatment.
- H. Telephone numbers of all emergency response personnel shall be prominently posted in the clean change area and equipment room, along with the location of the nearest telephone.

## **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 having an active roll in asbestos abatement will 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 documentation as required by Article entitled: "Submittals and Notices," herein. In addition, the Contractor shall be prepared to provide detailed information concerning:
  - 1. Preparation of regulated area.
  - 2. Personal protective equipment including respiratory protection and protective clothing.
  - 3. Employees who will participate in the project, including delineation of experience, training, certification, and assigned responsibilities during the project.
  - 4. Decontamination procedures for personnel, regulated area and equipment.
  - 5. Abatement methods and procedures to be utilized.
  - 6. Required air monitoring procedures.
  - 7. Procedures for handling and disposing of waste materials.
  - 8. Procedures for final decontamination and cleanup.

9. A sequence of work and performance schedule.
10. Procedures for dealing with heat stress.
11. Emergency procedures.
12. Methods of adhering plastic sheeting to the surfaces to be covered.

## **1.9 DELIVERY, STORAGE AND HANDLING**

- A. Deliver all materials in the original packages, containers or bundles bearing the name of the manufacturer and the brand name.
- B. Damaged, deteriorating or previously used materials shall not be used and shall be removed from the work site and disposed of properly.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Polyethylene sheeting for walls and stationary objects shall be a minimum of four (4) mil thick. For floors and all other uses sheeting of at least six (6) mil thickness 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. 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 or falling objects. 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.
- D. Disposal bags shall be of six (6) mil polyethylene, pre-printed with labels as required by OSHA Requirement 29 CFR 1926.1101 (k) (8).
- E. Disposal drums for transporting disposal bags shall be metal or fiberboard with locking ring tops.
- F. Stick-on labels as per EPA, OSHA or DNR requirements for disposal drums.
- G. Surfactant (Wetting Agent):
  1. For use with materials containing asbestos identified as "Amosite", shall be a 50/50 mixture of polyoxyethylene ether and polyoxyethylene ester, mixed in a proportion of one (1) fluid ounce to five (5) gallons of water or as specified by manufacturer.
  2. For all materials containing asbestos identified as "chrysotile", "crocidolite", or types other than Amosite, shall consist of soapy water mixed in a proportion of two (2) fluid ounces of liquid soap to five (5) gallons of water.
  3. Where regulated area temperature may cause freezing of the amended water solution, the addition of ethylene glycol in amounts sufficient to prevent freezing is permitted.
- H. Asbestos Removal Encapsulant (substitute for surfactant): In lieu of using a wetting agent in water to control airborne fibers, and asbestos removal encapsulant may be used. Products that meet these needs are: Serpiflex Shield manufactured by International Protective Coatings Carol 725



Carol Ave., Ocean, NJ 07710; and BWE 5000, by Better Working Environments, Inc., 3716 Scripps Way, Las Vegas, NV 89103; or an approved equal.

- I. Surfaces exposed as a result of removing asbestos containing material shall be coated with a nonpermanent sodium silicate material which shall act as a temporary sealant, pending application of a finish material by others.
- J. Encapsulating Material:
  1. 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, water insoluble when cured, and must retain sufficient integrity after six (6) years to allow re-coating. Products that meet these requirements are: Cable Coating No. 2B by American Coating Corporation and Decadix Fire Check by Pentagon Plastics.
  2. 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. Acceptable products are Cafco-Bond-Seal by U.S. Mineral, Protector Sealant (32-20 and 32-21) by H.B. Fuller Co., and SK-13 Emulsion by National Cellulose.

## 2.2 EQUIPMENT

- A. Negative Pressure Ventilation Units:
  1. A sufficient quantity of negative pressure ventilation units equipped with HEPA filtration and operated in accordance with ANSI Z9.2-79 (local exhaust ventilation requirements) and EPA guidance document EPA 560/5-83-002 Guidance for Controlling Friable Asbestos-Containing Material in Buildings Appendix F: Recommended Specifications and Operating Procedures for the Use of Negative Pressure Systems for Asbestos Abatement shall be utilized so as to provide one workplace air change every 15 minutes.
  2. To calculate total air flow requirement:
    - a.  $\text{Total Ft}^3/\text{Min.} = \text{Volume of Regulated area (in Ft}^3) \text{ 15 Min.}$
  3. To calculate the number of units needed for the abatement:
    - a. 
$$\text{Number of Units Needed} = \frac{\text{Total Ft}^3/\text{Min.}}{0.75(\text{Capacity of Unit in Ft}^3/\text{Min.})}$$
  4. The air filtering equipment shall be capable of filtering asbestos fibers at 0.3 um at 99.97 percent efficiency. Pre-filters, which protect the final filter by removing the larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. The first-stage pre-filter shall be a low efficiency type (e.g., for particles 10 um and larger). The second-stage (or intermediate) filter shall have a medium efficiency (e.g., effective for particles down to 5 um). Pre-filters and intermediate filters shall be installed either on or in the intake grid of the unit and held in place with special housings or clamps.

5. Exhaust air from the regulated area shall maintain a negative pressure of 0.02 inches of water (head). The ventilation shall operate on a 24 hours basis throughout the abatement process until final clearance has been approved.

B. Air Purifying Respirators:

1. Respirator bodies shall be of half face or full-face type with removable cartridges. Single use, disposable or quarter face respirators shall not be used. Full face respirators shall be equipped with a nose cup or other anti fogging devices as would be appropriate for use in air temperatures less than 32 degrees F.
2. Filter cartridges shall, at a minimum, be HEPA type filters labeled with NIOSH and MSHA Certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980). In addition, a chemical cartridge section may be added, if required, for solvents, etc., in use. In this case, each section of the combination canister shall be labeled with the appropriate color code and NIOSH/MSHA Certification.

C. Supplied Air Respirator System:

1. The equipment used shall be capable of producing air of the quality and volume required by OSHA Standard (29 CFR 1910) Section 1910.134 and Compressed Gas Association, Inc., New York, Pamphlet G-7, "Compressed Air for Human Respiration", and Specification G-7.1 "Commodity Specification for Air", applied to the job site conditions and crew size. The standards above shall be augmented by provisions of this specification with the more stringent standard governing.
2. Face piece and hose shall be by same manufacturer and shall be certified by NIOSH/MSHA as an approved Type "C" respirator assembly for continuous flow or pressure demand with a positive pressure face-piece.
3. Backup air supply shall be provided that is adequate to allow a minimum of one-half hour escape time for each six-man (woman) crew. The one-half hour shall be based upon all connections to the backup air supply being in use by an average sized adult male engaged in moderately strenuous activity or by the air requirements of the particular respirator in use is greater.
4. Warning device shall be located in the regulated area which will be clearly audible in all parts of the regulated area and can be heard above the noise level produced by equipment and work procedures in use. This warning device shall warn of:
  - a. Compressor shutdown or other fault requiring use of backup air supply.
  - b. Carbon Monoxide (CO) levels in excess of 50 PPM/V over 8 hours.
5. Carbon Monoxide (CO) levels shall be continually monitored and recorded. This monitor shall be placed in the air line between backup air supply and workers and shall also sound an alarm as specified under "Warning Devices".
6. The compressor shall automatically be shutdown and the alarms sounded if any of the following occur:
  - a. Carbon Monoxide (CO) concentrations exceed 500 PPM/V in the air line between the filter bank and backup air supply.
  - b. Compressor temperature exceeds normal operating range.
7. Compressor motor shall be an electric motor. Compressors driven by gas or diesel engines shall not be used.
8. An after cooler shall be provided at the entry to the filter system which is capable of reducing temperatures to outside ambient air temperatures.

9. System configuration shall permit the recharging of 1/2 hours 2260 PSI SCBA cylinders.
10. Compressed air systems shall be designed to provide air volumes and pressures to accommodate respirator manufacturer's specifications. The compressed air systems shall have a receiver of adequate capacity to allow escape of all respirator wearers from contaminated areas in the event of compressor failure. Compressors must meet the requirements of 29 CFR 1910.134 (d). Compressors must have an in-line carbon monoxide monitor; periodic inspection of the carbon monoxide monitor must be evidenced. Documentation of adequacy of compressed air systems/respiratory protection system must be retained on site. This documentation will include a list of compatible components with the maximum number and type of respirators that may be used with the system. Periodic testing of compressed air shall insure that systems provide air of sufficient quality (Grade D breathing air as described in Compressed Gas Association Commodity Specifications G-7.1).
11. Full body disposable protective clothing, including head, body and foot coverings consisting of material impenetrable by asbestos fibers (Tyvek<sup>®</sup> or equivalent) shall be provided to all workers and authorized visitors in sizes adequate to accommodate movement without tearing.
12. Additional safety equipment, such as hard hats meeting the requirements of ANSI Standard Z89.1-1981, eye protection meeting the requirements of ANSI Standard Z87.1-1979, safety shoes meeting the requirements of ANSI Standard Z41.1-1967, disposable PVC gloves, as necessary, shall be provided to all workers and authorized visitors.
13. Nonskid footwear shall be provided to all abatement workers. Disposable clothing shall be adequately sealed to the footwear to prevent body contamination.
14. Provide sufficient supply of disposable mops, rags and sponges for work area decontamination.
15. Provide scaffolds, ladders, lifts and hand tools such as scrapers, wire cutters, brushes, utility knives, wire saws, as the work requires.
16. Sprayers with pumps capable of providing 14-15 pounds per square inch (psi) at the nozzle tip at a flow rate of 2 gallons per minute for spraying amended water.
17. Rubber dust pans and rubber squeegees shall be provided for cleanup.
18. Brushes utilized for removing loose asbestos containing material shall have nylon or fiber bristles, not metal.
19. A sufficient supply of HEPA filtered vacuum systems shall be available during cleanup.
20. Airless spray equipment with an adjustable low pressure nozzle shall be provided for spraying encapsulants. Nozzle tip size and pressure adjustment shall conform to encapsulant manufacturers written recommendations.
21. Heavy duty power cables for temporary electrical service and a portable electric generator for maintaining negative pressure in the work area in case of power failure.
22. Warning Signs and Labels: As required OSHA Regulation 29 CFR 1925.1101(k).
23. Other equipment the Contractor deems necessary for asbestos abatement work shall be submitted to the Architect/Engineer for approval prior to their use.

## **PART 3 - EXECUTION**

### **3.1 GENERAL COMPLIANCE MEASURES**

- A. Mandatory Protection Conditions: Contractor's employees shall wear appropriate respiratory protection and protective clothing under the following conditions:
  1. During installation or implementation of engineering work practices and control measures.
  2. During maintenance and repair activities for which control measures, hereinafter described, are not feasible.

3. Whenever the control measures are not yet sufficient to reduce exposure below the Permissible Exposure Limits (TWA and/or Excursion Limits).
  4. Whenever emergency conditions exist.
- B. Control Measures: The Contractor shall use one or any combination of the following control methods to achieve compliance with the "Permissible Exposure Limits" defined hereinbefore:
1. Local exhaust ventilation equipped with HEPA filter dust collection systems.
  2. General dilution ventilation equipped with HEPA filtration systems on both exhaust and return air.
  3. Vacuum cleaners equipped with HEPA filters.
  4. Enclosure or isolation of processes producing airborne asbestos fibers and dust.
  5. Use of wet methods, wetting agents or removal encapsulants to control employee exposures during their performance of asbestos abatement activities.
  6. Prompt disposal of wastes contaminated with asbestos in leak-tight containers.
- C. Supplement to Control Measures: Whenever the control measures described above are not sufficient to reduce the employee exposure to or below the "Permissible Exposure Limits" (TWA and/or Excursion Limit), the Contractor shall continue to use the control measures to maintain the employee exposure to the lowest levels attainable and supplement them with the use of appropriate respiratory protection and protective clothing.
- D. Negative-Pressure Enclosure: A negative-pressure enclosure shall be employed whenever feasible, prior to commencing removal, demolition and renovation operations involving asbestos containing materials.
- E. Types of Respiratory Protection: The following Table represents the minimum respiratory protection required for given airborne concentrations of asbestos:

<u>Airborne Concentration of Asbestos, Tremolite, Anthophyllite, Actinolite, or a Combination of These Minerals</u>	<u>Required Respirator</u>
Not in excess of 2 f/cc (10 X PEL)	1. Half-mask air purifying respirator equipped with high-efficiency filters.
Not in excess of 10 f/cc (50 X PEL)	1. Full faceplate air purifying respirator equipped with high-efficiency filters.
Not in excess of 20 f/cc (100 X PEL)	1. Any powered air purifying respirator equipped with high efficiency filters.
Not in excess of 200 f/cc (1000 X PEL)	2. Any supplied air respirator operated in continuous flow mode.
Greater than 200 f/cc (1,000 X PEL) or unknown concentration	1. Full face-piece supplied air respirator operated in pressure demand mode. 1. Full face-piece supplied air respirator operated in pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus.

NOTE: Respirators assigned for higher environmental concentrations may be used at lower concentrations.

A high-efficiency filter means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers in diameter or larger.

- F. Employee Rotation: The Contractor shall not use employee rotation as a means of compliance with Permissible Exposure Limits (TWA and/or Excursion Limit).
- G. Supervision: The Contractor shall have a project supervisor on site at all times that only supervises the project and is responsible to assure contract and regulatory compliance.

### 3.2 PREPARATION OF REGULATED AREA

- A. Post warning signs at all approaches to a regulated area. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any person to read the sign and take the necessary protective measures to avoid exposure.
- B. Shutdown and lock out all heating, cooling and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Appropriate equipment and control measures shall be utilized to prevent contamination of building spaces. Seal all intake and exhaust vents in the work area with tape and 6 mil polyethylene. Also seal any seams in system components that pass through the regulated area.
- C. All electrical circuits to the area in which asbestos abatement work is to take place must be disconnected. The regulated area and other uncontaminated areas that were dependent on the disconnected electrical circuits shall be serviced by a temporary electrical service provided by owner. In accordance with the latest issue of the National Electrical Code, temporary electrical service shall be equipped with combination ground fault interrupted and circuit breakers meeting the requirements of UL for Class A, Group 1 devices. The ground fault interrupter portion shall be solid state type, insulated and isolated from the breaker mechanism. A test mechanism shall provide overload and short circuit protection and shall be operated by a toggle switch with over-center switching mechanism so that contact cannot be held closed.
- D. Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location.
- E. Pre-clean all fixed objects in the regulated area using HEPA filtered vacuums or wet cleaning techniques as appropriate, if contamination is visibly covering them. Careful attention must be paid to machinery and behind grills or gratings where access may be difficult but contamination significant. Also pay particular attention to wall, floor and ceiling penetrations behind fixed items. After pre-cleaning, enclose fixed objects in four (4) mil polyethylene sheeting and seal securely in place with tape.
- F. Pre-clean all surfaces in the regulated area using HEPA filtered vacuums and/or wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos containing materials during the pre-cleaning phase.
- G. Seal off all windows, doorways, elevator openings, corridors, tunnels, entrances, drains, ducts, grills, grates, diffusers, skylights and any other openings between the regulated area and uncontaminated areas outside of the regulated area (including the outside of the building, tunnels and crawl spaces) with four (4) mil polyethylene sheeting and tape.
- H. Wall Covering:
  - 1. Walls shall be covered with two (2) layers of four (4) mil polyethylene sheeting, starting at bottom of wall and extending up and across the ceiling area until it meets in the center

of the ceiling. Here the covering sheets shall be taped together to form a monolithic covering which completely encases the regulated area.

2. Polyethylene sheets shall be sized to minimize seams. Seams shall be staggered and separated by a distance of at least six (6) feet.
3. Wall sheeting shall be secured adequately to prevent it from falling away from the walls. This may require additional support/attachment when negative pressure ventilation systems are utilized.

I. Ceiling Covering:

1. The ceiling shall be covered with two (2) layers of four (4) mil polyethylene sheeting suspended from the ceiling structure with non-damaging fasteners and/or adhesive.
2. Polyethylene sheets shall be sized to minimize seams.
3. Ceiling sheeting shall extend at least 24" down the side walls of the work area.

### **3.3 DECONTAMINATION ENCLOSURE SYSTEM**

- A. A decontamination enclosure system shall be provided at each location where workers will enter or exit a regulated area.
- B. Plans for construction, including materials and layout, shall be submitted as shop drawings and approved by the Architect/Engineer prior to work initiation. Decontamination enclosure systems constructed at the work site shall utilize six (6) mil opaque black or white polyethylene sheeting or other acceptable materials for privacy. Detailed descriptions of portable, prefabricated units, if used, must be submitted for the Architect/Engineer's approval. Plans must include floor plan with dimensions, materials, size, thickness, plumbing and electrical utilities.
- C. The decontamination enclosure system shall consist of at least a clean room, a shower room, and an equipment room, each separated from each other and from the regulated area by air locks.
- D. Entry to and exit from all airlocks and decontamination enclosure system chambers shall be through curtained doorways consisting of three sheets of overlapping six (6) mil polyethylene sheeting. The curtain doorway sheets shall be secured at the top and one side opposite each other. All curtains shall have weights attached to the bottom to ensure that they hang straight and maintain a seal over the doorway when not in use. Doorway designs, providing equivalent protection and acceptable to the Architect/Engineer may be utilized.
- E. Access between any two rooms in the decontamination enclosure system shall be through an airlock with at least three (3) feet separating each curtained doorway. Pathways into (from clean to contaminated) and out from (contaminated to clean) the regulated area shall be clearly designated.
- F. Clean room shall be sized to adequately accommodate the work crew. Clean disposable clothing, replacement filters for respirators, disposable towels and other necessary items shall be provided in adequate supply at the clean room. A location for postings shall also be provided in this area. Whenever possible, a lockable door shall be used to permit access into the clean room from outside the regulated area.
- G. Shower room shall contain one or more shower heads as necessary to adequately accommodate workers. Each shower head shall be supplied with hot and cold water adjustable at the tap. The shower enclosure shall be constructed to insure against leakage of any kind. An adequate supply of soap and disposable towels shall be supplied by the Contractor and available at all times.

Shower water shall be drained, collected and filtered as specified in the Article entitled: "Water Collection and Disposal," herein.

- H. The equipment room shall be used for storage of equipment and tools at the end of a shift after workers have been decontaminated using a HEPA filtered vacuum and/or wet cleaning techniques as appropriate. Replacement filters (in sealed containers until used) for HEPA vacuums and negative pressure ventilation equipment, extra tools, containers or surfactant and other materials and equipment that may be required during the abatement may also be stored here as needed. A walk-off pan (a small children's swimming pool or equivalent filled with water) shall be located in the regulated area just outside the equipment room for workers to clean off foot coverings after leaving the regulated area and prevent excessive contamination of the worker decontamination enclosure system. A drum lined with a labeled six (6) mil polyethylene bag for collection of disposable clothing shall be located in this room. Contaminated rubber boots or other reusable footwear shall be stored in this area for reuse the following workday.
- I. Waste Container Pass-Out Airlock:
  - 1. The waste container pass-out airlock shall be constructed at some location away from the worker decontamination enclosure system. Wherever possible, this shall be located where there is direct access from the regulated area to the outside of the building.
  - 2. This airlock system shall consist of an airlock, a container staging area, and another airlock with access to outside the regulated area.
  - 3. The waste container pass-out airlock shall be constructed in similar fashion to the worker decontamination enclosure system using similar materials and airlock and curtain doorway designs.
  - 4. This airlock system shall not be used to enter or exit the regulated area. The airlock system shall be tightly sealed when not in use.
- J. Emergency exits shall be established and clearly marked with duct tape arrows or other effective designations to permit easy location from anywhere within the regulated area. They shall be secured to prevent access from uncontaminated areas, but still permit emergency exiting. These exits shall be properly sealed with polyethylene sheeting which can be cut to permit egress if needed. These exits may be through the decontamination enclosure, the waste pass-out airlock, other alternative exits satisfactory to fire officials.

### **3.4 TEMPORARY ISOLATION PARTITIONS**

- A. Large rooms or open areas that require temporary air tight barriers to separate a contaminated regulated area from an uncontaminated area shall be provided with temporary partitions, constructed in the following manner:
  - 1. Walls shall be constructed of wood or metal framing to support barriers in all openings larger than 4' x 8'.
  - 2. A sheathing material (plywood, drywall) of at least 3/8" thickness shall be applied to work side of barrier.
  - 3. Cover the work side of partition with a double layer of four (4) mil polyethylene sheeting with staggered joints and seal in place.
  - 4. Provide at least one (12" x 12") window in the barrier system, where feasible, for the purpose of viewing into the regulated area. The window shall consist of heavy gauge plastic or clear safety glass. Panes shall be framed into the barrier system and completely sealed to prevent any leakage of air through the unit.

### **3.5 MAINTENANCE OF ENCLOSURE SYSTEM**

- A. Following completion of the construction of all polyethylene barriers and decontamination system enclosures, initiate negative pressure system and allow overnight settling to ensure that barriers will remain intact and secured to walls and fixtures before beginning actual abatement activities.
- B. All polyethylene barriers and decontamination enclosure systems shall be inspected at least twice daily by the Contractor's competent person prior to the start of each day's abatement activities and following the completion of the day's abatement activities. Document inspections and observations in the daily project log.
- C. Damage and defects in the enclosure system are to be repaired immediately upon discovery.
- D. Use smoke tubes to test the effectiveness of the barrier system when directed by Owners Project Representative.
- E. Anytime during the abatement activities, if visible construction related dust or debris is observed outside of the regulated area or if damage occurs to barriers, work shall immediately stop, repairs shall be made to barriers, and debris/residue cleaned up using appropriate HEPA vacuuming and wet mopping procedures.
- F. Openings made in the enclosure system to accommodate negative air pressure system shall be made airtight with tape and caulking as needed. If more than one unit is installed, they should be turned on one at a time, checking the integrity of wall barriers for secure attachment and need for additional reinforcement. Ensure that adequate power supply is available to satisfy the requirements of the ventilating and exhaust units. Negative pressure units shall be exhausted to the outside of the building. They shall not be exhausted into occupied areas of the building. Careful installation and daily inspections shall be done to ensure that the ducting does not release fibers into uncontaminated building areas.
- G. Use of enclosure system shall not commence until the following has been accomplished:
  - 1. Enclosure systems have been constructed, inspected, and tested.
  - 2. Negative pressure systems are functioning adequately.
  - 3. All pre-abatement submissions, notifications, postings and permits have been provided and approved by the Architect/Engineer, or Construction Representative, as applicable.
  - 4. All equipment for abatement, cleanup and disposal are on hand.
  - 5. All worker training is completed.
  - 6. Contractor has received written notice to commence abatement work from the Owner, based on recommendation of the Owners Project Representative.

### **3.6 WORKPLACE ENTRY AND EXIT PROCEDURES**

- A. All workers and authorized personnel shall enter the regulated area through the decontamination enclosure system.
- B. All personnel who enter the regulated area must sign the registration log, located in the clean room, both upon entry and exiting the area.
- C. All personnel shall proceed first to the clean room, remove all street clothes, and appropriately don respiratory protection (as approved for the job conditions) and disposable coveralls, head covering and foot covering. Hard hats, eye protection and gloves shall also be utilized if required.



Clean respirators and protective clothing shall be provided and utilized by each person for each separate entry into the regulated area.

- D. Personnel wearing designated personal protective equipment shall proceed from the clean room through the decontamination enclosure system to the regulated area.
- E. Before leaving the regulated area, all personnel shall remove gross contamination from the outside of respirators and protective clothing by brushing or wet wiping procedures. (Small HEPA vacuums with brush attachments may be utilized for this purpose.) Each person shall clean bottoms of protective footwear in the walk-off pan just prior to entering the equipment room.
- F. Personnel shall proceed to equipment room where they remove all protective equipment except respirators. Deposit disposable clothing into appropriately labeled containers for disposal.
- G. Reusable, contaminated footwear shall be stored in the equipment room when not in use in the regulated area. Upon completion of abatement it shall be disposed of as asbestos contaminated waste. Rubber boots may be decontaminated at the completion of the abatement for reuse.
- H. Still wearing respirators, personnel shall proceed to the shower area, clean the outside of the respirators and the exposed face area under running water prior to removal of respirator and shower and shampoo to remove residual asbestos contamination. Various types of respirators will require slight modification of these procedures. An airline respirator with HEPA filtered disconnect protection may be disconnected in the equipment room and worn into the shower. A powered air purifying respirator face-piece will have to be disconnected from the filter/power pack assembly which is not waterproof, upon entering the shower. Cartridges must be in place for each new entry into the regulated area.
- I. After showering and drying off, proceed to the clean room and don street clothing even though there will be later reentry into the regulated area or street clothes if it is the end of the work shift.
- J. Workers shall NOT eat, drink, smoke, or chew gum or tobacco in the regulated area. To eat, drink or smoke, workers shall follow the procedure described above, and then dress in street clothes before entering the non-regulated areas of the building.
- K. These procedures shall be posted in the clean room and equipment room.

### **3.7 WASTE CONTAINER PASS-OUT PROCEDURE**

- A. Asbestos contaminated waste that has been containerized shall be transported out of the regulated area through the waste container pass-out airlock (or through the decontamination enclosure if a separate airlock has not been constructed).
- B. The inside team wearing protective clothing and respirators appropriate for the contaminated regulated area shall clean the entire surface, including bottoms, of properly labeled bags, using HEPA vacuums and wet wiping techniques and transport them into the waste container pass-out airlock where they will be placed into another properly labeled bag. No worker from the inside team shall further exit the regulated area through this airlock.
- C. Workers from outside the regulated area wearing appropriately assigned respirators shall enter the airlock from outside the regulated area. No worker from the outside team shall further enter the regulated area through this airlock.
- D. The exit from this airlock shall be secured to prevent unauthorized entry.

### **3.8 WATER COLLECTION AND DISPOSAL**

- A. All water resulting from pre-cleaning operation, excess from floor of regulated area and the final cleaning operation shall be collected and placed in sealed containers for disposal as contaminated material.
- B. 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:
  - 1. A centrifugal pump capable of pumping at least 25 gallons/minute.
  - 2. Two filter cartridge housings, one 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.
  - 3. Maintain two sets (6 cylinders per set) of 100 micron filters, to allow one set to be cleaned while the other set is in use.
  - 4. A common garden hose may be connected to final filter housing to drain water to sanitary sewer system.

### **3.9 WET REMOVAL PROCEDURE**

- A. Wet all asbestos containing material with an amended water solution, or removal encapsulant, using equipment capable of providing a fine spray mist, in order to reduce airborne fiber concentrations when the material is disturbed. Saturate the material to the substrate. Keep all removed material wet to prevent fiber release until it can be containerized for disposal. If regulated area temperatures are below 32°F and amended water is subject to freezing, modify as specified for surfactant in Article 2.1 entitled: "Materials," herein. Maintain a high humidity in the regulated area by misting or spraying to assist in fiber settling and reduce airborne concentrations.
- B. Saturated asbestos containing material shall be removed in manageable sections. Removed material should be containerized before moving to a new location for continuance of work. Surrounding areas shall be periodically sprayed and maintained in a wet condition until visible material is cleaned up.
- C. Material removed from building structures or components shall not be dropped or thrown to the floor. Material should be removed as intact sections or components whenever possible and carefully lowered to the floor. If this cannot be done for materials greater than 50 feet above the floor, a dust-tight chute shall be constructed to transport the material to containers on the floor or the material may be containerized at elevated levels (e.g. on scaffolds) and carefully lowered to the ground by mechanical means. For materials between 15 and 50 feet above the ground they may be containerized at elevated levels or dropped onto inclined chutes or scaffolding for subsequent collection and containerization.
- D. Bags shall be considered full when half their capacity has been filled. They should be securely sealed to prevent accidental opening and leakage by tying tops of bags in an overhand knot or by taping in gooseneck fashion. Do not seal bags with wire or cord.
- E. Asbestos containing waste with sharp edged components (e.g., nails, screws, metal lath, tin sheeting) shall be placed into drums for disposal in lieu of polyethylene bags. Drums shall be marked to differential contents from those drums containing bagged material.

- F. After completion of all stripping work, surfaces from which asbestos containing materials have been removed such as plaster base coat or metal deck, etc., the surfaces shall be wet brushed and sponged to remove all visible residues.

### 3.10 FLOORING SYSTEM REMOVAL

- A. Only Wet Removal Techniques will be allowed. Remove and dispose of all carpet, including pad, prior to plasticizing the work area. Where "carpet-to-remain" is scheduled, such carpet shall be thoroughly cleaned using HEPA vacuum equipment. A minimum of two layers of 6 mil plastic shall be used to cover remaining carpet during the floor system removal operations. All curtains or draperies shall be removed from the work area prior to beginning removal activities. Prepare work area with barriers as specified herein. Cover the wall surfaces of the work area with a minimum of two layers of 6 mil plastic.
- B. Areas immediately adjacent to removal areas such as corridors or hallways which do not receive asbestos material removal, but are necessary routes to and from the work areas, shall be protected with plastic on floors and walls, same as described herein. Openings from these areas into areas where asbestos material is removed shall have curtained doorways to minimize fiber release into other areas. All exits shall be marked in bold lettering "**EXIT**" or "**Emergency Exit**".
- C. Provide decontamination enclosures and differential air pressure as specified herein. Respiratory protection shall be ½ mask Air Purifying Respirators with HEPA cartridges at a minimum.
- D. Spray asbestos material with ample amounts of amended water, using equipment recommended by the manufacturer capable of providing a "mist" application to reduce the release of fibers. Spray the asbestos material repeatedly during the work process to maintain a wet condition and to minimize fiber release. Asbestos flooring materials shall be wetted sufficiently to minimize the possibility that they become broken, crumbled, pulverized, or reduced to powder. Care shall be taken by the workers to apply enough wetting agent to achieve the intent described herein.
- E. The Asbestos Abatement Contractor shall use removal techniques, methods, and equipment which will not permit the fiber count during flooring system removal operations to exceed 0.01 fibers/cc of air as detected by personal air sampling methods.
- F. All methods for removal of mastic must be approved by the Owner or Architect/Engineer. The preferred method for removing mastic or adhesives is by solvents. The solvent shall be required to conform to a minimum of the following conditions:
  - 1. Flash point (open or closed cup) > 200 degrees Fahrenheit.
  - 2. Auto Ignition Temperature > 600 degrees Fahrenheit.
  - 3. Slight odor, pH neutral, aromatic vapors < 100 ppm, and will not react violently with water.
  - 4. Respirator cartridges capable of filtering fumes will be required.
- G. Collect the material that has been removed and place it into clear sealable plastic bags (6 mil thick minimum). Each bag shall be cleaned, wet wiped, evacuated, and removed from the work area. All plastic bags and containers must be imprinted with required and specified warnings and/or labels. The preferred method is for the material to be placed directly into previously described containers.
- H. Clean the external surfaces of the containers thoroughly in the work area. Next, move the containers into the Equipment Decontamination Enclosures. Proper equipment decontamination requires:

1. Clean gross contamination in work area.
  2. Wet clean thoroughly in wash room.
  3. Place in clear sealable bags (6 mils thick minimum) with required warnings and/or labels.
  4. Evacuate air and seal with as little free air space as possible, twist top of bag, gooseneck, and wrap with duct tape.
  5. Move container into Holding Area.
- I. After all visible gross material has been properly bagged and removed; wet clean and HEPA vacuum the lower half of the wall surfaces.
  - J. The work floor and the outer layer of wall plastic shall be encapsulated. After the encapsulant has dried, one layer of plastic from the walls shall be removed and disposed of as contaminated material in double plastic bags.
  - K. Final air clearance is required by Transmission Electron Microscopy (TEM). After final clearance is achieved, the floor should be left in such a condition that floor replacement or removal can proceed.

### **3.11 ENCAPSULATION PROCEDURES**

- A. Clean and isolate the regulated area as specified in Article entitled: "Preparation of Regulated Area", hereinbefore.
- B. Repair damaged and missing areas of existing materials with non-asbestos-containing substitutes. Material must adhere adequately to existing surfaces and provide an adequate base for application of encapsulating agents. Filler material shall be applied in accordance with manufacturer's recommended specifications.
- C. Spray apply with airless equipment with low nozzle pressure to all surfaces where asbestos is removed or surfaces containing asbestos that are to remain in place. Spray must completely encapsulate any remaining asbestos, permanently locking it in place.
- D. Apply a minimum of one (1) coat with coverage in strict accordance with manufacturer's recommendations. Surfaces must be dry and free of dirt, oil and dust.

### **3.12 AIR MONITORING**

- A. Air samples shall be taken with a high volume pump having a capacity of 10 to 16 liters per minute. This does not include breathing zone pump.
- B. The Contractor and the Owner's Air Sampling Professional shall perform their air sampling independent of each other. All sample collection procedures and evaluation to determine employee exposure levels shall conform with the requirements of Appendix A to OSHA Standard 29 CFR 1926.1101. Base test (if required by the A/E) and clearance testing will be performed only by the Owner's Air Sampling Professional. Early-on and periodic testing may be performed by both the Contractor and Owner's Air Sampling Professional.
- C. All samples collected shall be analyzed by a laboratory accredited by the American Industrial Hygiene Association and the results of each analysis shall be submitted to the Owners Project Representative for the record. Copies of the analysis results shall also be made available to the Owner, Contractor and the Architect/Engineer upon request.
- D. Documentation requirements must include the following, as a minimum:

1. Air Sampling Procedures: Sampling times; sampling locations (with appropriate diagrams); evidence of periodic inspection of sampling equipment; documentation of pre and post calibration of equipment; detailed description of work conditions; description of worker protective devices; and a description of any atypical environmental conditions.
  2. Air Sampling Analysis: Sample identification; sample duration; sample flow rate; total air volume; total fibers counted; total fields counted; blank filter analysis; reticule field area; and fiber concentration in fibers per cubic centimeter.
  3. The concentration of fibers shall be determined by the membrane filter method at 400-450X (magnification) (4 millimeter objective) with phase contrast illumination.
- E. Minimum testing required for the project shall consist of the following:
1. Baseline Test: As required by the A/E, prior to the commencement of work, ambient air samples will be taken inside regulated area, within the confines of the building in close proximity to the regulated area, and also outside of the building area. A 1,200 liter sample (AHERA PCM protocol) will be taken of each of the areas specified.
  2. OSHA P.E.L. Compliance Testing as ref. 1910.28. Within the breathing zone of each worker category (i.e., wetter, receiver, bagger) 25% of the crew or one per job category.
- F. Daily Personal Air Monitoring (OSHA Compliance):
1. 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.
  2. Daily testing may be eliminated if employees are equipped with supplied-air respirators operated in a positive-pressure mode while performing abatement work.
- G. The Owners Project Representative has the authority to stop the abatement work under the provisions of the General Conditions of this contract at anytime the Construction Representative determines either personally or through the services of the air sampling professional that conditions are not in compliance with the specifications and applicable regulations. The stoppage of work shall continue until conditions have been corrected and corrective steps have been taken to the satisfaction of the Construction Representative. Standby time required to resolve violations shall be at the Contractor's expense.

### **3.13 CLEANUP PROCEDURE**

- A. Remove and containerize all visible accumulations of asbestos containing material and asbestos contaminated debris utilizing rubber dust pans and rubber squeegees to move material around. Do not use metal shovels to pick up or move accumulated waste. Special care shall be taken to minimize damage to floor sheeting.
- B. Wet clean all surfaces in the regulated area using rags, mops and sponges as appropriate. (Note: Some HEPA vacuums might not be wet-dry vacuums.)
- C. Prior to removing the inner layer of plastic sheeting, the sheeting shall be sprayed with an encapsulant, so that any residue remaining will be adhered to the plastic sheeting.
- D. Remove the cleaned inner layer of plastic sheeting from walls and floors. Windows, doors, HVAC system vents and all other openings shall remain sealed. The negative pressure ventilation units

shall remain in continuous operation. Decontamination enclosure systems shall remain in place and be utilized.

- E. Remove all containerized waste from the regulated area and waste container pass-out airlock.
- F. The Owner's Project Representative, MDNR/EPA Representative (if available), and the Contractor shall inspect the regulated area for visible residue. If any accumulation of residue is observed, it will be assumed to be asbestos and the cleaning cycle shall be repeated.
- G. After cleaning the regulated area the Contractor may either spray the remaining barrier material with encapsulant or, wait at least 24 hours to allow fibers to settle and HEPA vacuum and wet clean all objects and surfaces in the regulated area again.
- H. Decontaminate all tools and equipment and remove at the appropriate time in the cleaning sequence.
- I. The regulated area shall be cleaned until it is in compliance with clearance testing specified in Article entitled: "Clearance Testing," hereinafter.
- J. Following the satisfactory completion of clearance air testing remaining barriers may be removed and properly disposed of. All fixed objects within the area, which were covered with polyethylene prior to abatement work, shall be uncovered and thoroughly cleaned. A final visual inspection by the Owner's Project Representative, MDNR/EPA Representative (if available), and the Contractor shall insure that no contamination remains in the regulated area. Unsatisfactory conditions shall require additional cleaning and air testing.

### **3.14 CLEARANCE TESTING - TRANSMISSION ELECTRON MICROSCOPY (TEM)**

- A. Clearance sampling and analysis shall be performed only after the asbestos abatement work area has been completely cleaned and visually inspected.
- B. Simultaneously, five samples shall be collected within the enclosed work area and five additional samples shall be collected outside the enclosure for the purpose of comparison. The volume of air drawn for each sample collected shall be equal to or greater than 1200 liters of air using a 25 mm filter, or 2800 liters of air using a 37 mm filter. An additional three samples (referred to as field blanks) shall be provided. Two samples shall be taken by removing the cap for 30 seconds and replacing it. These samples shall be made at entrance to enclosure and at an ambient site. The third sample shall remain sealed and kept with the other samples.
- C. The sample collected from the enclosed work area shall be analyzed first, using the TEM method specified in EPA regulation 40 CFR Part 763, Appendix A to Subpart E. If the average concentration of asbestos in the five samples does not exceed the filter background level of 70 structures per square millimeter, then the area may be declared clear of asbestos.
- D. Should the analysis in Paragraph C. (herein) fail the background level, then a comparison of the ten samples shall be made to determine if the average of the enclosure samples is not significantly larger than the average of the outside samples and the three field blanks. A statistical comparison using the Z-test shall be used to determine if the two averages are significantly different. Should the test indicate no significant difference, the area will be considered clear of asbestos. If a significant difference is noted, the cleaning procedure shall be repeated and retesting shall be required.
  - 1. Each additional visual inspection: \$300.00.

2. Each additional clearance test: \$250.00.

### **3.15 DISPOSAL PROCEDURES**

- A. As the work progresses, to prevent exceeding available storage capacity on site, sealed and labeled containers of asbestos containing waste shall be removed and transported directly to the prearranged disposal location, which must be an authorized site in accordance with regulatory requirements of NESHAP and the State of Missouri. Use of intermediate storage locations is not an accepted disposal procedure.
- B. The Contractor shall provide documentation in the form of a transportation and disposal manifest that will provide a chain-of-custody record of all asbestos-containing waste from project site to the disposal site. All asbestos-containing waste generated must be accounted for by these records and copies of all such records shall be delivered to the Construction Representative.
- C. The approved landfill for this project shall be as specified in Paragraph 1.1 of this section unless an alternate is specifically approved in writing via addendum or change order.
- D. Transportation to the Landfill:
  1. Once bags have been removed from the regulated area, they shall be loaded into an enclosed truck for transportation.
  2. The enclosed cargo area of the truck shall be free of debris and lined with six (6) mil polyethylene sheeting to prevent contamination from leaking or spilled containers. Floor sheeting shall be installed first and extend up the side walls. Wall sheeting shall be overlapped and taped into place.
  3. Drums shall be placed on level surfaces in the cargo area and packed tightly together to prevent shifting and tipping. Large components shall be secured to prevent shifting and bags placed on top. Do not throw containers into truck cargo area.
  4. Personnel loading asbestos containing waste shall be protected by disposable clothing including head, body and foot protection and at a minimum, half-face-piece, air-purifying, dual cartridge respirators equipped with HEPA filters.
  5. Any debris or residue observed on containers or surfaces outside of the regulated area resulting from cleanup or disposal activities shall be immediately cleaned up using HEPA filtered vacuum equipment and/or wet methods.
- E. Disposal at the Landfill:
  1. Upon reaching the landfill, trucks are to approach the dump location as closely as possible for unloading of the asbestos containing waste.
  2. Bags, drums and components shall be inspected as they are off-loaded at the disposal site. Damaged containers shall be very carefully taped shut and repacked into drums or bags as applicable.
  3. Waste containers shall be placed on the ground at the disposal site, not pushed or thrown out of trucks (weight of wet material could rupture bags).
  4. Personnel off-loading containers at the disposal site shall wear protective equipment consisting of disposable head, body and foot protection and, at a minimum, half-face-piece, air-purifying, dual cartridge respirators equipped with HEPA filters.
  5. Following the removal of all containerized waste, the truck cargo area shall be decontaminated using HEPA vacuums and wet methods to meet the no visible residue criteria. Polyethylene sheeting shall be removed and discarded along with contaminated cleaning materials and protective clothing, in bags or drums at the disposal site.

### **3.16 REESTABLISHMENT OF REGULATED AREA**

- A. Reestablishment of the regulated area shall only occur following the completion of cleanup procedures and after clearance air monitoring has been performed and documented to the satisfaction of the Construction Representative.
- B. Re-secure mounted objects removed from their former positions during area preparation activities.
- C. Re-secure and relocate objects that were removed to temporary locations back to their original positions.
- D. Reestablish HVAC, mechanical and electrical systems in proper working order. Remove potentially contaminated HVAC system filters and dispose of as asbestos contaminated waste. Decontaminate filter assembly using HEPA vacuums and wet cleaning techniques.

**END OF SECTION 028213**



Name of Owner  
Name of Project  
Project Location

Project No. XX-XXXX  
Project Date

### CERTIFICATE OF WORKER'S RELEASE

DATE: \_\_\_\_\_

TO: \_\_\_\_\_  
(Insert Owner's Name and Address)

RE: \_\_\_\_\_  
(Insert Project Name and Address)

In consideration of my employment by \_\_\_\_\_ in connection  
(Contractor's Name)  
with the removal and disposal of asbestos, or other work in asbestos contaminated work areas,

1. I acknowledge and understand that I have been or will be employed in connection with the removal of, disposal of, or other treatment to, asbestos, or other work in asbestos contaminated work areas, and I acknowledge that in handling asbestos and breathing asbestos dust, including but not limited to, THE FACT THAT ASBESTOS CAN CAUSE ASBESTOSIS AND IS A KNOWN CARCINOGEN, AND CAN THEREFORE CAUSE VARIOUS TYPES OF CANCER.
2. I acknowledge and understand that ANY CONTACT WITH ASBESTOS, WHETHER IT CAN BE SEEN OR NOT, MAY CAUSE ASBESTOSIS AND VARIOUS FORMS OF CANCER, WHICH MAY NOT SHOW UP FOR MANY YEARS, and I covenant and agree faithfully to take all precautions required of me.
3. I knowingly assume all risks in connection with potential exposure to asbestos or asbestos containing materials and I do hereby waive and relinquish, covenant not to sue, and fully release and forever discharge \_\_\_\_\_ from any and all claims, causes of action, and liability whatsoever, at common law or otherwise, which may arise as a result of or in connection with any exposure I may sustain to asbestos or asbestos containing materials in the course of work at \_\_\_\_\_

\_\_\_\_\_  
(Name of Project)

\_\_\_\_\_  
(Name of Worker)  
(Must be Typed)

\_\_\_\_\_  
(Signature of Worker)

(As acknowledgement of reading and understanding this page of this two page Certificate)

4. I hereby warrant and represent that I have not been disabled, laid-off, or compensated in damages or otherwise, because of the disease of asbestosis.
5. I represent that I can read the English language, or that I have had someone read this instrument to me, and that I can understand the meaning of all the provisions contained herein.

SIGNATURE: \_\_\_\_\_

PRINTED OR TYPED NAME: \_\_\_\_\_

SOCIAL SECURITY NUMBER: \_\_\_\_\_

Name of Owner  
Name of Project  
Project Location

Project No. XX-XXXX  
Project Date

**ACKNOWLEDGEMENT**

**STATE OF MISSOURI**

COUNTY OF \_\_\_\_\_

This instrument was acknowledged before me on \_\_\_\_\_  
(date)

By \_\_\_\_\_  
Notary Public in and for  
The State of Missouri

\_\_\_\_\_  
Printed Name of Notary Public

My Commission Expires: \_\_\_\_\_

## **SECTION 040000 - MASONRY**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Concrete Block.
  - 2. Mortar and Grout.
  - 3. Reinforcement and Anchorage.
  - 4. Flashings.
  - 5. Accessories.

#### **1.2 SUBMITTALS**

- A. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

#### **1.3 REFERENCES**

- A. AS5TM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- B. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- D. ASTM C 90 - Standard Specification for Loadbearing Concrete Masonry Units.
- E. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.
- F. ASTM C 150 - Standard Specification for Portland Cement.
- G. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.
- H. ASTM C 216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale).
- I. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.
- J. ASTM C 404 - Standard Specification for Aggregates for Masonry Grout.
- K. ASTM C 476 - Standard Specification for Grout for Masonry.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

## **1.5 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

## **PART 2 - PRODUCTS**

### **2.1 CONCRETE MASONRY UNITS**

- A. CMU: ASTM C90; normal weight; color and texture per the following design:
  - 1. CMU: Smooth-face, exposed face color selected from manufacturer's standard color and texture.
  - 2. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depth of 8 inches.
  - 3. Concealed faces: Manufacturer's standard color and texture.

### **2.2 CONCRETE MASONRY MORTAR AND GROUT MATERIALS**

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Mortar Aggregate: ASTM C 144.
- D. Grout Aggregate: ASTM C 404.
- E. Pigments for Colored Mortar: Iron or chromium oxides with demonstrated stability and colorfastness.
  - 1. Color: As approved from manufactures standard colors.
- F. Water: Clean and potable.

### **2.3 REINFORCEMENT AND ANCHORAGE**

- A. Reinforcing Steel: ASTM A 615/A 615M, grade 60 (420) yield grade, deformed billet bars; uncoated.
- B. Joint Reinforcement for single-wythe walls: Ladder type; ASTM A 82 steel wire, hot dip galvanized after fabrication to ASTM A 153/A 153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

## **2.4 FLASHINGS**

- A. Flexible flashings: Flexible, self-adhering through wall flashing material, 40-mil overall thickness, synthetic rubber based with cross-laminated polyethylene cover. Provide "Perm-A-Barrier Flashing" by Grace Construction Products or equivalent.
- B. Stainless Steel: ASTM A 666, Type 304, soft temper; 26 gauge (0.45 mm) thick; finish 2B or 2D.

## **2.5 ACCESSORIES**

- A. Control / Expansion Joint Filler: Closed cell foam strip; oversized 50 percent to joint width; 3/8 inch wide x by roll length.
- B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

## **2.6 MORTAR AND GROUT MIXES**

- A. Mortar for Unit Masonry: ASTM C 270, Proportion Specification.
- B. Mortar for Unit Masonry: ASTM C 270, Property Specification.
  - 1. Concrete Masonry: Type S.
  - 2. Brick Masonry: Type N.
- C. Grout for Unit Masonry: ASTM C 476.
  - 1. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that infiltration barrier is installed over metal stud sheathed areas.

### **3.2 COURSING**

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:

1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

### **3.3 PLACING AND BONDING**

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar as work progresses.
- E. Interlock intersections and external corners.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

### **3.4 CONTROL AND EXPANSION JOINTS**

- A. Install control joints as indicated on the drawings, or at a distance of no more than 1.5 times the height of the wall.
- B. Form control and expansion joints with closed cell foam strip to keep joints free from mortar, no less than 3/8 inches wide, with uniform width the full height of the wall.

### **3.5 CLEANING**

- A. Remove excess mortar and mortar smears as work progresses.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution. Protect adjacent materials from cleaning solution.

### **3.6 SEALING**

- A. Exterior Masonry shall be sealed.
- B. Seal after completion of cleaning.
- C. Provide product for review by Architect.

**3.7 PROTECTION OF FINISHED WORK**

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION 040000**

## **SECTION 055000 - METAL FABRICATIONS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Aluminum angles with lag bolts.
  - 2. Structural supports for miscellaneous mechanical equipment support.

#### **1.2 SUBMITTALS**

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- B. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.
- C. Field Quality-Control Submittals: Indicate results of Owner-furnished tests and inspections.

#### **1.3 QUALITY ASSURANCE**

- A. Finish joints according to NOMMA Guideline 1.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Inspection: Accept metal fabrications on-Site in labeled shipments. Inspect for damage.
- B. Protect metal fabrications from damage by exposure to weather or by ground contact.

#### **1.5 EXISTING CONDITIONS**

- A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

### **PART 2 - PRODUCT**

#### **2.1 ANCHORS**

- A. Anchor Rods: ASTM F1554; Grade 36 or Grade 55.
  - 1. Shape: Straight.
  - 2. Furnish with nut and washer; Hot dipped galvanized.



- B. Epoxy Adhesive Anchors:
  - 1. Manufacturer List:
    - a. Hilti HIT-Hy 200 MAX
    - b. Substitutions: Permitted upon approval of Engineer.
  - 2. Grout: According to Section 051200 – Structural Steel Framing: Grout.
  - 3. Threaded Rod: Galvanized.

## 2.2 MATERIALS

- A. Stainless Steel:
  - 1. Bars and Shapes: ASTM A276; Type 316.
  - 2. Tubing: ASTM a554; Type 316.
  - 3. Pipe: ASTM A312; Type 316.
  - 4. Plate, Sheet, and Strip: ASTM A240; Type 316.
  - 5. Bolts, Nuts, and Washers: ASTM A354.
  - 6. Welding Materials: AWS D1.6; type required for materials being welded.
- B. Aluminum:
  - 1. Extruded Aluminum: ASTM B221 Alloy 6063, Temper T5.
  - 2. Sheet Aluminum: ASTM B209 Alloy, Temper.
  - 3. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 Alloy 6063, Temper T6.
  - 4. Aluminum-Alloy Bars: ASTM B211 Alloy 6063, Temper T6.
  - 5. Aluminum-Alloy Sand Castings: ASTM B26, Alloy.
  - 6. Aluminum-Alloy Die Castings: ASTM B85, Alloy as required to suit application.
  - 7. Bolts, Nuts, and Washers: Stainless steel.
  - 8. Welding Materials: AWS D1.1; type required for materials being welded.
- C. Bolts, Nuts, and Washers for Equipment and Piping:
  - 1. Carbon Steel:
    - a. Structural Connections: ASTM A325, hot-dip galvanized.
    - b. Anchor Bolts: ASTM F1554 Grade 36, hot-dip galvanized.
    - c. Pipe and Equipment Flange Bolts: ASTM A193, Grade B-7.
  - 2. Stainless Steel: Type 316 stainless steel, class 2; ASTM A193 for bolts; ASTM A194 for nuts.

## 2.3 FABRICATION

- A. Fit and shop assemble items in largest practical sections for delivery to Site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Exposed Welded Joints: NOMMA Guideline 1 Joint Finish.

- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- G. Fabrication Tolerances:
  - 1. Squareness: 1/8 in maximum difference in diagonal measurements.
  - 2. Maximum Offset between Faces: 1/16 in.
  - 3. Maximum Misalignment of Adjacent Members: 1/16 in.
  - 4. Maximum Bow: 1/8 inch in 48 in.
  - 5. Maximum Deviation from Plane: 1/16 inch in 48 in.

## 2.4 FINISHES

- A. Galvanized steel as indicated on drawings.
- B. Steel that is not galvanized shall be cleaned and primed. All exposed structural steel shall be primed and painted per Specification 099000.
- C. Steel:
  - 1. Prepare surfaces to be primed according to SSPC SP 2.
  - 2. Do not prime surfaces in direct contact with concrete or where field welding is required.
  - 3. Prime paint items with one coat except where galvanizing is specified.
  - 4. Galvanizing: ASTM A123; hot-dip galvanize after fabrication.
  - 5. Galvanizing for Fasteners, Connectors, and Anchors: Hot-Dip Galvanizing: ASTM A153.
  - 6. Bolts: Hot-dip galvanized.
  - 7. Nuts: Hot-dip galvanized.
  - 8. Washers: Hot-dip galvanized.
  - 9. Shop Primer: SSPC Paint 15, Type 1, red oxide.
  - 10. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type II Organic.
- D. Stainless Steel:
  - 1. Satin-Polished Finish: Number 4, satin directional polish parallel with long dimension of finished face.
  - 2. Mirror-Polished Finish: Number 8, mirror polish with preliminary directional polish lines removed.
- E. Aluminum:
  - 1. Prefinished extruded items finish:
    - a. Two-Coat Polyvinylidene fluoride (PVDF): AAMA 2605. Polyvinylidene fluoride finish containing not less than 70 percent PVDF resin (Kynar 500) by weight in color coat.
    - b. Color: As selected by Architect from manufacturer's full range
  - 2. Finish coatings to conform to AAMA 611. Comply with AA DAF-45.

3. Exterior Aluminum Surfaces: AAMA A41 anodized, prepared with mechanical or chemical pretreatment, anodized to clear color.
4. Interior Aluminum Surfaces: AAMA A41 anodized, prepared with mechanical or chemical pretreatment, anodized to clear color.
5. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

## **PART 4 - EXECUTION**

### **4.1 INSTALLATION**

- A. Field weld components indicated on Drawings and Shop Drawings. Do not weld exterior units that have been hot-dip galvanized after fabrication.
- B. Obtain approval of Engineer prior to Site cutting or making adjustments not scheduled.

**END OF SECTION 055000**

## **SECTION 061000 - ROUGH CARPENTRY**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

A. This Section includes the following:

1. Wood blocking.
2. Plywood Sheathing.

#### **1.2 SUBMITTALS**

A. Product Data: For each type of process and factory-fabricated product.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood.

### **PART 2 - PRODUCTS**

#### **2.1 WOOD PRODUCTS, GENERAL**

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide dressed lumber, S4S, unless otherwise indicated.

#### **2.2 WOOD-PRESERVATIVE-TREATED LUMBER**

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry, unless otherwise indicated:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood blocking and similar concealed members in contact with masonry or concrete.

### **2.3 MISCELLANEOUS LUMBER**

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  1. Blocking.
- B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content of any species.
- C. Plywood Sheathing:
  1. Backing Sheathing 5/8" thick. Standard B-C Interior Sheathing with Exterior Glue.
  2. Backing for Hardwood Veneer Plywood 1/4" thick. Standard B-C Interior Sheathing with Exterior Glue.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate blocking and similar supports to comply with requirements for attaching other construction.
- B. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

### **3.2 PROTECTION**

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

## **END OF SECTION 061000**

## SECTION 061600 - SHEATHING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Wall sheathing.
  - 2. Sheathing joint-and-penetration treatment.
  - 3. Flexible flashing at openings in sheathing.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
- B. Research/Evaluation Reports: For the following:
  - 1. Foam-plastic sheathing.
  - 2. Building wrap.

#### 1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

### PART 2 - PRODUCTS

#### 2.1 WALL SHEATHING

- A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
  - 1. Type and Thickness: **Type X**,  $\frac{5}{8}$  inch thick.

#### 2.2 FASTENERS

- A. General: Provide fasteners of size and type indicated.
  - 1. For wall sheathing panels, provide fasteners with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

## **2.3 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS**

- A. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, of type recommended by sheathing and tape manufacturers.

## **2.4 MISCELLANEOUS MATERIALS**

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with **ASTM D 3498** that is approved for use indicated by manufacturers of both adhesives and panels.
- B. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 0.025 inch.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
  - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's "Uniform Building Code."
  - 4. Table 2305.2, "Fastening Schedule," in BOCA's "BOCA National Building Code."
  - 5. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."
  - 6. Table R602.3 (1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
  - 7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One- and Two-Family Dwelling Code."
- B. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that exclude exterior moisture.
- C. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

### **3.2 GYPSUM SHEATHING INSTALLATION**

- A. Comply with GA-253 and with manufacturer's written instructions.
  - 1. Fasten gypsum sheathing to wood framing with **screws**.
  - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
  - 3. Install boards with a  $\frac{3}{8}$  inch gap where non-load-bearing construction abuts structural elements.
  - 4. Install boards with a  $\frac{1}{4}$  inch gap where they abut masonry or similar materials.

### **3.3 SHEATHING JOINT-AND-PENETRATION TREATMENT**

- A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed tape in sealant. Apply sealant to exposed fasteners. Seal other penetrations and openings.
3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

### **3.4 FLEXIBLE FLASHING INSTALLATION**

- A. Apply flexible flashing where indicated to comply with manufacturers written instructions.
  1. Lap seams and junctures with other materials at least 4 inches, except that at flashing flanges of other construction, laps need not exceed flange width.
  2. Lap flashing over weather-resistant building paper at bottom and sides of openings.
  3. Lap weather-resistant building paper over flashing at heads of openings.
  4. After flashing has been applied, roll surfaces with a hard rubber or metal roller.

**END OF SECTION 061600**



## **SECTION 072100 - THERMAL INSULATION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Cavity-wall insulation.
  - 2. Vapor retarders.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product test reports.
- D. Research/Evaluation Reports: For foam-plastic insulation.

#### **1.3 QUALITY ASSURANCE**

- A. Retain ASTM test method below based on product and kind of fire-resistance characteristic specified for each product in Part 2. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84 for surface-burning characteristics and other methods indicated with product, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

#### **2.2 FOAM-PLASTIC BOARD INSULATION**

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60 lb/cu. ft., with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:
  - 1. Available Manufacturers:

- a. DiversiFoam Products.
- b. Dow Chemical Company.
- c. Owens Corning.
- d. Pactiv Building Products Division.

## 2.3 VAPOR RETARDERS

- A. Vapor barrier shall have all of the following qualities:
  - 1. Maintain permeance of less than 0.03 Perms [grains/(ft<sup>2</sup> - hr - inHg)] as tested in accordance with mandatory conditioning test per ASTM eq745 Section 7.1 (7.1.1-7.1.5)
  - 2. Other performance criteria:
    - a. Strength: ASTM E1745 Class A.
    - b. Thickness: 10 mils minimum
  - 3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
- B. Vapor barrier products:
  - 1. Basis-Of-Design: Stego Wrap Class A Vapor Retarder (10-mil) by Stego Industries LLC., (877) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com), or comparable product by one of the following:
    - a. Raven Industries Inc., DURA – SKRIM.
    - b. Reef Industries Inc., Griffolyn.
- C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- D. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.
- E. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.
- F. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and with demonstrated capability to bond vapor retarders securely to substrates indicated.

## 2.4 AUXILIARY INSULATING MATERIALS

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

## 2.5 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate formed from perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square, welded to projecting copper-coated steel spindle

0.105 inch in diameter and of length capable of holding insulation of thickness indicated securely in position with 1-1/2-inch- square or diameter self-locking washers complying with the following requirements:

1. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel sheet, with beveled edge for increased stiffness.
- B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

### **3.2 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION**

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

### **3.3 INSTALLATION OF GENERAL BUILDING INSULATION**

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
  - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
  - 2. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
  - 3. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

### **3.4 INSTALLATION OF VAPOR RETARDERS**

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated.
- B. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- C. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

### **3.5 INSTALLATION OF FOAMED IN-PLACE INSULATION**

- A. Examination
  - 1. Verify existing conditions are ready to receive work.
  - 2. Beginning of application implies acceptance of existing conditions.
- B. Preparation
  - 1. Apply required primers for special conditions as recommended by manufacturer.
- C. Application
  - 1. Apply in accordance with ASTM C1029 and manufacturer's installation guidelines.

**END OF SECTION 072100**

## **SECTION 079200 - JOINT SEALANTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
  - 1. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 2. Interior joints in horizontal traffic surfaces.

#### **1.2 SUBMITTALS**

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Preconstruction field test reports.
- D. Compatibility and adhesion test reports.
- E. Product test reports.

#### **1.3 PERFORMANCE REQUIREMENTS**

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

#### **1.4 QUALITY ASSURANCE**

- A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- B. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 and in accordance with manufacturer's field adhesion test procedure (see Section 1.5.B); each that is appropriate for the types of Project joints.
- C. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

## **1.5 WARRANTY**

- A. Special installer's warranty for sealant installed at exterior side of precast concrete wall panel joints: 5 years period from date of Substantial Completion.
- B. Special manufacturer's warranty for sealant installed exterior side of precast concrete wall panel joints: 20 years from date of Substantial Completion (upon documentation of field adhesion tests as per the manufacturers field adhesion test procedure).
- C. Special Installer's Warranty for other sealants: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: 2 years from date of Substantial Completion.
- D. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: 10 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

### **2.2 MATERIALS, GENERAL**

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  1. Sealants: 250 g/L.
  2. Sealant Primers for Nonporous Substrates: 250 g/L.
  3. Sealant Primers for Porous Substrates: 775 g/L.

## 2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- D. Single-Component Neutral and Basic-Curing Silicone Sealant:
  - 1. Products:
    - a. Dow Corning Corporation; 790.
    - b. Tremco; Spectrem 1.
    - c. Pecora Corporation; 890.
    - d. GE Silicones; SilPruf NB SCS9000 NB.
  - 2. Type and Grade: S (single component) and NS (nonsag).
  - 3. Class: 100/50.
  - 4. Use Related to Exposure: NT (nontraffic).
  - 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
  - 6. Stain-Test-Response Characteristics: Non-staining to porous substrates per ASTM C 1248.
- E. Single-Component Neutral-Curing Silicone Sealant:
  - 1. Products:
    - a. Dow Corning Corporation; 799.
    - b. GE Silicones; UltraGlaze SSG4000.
    - c. GE Silicones; UltraGlaze SSG4000AC.
    - d. Tremco; Proglaze SG.
    - e. Tremco; Spectrem 2.
  - 2. Type and Grade: S (single component) and NS (nonsag).
  - 3. Class: 25.
  - 4. Use Related to Exposure: NT (nontraffic).
  - 5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
- F. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:
  - 1. Products:
    - a. Pecora Corporation; 898.
    - b. Tremco; Tremsil 600 White.
  - 2. Type and Grade: S (single component) and NS (nonsag).

3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

G. Single-Component Nonsag Urethane Sealant:

1. Products:
  - a. Sika Corporation, Inc.; Sikaflex - 1a.
  - b. Sonneborn, Division of ChemRex Inc.; Ultra.
  - c. Sonneborn, Division of ChemRex Inc.; NP 1.
  - d. Tremco; Vulkem 116.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, [G,] A, and, as applicable to joint substrates indicated, O.

H. Single-Component Pourable Urethane Sealant:

1. Products:
  - a. Sika Corporation, Inc.; Sikaflex - 1CSL.
  - b. Sonneborn, Division of ChemRex Inc.; SL 1.
  - c. Tremco; Vulkem Nova 300 SSL.
2. Type and Grade: S (single component) and P (pourable).
3. Class: 50.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, [G,] A, and, as applicable to joint substrates indicated, O.

I. Single-Component Pourable Urethane Sealant:

1. Products:
  - a. Bostik Findley; Chem-Calk 950.
  - b. Pecora Corporation; Urexpan NR-201.
  - c. Polymeric Systems Inc.; Flexiprene 952.
  - d. Schnee-Morehead, Inc.; Permthane SM7101.
  - e. Tremco; Tremflex S/L.
  - f. Tremco; Vulkem 45.
2. Type and Grade: S (single component) and P (pourable).
3. Class: 25.
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, [G,] A, and, as applicable to joint substrates indicated, O.



## **2.4 LATEX JOINT SEALANTS**

- A. Latex Sealant: Comply with ASTM C 834, Type O P, Grade NF.
- B. Products:
  - 1. Pecora Corporation; AC-20+.
  - 2. Schnee-Morehead, Inc.; SM 8200.
  - 3. Sonneborn, Division of ChemRex Inc.; Sonolac.
  - 4. Tremco; Tremflex 834.

## **2.5 ACOUSTICAL JOINT SEALANTS**

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
  - 1. Products:
    - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
    - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
    - c. Tremco; Tremco Acoustical Sealant
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
  - 1. Available Products:
    - a. Pecora Corporation; BA-98.
    - b. Tremco; Tremco Acoustical Sealant.

## **2.6 TAMPER PROOF SEALANTS**

- A. One component, non-sag, polyurethane sealant for tamper proof applications.
  - 1. Available Products:
    - a. Tremco HPL Sealant
    - b. Pecora DynaFlex SC
    - c. BASF MasterSeal CR 195

## **2.7 PREFORMED JOINT SEALANTS**

- A. Preformed Silicone-Sealant System: Manufacturer's standard system consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.
  - 1. Products:
    - a. Dow Corning Corporation; 123 Silicone Seal.
    - b. GE Silicones; UltraSpan US1100.

- c. Pecora Corporation; Sil-Span.
  - d. Tremco; Spectrem Ez Seal.
- B. Pre-Compressed Foam Sealants: Manufacturer's standard mildew-resistant, non-migratory, preformed, pre-compressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent. Custom size ¾" x 2" for precast concrete wall panel joints.
- 1. Provide following product or equal product that meets specified performance criteria in this section:
    - a. EMSEAL Joint Systems, Ltd.; Backerseal
  - 2. Pre-compressed sealant shall be pre-formed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, polymer-modified 100% acrylic dispersion.
  - 3. Material shall be capable of movements of +25%, -25% (50% total) of nominal material size.
  - 4. At precast concrete joints, pre-compressed sealant to be installed in two layers as shown on drawings at depth sufficient to allow installation of properly sized backer rod and liquid sealant in front of material.
  - 5. Pre-Compressed foam sealant must be supplied pre-compressed to less than the joint size, packaged in reels or shrink-wrapped lengths (sticks) with a mounting adhesive on one face, for ease of installation.

## **2.8 JOINT-SEALANT BACKING**

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C closed-cell material with a surface skin and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26°F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## **2.9 MISCELLANEOUS MATERIALS**

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
    - a. Clean, porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
  - 2. Remove laitance and form-release agents from concrete.
    - a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### **3.2 INSTALLATION**

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- G. Installation of Preformed Silicone-Sealant System: Comply with manufacturer's written instructions.
- H. Installation of Pre-Compressed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. Install in complete accordance with sealant manufacturer's written instructions. No drilling, or screwing, or fasteners of any type are permitted to anchor the system into the substrate.
- I. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### **3.3 JOINT-SEALANT SCHEDULE**

- A. Joint-Sealant Application: Exterior butt joints between metal panels.
1. Joint Sealant: Single-component neutral-curing silicone sealant.
  2. Joint-Sealant Color: Custom color as selected by Architect.
- B. Joint-Sealant Application: Exterior perimeter joints at louvers.
1. Joint Sealant: Single-component neutral-curing silicone sealant.
  2. Joint-Sealant Color: Custom color as selected by Architect.

- C. Joint-Sealant Application: Interior ceramic tile expansion, control, contraction, and isolation joints in horizontal traffic surfaces.
  - 1. Joint Sealant: Multicomponent non-sag urethane sealant, Multicomponent pourable urethane sealant or Single-component pourable urethane sealant.
  - 2. Joint-Sealant Color: From manufacturer's standard color chart.
  
- D. Joint-Sealant Application: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
  - 1. Joint Sealant: Single-component mildew-resistant neutral-curing silicone sealant.
  - 2. Joint-Sealant Color: From manufacturer's standard color chart.
  
- E. Joint-Sealant Application: Vertical joints on exposed surfaces of interior walls and partitions.
  - 1. Joint Sealant: Multicomponent non-sag urethane sealant, Single-component non-sag urethane sealant or Latex sealant.
  - 2. Joint-Sealant Color: From manufacturer's standard color chart.
  
- F. Joint-Sealant Application: Perimeter joints between interior wall surfaces and frames of interior doors and windows.
  - 1. Joint Sealant: Latex sealant.
  - 2. Joint-Sealant Color: From manufacturer's standard color chart.

**END OF SECTION 079200**

## **SECTION 081113 - HOLLOW METAL FRAMES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
1. Hollow metal frames.
  2. Factory machining for hardware.
- B. Related Sections:
1. Section 099000 – Painting and Coating for field painting hollow metal frames.
- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI/SDI A250.8 – Recommended Specifications for Standard Steel Doors and Frames
  2. ANSI/SDI A250.4 – Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcing
  3. ANSI/SDI A250.6 – Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
  4. ANSI/SDI A250.10 – Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
  5. ANSI/SDI A250.11 – Recommended Erection Instructions for Steel Frames.
  6. ASTM A1008 – Standard Specification for Steel Sheet, Cold-rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
  7. ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  8. ANSI/BHMA A156.15 – Hardware Preparation in Steel Doors and Frames.
  9. ANSI/SDI 122 – Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
  10. ANSI/NFPA 80 – Standard for Fire Doors and Fire Windows; National Fire Protection Association.
  11. ANSI/NFPA 105 – Standard for the Installation of Smoke Door Assemblies.
  12. NFPA 252 – Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
  13. UL 10C – Positive Pressure Fire Tests of Door Assemblies; UL 1784 – Standard for Air Leakage Tests of Door Assemblies.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include construction details, materials descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  2. Locations of reinforcement and preparations for hardware

3. Details of anchorages, joints, field splices, and connections
4. Details of accessories
5. Details of moldings, removable stops, and glazing
6. Details of conduit and preparations for power, signal and control systems.

### **1.3 QUALITY ASSURANCE**

- A. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to UL 10C.
  1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide frames that have a maximum transmitted temperature end point of not more than 450°F above ambient after 30 minutes of standard fire-test exposure.
  2. Smoke Control Doors Assemblies: Frames to bear “S” label and include smoke and draft control gasketing applied to frame.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

### **1.5 PROJECT CONDITIONS**

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

### **1.6 COORDINATION**

- A. Coordinate installation of anchors for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchors. Deliver such items to Project site in time for installation.

### **1.7 WARRANTY**

- A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace frames that fail in materials or workmanship within specified warranty period. Warranty includes installation and finishing that may be required due to repair or replacement of defective frames.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ceco Door Products; an Assa Abloy Group Company.
  - 2. Amweld Building Products, LLC
  - 3. Steelcraft; an Ingersoll-Rand Company.
  - 4. Curries Company

### **2.2 MATERIALS**

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.
- B. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- D. Glazing: Division 08 Section "Glazing."

### **2.3 STANDARD HOLLOW METAL FRAMES**

- A. General: Comply with ANSI/SDI A250.8.
- B. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
  - 1. Fabricate frames with mitered or coped corners.
  - 2. Fabricate frames with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
  - 3. Frames for Wood Doors: Minimum 16 gauge (0.053-inch-) thick steel sheet.
  - 4. Frames for Borrowed Lights: Minimum 16 gauge (0.053-inch-) thick steel sheet
- C. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- D. Hardware Reinforcement: ANSI/SDI A250.6 Table 4 with reinforcement plates from same materials as frame.

### **2.4 FRAME ANCHORS**

- A. Jamb Anchors:
  - 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick.



## 2.5 STOPS AND MOLDINGS

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricators shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated. Provide fixed frame moldings and stops on secure side of interior doors and frames.
- C. Loose Stops for Glazed Lites in Frames: Minimum 20 gauge (0.032 inch) thick, same material as frames.

## 2.6 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.
- C. Silencers: Frames shall be supplied with factory-installed rubber silencers.

## 2.7 FABRICATION

- A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- B. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
    - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
  - 2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  - 5. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches high.
      - 2) Four anchors per jamb from 60 to 90 inches high.
      - 3) Five anchors per jamb from 90 to 96 inches high.
      - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

- 5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
- 6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.
  - a. Single-Door Frames: Three door silencers.
  - b. Double-Door Frames: Two door silencers.
- C. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
  - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  - 2. Reinforce frames to receive nontemplated, mortised and surface-mounted door hardware.
  - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  - 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 electrical Sections.

## **2.8 STEEL FINISHES**

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
  - 1. Shop Primer: ANSI/SDI A250.10.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-protection-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install frames with removable glazing stops located on secure side of opening.
    - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.

4. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
5. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
  - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
  - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

### **3.2 ADJUSTING AND CLEANING**

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

**END OF SECTION 081113**

## **SECTION 090561 - COMMON WORK RESULTS FOR FLOORING PREPARATION**

### **PART 1 – GENERAL**

#### **1.1 SECTION INCLUDES**

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
  - 1. Luxury Vinyl Tile.
  - 2. Carpet tile.
- B. Removal of existing floor coverings.
- C. Preparation of new and existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Patching compound.
- F. Remedial floor coatings.
- G. Remedial floor sheet membrane.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 006325 – Product Substitution Request: Bid pricing for remediation treatments if required.

#### **1.3 SUBMITTALS**

- A. Visual Observation Report: For existing floor coverings to be removed.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
  - 1. Moisture and alkalinity (pH) limits and test methods.
  - 2. Manufacturer's required bond/compatibility test procedure.
- C. Testing Agency's Report:
  - 1. Description of areas tested; include floor plans and photographs if helpful.
  - 2. Summary of conditions encountered.
  - 3. Moisture and alkalinity (pH) test reports.
  - 4. Copies of specified test methods.
  - 5. Recommendations for remediation of unsatisfactory surfaces.
  - 6. Product data for recommended remedial coating.
  - 7. Submit report to Architect.
  - 8. Submit report not more than two business days after conclusion of testing.
- D. Adhesive Bond and Compatibility Test Report.
- E. Copy of RFCI (RWP).

#### **1.4 QUALITY ASSURANCE**

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
  - 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
  - 1. Provide access for and cooperate with testing agency.
  - 2. Confirm date of start of testing at least 10 days prior to actual start.

3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

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

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

### **1.6 FIELD CONDITIONS**

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

## **PART 2 – PRODUCTS**

### **2.1 MATERIALS**

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
  1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
  2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
  3. Products:
    - a. ARDEX Engineered Cements; ARDEX Feather  
Finish: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. H.B. Fuller Construction Products, Inc; TEC Feather Edge Skim  
Coat: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
    - c. USG Corporation; Durock Brand Advanced Skim Coat Floor  
Patch: [www.usg.com/#sle](http://www.usg.com/#sle).
    - d. Substitutions: See Section 016000 - Product Requirements.
- B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
  1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
  2. Use product recommended by testing agency.
- D. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to

degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

1. Tape: Types recommended by underlayment manufacturer to install membrane and cover seams.

## **PART 3 – EXECUTION**

### **3.1 CONCRETE SLAB PREPARATION**

- A. Perform following operations in the order indicated:
  1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
    - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
    - b. Removal of existing floor covering.
  2. Preliminary cleaning.
  3. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
  4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  5. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  6. Specified remediation, if required.
  7. Patching, smoothing, and leveling, as required.
  8. Other preparation specified.
  9. Adhesive bond and compatibility test.
  10. Protection.

### **3.2 REMOVAL OF EXISTING FLOOR COVERINGS**

- A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

### **3.3 PRELIMINARY CLEANING**

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

### **3.4 MOISTURE VAPOR EMISSION TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.
- F. Report: Report the information required by the test method.

### **3.5 INTERNAL RELATIVE HUMIDITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

### **3.6 ALKALINITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

### **3.7 PREPARATION**

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

### **3.8 ADHESIVE BOND AND COMPATIBILITY TESTING**

- A. Comply with requirements and recommendations of floor covering manufacturer.

### **3.9 APPLICATION OF REMEDIAL FLOOR COATING**

- A. Comply with requirements and recommendations of coating manufacturer.

### **3.10 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE**

- A. Install in accordance with sheet membrane manufacturer's instructions.

### **3.11 PROTECTION**

- A. Cover prepared floors with building paper or other durable covering.

## **END OF SECTION 090561**

## **SECTION 092216 - NON-STRUCTURAL METAL FRAMING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes non-load-bearing steel framing members for the following applications:
  - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
  - 2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

#### **1.2 SUBMITTALS**

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

#### **1.3 QUALITY ASSURANCE**

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. Sound Transmission Characteristics: For STC-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

### **PART 2 - PRODUCTS**

#### **2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL**

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
  - 2. Protective Coating: manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.

#### **2.2 SUSPENSION SYSTEM COMPONENTS**

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.



- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
  - 1. Depth: 2-1/2 inches.
- E. Furring Channels (Furring Members):
  - 1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
  - 2. Steel Studs: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.0312 inch.
    - b. Depth: 3-5/8 inches.
  - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base Metal Thickness: 0.0312 inch.
  - 4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
    - a. Configuration: Asymmetrical or hat shaped.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
  - 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. Armstrong World Industries, Inc.; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; 640-C Drywall Furring System.
    - c. USG Corporation; Drywall Suspension System.

### **2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES**

- A. Steel Studs and Runners: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: As indicated on Drawings.
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
  - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
  - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
  - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

- C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: 0.0312 inch.
- D. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
  - 1. Depth: 1-1/2 inches.
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base Metal Thickness: As indicated on Drawings.
  - 2. Depth: As indicated on Drawings.
- F. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
  - 1. Depth: As indicated on Drawings.
  - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
  - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch- diameter wire.
- G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

## **2.4 AUXILIARY MATERIALS**

- A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:
  - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
  - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Installation Standard: ASTM C 754.
  - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

### **3.2 INSTALLING SUSPENSION SYSTEMS**

- A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- B. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
  - 3. Do not attach hangers to steel roof deck.
  - 4. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  - 5. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- C. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- D. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

### **3.3 INSTALLING FRAMED ASSEMBLIES**

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb, unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.

- c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
- 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
  - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- C. Direct Furring:
  - 1. Screw to wood framing.
  - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

**END OF SECTION 092216**

## **SECTION 092900 - GYPSUM BOARD**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Interior gypsum board.
- B. Related work
  - 1. Specified elsewhere
    - a. Metal Framing specified in Section 092216.
    - b. Painting Section 099100.

#### **1.2 SUBMITTALS**

- A. Product Data/Samples
  - 1. Submit for Engineer/Architect's approval:
    - a. Manufacturer's data and/or catalog sheets clearly indicating products proposed for use.
    - b. Manufacturer's recommended installation instructions for each specific installation.

#### **1.3 QUALITY ASSURANCE**

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Contractor shall employ only skilled and experienced workmen/workwomen who are fully qualified in the installation of specified materials and shall provide a fully qualified superintendent or foreman who shall be present at all times during execution of this work.
- D. Application and Finishing Standards:
  - 1. Gypsum Association File 216.
  - 2. ASTM C840.

## **1.4 DELIVERY, STORAGE, HANDLING**

- A. All materials shall be delivered in their original unopened packages, properly labeled; stored and handled at job site in a manner to prevent damage in accordance with manufacturer's recommendations.
  - 1. Damaged or deteriorated materials shall not be used in the construction and shall be removed from the job site.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
- B. Provide in longest lengths practicable as will result in a minimum of joints.
- C. Provide recessed or tapered edge type for single layer application and for face layer of double layer application. Use square edge type for back-up layer of double layer application.
  - 1. Provide in thickness indicated on the drawings.
- D. General: Interior gypsum board complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

### **2.2 MANUFACTURERS**

- A. Acceptable Manufacturers:
  - 1. National Gypsum Company
  - 2. USG Corp.
  - 3. CertainTeed Corp.
  - 4. Georgia-Pacific Gypsum LLC

### **2.3 STANDARD GYPSUM BOARD**

- A. Basis-of-Design: National Gypsum Gold Bond Brand Gypsum Board
  - 1. Panel Physical Characteristics
    - a. Core: Regular gypsum core
    - b. Surface Paper: 100 percent recycled content paper on front, back and long edges
    - c. Long Edges: Tapered
    - d. Overall thickness: As shown on drawings
    - e. Panel complies with requirements of ASTM C 1396

## **2.4 TYPE "X" GYPSUM BOARD**

- A. Basis-of-Design: National Gypsum Gold Bond Fire-Shield Brand Gypsum Board
  - 1. Panel Physical Characteristics
    - a. Core: Type "X" gypsum core
    - b. Surface Paper: 100 percent recycled content paper on front, back and long edges
    - c. Long Edges: Tapered
    - d. Overall thickness: As shown on drawings
    - e. Panel complies with requirements of ASTM C 1396

## **2.5 MOISTURE RESISTANT XP TYPE GYPSUM BOARD**

- A. Basis-of-Design: National Gypsum Gold Bond Brand XP Gypsum Board
  - 1. Panel Physical Characteristics
    - a. Core: Mold and moisture resistant gypsum core
    - b. Surface paper: 100 percent recycled content moisture/mold/mildew resistant paper on front, back, and long edges Long Edges: Tapered
    - c. Overall thickness: As shown on drawings
    - d. Panel complies with requirements of ASTM C 1396
    - e. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273
    - f. For use at toilet rooms and wet walls.

## **2.6 TRIM ACCESSORIES**

- A. Interior Trim: ASTM C 1047.
  - 1. Material: Formed from zinc-coated steel not lighter than 26 ga., comply with Fed Spec. QQ-S-775, Type I, Class D or E, as approved by the Engineer/Architect.
  - 2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.
    - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Exterior Trim: ASTM C 1047.
  - 1. Material: Hot-dip galvanized steel sheet, or rolled zinc.
  - 2. Shapes:
    - a. Cornerbead.
    - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

## **2.7 JOINT TREATMENT MATERIALS**

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape
  - 1. Interior Gypsum Wallboard: Paper.
  - 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
  - 3. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all purpose compound.
  - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
  - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
  - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Exterior Applications:
  - 1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

## **2.8 AUXILIARY MATERIALS**

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

## **PART 3 - EXECUTION**

### **3.1 GENERAL INSTALLATION AND WORKMANSHIP**

- A. Comply with all pertinent recommendations of the applicable standards and manufacturer's installation recommendations for each specific type application.



- B. Installation of all materials shall be fully qualified, experienced workmen/workwomen, skilled in application of gypsum wallboard to metal framed and/or wood framed structures and skilled in the application and finishing of joint treatment specified.
- C. Panels shall be secured to framing members with screws of proper type and size spaced maximum of 10" o.c.; or by a combination of screw attachment and adhesive as may be recommended by the manufacturer and approved by the Engineer/Architect.
- D. Wallboard for ceiling shall be installed first and shall be installed in longest lengths practicable with long dimension perpendicular to framing members and with joints staggered a minimum of two framing spaces between adjacent panel rows.
  - 1. Where cross furring is indicated on the drawings, install wallboard with long dimension perpendicular to furring.
  - 2. For double layer application, reverse direction between layers.
- E. At junction of wallboard partitions with other type materials, provide continuous full height length acoustical sealant bead between wallboard edge trim and adjacent material.
- F. Neatly cut and fit wallboard to all electrical boxes and other penetrations through wallboard and provide compound filter and/or sealant bead around same to form an effective seal between wallboard surface and finishing plates.

### **3.2 APPLYING AND FINISHING PANELS, GENERAL**

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load bearing partitions at structural abutments, except floors. Provide 1/4" wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

### **3.3 INSTALLING TRIM ACCESSORIES**

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on drawings, and according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners.
  - 2. Bullnose Bead: Use where indicated on drawings.
  - 3. LC-Bead: Use at exposed panel edges.
  - 4. L-Bead: Use where indicated.
  - 5. U-Bead: Use at exposed panel edges.
  - 6. Curved-Edge Cornerbead: Use at curved openings.

D. Exterior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

### **3.4 FINISHING GYPSUM BOARD**

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape. Tape and seal all joints and internal corners with reinforcing tape and joint compound. Apply tape and compound in strict accordance with manufacturer's directions and recommendations of the applicable standards.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  2. Level 2: Panels that are substrate for tile.
  3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in other Division 09 Sections.
  4. Level 5: In Conference rooms.
    - a. Primer and its application to surfaces are specified in other Division 09 Sections.
  5. All taped and filled joints, filled depressions at screws, filled corner beads, and areas around electrical outlet boxes and other wall penetrations shall be expertly feathered out onto panel faces and sanded perfectly smooth, fully acceptable for final painting or other finish.
    - a. Careful attention shall be given to all internal corners and areas around electrical outlet boxes.
    - b. Joints shall be feathered out a minimum of 12" and further as necessary to render joints undetectable under finish painted surfaces.
- E. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- F. Remove and replace panels that are wet, moisture damages, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

### **END OF SECTION 092900**

## **SECTION 096500 – RESILIENT FLOORING**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Resilient tile flooring.
- B. Resilient base.
- C. Installation accessories.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

#### **1.3 REFERENCE STANDARDS**

- A. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).
- B. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.

#### **1.4 SUBMITTALS**

- A. Shop Drawings: Indicate floor patterns.
- B. Verification Samples: Submit two samples, illustrating color and pattern for each resilient flooring product specified.
- C. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- D. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- E. Installer's Qualification Statement.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Extra Flooring Material: 20 square feet of each type and color.
  - 2. Extra Wall Base: 10 lineal feet of each type and color.

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

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
- D. Do not double stack pallets.

## **1.6 FIELD CONDITIONS**

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

## **PART 2 - PRODUCTS**

### **2.1 RESILIENT/LUXURY VINYL TILE**

- A. Luxury Vinyl Tile (LVT-1): Homogeneous, with color extending throughout thickness.
  - 1. Manufacturers; Subject to compliance with requirements, provide product as indicated as Basis of Design or a comparable product by one of the following:
    - a. Basis of Design: Patcraft; Timber Grove II 20 mil, glue down: [www.patcraft.com](http://www.patcraft.com).
    - b. Parallel USA 20, Armstrong. [www.armstrongflooring.com](http://www.armstrongflooring.com)
    - c. Mannington Select – Wood, Mannington, [www.mannington.com](http://www.mannington.com)
    - d. Contour Wood, Tarkett, [commercial.tarkett.com](http://commercial.tarkett.com)
  - 2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
  - 3. Size: 5.96 by 48 inch (15.1 cm by 121.9 cm).
  - 4. Thickness: 0.098 inch (2.5 mm).
  - 5. Color: Boxwood 00766.

### **2.2 RESILIENT BASE**

- A. Resilient Base (RES-: ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled.
  - 1. Manufacturers:
    - a. Basis of Design: Johnsonite, a Tarkett Company; [www.johnsonite.com](http://www.johnsonite.com). Subject to compliance with requirements, provide product as indicated in the specification or a comparable product by one of the following:
      - 1) Mannington Commercial.
      - 2) Shaw Contract.
      - 3) Tarkett.

2. Height: 4 inch (100 mm).
3. Thickness: 0.125 inch (3.2 mm).
4. Finish: Satin.
5. Length: Roll.
6. Color: 167 Fudge
7. Accessories: Pre-molded external corners and internal corners.

### **2.3 ACCESSORIES**

- A. Subfloor Preparation: Abatement chemical residue removal as recommended by manufacturer.
- B. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- C. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- D. Moldings, Transition and Edge Strips: Same material as flooring.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  1. Test in accordance with Section 090561.
  2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
  3. Follow moisture and alkalinity remediation procedures in Section 090561.
- D. Verify that required floor-mounted utilities are in correct location.

### **3.2 PREPARATION**

- A. Prepare floor substrates for installation of flooring in accordance with Section 090561.

### **3.3 INSTALLATION – GENERAL**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:

1. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions.
  2. Fit joints and butt seams tightly.
  3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- F. Install flooring in recessed floor access covers, maintaining floor pattern.
- G. At movable partitions, install flooring under partitions without interrupting floor pattern.

### **3.4 INSTALLATION – TILE FLOORING**

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. Install square tile to stacked pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

### **3.5 INSTALLATION – RESILIENT BASE**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Miter internal corners. At external corners, use pre-molded units. At exposed ends, use pre-molded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

### **3.6 CLEANING**

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

### **3.7 PROTECTION**

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

## **END OF SECTION 096500**

## **SECTION 099000 – PAINTING AND COATING**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Surface preparation.
- B. Interior painting and coating systems.
- C. Scope:
  - a. Interior:
    - i. Masonry CMU: Concrete, split face, scored, smooth, high density, low density, and fluted.
    - ii. Metal: Structural steel columns, joists, trusses, beams, miscellaneous and ornamental iron, structural iron, and ferrous metal.
    - iii. Drywall: Walls, ceilings, gypsum board, and similar items.

#### **1.2 REFERENCE STANDARDS**

- A. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- B. SSPC-SP 6 - Commercial Blast Cleaning 2007.

#### **1.3 SUBMITTALS**

- A. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
  - 2. MPI product number (e.g., MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- B. Samples: Submit two paper draw down samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
  - 2. Label each container with color in addition to manufacturer's label.

#### **1.4 QUALITY ASSURANCE**

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

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

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, product name, product code, color designation, VOC content, batch date, environmental handling, surface preparation, application, and use instructions.
- C. Paint Materials: Store at a minimum of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

## **1.6 FIELD CONDITIONS**

- A. Do not apply materials when environmental conditions are outside the ranges required by manufacturer.
- B. Follow manufacturer's recommended procedures for producing the best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Basis of Design Products: Subject to compliance with requirements, provide Sherwin-Williams Company (The) products indicated; [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
- B. Comparable Products: Products of approved manufacturers will be considered from the following manufacturers:
  - 1. Other Acceptable Manufacturers:
    - a. Benjamin Moore.
    - b. PPG Architectural Coatings.

### **2.2 PAINTINGS AND COATINGS**

- A. General:
  - 1. Material Compatibility:
    - a. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
    - b. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
  - 2. Provide factory-mixed coatings unless otherwise indicated.
  - 3. Do not reduce, thin, or dilute coatings or add materials to coatings unless specifically indicated in manufacturer's instructions.
- B. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.



C. Colors as follows:

1. Repainting of existing walls: color to match
2. Store Room 116: color to match Sherwin Williams: SW 7043 Worldly Gray

## 2.3 PAINT SYSTEMS – INTERIOR

A. Masonry CMU: Concrete, split face, scored, smooth, high density, low density, and fluted.

1. Alkyd Systems, Water Based:

a. Semi-Gloss Finish:

- 1) 1st Coat: Sherwin-Williams PrepRite Block Filler, B25W25: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  - a) 75 to 125 sq ft/gal (1.8 to 3.1 sq m/L).
- 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  - a) 4 to 5 mils wet, 1.4 to 1.7 mils dry per coat.

B. Metal: Structural steel columns, joists, trusses, beams, miscellaneous and ornamental iron, structural iron, and ferrous metal.

1. Latex Systems:

a. Semi-Gloss Finish:

- 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
- 2) 5 mils wet, 2 mils dry per coat.
- 3) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Acrylic Semi-Gloss, B66-650 Series: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).

C. Drywall: Walls, ceilings, gypsum board, and similar items.

1. Epoxy Systems, Water Based:

a. Egg-Shel/Low Luster Finish:

- 1) 1st Coat: Benjamin Moore Ultra Spec 500 Interior Latex Primer, B28W2600: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  - a) 4 mils wet, 1.5 mils dry per coat.
- 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45 Series: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  - a) 4 mils wet, 1.5 mils dry per coat.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

- C. Test shop-applied primer for compatibility with subsequent cover materials.

### **3.2 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove mildew from impervious surfaces by scrubbing with solution of water and bleach. Rinse with clean water and allow surface to dry.
- D. Gypsum Board: Fill minor defects with filler compound; sand smooth and remove dust prior to painting.
- E. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Prime bare steel surfaces.
  - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended by paint manufacturer and blast cleaning according to SSPC-SP 6. Protect from corrosion until coated.

### **3.3 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions.
- C. Apply coatings at spread rate required to achieve manufacturer's recommended dry film thickness.
- D. Regardless of number of coats specified, apply additional coats until complete hide is achieved.

### **3.4 PRIMING**

- A. Apply primer to all surfaces unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.
- B. Primers specified in painting schedules may be omitted on factory primed or factory finished items, if acceptable to top coat manufacturers.

### **3.5 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.

- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

### **3.6 PROTECTION**

- A. Protect finished coatings from damage until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION 099000**

## **SECTION 102600 – WALL PROTECTION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Corner guards.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include sections, details, and attachments to other work.
- C. Samples: For each type of unit and for each color and texture required.
- D. Maintenance data.

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

- A. Store plastic wall-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70°F.

#### **1.4 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall-protection units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Manufacturer's Limited Lifetime Warranty.

## **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. Basis-of-Design Product: The design for each impact-resistant wall-protection unit is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

### **2.2 MATERIALS**

- A. Extruded Rigid Plastic: High-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout.
- B. Aluminum Extrusions: ASTM B 221.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M.
- D. Fasteners: Aluminum, nonmagnetic stainless steel, or other noncorrosive metal; security-type where exposed to view.

### **2.3 CORNER GUARDS**

- A. Surface-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
  - 1. Basis-of-Design Product: IPC Door and Wall Protection Systems; Division of InPro Corporation, Model 150 Surface Mount Corner Guard or a comparable product by one of the following:
  - 2. Acceptable Comparable Manufacturers:
    - a. Construction Specialties, Inc.
    - b. Korogard Wall Protection Systems; Division of RJF International Corporation.
  - 3. Cover: Extruded rigid plastic, minimum .080" wall thickness; as follows:

- a. Profile: Nominal 3” wings.
  - b. Height: 4 feet.
  - c. Color and Texture: As selected by Architect from manufacturer's full range. Maximum of three colors will be selected.
4. Retainer: Minimum 0.070-inch- thick, 1-piece, extruded aluminum.
  5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.
- B. Install impact-resistant wall-protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
  1. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
- C. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- D. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

## **END OF SECTION 102600**

## **SECTION 221116 - DOMESTIC WATER PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
  - 2. Specialty valves.
  - 3. Flexible connectors.

#### **1.2 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

### **PART 2 - PRODUCTS**

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

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
  - 1. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
  - 2. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

#### **2.2 PIPING JOINING MATERIALS**

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

#### **2.3 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are 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 shutoff valve immediately upstream of each dielectric fitting.
- C. Install domestic water piping level and plumb.

- D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- E. 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.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- G. Install piping adjacent to equipment and specialties to allow service and maintenance.
- H. Install piping to permit valve servicing.
- I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

## **2.4 JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

## **2.5 HANGER AND SUPPORT INSTALLATION**

- A. Vertical Piping: MSS Type 8 or 42, clamps.
- B. Individual, Straight, Horizontal Piping Runs:
  1. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
  2. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
  3. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.



## 2.6 FIELD QUALITY CONTROL

- A. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
- B. Piping Tests:
  - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
  - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
- C. Domestic water piping will be considered defective if it does not pass tests.

## 2.7 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
- B. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

## 2.8 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

- C. Aboveground domestic water piping, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L, cast or wrought copper solder-joint fittings; and soldered joints.

**END OF SECTION 221116**

## **SECTION 223100 – DOMESTIC WATER SOFTENERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes house hold water softeners.
  - 1. Chemicals.
  - 2. Water testing kits.

#### **1.2 SUBMITTALS**

- A. Product Data: Include rated capacities, operating characteristics, dimensions, piping system connection, furnished specialties, and accessories.
- 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.

#### **1.4 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Salt for Brine Tanks: Furnish crystallized solar salt and at least two times original load.. Deliver on pallets in 40- or 50-lbpackages.
  - 2. Store salt on raised platform where directed by Owner. Do not store in contact with concrete floor.

### **PART 2 - PRODUCTS**

#### **2.1 HOUSEHOLD WATER SOFTENERS**

- A. Available Manufacturers:
  - 1. Alamo Water Refiners, Inc.
  - 2. CSI Water Treatment Systems; a division of Chandler Systems, Inc.
  - 3. Culligan International Company.
  - 4. CUNO Incorporated.
  - 5. Diamond Water Conditioning.
  - 6. EcoWater Systems, Inc.
  - 7. Flint & Walling, Inc.; a subsidiary of Zoeller Co.
  - 8. Ion Exchange Products, Inc.

9. Kinetico Incorporated.
10. Marlo, Inc.
11. Plymouth Products, Inc.
12. Rainsoft Div.; Aquion Partners L.P.
13. Springsoft Intl., Inc.
14. Water Soft, Inc.

B. Description: Factory-assembled, fully-automatic, pressure-type water softener.

1. Configuration: Unit with one mineral tank and one brine tank or cabinet-style, combination mineral and brine tank unit with equivalent characteristics.
2. Mineral Tank: Steel or FRP, with coating or liner suitable for potable-water service and 125-psig minimum pressure rating.
3. Comply with NSF 61, "Drinking Water System Components--Health Effects."
4. Controls: For fully automatic operation.
5. Brine Tank: Combination measuring and wet-salt storing system.
  - a. Tank and Cover Material: FRP or molded PE.
  - b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawn and freshwater refill.
  - c. Size: Large enough for at least two regenerations at full salting.
6. Factory-Installed Accessories:
  - a. Piping, valves, tubing, and drains.
  - b. Sampling cock.
  - c. Main-operating-valve position indicator.

C. Capacity and Characteristics:

1. Service: Household.
2. Continuous Service Flow Rate: 9 gpm at 15-psig pressure drop.
3. Mineral Quantity: 1 cu. ft..
4. Mineral Exchange Capacity: 31,000 grains@ 12 lb of salt.
5. Electrical Characteristics:
  - a. Volts: 120.
6. Salt Capacity: 250 lb.

## 2.2 CHEMICALS

- A. Salt for Brine Tanks: High-purity sodium chloride; free of dirt and foreign material. Rock and granulated forms are not acceptable.
1. Form: Processed, crystallized solar salt from shallow ponds and milled into irregular particles..

## **2.3 WATER TESTING SETS**

- A. Description: Manufacturer's standard water-hardness testing apparatus and chemicals with testing procedure instructions. Include metal container suitable for wall mounting.

## **PART 3 - EXECUTION**

### **3.1 WATER SOFTENER INSTALLATION**

- A. Install household water softeners on floor.
- B. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.
- C. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.
- D. Install water testing sets mounted on wall, unless otherwise indicated, and near water softeners.

### **3.2 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Make piping connections between water-softener-unit headers and dissimilar-metal water piping with dielectric fittings.
- D. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank
- E. Install pressure gages on raw-water inlet and soft-water outlet piping of each mineral tank.
- F. Install valved bypass water piping around water softeners.
- G. Install drains as indirect wastes to spill into open drains or over floor drains.

### **3.3 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning water softeners that do not pass tests and inspections and retest as specified above.

- C. Add water to brine tanks and fill with salt.
- D. Sample water softener effluent after startup. and prepare certified test reports for required water performance characteristics. Comply with the following:
  - 1. ASTM D 1068, "Test Methods for Iron in Water."
  - 2. ASTM D 1126, "Test Method for Hardness in Water."

**END OF SECTION 223100**

## **SECTION 223400 – FUEL FIRED DOMESTIC WATER HEATERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following fuel-fired water heaters:
  - 1. Commercial, power-burner, storage, gas water heaters.
  - 2. Water heater accessories.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Operation and maintenance data.
- C. Warranty.

#### **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. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

#### **1.4 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including storage tank and supports.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  - 2. Warranty Period:
    - a. Commercial, Gas Water Heaters: Three years for the tank and one year on parts.

## PART 2 - PRODUCTS

### 2.1 COMMERCIAL, GAS WATER HEATERS

- A. Commercial, Power-Burner, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
1. Manufacturers:
    - a. American Water Heaters.
    - b. Rheem.
    - c. Smith, A. O. Water Products Company.
  2. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
    - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
    - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
  3. Factory-Installed, Storage-Tank Appurtenances:
    - a. Anode Rod: Non-sacrificial, powered anodes.
    - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
    - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
    - e. Jacket: Steel with enameled finish.
    - f. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
  4. Burner: Comply with UL 795 for power-burner water heaters and for natural-gas fuel.
    - a. Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
  5. Temperature Control: Adjustable thermostat.
  6. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
  7. Special Requirements: NSF 5 construction.
  8. Draft Hood: Draft diverter; complying with ANSI Z21.12.
  9. Energy Management System Interface: Normally closed dry contacts for enabling and disabling water heater.
- B. Capacity and Characteristics:



1. As specified on plan sheets.
2. Electrical Characteristics: As specified on plan sheets.
3. Minimum Vent Diameter: Per manufacturer's recommendations and National Fuel Gas Code, latest edition.

## **2.2 WATER HEATER ACCESSORIES**

- A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.
- B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.
- C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.
- D. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

## **PART 3 - EXECUTION**

### **3.1 WATER HEATER INSTALLATION**

- A. Install commercial water heaters on concrete bases.
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install gas water heaters according to NFPA 54.
  1. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
  2. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
  3. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.
- D. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial, water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains.
- F. Install thermometer on outlet piping of water heaters.
- G. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- H. Fill water heaters with water.

### **3.2 CONNECTIONS**

- A. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### **3.3 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections:
  - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

**END OF SECTION 223400**

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

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

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

#### **1.2 SUBMITTALS**

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

### **PART 2 - PRODUCTS**

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

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product 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. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product 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 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.

### **2.4 PRESSURE GAGES**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product 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. 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 where shown on the Drawings and in the following locations:
  - 1. Inlet and outlet of each boiler and chiller.
  - 2. Inlet and outlet of each hydronic heat exchanger.
  - 3. Inlet and outlet of each hydronic coil in air-handling units.
  - 4. Outside-air, return-air, and mixed-air ducts.
  
- B. 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. Air Ducts: 30 to 240 deg F, with 2-degree scale divisions.

### **3.2 GAGE APPLICATIONS**

- A. Install liquid-filled-case-type pressure gages at chilled- and condenser-water inlets and outlets of chillers.
  
- B. 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.
- F. Install magnetic-type flowmeter elements with at least minimum straight lengths of pipe upstream and downstream from element as prescribed by manufacturer's written instructions and where shown on Drawings.
- G. Install connection fittings for attachment to portable indicators in accessible locations.

### **3.4 CONNECTIONS**

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

### **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.

#### **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. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- B. Valve Sizes: Same as upstream piping unless otherwise indicated.
- C. 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.
- D. 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.

E. 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.

## 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 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.

## **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 for NPS 2-1/2 and smaller
  - 2. Shutoff Service: Butterfly valves for NPS 3 and larger
- 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 or solder-joint valve-end.
  - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  - 3. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends.

4. For Steel Piping, NPS 5 and Larger: Flanged ends.

**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 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. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Galvanized, Metallic Coatings: Pregalvanized 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, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## **PART 3 - EXECUTION**

### **3.1 HANGER AND SUPPORT APPLICATIONS**

- A. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- B. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- D. Use padded hangers for piping that is subject to scratching.
- E. 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.
- F. 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.
- G. 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.
- H. 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-joist 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.
- I. 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.
- J. 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.



- K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- M. 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 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

## **PART 1 - GENERAL**

### **1.1 SUMMARY**

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Valve tags.

### **1.2 SUBMITTAL**

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

### **1.3 QUALITY ASSURANCE**

- A. Handwritten identification for HVAC piping and equipment is specifically prohibited.

## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT LABELS**

A. 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.

- B. Label Content: Include equipment's Drawing designation or unique equipment number.

### **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: Red.
- 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.

## **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 VALVE TAGS**

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass beaded chain.
- B. Label Content: Include valve's Drawing designation.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Contractor is responsible for labeling pipe, equipment, and valves installed or modified as part of this project. Labeling existing pipe, equipment, and valves that are not modified as part of this project is not required.

### **3.2 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.

### **3.3 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on all equipment that is uniquely identified on the Drawings.
- B. Locate equipment labels where accessible and visible.

### **3.4 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. Condenser-Water Piping:
    - a. Background Color: White.
    - b. Letter Color: Blue.
  - 3. Heating Water Piping:
    - a. Background Color: Yellow.
    - b. Letter Color: Red.
  - 4. Refrigerant Piping:
    - a. Background Color: Green.
    - b. Letter Color: White.

### **3.5 DUCT LABEL INSTALLATION**

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
  - 1. Blue: For supply-air ducts.
  - 2. Yellow: For return-air ducts.
  - 3. Green: For outside-air ducts.
  
- B. Locate labels near points where ducts enter into basement air-handling unit.

### **3.6 VALVE TAG INSTALLATION**

- A. Install valve tags on all valves that are identified with a unique designation on the Drawings.

**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-air-volume systems.
  - 2. Hydronic Piping Systems:
    - a. Variable-flow systems.
  - 3. Verifying that automatic control devices are functioning properly.
  - 4. Reporting results of activities and procedures specified in this Section.

#### 1.2 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
- C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- E. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- F. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- G. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- H. TAB: Testing, adjusting, and balancing.
- I. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- J. Test: A procedure to determine quantitative performance of systems or equipment.
- K. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.



### **1.3 SUBMITTALS**

- A. Certified TAB Reports: Submit electronic copies of reports prepared, as specified in this Section.
- B. 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.

### **1.4 QUALITY ASSURANCE**

- A. TAB Firm Qualifications:
  - 1. Certified by AABC, NEBB, TABB.
  - 2. 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 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."
- 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.

### **1.5 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.

### **1.6 COORDINATION**

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

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

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine equipment performance data including fan and pump 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 AIR SYSTEMS**

- A. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- B. 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.
- C. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- D. Verify that motor starters are equipped with properly sized thermal protection.
- E. Check dampers for proper position to achieve desired airflow path.
- F. Check for airflow blockages.
- G. Check condensate drains for proper connections and functioning.
- H. Check for proper sealing of air-handling unit components.
- I. Check for proper sealing of air duct system.
- J. 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 fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
  - 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. 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.
  5. Obtain approval from Engineer 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.
  6. 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.
- K. 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.
- L. 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.
- M. 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.

### 3.4 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
1. Open all manual valves for maximum flow.
  2. Check expansion tank liquid level.
  3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
  4. Check flow-control valves for specified sequence of operation and set at indicated flow.
  5. Set differential-pressure control valves at the specified differential pressure.
  6. Set system controls so automatic valves are wide open to heat exchangers.
  7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
  8. Check air vents for a forceful liquid flow exiting from vents when manually operated.
- B. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
  2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
  3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  4. Report flow rates that are not within plus or minus 5 percent of design.
- C. Set calibrated balancing valves, if installed, at calculated presettings.
- D. Measure flow at all stations and adjust, where necessary, to obtain first balance.
1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- E. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- F. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
1. Determine the balancing station with the highest percentage over indicated flow.
  2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
  3. Record settings and mark balancing devices.
- G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- H. Measure the differential-pressure control valve settings existing at the conclusions of balancing.
- I. Take and report testing and balancing measurements in inch-pound (IP) units.

### **3.5 PROCEDURES FOR CHILLERS**

- A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
  2. If water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
  3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
  4. Power factor if factory-installed instrumentation is furnished for measuring kilowatt.
  5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatt.
  6. Capacity: Calculate in tons of cooling.

### **3.6 PROCEDURES FOR PUMP 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.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

### **3.7 PROCEDURES FOR DRY COOLERS**

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Measure fluid pressure drop between inlet and outlet.

### **3.8 PROCEDURES FOR HYDRONIC HEAT EXCHANGERS**

- A. Hydronic Heat Exchangers: Measure the following data for each heat exchanger:
  - 1. Entering and leaving water temperature on the heat rejection side.
  - 2. Entering and leaving water temperature on the process side.
  - 3. Water flowrates on both the heat rejection side and process side of the heat exchanger.
  - 4. Waterside pressure drops on both the condenser side and chilled water side of the heat exchanger.

### **3.9 PROCEDURES FOR PRESSURE CONTROL VALVES**

- A. Keep pressure control valves in the fully closed position until the primary pumps have reached their minimum specified pump speed.
- B. Measure the primary loop differential pressure.
- C. Once the primary pumps have reached their minimum specified pump speed, begin to open the pressure control valve to maintain the previously measured primary loop differential pressure setpoint. Measure flow in the primary loop supply and return pipes to ensure they are equal.

### **3.10 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 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. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- J. Note operation of electric actuators using spring return for proper fail-safe operations.

### **3.11 TOLERANCES**

- A. Set HVAC system air flow 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.

### **3.12 FINAL REPORT**

- A. General: Electronic copy in letter-quality font.
- B. Include a certification sheet in front, 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. Engineer's name and address.

6. Contractor's name and address.
7. Report date.
8. Signature of TAB firm who certifies the report.
9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
10. 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.
11. Nomenclature sheets for each item of equipment.
12. Notes to explain why certain final data in the body of reports varies from indicated values.
13. Test conditions for fans and pump performance forms including the following:
  - a. Settings for outside-, return-, and exhaust-air dampers.
  - b. Conditions of filters.
  - c. Cooling coil, wet- and dry-bulb conditions.
  - d. Fan drive settings including settings and percentage of maximum pitch diameter.
  - e. Settings for supply-air, static-pressure controller.
  - f. Any other system operating conditions that affect performance.

E. 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: Identify thermal conductivity, thickness, and jackets (both factory and field applied), for each type of product indicated.

#### **1.3 QUALITY ASSURANCE**

- A. Fire-Test-Response characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
  - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less and smoke-developed rating 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 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

#### **1.5 COORDINATION**

- A. Coordinate size and location of supports, hangers, and insulation shields.

- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## **1.6 SCHEDULING**

- A. Schedule insulation application after testing piping systems. Insulation application may begin on segments of piping that have satisfactory test results.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Mineral-Fiber Insulation:
    - a. CertainTeed Manson.
    - b. Knauf FiberGlass GmbH.
    - c. Owens-Corning Fiberglas Corp.
    - d. Schuller International, Inc.

### **2.2 INSULATION MATERIALS**

- A. 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. Flexible Elastomeric insulation to be used for refrigerant piping only.
- B. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
  - 1. Preformed Pipe Insulation: Comply with ASTM C547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
  - 2. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
    - a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
    - b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
  - 3. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
  - 4. Mineral-Fiber Insulating Cements: Comply with ASTM C195.
  - 5. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C196.
  - 6. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C499/C 499M.

### **2.3 INTERIOR PIPING INSULATION JACKETS**

- A. General: ASTM C921, Type 1, unless otherwise indicated.
- B. Heavy Duty PVC Jackets on all piping within 10ft of finished floor in mechanical room.
- C. Heavy Duty PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- (0.5-mm-) thick, high-impact, ultraviolet-resistant PVC.
  - 1. Shapes: 45- and 90- degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
  - 2. Adhesive: As recommended by insulation material manufacturer.

### **2.4 EXTERIOR PIPING INSULATION JACKETS**

- A. General: ASTM C1729, Aluminum-alloy, smooth finish, unless otherwise indicated.
- B. All exterior piping to be provided with Aluminum-Alloy jacketing.
- C. Aluminum-Alloy Fitting Covers: Factory-fabricated fitting covers manufactured from 0.016-inch (0.41-mm-) thick, aluminum-alloy.
  - 1. Shapes: 45- and 90- degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, traps, mechanical joints, and P-trap.
  - 2. Adhesive: As recommended by insulation material manufacturer.

### **2.5 ACCESSORIES AND ATTACHMENTS**

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, pre-sized a minimum of 8 oz./sq.yd.
  - 1. Tape Width: 4 inches.
- B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
  - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
  - 2. Galvanized Steel: 0.005 inch thick.
  - 3. Aluminum: 0.007 inch thick.
  - 4. Brass: 0.010 inch thick.
  - 5. Nickel-Copper Alloy: 0.005 inch thick.
- C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

### **2.6 VAPOR RETARDERS**

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirement 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. Remove materials that will adversely affect insulation application.

### **3.3 GENERAL APPLICATION REQUIREMENTS**

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply 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. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- H. Keep insulation materials dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instruction for applying insulation over fittings, valves, and specialties.
- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
  2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
  3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shield over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- O. Apply insulation with integral jackets as follows:
1. Pull jacket tight and smooth.
  2. Circumferential Joints: Cover with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.
  3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
  4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
  5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

### 3.4 PENETRATIONS

- A. 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.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. 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.

### 3.5 MINERAL-FIBER INSULATION APPLICATION

#### A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

#### B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

#### C. Apply insulation to fittings and elbows as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When pre-molded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape or bands.
3. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

#### D. Apply insulation to valves and specialties as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When pre-molded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

- E. **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.

### **3.6 PIPING SYSTEM APPLICATIONS**

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. **Items Not Insulated:** Unless otherwise indicated, do not apply insulation to the following systems, materials and equipment:
1. Flexible connectors.
  2. Vibration-control devices.
  3. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

### **3.7 INSULATION APPLICATION SCHEDULE, GENERAL**

- A. Refer to insulation application schedules for required insulation materials, vapor retarders and field-applied jackets.
- B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

### **3.8 INTERIOR PIPING INSULATION APPLICATION SCHEDULE**

- A. **Service:** Chilled water:
1. Operating Temperature: 0 to 100 deg F.
  2. Insulation Material: Mineral fiber.

3. Insulation Thickness: Apply the following insulation thicknesses:
  - a. NPS 1-1/4 and Smaller: 1-1/2 inch thickness.
  - b. NPS 1-1/2 through 12: 2 inch thickness.
4. Jacket: PVC, within 10' from the floor level of all mechanical rooms.
5. Vapor Retarder Required: Yes.
6. Finish: None.

B. Condensate Water:

1. Operating Temperature: 0 to 100 deg F.
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: ½ inch thickness.
4. Jacket: PVC, within 10' from the floor level of all mechanical rooms.
5. Vapor Retarder Required: No.
6. Finish: None.

C. Refrigerant Suction and Liquid Piping:

1. Operating Temperature: -20 to 120 deg F.
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: ½ inch thickness.
4. Jacket: PVC, within 10' from the floor level of all mechanical rooms.
5. Vapor Retarder Required: Yes.
6. Finish: None.

### 3.9 EXTERIOR PIPING INSULATION APPLICATION SCHEDULE

A. Service: Condenser Water:

1. Operating Temperature: -20 to 120 deg F.
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: Apply the following insulation thicknesses:
  - a. NPS 1-1/4 and Smaller: 1-1/2 inch thickness.
  - b. NPS 1-1/2 through 12: 2 inch thickness.
4. Jacket: Aluminum-Alloy.
5. Vapor Retarder Required: Yes.
6. Finish: None.

B. Refrigerant Suction and Liquid Piping:

1. Operating Temperature: -20 to 120 deg F.
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: ½ inch thickness.
4. Jacket: Aluminum-Alloy.
5. Vapor Retarder Required: Yes.
6. Finish: None.

### 3.10 DUCT INSULATION APPLICATION SCHEDULE

A. Plenums and Ducts Requiring Insulation:



1. Indoor supply and outdoor air.
  2. Indoor return air.
  3. Outdoor, supply and return.
- B. Items Not Insulated:
1. Factory-insulated flexible ducts.
  2. Factory-insulated access panels and doors.
- C. Service: Exposed, Supply/Neutral/Return Air, rectangular, duct insulation shall be the following:
1. Mineral-Fiber Board: 1 inches thick and 6-lb/cu. ft. nominal density.

**END OF SECTION 230700**

## **SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes control equipment for HVAC systems and components.
- B. See Drawings for requirements that relate to this Section.

#### **1.2 SUBMITTALS**

- A. Product Data: For each control device 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.
- B. Facility has an existing instrumentation and control system. All additions and upgrades to be performed by original installer of the existing system.

### **PART 2 - PRODUCTS**

#### **2.1 CONTROL SYSTEM**

- A. Manufacturers:
  - 1. Schneider Electric by C&C Group. Please contact Brian Schepers at (573) 632-4247 or [bschepers@c-cgroup.com](mailto:bschepers@c-cgroup.com).
- B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

#### **2.2 DDC EQUIPMENT**

- A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation.
  2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    - a. Global communications.
    - b. Discrete/digital, analog, and pulse I/O.
    - c. Monitoring, controlling, or addressing data points.
    - d. Software applications, scheduling, and alarm processing.
    - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
- B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
  2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    - a. Global communications.
    - b. Discrete/digital, analog, and pulse I/O.
    - c. Monitoring, controlling, or addressing data points.
  3. Local operator interface provides for download from or upload to operator workstation.
- C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
  2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
  3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
  4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation.
  5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
  6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
  7. Universal I/Os: Provide software selectable binary or analog outputs.
- D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
  2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
  3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1000 V.
  2. Maximum response time of 10 nanoseconds.
  3. Minimum transverse-mode noise attenuation of 65 dB.
  4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

## 2.3 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
  
- B. Thermistor Temperature Sensors and Transmitters:
  - 1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. Ebtron, Inc.
    - c. Heat-Timer Corporation.
    - d. I.T.M. Instruments Inc.
    - e. MAMAC Systems, Inc.
    - f. RDF Corporation.
  - 2. Accuracy: Plus or minus 0.5 deg F at calibration point.
  - 3. Wire: Twisted, shielded-pair cable.
  - 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
  - 5. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft..
  - 6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
  
- C. RTDs and Transmitters:
  - 1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. Ebtron, Inc.
    - c. Heat-Timer Corporation.
    - d. I.T.M. Instruments Inc.
    - e. MAMAC Systems, Inc.
    - f. RDF Corporation.
  - 2. Accuracy: Plus or minus 0.2 percent at calibration point.
  - 3. Wire: Twisted, shielded-pair cable.
  - 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
  - 5. Averaging Elements in Ducts: 24 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
  - 6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
  
- D. Pressure Transmitters/Transducers:
  - 1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. General Eastern Instruments.
    - c. MAMAC Systems, Inc.
    - d. ROTRONIC Instrument Corp.
    - e. TCS/Basys Controls.
    - f. Vaisala.
  - 2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
    - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
    - b. Output: 4 to 20 mA.
    - c. Building Static-Pressure Range: 0- to 0.25-inch wg.
    - d. Duct Static-Pressure Range: 0- to 5-inch wg.

3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
6. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.

## 2.4 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.
- B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.
- C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- E. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- F. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

## 2.5 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
  1. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
  2. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
  3. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
  4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
  5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
  1. Manufacturers:
    - a. Belimo Aircontrols (USA), Inc.

- b. KMC Controls.
- c. Siemens.
- 2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
- 3. Dampers: Size for running torque calculated as follows:
  - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
  - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
  - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
  - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
  - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
  - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
- 4. Coupling: V-bolt and V-shaped, toothed cradle.
- 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
- 6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
- 7. Power Requirements (Two-Position Spring Return): 120-V ac.
- 8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
- 9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
- 10. Temperature Rating: Minus 22 to plus 122 deg F.
- 11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
- 12. Run Time: 12 seconds open, 5 seconds closed.

## 2.6 CONTROL VALVES

- A. Manufacturers:
  - 1. Danfoss Inc.; Air Conditioning & Refrigeration Div.
  - 2. Erie Controls.
  - 3. Hayward Industrial Products, Inc.
  - 4. Magnatrol Valve Corporation.
  - 5. Neles-Jamesbury.
  - 6. Parker Hannifin Corporation; Skinner Valve Division.
  - 7. Pneuline Controls.
  - 8. Sauter Controls Corporation.
- B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
- C. Hydronic system globe valves shall have the following characteristics:
  - 1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
  - 2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
  - 3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
    - a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
    - b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
  - 4. Sizing: 3-psig maximum pressure drop at design flow rate or the following:
    - a. Two Position: Line size.

- b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
    - c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
  - 5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
  - 6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.
- D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
- 1. Body Style: Lug.
  - 2. Disc Type: Nickel-plated ductile iron.
  - 3. Sizing: 1-psig maximum pressure drop at design flow rate.
- E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
- 1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
  - 2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
  - 3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
- F. Self-Contained Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
- 1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
  - 2. Thermostatic Operator: Liquid-filled remote sensor with remote adjustable dial.

## 2.7 FLOW METER

- A. Electronics Enclosure: Weathertight NEMA 4 aluminum enclosure.
- B. Sensing Method: Dual turbine electronic impedance sensing (non-magnetic and non-photoelectric) and frequency averaging circuitry.
- C. Flow Range: 0.1ft/s to 20 ft/s.
- D. Liquid Temperature Range: 15°F to 180°F.
- E. Ambient Temperature Range: -5°F to 160°F.
- F. Wetted Metal Components: Electroless nichel plated brass.
- G. Accuracy: Plus or minus 2 percent of reading from 0.4ft/s to 20ft/s.

## **PART 3 - EXECUTION**

### **3.1 ELECTRICAL WIRING AND CONNECTION INSTALLATION**

- A. Connect manual-reset limit controls independent of manual-control switch positions.
- B. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

### **3.2 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
  - 2. Test and adjust controls and safeties.
  - 3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
  - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
  - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
  - 6. Test each system for compliance with sequence of operation.
  - 7. Test software and hardware interlocks.
- C. DDC Verification:
  - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
  - 2. Check instruments for proper location and accessibility.
  - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
  - 4. Check instrument tubing for proper fittings, slope, material, and support.
  - 5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
  - 6. Check temperature instruments and material and length of sensing elements.
  - 7. Check control valves. Verify that they are in correct direction.
  - 8. Check DDC system as follows:
    - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    - c. Verify that spare I/O capacity has been provided.
    - d. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

### **3.3 DEMONSTRATION**

- A. Refer to requirements listed in Section 017900 "Demonstration and Training".



- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls.
  - 1. The training shall be for a minimum of four hours.
  - 2. The Owner shall provide four maintenance personnel to be trained by the factory-authorized service representative.

**END OF SECTION 230900**

## **SECTION 231123 – FACILITY NATURAL GAS PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Pipes, tubes, and fittings.
  - 2. Piping specialties.
  - 3. Piping and tubing joining materials.
  - 4. Valves.
  - 5. Pressure regulators.

#### **1.2 SUBMITTALS**

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

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Minimum Operating-Pressure Ratings:
  - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
  - 2. Service Regulators: 100 psig Insert value minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

#### **1.4 QUALITY ASSURANCE**

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. 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.

### **PART 2 - PRODUCTS**

#### **2.1 PIPES, TUBES, AND FITTINGS**

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.

3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
  - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

## 2.2 PIPING SPECIALTIES

### A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

### B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

### C. 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.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

### D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

## 2.3 JOINING MATERIALS

### A. Joint Compound and Tape: Suitable for natural gas.

### B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

### C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

## 2.4 MANUAL GAS SHUTOFF VALVES

- A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
1. CWP Rating: 125 psig.
  2. Threaded Ends: Comply with ASME B1.20.1.
  3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
  4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
  6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BrassCraft Manufacturing Company; a Masco company.
    - b. Conbraco Industries, Inc.; Apollo Div.
    - c. Lyall, R. W. & Company, Inc.
    - d. McDonald, A. Y. Mfg. Co.
    - e. Perfection Corporation; a subsidiary of American Meter Company.
  2. Body: Bronze, complying with ASTM B 584.
  3. Ball: Chrome-plated bronze.
  4. Stem: Bronze; blowout proof.
  5. Seats: Reinforced TFE; blowout proof.
  6. Packing: Threaded-body packnut design with adjustable-stem packing.
  7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  8. CWP Rating: 600 psig.
  9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- C. Bronze Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Lee Brass Company.
    - b. McDonald, A. Y. Mfg. Co.
  2. Body: Bronze, complying with ASTM B 584.
  3. Plug: Bronze.
  4. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  5. Operator: Square head or lug type with tamperproof feature where indicated.
  6. Pressure Class: 125 psig.
  7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

## 2.5 MOTORIZED GAS VALVES

A. Electrically Operated Valves: Comply with UL 429.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. ASCO Power Technologies, LP; Division of Emerson.
  - b. Dungs, Karl, Inc.
  - c. Eclipse Combustion, Inc.
  - d. Goyen Valve Corp.; Tyco Environmental Systems.
  - e. Magnatrol Valve Corporation.
  - f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
  - g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

## 2.6 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- a. Actaris.
  - b. American Meter Company.
  - c. Eclipse Combustion, Inc.
  - d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
  - e. Invensys.
  - f. Maxitrol Company.
  - g. Richards Industries; Jordan Valve Div.
3. Body and Diaphragm Case: Cast iron or die-cast aluminum.
  4. Springs: Zinc-plated steel; interchangeable.
  5. Diaphragm Plate: Zinc-plated steel.
  6. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
  7. Orifice: Aluminum; interchangeable.
  8. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
  9. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
  10. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
  11. Overpressure Protection Device: Factory mounted on pressure regulator.
  12. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
  13. Maximum Inlet Pressure: 5 psig.
- C. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Canadian Meter Company Inc.
    - b. Eaton Corporation; Controls Div.
    - c. Harper Wyman Co.
    - d. Maxitrol Company.
    - e. SCP, Inc.
  3. Body and Diaphragm Case: Die-cast aluminum.
  4. Springs: Zinc-plated steel; interchangeable.
  5. Diaphragm Plate: Zinc-plated steel.
  6. Seat Disc: Nitrile rubber.
  7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
  8. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
  9. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
  10. Maximum Inlet Pressure: 2 psig.

## 2.7 DIELECTRIC UNIONS

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

2. Central Plastics Company.
3. Hart Industries International, Inc.
4. McDonald, A. Y. Mfg. Co.
5. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
6. Wilkins; Zurn Plumbing Products Group.

- B. Minimum Operating-Pressure Rating: Insert pressure.
- C. Combination fitting of copper alloy and ferrous materials.
- D. Insulating materials suitable for natural gas.
- E. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

## **2.8 SLEEVES**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

## **2.9 MECHANICAL SLEEVE SEALS**

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico Inc.
    - c. Metraflex Company (The).
    - d. Pipeline Seal and Insulator, Inc.
  2. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
  3. Pressure Plates: Carbon steel.
  4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

## **2.10 LABELING AND IDENTIFYING**

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

## **PART 3 - EXECUTION**

### **3.1 INDOOR PIPING INSTALLATION**

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are 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.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. 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.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
  - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.



- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- S. Do not use natural-gas piping as grounding electrode.
- T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- U. Install pressure gage downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

### **3.2 VALVE INSTALLATION**

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

### **3.3 PIPING JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  2. Cut threads full and clean using sharp dies.
  3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
  5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
  1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
  2. Bevel plain ends of steel pipe.
  3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

### **3.4 HANGER AND SUPPORT INSTALLATION**

- A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
  1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.

2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- B. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
  2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
  3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

### **3.5 CONNECTIONS**

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

### **3.6 LABELING AND IDENTIFYING**

- A. Install detectable warning tape directly on gas piping.

### **3.7 FIELD QUALITY CONTROL**

- A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.8 INDOOR PIPING SCHEDULE**

- A. Aboveground, branch piping NPS 1 Inset pipe size and smaller shall be the following:
  1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
  1. Steel pipe with malleable-iron fittings and threaded joints.
  2. Steel pipe with wrought-steel fittings and welded joints.

- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

### **3.9 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- C. Valves in branch piping for single appliance shall be the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.

**END OF SECTION 231123**

## **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. Condenser-water piping.
  - 4. Makeup-water piping.
  - 5. Condensate-drain piping.
  - 6. Blowdown-drain piping.
  - 7. Air-vent piping.
  - 8. 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.
  - 5. Hydronic specialties.
- B. 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.
  - 2. Chilled-Water Piping: 125 psig at 200 deg F.
  - 3. Condenser-Water Piping: 125 psig at 150 deg F.
  - 4. Makeup-Water Piping: 80 psig at 150 deg F.
  - 5. Condensate-Drain Piping: 150 deg. F.
  - 6. Blowdown-Drain Piping: 200 deg F Insert temperature.
  - 7. Air-Vent Piping: 200 deg F Insert temperature.
  - 8. 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 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.

### **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.
- 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, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

## **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:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of 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.
  - 3. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Calpico, Inc.
    - b. Lochinvar Corporation.
    - c. Watts.
  - 2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

## **2.4 AIR CONTROL DEVICES**

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

C. Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested with taps fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
3. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
4. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- diameter gage glass, and slotted-metal glass guard.

D. In-Line Air Separators:

1. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
2. Maximum Working Pressure: Up to 175 psig.
3. Maximum Operating Temperature: Up to 300 deg F.

## 2.5 CHEMICAL TREATMENT

- A. Propylene Glycol: Pre-mixed, industrial grade with corrosion inhibitors and environmental-stabilizer additives for mixing with water in systems indicated to contain antifreeze or glycol solutions.
- B. Coordinate with Walter Louis Fluid Technologies.

## 2.6 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.

C. Test Plugs

1. Manufacturers:
  - a. Winters.
  - b. Petersen.
  - c. Watts.
2. 1/4 inch NPT or 1/2 inch NPT stainless steel fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with:
  - a. Neoprene core for temperatures up to 200 degrees F.
  - b. Nordel core for temperatures up to 350 degrees F.
  - c. Viton core for temperatures up to 400 degrees F.
3. Test Kit:
  - a. Carrying case, internally padded and fitted containing:
    - 1) One 3-1/2 inch diameter pressure gages.
    - 2) One gage adapters with 1/8 inch probes.
    - 3) Two 1-1/2 inch dial thermometers.

D. Flexible Connectors

1. Manufacturers:
  - a. Hosecraft.
  - b. Ferguson Enterprises, Inc.
  - c. Zoro.
2. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 500 psig.

E. Air Vents

1. Manufacturers:
  - a. Watts.
  - b. Bell and Gossett.
  - c. Honeywell.
2. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
3. Float Type:
  - a. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
4. Washer Type:
  - a. Brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

F. Strainers

1. Manufacturers:
  - a. Watts.
  - b. Bell and Gossett.
  - c. Honeywell.
2. Size 2 inch and Smaller:
  - a. Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.



3. Size 2-1/2 inch to 4 inch:
    - a. Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.
  4. Size 5 inch and Larger:
    - a. Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.
- G. Relief Valves
1. Manufacturers:
    - a. Watts.
    - b. Bell and Gossett.
    - c. Zoro.
  2. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

## **PART 3 - EXECUTION**

### **3.1 PIPING APPLICATIONS**

- A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:
  1. 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. 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. 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. Schedule 40 steel pipe; welded, mechanical joint coupling and fittings; and welded, mechanical joints.
- E. Condenser-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
  1. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- F. Makeup-water piping installed aboveground shall be the following:
  1. Type L, drawn-temper copper tubing, wrought-copper fittings, and pressure-seal or brazed joints.
- G. Condensate-Drain Piping: Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.
- H. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

- I. Air-Vent Piping:
  - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
  - 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- J. 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 with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

### **3.2 VALVE APPLICATIONS**

- A. Install shutoff-duty valves at each branch connection to supply and return mains, and at supply and return connection to each piece of equipment.
- B. Install check valves at each pump discharge and elsewhere as required to control flow direction.

### **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. Locate test plugs adjacent to thermometers and thermometer sockets.
- J. Where large air quantities accumulate, provide enlarged air collection standpipes.
- K. Install manual air vents at system high points.
- L. For automatic air vents in ceiling spaces or other concealed locations, install vent tubing to nearest drain.
- M. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

- N. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- O. Pipe relief valve outlet to nearest floor drain.
- P. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
- Q. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Clean and flush glycol system before adding glycol solution.
- R. Install piping to allow application of insulation.
- S. Select system components with pressure rating equal to or greater than system operating pressure.
- T. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- U. 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.
- V. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- W. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- X. 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.
- Y. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- Z. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- AA. 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.

### **3.4 HANGERS AND SUPPORTS**

- A. 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.
- B. 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.

C. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### **3.5 PIPE JOINT CONSTRUCTION**

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

### **3.6 HYDRONIC SPECIALTIES INSTALLATION**

- A. Install gage taps in piping.
- B. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage. Extend nipples to allow clearance from insulation.
- C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.
- D. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.
- E. Coil and conceal excess capillary on remote element instruments.
- F. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- G. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- H. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

- I. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- J. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.
- K. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.
- L. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.
- M. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.
  - 1. Install tank fittings that are shipped loose.
  - 2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

### **3.7 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.
- B. Notify Owner that system has been filled with fresh water and is ready for the water treatment contractor to assume responsibility for water treatment.
- C. Fill systems indicated to have pre-mixed glycol solution with the following concentrations:
  - 1. Dry Cooler Condenser-Water Piping: Inhibited propylene glycol and water solution mixed 30 percent glycol - 70 percent water, suitable for operating temperatures from 0 degrees F to 250 degrees F.
- D. Coordinate these instructions with Walter Louis Fluid Technologies.

### **3.8 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. Do not install hydronic pressure gauges until after systems are pressure tested.
  - 3. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 4. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 5. 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.

6. 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. Test the individual hydronic loops and confirm test results match all equipment manufacturer's written recommendations.
2. Open manual valves fully.
3. Inspect pumps for proper rotation.
4. Set makeup pressure-reducing valves for required system pressure.
5. 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).
6. Set temperature controls so all coils are calling for full flow.
7. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
8. Verify lubrication of motors and bearings.

**END OF SECTION 232113**

## **SECTION 232123 - HYDRONIC PUMPS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Close-coupled, in-line centrifugal pumps.
  - 2. Close-coupled, end-suction centrifugal pumps.

#### **1.2 SUBMITTALS**

- A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Operation and maintenance data.
- C. Warranty.

#### **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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

### **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 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS**

- A. Manufacturers:
  - 1. Armstrong Pumps Inc.
  - 2. Aurora Pump; Division of Pentair Pump Group.
  - 3. Bell & Gossett; Div. of ITT Industries.
  - 4. Patterson Pump Co.; a Subsidiary of The Gorman-Rupp Co.
  - 5. Peerless Pump; a Member of the Sterling Fluid Systems Group.

- B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 250-psig minimum working pressure and a continuous water temperature of 200 deg F.
- C. Pump Construction:
  - 1. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
  - 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
  - 3. Pump Shaft: Stainless steel.
  - 4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPT bellows and gasket. Include water slinger on shaft between motor and seal.
  - 5. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
  - 6. Pump Bearings: Permanently lubricated ball bearings.
- D. Motor: Single speed, with permanently lubricated ball bearings, unless otherwise indicated; and rigidly mounted to pump casing.

### 2.3 CLOSE-COUPLED, END-SUCTION CENTRIFUGAL PUMPS

- A. Manufacturers:
  - 1. Armstrong Pumps Inc.
  - 2. Aurora Pump; Division of Pentair Pump Group.
  - 3. Bell & Gossett; Div. of ITT Industries.
  - 4. Patterson Pump Co.; a Subsidiary of The Gorman-Rupp Co.
  - 5. Peerless Pump; a Member of the Sterling Fluid Systems Group.
- B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.
- C. Pump Construction:
  - 1. Casing: Radially split, cast iron, with replaceable bronze wear rings, drain plug at bottom and air vent at top of volute, threaded gage tappings at inlet and outlet, and flanged connections.
  - 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
  - 3. Pump Shaft: Stainless steel.
  - 4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPT bellows and gasket. Include water slinger on shaft between motor and seal.
  - 5. Pump Bearings: Permanently lubricated ball bearings.



6. Motor: Single speed, with permanently lubricated ball bearings, unless otherwise indicated; rigidly mounted to pump casing with integral pump support.

## **2.4 PUMP SPECIALTY FITTINGS**

- A. Suction Diffuser: Angle pattern, 300-psig pressure rating, cast-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory-fabricated support.
- B. Triple-Duty Valve (Close-Coupled, End Suction Centrifugal Pumps Only): Angle or straight pattern, 300-psig pressure rating, cast-iron body, pump-discharge fitting; with drain plug and bronze-fitted shutoff, balancing, and check valve features. Brass gage ports with integral check valve, and orifice for flow measurement.
- C. Circuit Setter (Close-Coupled, In-Line Centrifugal Pumps Only): Brass, full port ball valve with calibrated nameplate and memory stop, integrated pressure and temperature ports, and integrated valved readout ports. CSA, AB1953, and ANSI/NSF-61 certified.

## **PART 3 - EXECUTION**

### **3.1 PUMP INSTALLATION**

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.
- D. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- E. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of sufficient size to support pump weight. Fabricate brackets or supports as required.
- F. Suspend vertically mounted, in-line centrifugal pumps independent of piping. Install pumps with motor and pump shafts vertical. Use continuous-thread hanger rods and spring hangers with vertical-limit stop of sufficient size to support pump weight.
- G. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.
  1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches between pump base and foundation for grouting.
  2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

### **3.2 ALIGNMENT**

- A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.
- B. Comply with pump and coupling manufacturers' written instructions.
- C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."
- D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

### **3.3 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- D. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.
- E. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps.
- F. Support pump fittings with floor mounted pipe and flange supports.
- G. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- H. Install check valve and throttling valve on discharge side of pumps.
- I. Install suction diffuser and shutoff valve on suction side of pumps.
- J. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.
- K. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.

**END OF SECTION 232123**

## **SECTION 233113 – METAL DUCTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Sheet metal materials.
  - 3. Sealants and gaskets.
  - 4. Hangers and supports.

### **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 SHEET METAL MATERIALS**

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90.

## **2.3 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.

## **2.4 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 ducts with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- G. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- H. 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.
- I. 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. Fabricate ducts with galvanized sheet steel.
- B. 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."

**END OF SECTION 233113**

## **SECTION 233300 – AIR DUCT ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

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

#### **1.2 SUBMITTALS**

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

#### **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:
1. Air Balance Inc.; a division of Mestek, Inc.
  2. American Warming and Ventilating; a division of Mestek, Inc.
  3. Flexmaster U.S.A., Inc.
  4. McGill AirFlow LLC.
  5. METALAIRE, Inc.
  6. Nailor Industries Inc.
  7. Pottorff; a division of PCI Industries, Inc.
  8. Ruskin Company.
  9. Trox USA Inc.
  10. 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 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.

## **2.4 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. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- C. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

## **2.5 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.

## **2.6 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.

## **2.7 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 test holes at fan inlets and outlets and elsewhere as indicated.
- D. 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.
- E. Install access doors with swing against duct static pressure.
- F. 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.
- G. Install flexible connectors to connect ducts to equipment with an airflow over 2000 cfm.
- H. Install duct test holes where required for testing and balancing purposes.

**END OF SECTION 233300**

## **SECTION 233413 – AXIAL HVAC FANS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Tube axial 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. Dampers, including housings, linkages, and operators.
- B. Operation and Maintenance Data: For axial fans 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.

### **PART 2 - PRODUCTS**

#### **2.1 TUBE AXIAL 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. CaptiveAire.
  - 2. Carnes Company HVAC.
  - 3. Greenheck.
  - 4. Loren Cook Company.
- B. Direct-drive duct fan.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install axial fans level and plumb.
- B. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1/2 inch.
- C. Install units with clearances for service and maintenance.

### **3.2 CONNECTIONS**

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

**END OF SECTION 233413**

## **SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes ceiling- and wall-mounted 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.

### **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. Nailor Industries of Texas Inc.
  - 2. Price Industries.
  - 3. 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 235216 – CONDENSING BOILERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, water-tube condensing boilers, trim, and accessories for generating hot water.

#### **1.2 SUBMITTALS**

- A. Product Data: Include performance data, operating characteristics, furnished specialties, wiring diagrams, and accessories.
- B. Field quality-control test reports.
- C. Operation and maintenance data.
- D. Warranty.

#### **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. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
- C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
- D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
- E. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

#### **1.4 WARRANTY**

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within the manufacturer's standard warranty period.



## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- 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. Fulton Boiler Works, Inc.
  2. RBI; a division of Mestek, Inc.
  3. AERCO International.

### **2.2 MANUFACTURED UNITS**

- A. Description: Factory-fabricated, -assembled, and -tested, condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.
- B. Heat Exchanger: Stainless-steel designed to drain condensation to the bottom of the heat exchanger assembly. A built-in trap shall allow condensation to drain from the heat exchanger assembly.
- C. Burner: Modulating, natural gas, forced draft drawing from gas premixing valve.
- D. Blower: Variable speed to precisely control fuel/air mixture to achieve maximum efficiency at various firing rates.
- E. Gas Train: Combination gas valve with manual shutoff and pressure regulator.
- F. Ignition: Direct spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
- G. Integral Circulator: Cast-iron body and stainless-steel impeller sized for minimum flow required in heat exchanger.
- H. Casing:
1. Jacket: Sheet metal, with snap-in or interlocking closures.
  2. Control Compartment Enclosures: NEMA 250, Type 1A.
  3. Finish: Textured epoxy.
  4. Combustion-Air Connections: Inlet and vent duct collars.

### **2.3 TRIM**

- A. Aquastat Controllers: Operating firing rate, and high limit.
- B. Safety Relief Valve: ASME rated.
- C. Pressure and Temperature Gage: Minimum 3-1/2-inch- diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.

- D. Drain Valve: Minimum NPS 3/4 hose-end gate valve.
- E. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.

## 2.4 CONTROLS

- A. Boiler operating controls shall include the following devices and features:
  - 1. Control transformer.
  - 2. Set-Point Adjust: Set points shall be adjustable.
  - 3. Boiler shall include an electronic display for boiler set-up, boiler status, and boiler diagnostics.
  - 4. Boiler shall provide power to and control operation of boiler circulation pump.
- B. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
  - 1. High Cutoff: Automatic reset stops burner if operating conditions rise above maximum boiler design temperature.
  - 2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be automatic-reset type.
  - 3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
  - 4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
- C. Building Management System Interface: Factory install hardware and software to enable building management system to monitor, control, and display boiler status and alarms.
  - 1. A communication interface with building management system shall enable building management system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building management system.

## 2.5 ELECTRICAL POWER

- A. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
  - 1. House in NEMA 250, Type 1 enclosure.
  - 2. Wiring shall be numbered and color-coded to match wiring diagram.
  - 3. Install factory wiring outside of an enclosure in a metal raceway.
  - 4. Field power interface shall be to circuit breaker.
  - 5. Provide branch power circuit to each motor and to controls with a circuit breaker.
  - 6. Provide each motor with overcurrent protection.

## **2.6 VENTING KITS**

- A. Kit: Complete system, ASTM A 959, Type 29-4C stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant.
- B. Combustion-Air Intake: Complete system, stainless steel, pipe, vent terminal with screen, inlet air coupling, and sealant.

## **2.7 SOURCE QUALITY CONTROL**

- A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- C. If required by any local or state laws, complete and submit all safety inspection forms and submit to the responsible local or state agency and arrange/complete any required inspections. Any inspection permits and inspection fees related to any required local or state inspections are to be paid for by the Contractor. The Contractor is also responsible for any non-compliance fees assessed by the local or state agency governing safety of Boilers and Pressure Vessels

## **PART 3 - EXECUTION**

### **3.1 BOILER INSTALLATION**

- A. Install boilers level on concrete base.
- B. Vibration Isolation: Elastomeric isolation pads or mounts with a minimum static deflection of 0.25 inch.
- C. Install gas-fired boilers according to NFPA 54.
- D. Assemble and install boiler trim.
- E. Install electrical devices furnished with boiler but not specified to be factory mounted.
- F. Install control wiring to field-mounted electrical devices.

### **3.2 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
- D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service.

- E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- F. Connect hot-water piping to supply- and return-boiler tapplings with shutoff valve and union or flange at each connection.
- G. Install piping from safety relief valves to nearest floor drain.
- H. Boiler Venting:
  - 1. Install flue venting kit and combustion-air intake.
  - 2. Connect full size to boiler connections.
- I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### **3.3 FIELD QUALITY CONTROL**

- A. Engage a factory-authorized service representative to perform startup service.
- B. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
  - 1. Perform installation and startup checks according to manufacturer's written instructions.
  - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
    - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- D. Remove and replace malfunctioning units and retest as specified above.

### **3.4 DEMONSTRATION**

- A. Refer to requirements listed in Section 017900 "Demonstration and Training".
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers.

### **END OF SECTION 235216**

## **SECTION 235700 - HEAT EXCHANGERS FOR HVAC**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes plate heat exchangers.

#### **1.2 SUBMITTALS**

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Operation and Maintenance Data.
- C. Warranty.

#### **1.3 QUALITY ASSURANCE**

- A. ASME Compliance: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

### **PART 2 - PRODUCTS**

#### **2.1 GASKETED PLATE HEAT EXCHANGERS**

- A. Manufacturers:
  - 1. Alfa Laval Thermal, Inc.
  - 2. API Heat Transfer Inc.
  - 3. Armstrong Pumps, Inc.
  - 4. Invensys APV, Inc.
  - 5. ITT Industries; Bell & Gossett.
  - 6. Mueller, Paul Company.
  - 7. Polaris Plate Heat Exchangers.
  - 8. Tranter PHE, Inc.
  - 9. Taco.
- B. Configuration: Freestanding assembly consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets.
- C. Frame:
  - 1. Capacity to accommodate 20 percent additional plates.
  - 2. Painted carbon steel with provisions for anchoring to support.
- D. Top and Bottom Carrying and Guide Bars: Painted carbon steel, aluminum, or stainless steel.

- E. End-Plate Material: Painted carbon steel.
- F. Tie Rods and Nuts: Steel or stainless steel.
- G. Plate Material: 0.024 inch thick before stamping; Type 304 stainless steel.
- H. Gasket Material: Nitrile rubber or EPDM.
- I. Piping Connections:
  - 1. Threaded port for NPS 2 and smaller. For larger sizes, furnish end-plate port with threaded studs suitable for flanged connection.
- J. Enclose plates in a solid aluminum removable shroud.
- K. Minimum Efficiency: 95%.

## **2.2 REMOVABLE INSULATION JACKET**

- A. Manufacturers:
  - 1. Thermaxx Jackets.
  - 2. Standard Xchange a Xylem Brand.
  - 3. Madrass Insulation.
- B. Configuration: Blanket insulation custom designed to fit the heat exchanger provided. Provide with straps to secure insulation jacket to the heat exchanger.
  - 1. Design operating temperatures:
    - a. Internal temperature: 35°F
    - b. External temperature: 75°F
  - 2. Internal jacket material: EJ1650.
  - 3. External jacket material: EJ1650.
  - 4. Insulation material: Fiberglass or Mineral Wool.
  - 5. Minimum jacket r-value: 0.57 (ft<sup>2</sup>-°F-hr/Btu)
- C. Provide with internal vapor barrier.

## **PART 3 - EXECUTION**

### **3.1 HEAT-EXCHANGER INSTALLATION**

- A. Install heat exchangers on, and anchor to, concrete base.
- B. Connect chilled water and condenser water piping.
- C. Install insulation jacket.

### **3.2 CONNECTIONS**

- A. Install shutoff valves at heat-exchanger inlet and outlet connections.

- B. Install relief valves on heat-exchanger heated-fluid connection and install pipe relief valves, full size of valve connection, to floor drain.
- C. Install vacuum breaker at heat-exchanger steam inlet connection.
- D. Install hose end valve to drain shell.

**END OF SECTION 235700**

## **SECTION 236423 – SCROLL WATER CHILLERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Packaged, air-cooled, electric-motor-driven, scroll water chillers.

#### **1.2 SUBMITTALS**

- A. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Startup service reports.
- C. Operation and maintenance data.
- D. Warranty.

#### **1.3 QUALITY ASSURANCE**

- A. ARI Certification: Certify chiller according to ARI 590 certification program.
- B. ARI Rating: Rate water chiller performance according to requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
- C. ASHRAE Compliance:
  - 1. ASHRAE 15 for safety code for mechanical refrigeration.
  - 2. ASHRAE Guideline 3 for refrigerant leaks, recovery, and handling and storage requirements.
  - 3. ASHRAE/IESNA 90.1 for energy efficiency.
- D. Comply with NFPA 70.

#### **1.4 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship within specified period.
  - 1. Compressor Warranty Period: Five years from date of Substantial Completion.



## **PART 2 - PRODUCTS**

### **2.1 PACKAGED AIR-COOLED WATER CHILLERS**

- 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. Carrier Corporation.
  2. ClimaCool Corporation.
  3. Multistack, LLC.
- B. Description: Factory-assembled and run-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
- C. Cabinet:
1. Base: Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
  2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported from base.
  3. Casing: Galvanized steel.
  4. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 500-hour salt-spray test according to ASTM B 117.
  5. Sound-reduction package consisting of the following:
    - a. Acoustic sound blanket around digital compressors, designed to reduce sound level without affecting performance.
- D. Compressors:
1. Description: Positive-displacement direct drive with hermetically sealed casing.
  2. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
  3. Operating Speed: Nominal 3600 rpm for 60-Hz applications.
  4. Capacity Control: On-off compressor cycling or digital compressor where indicated on drawings.
  5. Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
  6. Vibration Isolation: Mount individual compressors on vibration isolators.
- E. Compressor Motors:
1. Hermetically sealed and cooled by refrigerant suction gas.
  2. High-torque, two-pole induction type with inherent thermal-overload protection on each phase.
- F. Compressor Motor Controllers:
1. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.
- G. Refrigeration:

1. Refrigerant: R-410a. Classified as Safety Group A1 according to ASHRAE 34.
2. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
3. Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
4. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.

H. Evaporator:

1. Brazed-plate design.
2. Brazed Plate:
  - a. Direct-expansion, single-pass, brazed-plate design.
  - b. Type 316 stainless-steel construction.
  - c. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
  - d. Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.

I. Air-Cooled Condenser:

1. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig.
  - a. Construct coils of copper tubes mechanically bonded to aluminum fins.
  - b. Coat coils with a baked epoxy corrosion-resistant coating after fabrication.
  - c. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
3. Fan Motors: Totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.
4. Fan Guards: Steel safety guards with corrosion-resistant coating.

J. Electrical Power:

1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
2. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door with lock and key or padlock and key.
3. Wiring shall be numbered and color-coded to match wiring diagram.
4. Install factory wiring outside of an enclosure in a raceway.
5. Field power interface shall be to wire lugs.
6. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:

- a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
  - b. NEMA KS 1, heavy-duty, nonfusible switch.
  - c. NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
- 7. Provide each motor with overcurrent protection.
  - 8. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
  - 9. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.
  - 10. Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
    - a. Power unit-mounted controls.
  - 11. Control Relays: Auxiliary and adjustable time-delay relays.
  - 12. Indicate the following for water chiller electrical power supply:
    - a. Current, phase to phase, for all three phases.
    - b. Voltage, phase to phase and phase to neutral for all three phases.
    - c. Three-phase real power (kilowatts).
    - d. Three-phase reactive power (kilovolt amperes reactive).
    - e. Power factor.
    - f. Running log of total power versus time (kilowatt hours).
    - g. Fault log, with time and date of each.

Controls:

- 13. BACnet communication.
- 14. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
- 15. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:
  - a. Date and time.
  - b. Operating or alarm status.
  - c. Operating hours.
  - d. Outside-air temperature if required for chilled-water reset.
  - e. Temperature and pressure of operating set points.
  - f. Entering and leaving temperatures of chilled water.
  - g. Refrigerant pressures in evaporator and condenser.
  - h. Saturation temperature in evaporator and condenser.
  - i. No cooling load condition.
  - j. Elapsed time meter (compressor run status).
  - k. Pump status.
  - l. Antirecycling timer status.
  - m. Percent of maximum motor amperage.
  - n. Current-limit set point.
  - o. Number of compressor starts.
- 16. Control Functions:
  - a. Manual or automatic startup and shutdown time schedule.

- b. Entering and leaving chilled-water temperatures, control set points, and motor load limit.
  - c. Current limit and demand limit.
  - d. External water chiller emergency stop.
  - e. Antirecycling timer.
  - f. Automatic lead-lag switching.
17. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
- a. Low evaporator pressure or high condenser pressure.
  - b. Low chilled-water temperature.
  - c. Refrigerant high pressure.
  - d. High or low oil pressure.
  - e. High oil temperature.
  - f. Loss of chilled-water flow.
  - g. Control device failure.

K. Insulation:

- 1. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
- 2. Factory-applied insulation over cold surfaces of water chiller components.
  - a. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
- 3. Apply protective coating to exposed surfaces of insulation.

L. Accessories:

- 1. Factory-furnished, chilled-water flow switches for field installation.
- 2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigeration circuit.

## 2.2 SOURCE QUALITY CONTROL

- A. If required by any local or state laws, complete and submit all safety inspection forms and submit to the responsible local or state agency and arrange/complete any required inspections. Any inspection permits and inspection fees related to any required local or state inspections are to be paid for by the Contractor. The Contractor is also responsible for any non-compliance fees assessed by the local or state agency governing safety of Boilers and Pressure Vessels.

## PART 3 - EXECUTION

### 3.1 WATER CHILLER INSTALLATION

- A. Install water chillers on support structure indicated.
- B. Equipment Mounting: Install water chiller on concrete bases using factor provided leveling legs.

- C. Maintain manufacturer's recommended clearances for service and maintenance.
- D. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.
- E. Install separate devices furnished by manufacturer and not factory installed.

### **3.2 CONNECTIONS**

- A. Install piping adjacent to chiller to allow service and maintenance.
- B. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with pressure gage, and drain connection with valve. Make connections to water chiller with a flange.
- C. Connect each drain connection with a union and drain pipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

### **3.3 STARTUP SERVICE**

- A. Engage a factory-authorized service representative to perform startup service.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
- C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
  - 1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
  - 2. Verify that pumps are installed and functional.
  - 3. Verify that thermometers and gages are installed.
  - 4. Operate water chiller for run-in period.
  - 5. Check bearing lubrication and oil levels.
  - 6. Verify proper compressor operation.
  - 7. Verify and record performance of chilled-water flow and low-temperature interlocks.
  - 8. Verify and record performance of condenser-water flow and high- and low-temperature interlocks
  - 9. Verify and record performance of water chiller protection devices.
  - 10. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- D. Prepare a written startup report that records results of tests and inspections.

### **3.4 DEMONSTRATION**

- A. Refer to requirements listed in Section 017900 "Demonstration and Training".
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chillers.

## **END OF SECTION 236423**

## **SECTION 236533 – LIQUID COOLERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Related Documents:
  - 1. Drawings and general provisions of the Subcontract apply to this Section.
  - 2. Review these documents for coordination with additional requirements and information that apply to work under this Section.
- B. Section Includes:
  - 1. Liquid cooler.

#### **1.2 REFERENCES**

- A. General:
  - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
  - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
- B. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- C. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- D. ASME PTC-23 - Atmospheric Water-Cooling Equipment.
- E. ASTM E84 - Surface Burning Characteristics of Building Materials.
- F. CTI (Cooling Tower Institute) ATC-105 - Acceptance Test Code for Water Cooling Towers.
- G. CTI (Cooling Tower Institute) STD-201 - Certification Standard.

#### **1.3 SUBMITTALS**

- A. Product Data, indicating rated capacities, dimensions, weights and point loadings, accessories, required clearances, electrical requirements and wiring diagrams, and location and size of field connections. Submit schematic indicating capacity controls.
- B. Operation and Maintenance Data:
  - 1. Include start-up instructions, maintenance data, parts lists, controls, and accessories.
  - 2. Include cleaning methods and cleaning materials recommended.
- C. Warranty.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Factory assemble entire unit. For shipping, disassemble into as large as practical sub-assemblies so that minimum amount of field work is required for re-assembly.
- B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

## **1.5 WARRANTY**

- A. Provide five year warranty.
- B. Warranty: Include coverage for liquid cooler package, fan drive, motor, pan, casing and cooler coil.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. USA Coil and Air.
- B. Evapco.
- C. Kelvion.

### **2.2 MANUFACTURED UNITS**

- A. Provide units for outdoor use with 30 percent glycol to water, factory assembled, sectional, counterflow, horizontal discharge, blow through design, with fan assemblies built into pan and casing.

### **2.3 COMPONENTS**

- A. Pan and Casing: Galvanized steel, 14 gage (1.8 mm) for casing and 8 gage (4.0 mm) for reinforcing angles and channels with access doors at both ends of cooler to air plenum, lift out steel strainer, bleed line (from pump discharge) with valve.
- B. Cooler Coil: Steel tubing, air tested under water to 350 psig (2420 kPa), sloped to ensure drainage, encased in steel framework.
- C. Fans: Multi blade, cast aluminum, axial type or forward curved centrifugal type mounted on steel shaft, with belt drive or direct drive, bearings with ANSI/AFBMA 9 or ANSI/AFBMA 11 L-10 life expectancy at 30,000 hours, with extended grease fittings.
- D. Fan Motors: Single speed mounted on adjustable steel base.
- E. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheave for motors 15 hp (11.2 kW) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 20 hp (15 kW) and over, matched belts. Drive rated minimum 1.5 times nameplate rating of motor.
- F. Fan Guard: Removable, welded steel rod and wire guard.
- G. Distribution Section: Galvanized steel piping header.

- H. Hardware: Galvanized steel nuts, bolts, and washers stainless steel 0.25 inch (7 mm) nuts, bolts, washers, and nails.
- I. Finish of steel components: G210 hot dipped galvanized steel with zinc chromated aluminum paint.

## **2.4 FACTORY FINISHING**

- A. Finish of steel components: G210 hot dipped galvanized steel with zinc chromated aluminum paint.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that openings are ready to receive work.
- B. Verify field measurements are as shown on Drawings.
- C. Verify that required utilities are available, in proper location, and ready to use.
- D. Beginning of installation means installer accepts existing conditions.

### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Connect cooler water piping with flanged connections to cooler.

### **3.3 ADJUSTING**

- A. Adjust temperature controls and verify operation.

## **END OF SECTION 236533**



## **SECTION 237300 – INDOOR CENTRAL-STATION AIR-HANDLING UNITS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes custom factory fabricated air-handling units and accessories.

#### **1.2 REFERENCES**

- A. Air-Conditioning and Refrigeration Institute:
  - 1. ARI 430 - Central-Station Air-Handling Units.
  - 2. ARI Guideline D - Application and Installation of Central Station Air-Handling Units.
- B. National Electrical Manufacturers Association:
  - 1. NEMA MG 1 - Motors and Generators.
- C. Underwriters Laboratories Inc.:
  - 1. UL 900 - Air Filter Units.

#### **1.3 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. Indicate factory installed and field installed wiring.
- C. Manufacturer's Installation Instructions.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: Submit instructions for lubrication, filter replacement, motor and drive replacement, and wiring diagrams.

## **1.5 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

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

- A. Accept units and components on or off 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.

## **PART 2 - PRODUCTS**

### **2.1 AIR HANDLING UNITS**

- 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. Carrier Corporation; a United Technologies company.
  - 2. Trane Company (The).
  - 3. YORK International Corporation.

### **2.2 CASING**

- A. Channel base of welded steel.
- B. 2-inch thick, double-wall, insulated galvanized steel casing with foam insulation.
- C. Fully welded galvanized steel floor plate with welds on 6-inch centers.
- D. Finish: Polyurethane powder coat paint in manufacturer's standard color.
- E. Inspection Doors: 2-inch thick, double-wall, insulated galvanized steel with foam insulation, designed for flush mounting, with gasket, latch, and handle assembly and 1/4 inch thick Plexiglas inspection window. All doors to open against internal pressure caused by the supply fan section.
- F. Lights: Located in accessible sections suitable for damp locations with wire guards, factory wired to switch mounted on casing exterior.
- G. Drain Pans: Double thickness stainless steel with 2-inch foam insulation between layers and welded corners. Cross break and pitch to drain connection. Furnish drain pans under cooling coil section.

### **2.3 FANS**

- A. Fan: Backward curved, plenum; statically and dynamically balanced, galvanized steel, mounted on solid-steel shaft with self-aligning, permanently lubricated ball bearings.
- B. Motor: ECM motor.

- C. Drive: Direct drive.
- D. Mounting: Fan wheel and motor shall be mounted in fan casing.

## **2.4 COILS**

- A. Casing with access to coils. Enclose coils with headers and return bends fully contained within casing.
- B. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.
- C. Fabrication:
  - 1. Tubes: 5/8 inch OD seamless copper expanded into fins, brazed joints.
  - 2. Fins: Aluminum.
  - 3. Casing: 304 stainless steel.
- 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.

## **2.5 FILTERS**

- A. Outdoor Air Filters: 2-inch, flat disposable MERV 13 panel filters.
- B. Mixed Air Filters: 4-inch, flat disposable MERV 13 panel filters.
- C. Filter Gauges: 3-1/2 inch diameter diaphragm actuated dial in metal case with static pressure tips.

## **2.6 DAMPERS**

- A. Outside Air Damper Leakage: Maximum 3.0 cfm per square foot at 1.0 inches wg pressure differential.
- B. Return Air Damper Leakage: Maximum 2 percent at 4 inch wg differential pressure when sized for 2000 fpm face velocity.

## **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.
- 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. Insulate coil headers located outside airflow as specified for piping.
- E. 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 the following piping accessories on chilled water piping connections.
  - 1. On supply:
    - a. Thermometer well and thermometer.
    - b. DDC temperature sensor well.
    - c. Shutoff valve.
    - d. Strainer.
    - e. Control valve.
    - f. Pressure gage.
  - 2. On return:
    - a. Thermometer well and thermometer.
    - b. DDC temperature sensor well.
    - c. Pressure gage.
    - d. Shutoff valve.
- F. Install automatic 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 the following piping accessories on hot water piping connections.
  - 1. On supply:
    - a. Thermometer well and thermometer.
    - b. Well for control system temperature sensor.
    - c. Shutoff valve.
    - d. Strainer.
    - e. Control valve.
    - f. Pressure gage.
  - 2. On return:
    - a. Thermometer well and thermometer.
    - b. Well for control system temperature sensor.
    - c. Pressure gage.
    - d. Shutoff valve.
- 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 two days to oversee and provide instruction on any section required to be shipped disassembled and requiring field assembly.

### **3.5 CLEANING**

- A. Vacuum clean coils and inside of unit cabinet.
- B. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

### **3.6 PROTECTION OF FINISHED WORK**

- A. Do not operate units until filters are in place, bearings lubricated, and fan has been test run under observation.

### **3.7 DEMONSTRATION**

- A. Refer to requirements listed in Section 017900 "Demonstration and Training".
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain indoor central-station air-handling unit.

## **END OF SECTION 237300**

## **SECTION 238126 – SPLIT-SYSTEM AIR-CONDITIONERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

#### **1.2 SUBMITTALS**

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

#### **1.3 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

### **PART 2 - PRODUCTS**

#### **2.1 SPLIT SYSTEM AIR CONDITIONER**

- A. Manufacturers:
  - 1. Carrier Corporation.
  - 2. LG Electronics.
  - 3. Mitsubishi Electronics America, Inc.; HVAC Division.
- B. Furnish materials in accordance with specified building codes and manufacturer standards.
- C. Compressor:
  - 1. Inverter Compressor.
- D. R-410A refrigerant.
- E. Wall Mounted Indoor Unit.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install ground-mounting, compressor-condenser components on 4-inch-thick, reinforced concrete base; 4 inches larger on each side than unit.
- D. Install roof-mounting compressor-condenser components on equipment supports.
- E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.
- F. Install piping adjacent to unit to allow service and maintenance.

**END OF SECTION 238126**

## **SECTION 238219 – FAN COIL UNITS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes fan-coil units and accessories.

#### **1.2 SUBMITTALS**

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, wiring diagrams, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. 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.
- B. Unit shall be tested and certified in accordance with ARI 440 and UL 1995.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
  - 1. Carrier Corporation.
  - 2. Daikin Applied.
  - 3. YORK International Corporation.
  - 4. Modine HVAC.
  - 5. Multiaqua, Inc.

#### **2.2 CABINET FAN-COIL UNITS**

- A. Description: Factory-assembled, vertical, blow-thru type floor-mounted fan coil for exposed installations. Unit shall be complete with water coils, fan(s), motor(s), drain pan, and manufacturer's factory-installed valve package.



- B. Coil Section Insulation: 1/2-inch thick, foil-covered glass fiber or closed-cell foam complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
- C. Drain Pans: Stainless steel formed to slope from all directions to the drain connection as required by ASHRAE 62.
- D. Chassis: Galvanized steel where exposed to moisture. Floor-mounting units shall have leveling screws.
- E. Cabinet: Steel with powder coated finish in manufacturer's standard color.
  - 1. Free-standing with two access doors and stamped supply grille in the top of the cabinet.
  - 2. Top panel shall slope down from back to front at an angle of at least 25 degrees.
- F. Filters: 1-inch fiberglass throwaway filter.
- G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.
- H. Fan and Motor Board:
  - 1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
  - 2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board.
  - 3. Wiring Termination: Connect motor to chassis wiring with plug connection.
- I. Factory, Hydronic Piping Package: ASTM B 88, Type L or ASTM B 88, Type M copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.
  - 1. Modulating control valve for chilled-water coil.
  - 2. Modulating control valve for heating coil.
  - 3. Two-Piece Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.
  - 4. Calibrated-Orifice Balancing Valves: Bronze body, ball type; 125-psig working pressure, 250-deg F maximum operating temperature; with calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
  - 5. Automatic Flow-Control Valve: Brass or ferrous-metal body; 300-psig working pressure at 250 deg F, with removable, corrosion-resistant, tamperproof, self-cleaning piston spring; factory set to maintain constant indicated flow with plus or minus 10 percent over differential pressure range of 2 to 80 psig.
  - 6. Y-Pattern Hydronic Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 hose-end, full-port, ball-type blowdown valve in drain connection.
  - 7. Wrought-Copper Unions: ASME B16.22.
- J. Basic Unit Controls:
  - 1. 24-volt controls by others.

### **2.3 CEILING SUSPENDED FAN-COIL UNITS**

- A. Description: Factory-assembled, horizontal, ceiling suspended, fan coil unit with exposed cabinet. Unit shall be complete with water coils, fan(s), motor(s), and drain pan.
- B. Coil Section Insulation: 1/2-inch thick, foil-covered glass fiber or closed-cell foam complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
- C. Drain Pans: Stainless steel formed to slope from all directions to the drain connection as required by ASHRAE 62.
- D. Chassis: Galvanized steel where exposed to moisture.
- E. Cabinets: Steel with powder coated finish in manufacturer's standard color.
  - 1. Hinged, bar-type return air grille.
  - 2. Integral double deflection supply air grille.
- F. Filters: 1-inch fiberglass throwaway filter.
- G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.
- H. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.
- I. Basic Unit Controls:
  - 1. 24-volt controls by others.

### **2.4 CEILING CASSTTE FAN-COIL UNITS**

- A. Description: Factory-assembled, downward discharge, in-ceiling mounted fan coil. Unit shall be complete with water coils, fan(s), motor(s), condensate pump, fascia, and drain pan.
- B. Coil Section Insulation: 1/2-inch thick, foil-covered glass fiber or closed-cell foam complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
- C. Drain Pans: Stainless steel formed to slope from all directions to the drain connection as required by ASHRAE 62.
- D. Cabinets: Galvanized steel.
  - 1. Fascia shall be constructed of high impact polystyrene.
  - 2. Air outlet vanes shall be fully insulated aluminum.
- E. Filters: Cleanable.
- F. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.

- G. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.
- H. Basic Unit Controls:
  - 1. 24-volt controls by others.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install fan-coil units to comply with NFPA 90A.
- B. Suspend fan-coil units from structure with elastomeric hangers.
- C. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
  - 1. Install piping adjacent to machine to allow service and maintenance.
  - 2. Connect piping to fan-coil-unit factory hydronic piping package. Install piping package if shipped loose.
  - 3. Connect condensate drain to indirect waste.
    - a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

#### **3.2 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- B. Remove and replace malfunctioning units and retest as specified above.

#### **3.3 DEMONSTRATION**

- A. Refer to requirements listed in Section 017900 “Demonstration and Training”.
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain indoor central-station air-handling unit.

### **END OF SECTION 238219**

## **SECTION 239100 - LOUVERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes operable louvers with integral control dampers, frames and accessories.

#### **1.2 REFERENCES**

- A. Air Movement and Control Association International, Inc.:
  - 1. AMCA 500- L - Test Methods for Louvers, Dampers, and Shutters.

#### **1.3 SUBMITTALS**

- A. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.
- B. Product Data: Submit data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

#### **1.4 QUALITY ASSURANCE**

- A. Perform Work in accordance with AMCA Certification for Water Penetration, Air Performance, and Wind Driven Rain, in compliance with AMCA 500-L. Attach AMCA seal to louvers.
- B. Perform Work in accordance with specified building codes and manufacturer standards.

#### **1.5 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

### **PART 2 - PRODUCTS**

#### **2.1 OPERABLE WALL LOUVERS - DRAINABLE STYLE**

- A. Manufacturers:
  - 1. Greenheck Corporation
  - 2. Ruskin Company
  - 3. United Enertech
- B. Furnish materials in accordance with specified building codes and manufacturer standards.

- C. Louver Construction: Aluminum.
- D. Louver Panel Thickness: as indicated on Drawings.
- E. Louver Blade Design: Sloped at 45 degrees; dual drain style.
- F. Louver: To permit 35 percent free area.
- G. Water Penetration: Not more than 0.01 oz/sq ft of free area at minimum 500 ft / min face velocity.

## **2.2 ACCESSORIES**

- A. Fasteners and Anchors: Stainless steel type.
- B. Primer: Zinc chromate, alkyd type.
- C. Flashings: Of same material as louver frame.
- D. Damper actuator to be provided by controls vendor.

## **2.3 FABRICATION**

- A. Screens: Install screen mesh in shaped frame, reinforce corner construction.

## **2.4 FACTORY FINISHING**

- A. Exterior Aluminum Surfaces, Screen and Blank-Out Sheeting: Mill finish. Coordinate color with Architect.
- B. Interior Aluminum Surfaces and Blank Out Sheeting: Unfinished.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify prepared openings and flashings are ready to receive Work and opening dimensions are as indicated on shop drawings.

### **3.2 INSTALLATION**

- A. Install louvers level and plumb.
- B. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- C. Install insect screen and frame to interior of louver.

### **3.3 CLEANING**

- A. Clean surfaces and components.

**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. 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.
- B. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.
- D. Coordinate sleeve selection and application with selection and application of firestopping.

#### **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

- 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.

## **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 260519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

## **PART 1 - GENERAL**

### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

### **1.2 SUBMITTALS**

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

### **1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

## **PART 2 - PRODUCTS**

### **2.1 STANDARDS**

- A. Insulation types, ratings and usage shall be in accordance with the National Electrical Code requirements.
- B. All conductors shall be copper
- C. Unless otherwise noted, minimum wire size for lighting and power branch circuits shall be No. 12 AWG. For control and auxiliary systems the minimum size shall be No. 14 AWG.

### **2.2 CONDUCTORS AND CABLES**

- A. All wire and cable shall be UL listed.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW, and SO.
  - 1. THHN-THWN- 90 degree C temperature rating in dry or wet locations.
- D. Multiconductor Cable: Comply with NEMA WC 70 for metal clad cable, Type MC and Type SO with ground wire.

## **2.3 CONNECTORS AND SPLICES**

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- B. All components used at wiring terminations, connections and splices shall be UL listed.

## **PART 3 - EXECUTION**

### **3.1 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### **3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Service Entrance: Type THHN-THWN, single conductors in raceway or Type XHHW, single conductors in raceway.
- B. Feeders and Branch Circuits: Type THHN-THWN, single conductors in raceway.
- C. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- D. Concealed light fixture whips: Metal clad cable (Type MC) limited to six feet in length.
- E. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- F. Class 2 Control Circuits: Power-limited cable, concealed in building finishes.

### **3.3 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

- F. Install and make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice, tap conductor and equipment termination for aluminum conductors.
- G. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

**END OF SECTION 260519**

## **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. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. 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.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. 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. 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.
  6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  7. To Light Steel: Sheet metal screws.
  8. 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 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. EMT: ANSI C80.3.
- C. FMC: Zinc-coated steel.
- D. LFMC: Flexible steel conduit with PVC jacket.
- E. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
  - 1. Fittings for EMT: Steel, set-screw or compression type. Die cast fittings are not acceptable.
- F. 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 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.

## **2.3 BOXES AND ENCLOSURES**

- A. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- B. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

## **PART 3 - EXECUTION**

### **3.1 RACEWAY APPLICATION**

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
  - 1. Exposed Conduit: Rigid Steel Conduit.
  - 2. Concealed Conduit: EMT.
  - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. 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.
- C. 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. 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.
- C. 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.
- D. 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.
- E. Complete raceway installation before starting conductor installation.
- F. 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.
- G. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- H. 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.
- I. 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.
- J. 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.
- K. Install expansion fittings at all locations where conduits cross building expansion joints.
- L. Secure rigid conduit at cabinets and boxes using insulated throat type grounding and bonding bushings. Locknuts shall be tightened to cut through painted surfaces.
- M. 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.
- N. 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.

#### **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. Equipment identification labels.

#### **1.3 SUBMITTALS**

- A. Product Data: For each product indicated

#### **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.

#### **1.5 QUALITY ASSURANCE**

- A. Magic marker, pen, pencil, or other hand applied lettering and labeling technique are not allowed for the purpose of equipment identification.

### **PART 2 - PRODUCTS**

#### **2.1 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.

#### **2.2 PANEL SCHEDULES**

- A. For electrical panels which are to be modified within the scope of this project, 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.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. 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. Variable Frequency Drives.
    - b. Control Panels.
    - c. Disconnect 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. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- E. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded 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.

**END OF SECTION 260553**

## **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. Nonfusible 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 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, Type Heavy Duty, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Non-fusible Switch, 600 A and Smaller: NEMA KS 1, Type Heavy Duty Duty, lockable handle with capability to accept two padlocks, and 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. ( If required)
  3. Switches feeding a VFD: Auxiliary interlock to break control circuit prior to the opening of the phase conductors

## **2.2 ENCLOSURES**

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
1. Outdoor Locations: NEMA 250, Type 3R.
  2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  3. 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. Anchor floor-mounting switches to concrete base.
- 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.
- 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**



## **SECTION 262923 - VARIABLE FREQUENCY MOTOR CONTROLLERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes solid-state, pulse-width modulated (PWM), variable frequency controllers (VFCs) for speed control of three-phase, squirrel-cage induction motors.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of VFC including wiring diagrams.
- B. Operation and maintenance data.
- C. Warranty.

#### **1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
- B. Comply with NFPA 70.

#### **1.4 PROJECT CONDITIONS**

- A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions, unless otherwise indicated:
  - 1. Ambient Temperature: 0 to 40 deg C.
  - 2. Humidity: Less than 90 percent (noncondensing).
  - 3. Altitude: Not exceeding 3300 feet.

#### **1.5 COORDINATION**

- A. Coordinate features of VFCs, installed units, and accessory devices with pilot devices and control circuits to which they connect.
- B. Coordinate features, accessories, and functions of each VFC and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Danfoss Inc.; Danfoss Electronic Drives Div.
  2. Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.
  3. Toshiba International Corporation.
  4. Yaskawa America, Inc

### **2.2 VARIABLE FREQUENCY CONTROLLERS**

- A. Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
- B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- C. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
- D. Unit Operating Requirements:
1. Input ac voltage tolerance of 188 to 228 V, plus or minus 10 percent.
  2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
  3. Minimum Efficiency: 96 percent at 60 Hz, full load.
  4. Minimum Displacement Primary-Side Power Factor: 96 percent.
  5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
  6. Starting Torque: 100 percent of rated torque or as indicated.
  7. Speed Regulation: Plus or minus 1 percent.
- E. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
1. Electrical Signal: 4 to 20 mA at 24 V.
- F. Internal Adjustability Capabilities:
1. Minimum Speed: 5 to 25 percent of maximum rpm.
  2. Maximum Speed: 80 to 100 percent of maximum rpm.
  3. Acceleration: 2 to a minimum of 22 seconds.
  4. Deceleration: 2 to a minimum of 22 seconds.
  5. Current Limit: 50 to a minimum of 110 percent of maximum rating.
- G. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors.
  2. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
  3. Motor Overload Relay: Adjustable and capable of NEMA ICS 2, Class 20 performance.
  4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.

5. Instantaneous line-to-line and line-to-ground overcurrent trips.
  6. Loss-of-phase protection.
  7. Reverse-phase protection.
  8. Short-circuit protection.
  9. Motor overtemperature fault.
- H. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
- I. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- J. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- K. Input Line Conditioning: 3% line reactor.
- L. VFC Output Filtering: 3% dv/dt filter.
- M. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
1. Power on.
  2. Run.
  3. Overvoltage.
  4. Line fault.
  5. Overcurrent.
  6. External fault.
- N. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
1. Output frequency (Hz).
  2. Motor speed (rpm).
  3. Motor status (running, stop, fault).
  4. Motor current (amperes).
  5. Motor torque (percent).
  6. Fault or alarming status (code).
  7. PID feedback signal (percent).
  8. DC-link voltage (VDC).
  9. Set-point frequency (Hz).
  10. Motor output voltage (V).
- O. Control Signal Interface:
1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
  2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:
    - a. 0 to 10-V dc.
    - b. 0-20 or 4-20 mA.
    - c. RS485.
    - d. Keypad display for local hand operation.

3. Output Signal Interface:
  - a. A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
    - 1) Output frequency (Hz).
    - 2) Output current (load).
    - 3) DC-link voltage (VDC).
    - 4) Motor torque (percent).
    - 5) Motor speed (rpm).
    - 6) Set-point frequency (Hz).
4. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
  - a. Motor running.
  - b. Set-point speed reached.
  - c. Fault and warning indication (overtemperature or overcurrent).
  - d. PID high- or low-speed limits reached.
  - e. VFC in Local control mode
- P. Communications: Provide an RS485 interface allowing VFC to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFC to be programmed via BMS control. Provide capability for VFC to retain these settings within the nonvolatile memory.
- Q. Integral Disconnecting Means: NEMA AB 1, instantaneous-trip circuit breaker or NEMA KS 1, fusible switch with lockable handle.
- R. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

## 2.3 ENCLOSURES

- A. NEMA 250 Type 1.

## 2.4 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Standard Displays:
  1. Output frequency (Hz).
  2. Set-point frequency (Hz).
  3. Motor current (amperes).
  4. DC-link voltage (VDC).
  5. Motor torque (percent).
  6. Motor speed (rpm).
  7. Motor output voltage (V).
- C. Historical Logging Information and Displays:
  1. Real-time clock with current time and date.
  2. Running log of total power versus time.

3. Total run time.
4. Fault log, maintaining last four faults with time and date stamp for each.

## **2.5 FACTORY FINISHES**

- A. Finish: Manufacturer's standard paint applied to VFCs before shipping.

## **PART 3 - EXECUTION**

### **3.1 APPLICATIONS**

- A. Select features of each VFC to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, controller, and load.
- B. Select horsepower rating of controllers to suit motor controlled.

### **3.2 INSTALLATION**

- A. Construct freestanding metal frame structure to mount VFC.

### **3.3 IDENTIFICATION**

- A. Identify VFCs, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."

## **END OF SECTION 262923**

# APPENDIX A

---

# LIMITED ASBESTOS INSPECTION REPORT

1616 Missouri Blvd  
Jefferson City, MO.

September 26, 2022

*Prepared for:*

STATE OF MISSOURI  
DEPARTMENT OF AGRICULTURE

1616 Missouri Blvd  
Jefferson City, MO

*Prepared by:*

KLINGNER & ASSOCIATES, P.C.

610 N. 4<sup>th</sup> Street, Suite 100  
Burlington, IA 52601

Project No. 21-5055

## TABLE OF CONTENTS

---

1.0	INTRODUCTION.....	1
2.0	SITE DESCRIPTION.....	1
3.0	ASBESTOS INSPECTION .....	1
3.1	Introduction.....	1
3.2	Regulations.....	2
3.3	Inspection Results.....	2
3.4	Recommendations.....	3
4.0	CERTIFICATION.....	4

### 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 – MISSOURI ASBESTOS INSPECTOR LICENSE



## 1.0 INTRODUCTION

---

The limited asbestos inspection was requested by the State of Missouri as part of HVAC upgrades for the structure located at 1616 Missouri Blvd in Jefferson City, Missouri. The purpose of the inspection was to determine if asbestos containing building materials are currently located in the areas of the structure that may be disturbed during renovation activities. A full building inspection was not completed.

## 2.0 SITE DESCRIPTION

---

Property Address: G. W. Carver Building, 1616 Missouri Blvd, Jefferson City, MO  
Property Owner: State of Missouri, Department of Agriculture

The structure inspected is a three-story office building. The inspection included sampling visible suspect asbestos containing materials located on materials that may be disturbed during renovations of the HVAC system. Additionally, samples were taken from the floor tile of the first-floor computer room where renovations to the raised floor are proposed. Samples were taken from pipe wrap and joint compound materials, flooring materials and mastics, ceiling tiles, floor leveler, and caulking. A full building inspection was not completed.

## 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

Mr. Skyler Troutman, Licensed Asbestos Inspector – Missouri license number 7118010522MOI121991 (see Exhibit F – Missouri Asbestos Inspector License) of Klingner & Associates, P.C. performed a limited asbestos inspection at 1616 Missouri Blvd in Jefferson City, Missouri on July 5, 2022. Mr. Troutman returned for supplemental sampling on September 16, 2022. The inspection included a visual assessment for possible asbestos containing building materials (ACBM) in the structure. Samples were collected from observed suspect materials. Samples were shipped under chain of custody to EMSL Analytical, Inc. in Indianapolis, Indiana and Cinnaminson, New Jersey. 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
- Exhibit B – Photographs
- Exhibit C – Sample Location Map
- Exhibit D – Laboratory Report

- Exhibit E – Asbestos Location Map
- Exhibit F – Missouri Asbestos Inspector License

During the July 5<sup>th</sup> inspection, eighteen (18) homogeneous areas were identified and fifty-four (54) samples were collected. Samples were collected from pipe insulation wrap, pipe joint compounds, floor tiles, floor mastics, ceiling tiles, and caulking. Analytical results indicated one (1) 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.

During the September 19<sup>th</sup> inspection, five (5) homogenous areas and fifteen (15) samples were collected. Samples were collected from floor coverings and mastics, floor leveler, and window caulking. Analytical results indicated that none of the identified materials contain asbestos.

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
July 5 <sup>th</sup> Inspection Results						
1	Room 116 (Computer Room)	2%- Chrysotile	9"x9" Brown Floor Tile	Category I	Fair	Approx. 210 SF

### 3.4 Recommendations

If the asbestos containing building materials identified in Section 3.3 above are going to be disturbed directly or indirectly during renovation activities, the materials to be disturbed should be removed by a Missouri licensed asbestos abatement contractor prior to disturbance. A full building inspection was not completed, if the scope of the project changes, additional areas and materials to be impacted should be inspected by a licensed asbestos building inspector.

## 4.0 CERTIFICATION

---

I, Skyler Troutman, certify that this asbestos inspection was performed in compliance with Missouri Rules and Regulations, the National Emission Standards for Hazardous Air Pollutants for asbestos, and our Agreement with the State of Missouri. 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).



\_\_\_\_\_  
Skyler Troutman

Missouri Asbestos Inspector License #7118010522MOII21991

September 26, 2022

Date

# **EXHIBIT A**

---

## **ASBESTOS SAMPLE RESULTS SUMMARY**

## ASBESTOS SAMPLE RESULTS SUMMARY

For: State of Missouri

Site Identification: George Washington Carver Building

1616 Missouri Blvd, Jefferson City, MO

Inspection Date: 7/5/2022, 9/19/2022

Klingner & Associates, P.C. Project Number 21-5055

Sample ID	Location	ASBESTOS		Sample Description	Category I, Category II, or Friable	Condition (Good, Fair, or Poor)	Quantity
		Percent	Type				
July 5, 2022 Sample Summary							
1A	Room 116 (Computer Room)	2%	Chrysotile	9x9 Brown floor tile	Category I	Fair	Approx. 210 SF
1B		PS	PS				
1C		PS	PS				
2A	Room 116 (Computer Room)	ND	NA	Mastic for 1	NA	NA	NA
2B		ND	NA				
2C		ND	NA				
3A	1st, 2nd, 3rd floor ceiling	ND	NA	2'x4' ceiling tile	NA	NA	NA
3B		ND	NA				
3C		ND	NA				
4A	Above 1st floor ceiling tile	ND	NA	1st floor pipe insulation wrap	NA	NA	NA
4B		ND	NA				
4C		ND	NA				
5A	Above 1st floor ceiling tile	ND	NA	1st floor pipe joint compound	NA	NA	NA
5B		ND	NA				
5C		ND	NA				
6A	Break Rooms and Maintenance areas	ND	NA	12x12 pink floor tile	NA	NA	NA
6B		ND	NA				
6C		ND	NA				
7A	Break Rooms and Maintenance areas	ND	NA	Mastic for 6	NA	NA	NA
7B		ND	NA				
7C		ND	NA				
8A	1st Floor North Exit Vestibule	ND	NA	12x12 white floor tile	NA	NA	NA
8B		ND	NA				
8C		ND	NA				
9A	1st Floor North Exit Vestibule	ND	NA	Mastic for 8	NA	NA	NA
9B		ND	NA				
9C		ND	NA				
10A	Above 2nd floor ceiling tile	ND	NA	2nd floor pipe insulation wrap	NA	NA	NA
10B		ND	NA				
10C		ND	NA				
11A	Above 2nd floor ceiling tile	ND	NA	2nd floor pipe joint compound	NA	NA	NA
11B		ND	NA				
11C		ND	NA				
12A	Around AC units	ND	NA	Caulking	NA	NA	NA
12B		ND	NA				
12C		ND	NA				
13A	1st, 2nd, 3rd floor	ND	NA	Carpet mastic	NA	NA	NA
13B		ND	NA				
13C		ND	NA				
14A	Basement	ND	NA	White pipe insulation wrap	NA	NA	NA
14B		ND	NA				
14C		ND	NA				
15A	Basement	ND	NA	White pipe joint compound	NA	NA	NA
15B		ND	NA				
15C		ND	NA				
16A	Basement	ND	NA	Yellow pipe insulation wrap	NA	NA	NA
16B		ND	NA				
16C		ND	NA				
17A	Basement	ND	NA	Blue pipe insulation wrap	NA	NA	NA
17B		ND	NA				
17C		ND	NA				
18A	Basement	ND	NA	Green pipe insulation wrap	NA	NA	NA
18B		ND	NA				
18C		ND	NA				
September 19, 2022 Sample Summary							
RF-1A	Beneath carpet and tile in 1st, 2nd, and 3rd floors	ND	NA	Layered Linoleum Flooring Material	NA	NA	NA
RF-1B		ND	NA				
RF-1C		ND	NA				
RF-2A	Beneath carpet and tile in 1st, 2nd, and 3rd floors	ND	NA	Mastic for 1	NA	NA	NA
RF-2B		ND	NA				
RF-2C		ND	NA				
RF-3A	SE offices on 2nd floor	ND	NA	Floor Leveler	NA	NA	NA
RF-3B		ND	NA				
RF-3C		ND	NA				
RF-4A	Storage area and offices on west half of 2nd floor	ND	NA	Alternate Carpet Mastic	NA	NA	NA
RF-4B		ND	NA				
RF-4C		ND	NA				
RF-5A	NE window on 1st floor, outside room 116	ND	NA	Black Exterior Window Caulking	NA	NA	NA
RF-5B		ND	NA				
RF-5C		ND	NA				
Notes:							
ND = None Detected PS = Positive Stop							
NA = Not Applicable							

# **EXHIBIT B**

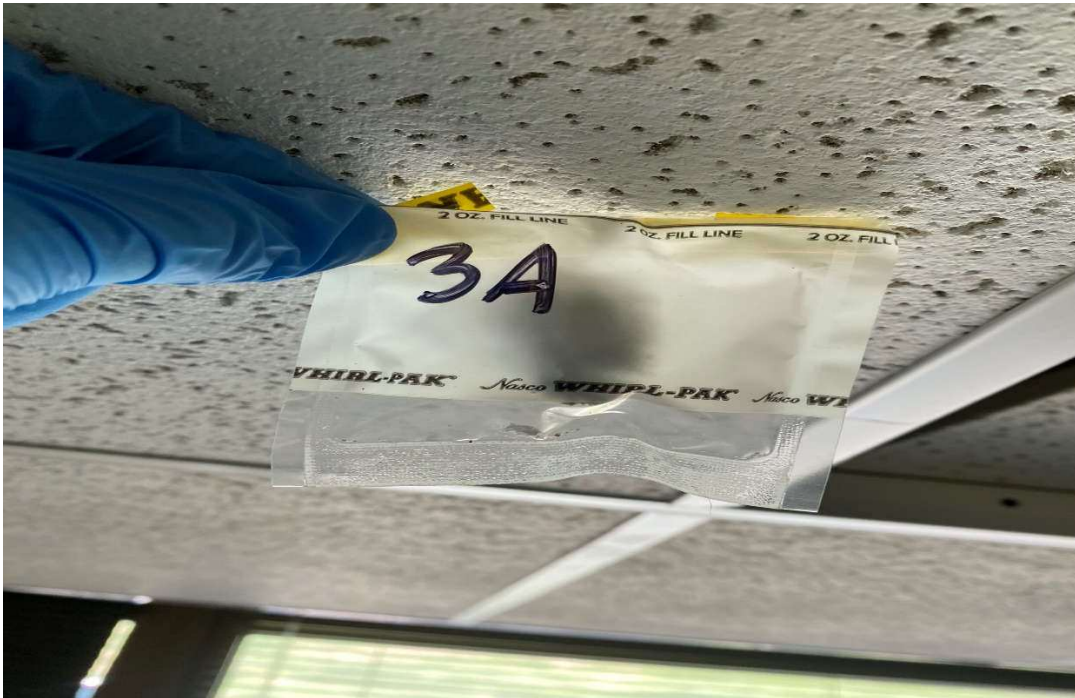
---

## **PHOTOGRAPHS**



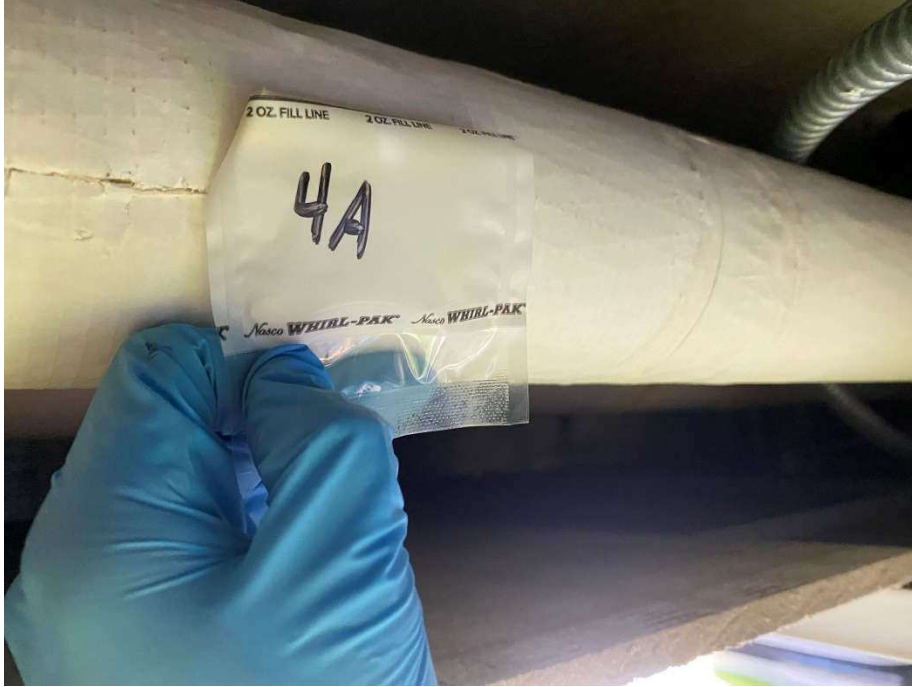


1	Description	Samples 1 and 2 – 9x9 floor tile and mastic	Percent Asbestos  FT = 2% Chrysotile  Mastic = ND
	Date	7/5/2022	



2	Description	Sample 3 – 2x4 ceiling tile	Percent Asbestos  ND
	Date	7/5/2022	

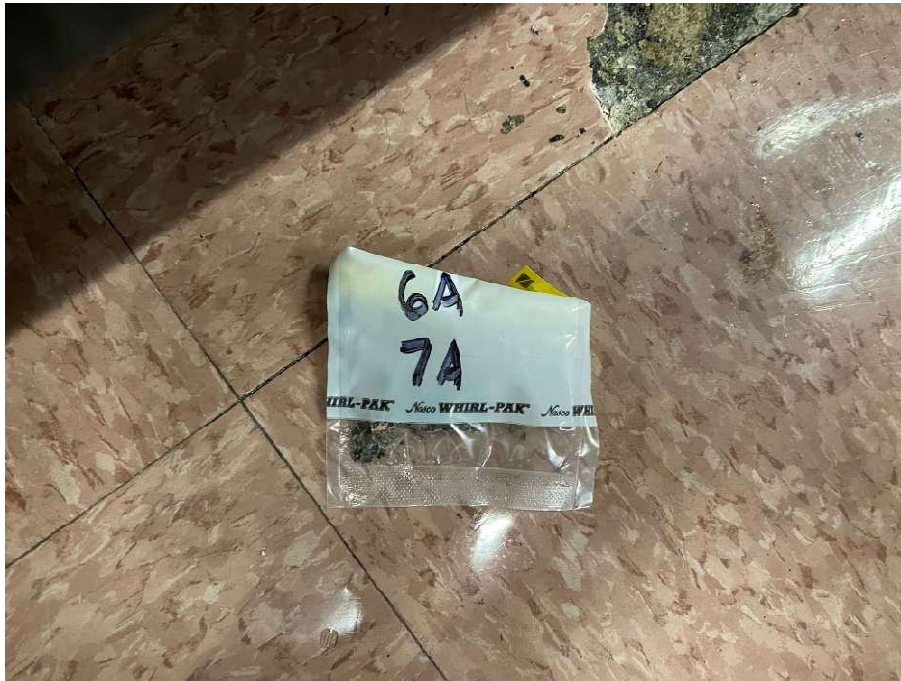




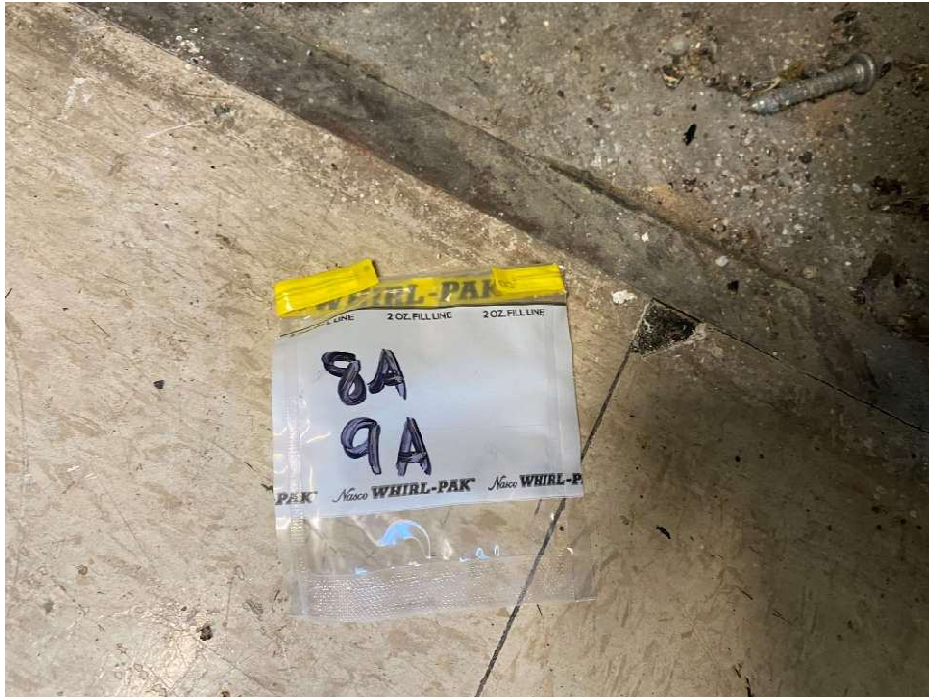
3	Description	Sample 4 – 1 <sup>st</sup> floor pipe insulation wrap	Percent Asbestos  ND
	Date	7/5/2022	



4	Description	Sample 5 – 1 <sup>st</sup> floor pipe joint compound (Not pictured: Sample 11 – 2 <sup>nd</sup> floor pipe joint compound, similar to Sample 5)	Percent Asbestos  ND
	Date	7/5/2022	



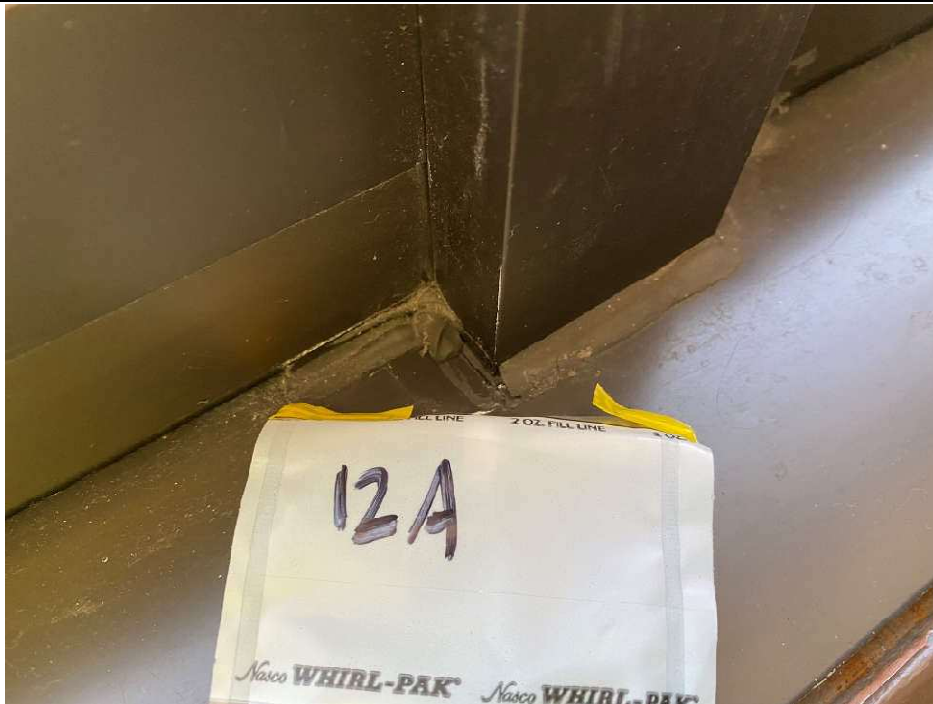
<b>5</b>	Description	Samples 6 and 7 – 12x12 pink floor tile and mastic	Percent Asbestos  ND
	Date	7/5/2022	



<b>6</b>	Description	Samples 8 and 9 – 12x12 white floor tile and mastic	Percent Asbestos  ND
	Date	7/5/2022	



<b>7</b>	Description	Sample 10 – 2 <sup>nd</sup> floor pipe insulation wrap	Percent Asbestos  ND
	Date	7/5/2022	



<b>8</b>	Description	Sample 12 – caulking around AC units	Percent Asbestos  ND
	Date	7/5/2022	





<b>9</b>	Description	Sample 13 – carpet mastic	Percent Asbestos  ND
	Date	7/5/2022	



<b>10</b>	Description	Sample 14 – white pipe insulation wrap	Percent Asbestos  ND
	Date	7/5/2022	



<b>11</b>	Description	Sample 15 – white pipe joint compound	Percent Asbestos  ND
	Date	7/5/2022	



<b>12</b>	Description	Sample 16 – yellow pipe insulation wrap	Percent Asbestos  ND
	Date	7/5/2022	





<b>13</b>	Description	Sample 17 – blue pipe insulation wrap	Percent Asbestos  ND
	Date	7/5/2022	



<b>14</b>	Description	Sample 18 – green pipe insulation wrap	Percent Asbestos  ND
	Date	7/5/2022	



<b>15</b>	Description	Visual of ceiling tiles in areas affected	Percent Asbestos  ND
	Date	7/5/2022	

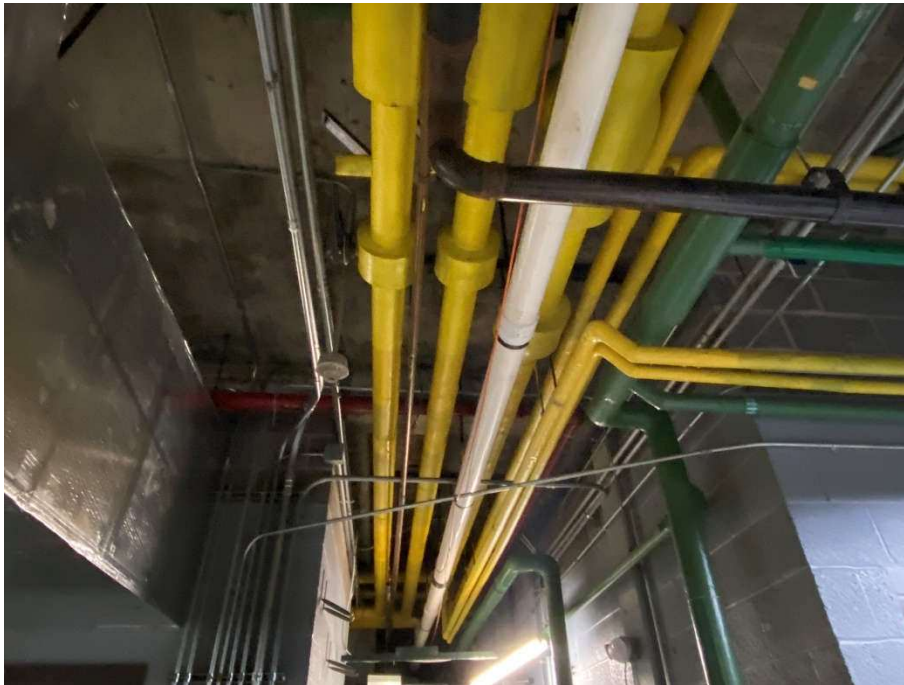


<b>16</b>	Description	Visual of piping above ceiling on 1 <sup>st</sup> and 2 <sup>nd</sup> floors	Percent Asbestos  ND
	Date	7/5/2022	





<b>17</b>	Description	Piping and equipment in basement	Percent Asbestos  ND
	Date	7/5/2022	



<b>18</b>	Description	Pipe runs along ceiling of basement	Percent Asbestos  ND
	Date	7/5/2022	





<b>19</b>	Description	Piping and equipment in basement	Percent Asbestos  ND
	Date	7/5/2022	



<b>20</b>	Description	Piping and equipment in basement	Percent Asbestos  ND
	Date	7/5/2022	



<b>21</b>	Description	Samples RF-1 and RF-2 – Layered Linoleum Flooring material and Mastic	Percent Asbestos  ND
	Date	9/19/2022	

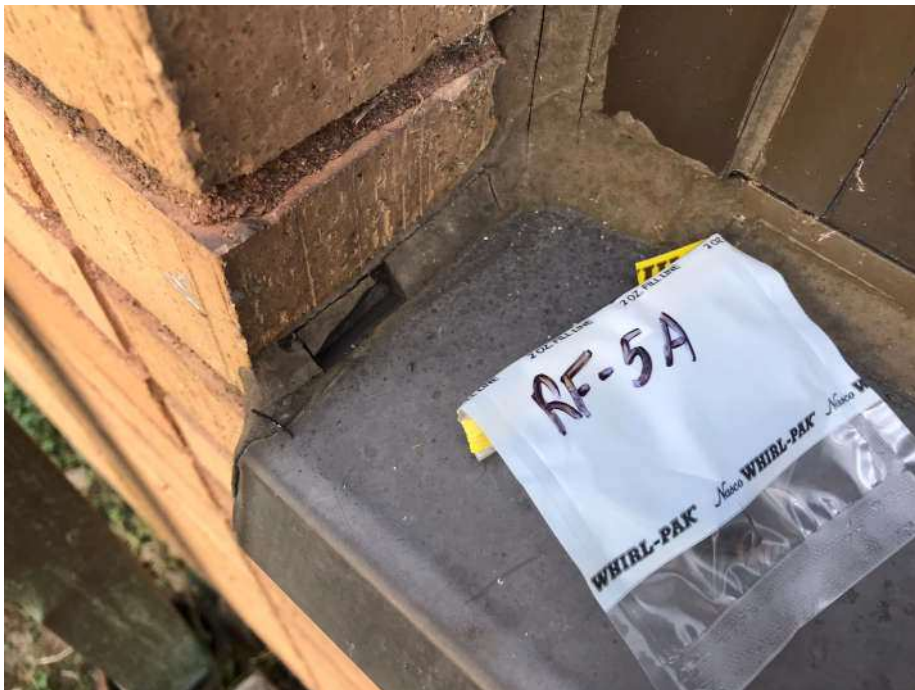


<b>22</b>	Description	Sample RF-3 floor leveler (white material beneath mastic)	Percent Asbestos  ND
	Date	9/19/2022	





<b>23</b>	Description	Sample RF-4 – Alternate Carpet Mastic	Percent Asbestos  ND
	Date	9/19/2022	



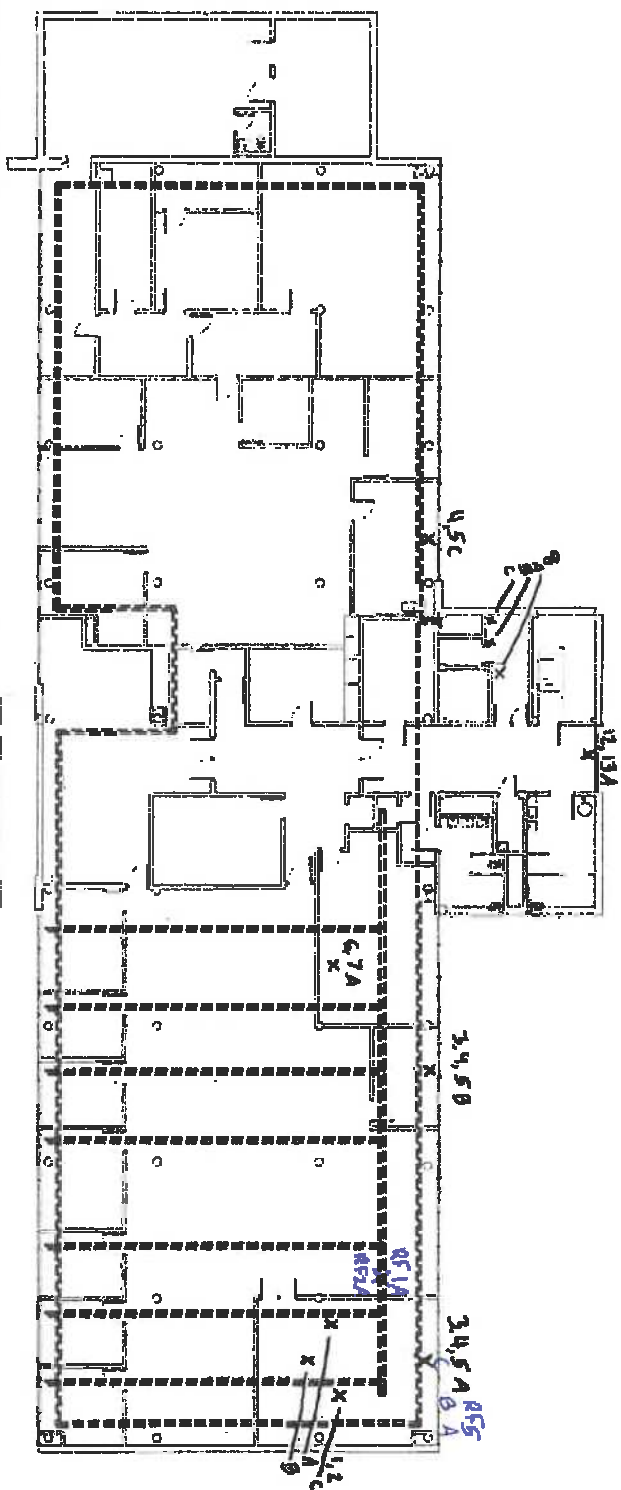
<b>24</b>	Description	Sample RF-5 – Black exterior window caulking	Percent Asbestos  ND
	Date	9/19/2022	

# **EXHIBIT C**

---

## **SAMPLE LOCATION MAP**

① MAIN LEVEL DEMOLITION PLAN



DATE	DESCRIPTION
07/17/2012	ISSUED FOR PERMIT

STATE OF MISSOURI  
MICHAEL L. FARROW  
GOVERNOR

NOT FOR CONSTRUCTION  
DESIGN DEVELOPMENT  
12/19/11 AMT

**KLINGNER & ASSOCIATES P.C.**  
Engineers - Architects - Surveyors

Columbia, Missouri      www.klingner.com  
201 East Ash Street      Scott A. Klingner, P.E.  
St. Louis, MO      Douglas A. Farrow, P.E.

KLINGNER & ASSOCIATES, P.C. - ENGINEERS  
MISSOURI STATE CERTIFICATE OF AUTHORITY 000000

OFFICE OF ADMINISTRATION  
REVISION OF FACILITIES  
MANAGEMENT  
DEMOLITION AND CONSTRUCTION

GEORGE WASHINGTON  
CARVER BUILDING  
STATE OF MISSOURI

100 MISSOURI BLVD  
JEFFERSON CITY, MO 64108

PROJECT # 08223-01  
SHEET # 101D  
ASSET # 310101001

REVISIONS:  
DATE  
BY  
REASON

DATE PLOTTED: 07/17/2012  
PLOTTER: HP DesignJet T110  
COURTESY OF: MISSOURI  
DESIGN DEVELOPMENT  
12/19/11 AMT

SHEET TITLE:  
**1ST FLOOR  
DEMOLITION  
FLOOR PLAN**

SHEET NUMBER:  
**D101**

DATE: JULY 14, 2012

DATE	DESCRIPTION

STATE OF MISSOURI  
MICHAEL L. PARSON,  
GOVERNOR

NOT FOR CONSTRUCTION  
DESIGN DEVELOPMENT  
REVISION SET

**KLINGNER & ASSOCIATES P.C.**  
Engineers • Architects • Surveyors

Columbia, Missouri      www.klingner.com  
807 Broadway Street      Contact: 636.336.2200  
St. Louis, MO      636.336.2200

KLINGNER & ASSOCIATES, P.C. - MISSOURI  
MISSOURI STATE CONTRACTORS OF ARCHITECTURE #00000

OFFICE OF ADMINISTRATION  
DIVISION OF FACILITIES  
MANAGEMENT  
DESIGN AND CONSTRUCTION

GEORGE WASHINGTON  
CARVER BUILDING

STATE OF MISSOURI

216 HARRINGTON BLVD  
JEFFERSON CITY, MO 64500

PROJECT # 0722241  
RTR# 105  
ASSET # 3101019001

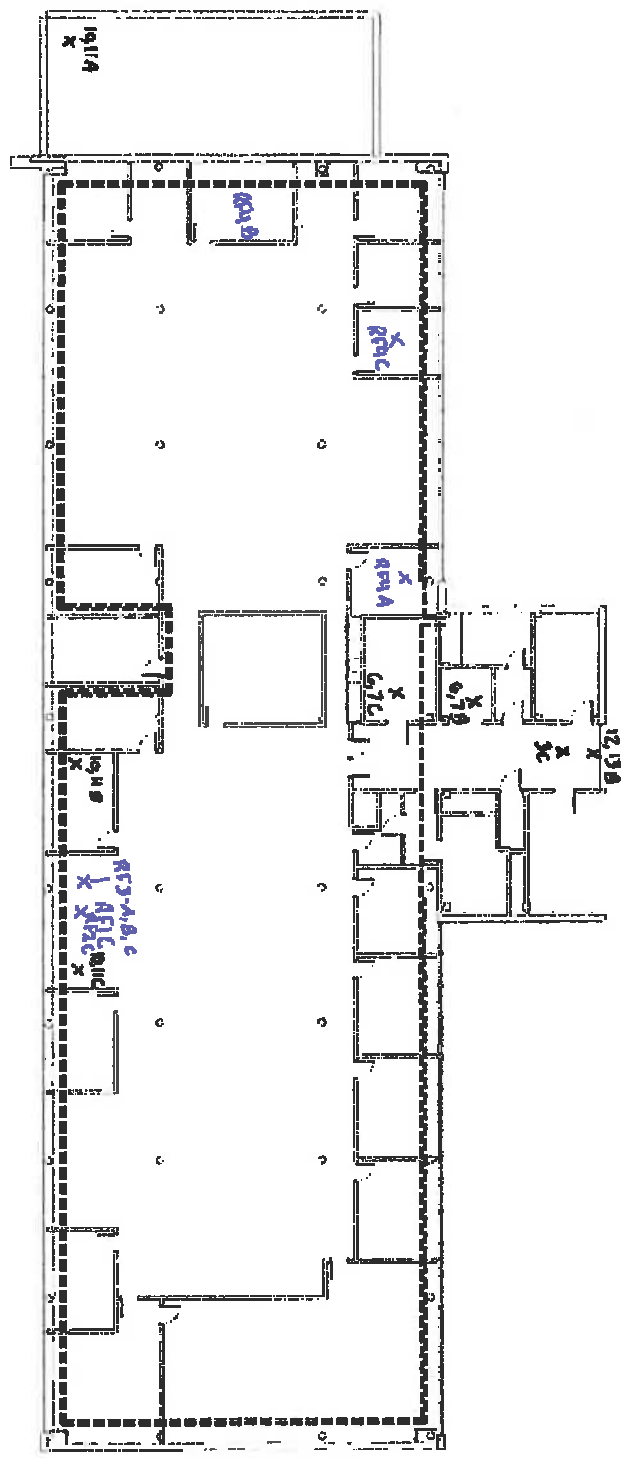
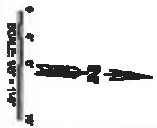
DATE:      /      /  
BY:      /      /  
CHECKED BY:      /      /  
APPROVED BY:      /      /

CAD FILE NO.      /      /  
DRAWING NO.      /      /  
REVISION NO.      /      /  
DATE      /      /

PROJECT TITLE:  
**2ND FLOOR  
DEMOLITION  
FLOOR PLAN**

SHEET NUMBER:  
**D102**

JULY 14, 2002



1 SECOND LEVEL DEMOLITION PLAN

REVISIONS

NO.	DATE	DESCRIPTION

STATE OF MISSOURI  
 MICHAEL L. PARSON,  
 GOVERNOR

NOT FOR CONSTRUCTION  
 DESIGN DEVELOPMENT  
 REVIEW SET

**KLINGNER**  
**ASSOCIATES P.C.**  
 Engineers • Architects • Surveyors

Columbia, Missouri      www.klingner.com  
 877 West Ash Street      Omaha, Nebraska, NE  
 Independence, MO      68101-2000

KLINGNER & ASSOCIATES, P.C. - MISSOURI  
 MISSOURI STATE CERTIFICATE OF AUTHORITY 0000000

OFFICE OF ADMINISTRATION  
 DIVISION OF FACILITIES  
 MANAGEMENT  
 MISSOURI ARCHITECTURAL BOARD

GEORGE WASHINGTON  
 CARVERA BUILDING  
 STATE OF MISSOURI

1014 MARSHALL BLVD.  
 JEFFERSON CITY, MO 65101

PROJECT # 0222-01  
 SITE # 1818  
 ASSSET # 310018001

REVISIONS  
 REVISED BY  
 REVISED DATE  
 REVISED DATE

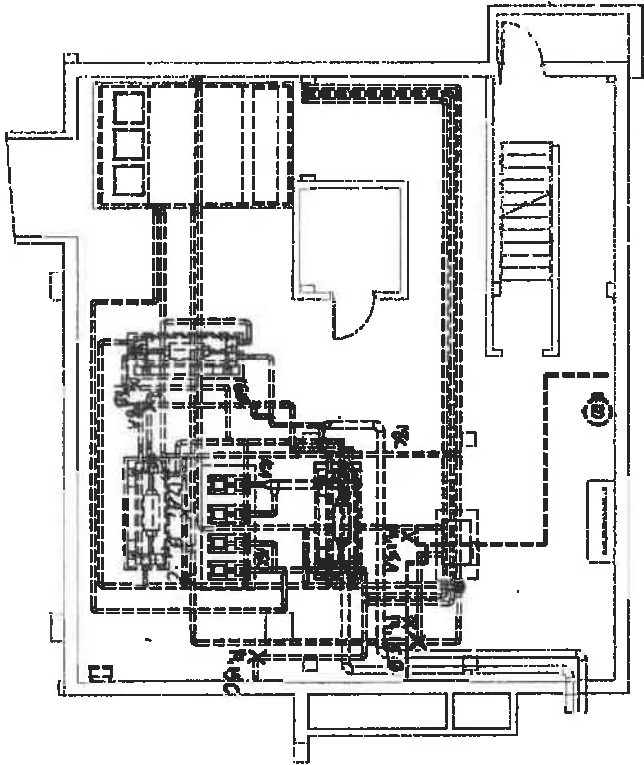
3RD FLOOR  
 DEMOLITION  
 FLOOR PLAN

PROJECT NUMBER:  
**D103**

DATE: 10/14/2012



① THIRD LEVEL DEMOLITION PLAN



① BASEMENT DEMOLITION FLOOR PLAN

DATE	DESCRIPTION

STATE OF MISSOURI  
MICHAEL L. PARSON,  
GOVERNOR

NOT FOR CONSTRUCTION  
DESIGN DEVELOPMENT  
REVIEW SET

**KLINGNER & ASSOCIATES, P.C.**  
Engineers - Architects - Surveyors

Columbia, Missouri      www.klinger.com  
215 East 2nd Street      647-874-1111  
Kansas City, Missouri      647-874-1111

KLINGNER & ASSOCIATES, P.C. - MISSOURI  
MISSOURI STATE CERTIFICATE OF AUTHORITY 000000

OFFICE OF ADMINISTRATION  
DIVISION OF FACILITIES  
MANAGEMENT,  
DESIGN AND CONSTRUCTION

GEORGE WASHINGTON  
CAREER BUILDING

STATE OF MISSOURI

1616 MISSOURI BLDG.  
JEFFERSON CITY, MO 64508

PROJECT # 0222-01  
SITE # 1010  
ASSIST # 110101001

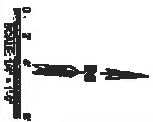
DATE: 11/11/03  
BY: [Signature]  
CHECKED: [Signature]  
DATE: 11/11/03  
BY: [Signature]

DATE: 11/11/03  
BY: [Signature]  
CHECKED: [Signature]  
DATE: 11/11/03  
BY: [Signature]

PROJECT TITLE:  
**BASEMENT  
DEMOLITION  
FLOOR PLAN**

SHEET NUMBER  
**D104**

NOV 14 2003





# **EXHIBIT D**

---

## **LABORATORY REPORT**



# EMSL Analytical, Inc.

6340 CastlePlace Dr. Indianapolis, IN 46250  
Tel/Fax: (317) 803-2997 / (317) 803-3047  
<http://www.EMSL.com> / [indianapolislaboratory@emsl.com](mailto:indianapolislaboratory@emsl.com)

**EMSL Order:** 162215250  
**Customer ID:** KLIN50  
**Customer PO:**  
**Project ID:**

**Attention:** Skyler Troutman  
Klingner & Associates, P.C.  
616 North 24th Street  
Quincy, IL 62301

**Phone:** (319) 671-2574  
**Fax:** (217) 223-3603  
**Received Date:** 07/07/2022 9:50 AM  
**Analysis Date:** 07/14/2022  
**Collected Date:** 07/05/2022

**Project:** GW CARVER BUILDING 21-5055

## 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
1A 162215250-0001	9X9 FLOOR TILE	Brown Non-Fibrous Homogeneous	HA: 1	98% Non-fibrous (Other)	2% Chrysotile
1B 162215250-0002	9X9 FLOOR TILE		HA: 1		Positive Stop (Not Analyzed)
1C 162215250-0003	9X9 FLOOR TILE		HA: 1		Positive Stop (Not Analyzed)
2A 162215250-0004	MASTIC FOR 1	Black Non-Fibrous Homogeneous	HA: 2	100% Non-fibrous (Other)	None Detected
2B 162215250-0005	MASTIC FOR 1	Black Non-Fibrous Homogeneous	HA: 2	100% Non-fibrous (Other)	None Detected
2C 162215250-0006	MASTIC FOR 1	Black Non-Fibrous Homogeneous	HA: 2	100% Non-fibrous (Other)	None Detected
3A 162215250-0007	2'X4' CEILING TILE	Gray/White Fibrous Homogeneous	HA: 3	60% Cellulose 20% Min. Wool 15% Perlite 5% Non-fibrous (Other)	None Detected
3B 162215250-0008	2'X4' CEILING TILE	Gray/White Fibrous Homogeneous	HA: 3	60% Cellulose 20% Min. Wool 15% Perlite 5% Non-fibrous (Other)	None Detected
3C 162215250-0009	2'X4' CEILING TILE	Gray/White Fibrous Homogeneous	HA: 3	50% Cellulose 30% Min. Wool 15% Perlite 5% Non-fibrous (Other)	None Detected
4A 162215250-0010	1ST FLOOR PIPE INSULATION WRAP	White Fibrous Homogeneous	HA: 4	80% Cellulose 10% Glass 10% Non-fibrous (Other)	None Detected
4B 162215250-0011	1ST FLOOR PIPE INSULATION WRAP	White Fibrous Homogeneous	HA: 4	80% Cellulose 10% Glass 10% Non-fibrous (Other)	None Detected
4C 162215250-0012	1ST FLOOR PIPE INSULATION WRAP	White Fibrous Homogeneous	HA: 4	90% Cellulose 10% Non-fibrous (Other)	None Detected

Initial report from: 07/14/2022 14:54:19



# EMSL Analytical, Inc.

6340 CastlePlace Dr. Indianapolis, IN 46250

Tel/Fax: (317) 803-2997 / (317) 803-3047

<http://www.EMSL.com> / [indianapolislabs@emsl.com](mailto:indianapolislabs@emsl.com)

**EMSL Order:** 162215250  
**Customer ID:** KLIN50  
**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
5A 162215250-0013	1ST FLOOR PIPE JOINT COMPOUND	White Non-Fibrous Homogeneous	HA: 5	100% Non-fibrous (Other)	None Detected
5B 162215250-0014	1ST FLOOR PIPE JOINT COMPOUND	White Non-Fibrous Homogeneous	HA: 5	100% Non-fibrous (Other)	None Detected
5C 162215250-0015	1ST FLOOR PIPE JOINT COMPOUND	White/Black Non-Fibrous Homogeneous	HA: 5	100% Non-fibrous (Other)	None Detected
6A 162215250-0016	12X12 PINK FLOOR TILE	Pink Non-Fibrous Homogeneous	HA: 6	100% Non-fibrous (Other)	None Detected
6B 162215250-0017	12X12 PINK FLOOR TILE	Pink Non-Fibrous Homogeneous	HA: 6	100% Non-fibrous (Other)	None Detected
6C 162215250-0018	12X12 PINK FLOOR TILE	Pink Non-Fibrous Homogeneous	HA: 6	100% Non-fibrous (Other)	None Detected
7A 162215250-0019	MASTIC FOR 6	Black Non-Fibrous Homogeneous	HA: 7	100% Non-fibrous (Other)	None Detected
7B 162215250-0020	MASTIC FOR 6		HA: 7		Insufficient Material
7C 162215250-0021	MASTIC FOR 6	Black Non-Fibrous Homogeneous	HA: 7	100% Non-fibrous (Other)	None Detected
8A 162215250-0022	WHITE 12X12 FLOOR TILE	White Non-Fibrous Homogeneous	HA: 8	100% Non-fibrous (Other)	None Detected
8B 162215250-0023	WHITE 12X12 FLOOR TILE	White Non-Fibrous Homogeneous	HA: 8	100% Non-fibrous (Other)	None Detected
8C 162215250-0024	WHITE 12X12 FLOOR TILE	Gray/White Non-Fibrous Homogeneous	HA: 8	100% Non-fibrous (Other)	None Detected
9A 162215250-0025	MASTIC FOR 8	Black Non-Fibrous Homogeneous	HA: 9	100% Non-fibrous (Other)	None Detected
9B 162215250-0026	MASTIC FOR 8	Black Non-Fibrous Homogeneous	HA: 9	100% Non-fibrous (Other)	None Detected
9C 162215250-0027	MASTIC FOR 8	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 07/14/2022 14:54:19



# EMSL Analytical, Inc.

6340 CastlePlace Dr. Indianapolis, IN 46250

Tel/Fax: (317) 803-2997 / (317) 803-3047

<http://www.EMSL.com> / [indianapolislabs@emsl.com](mailto:indianapolislabs@emsl.com)

**EMSL Order:** 162215250  
**Customer ID:** KLIN50  
**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
HA: 9					
10A <small>162215250-0028</small>	2ND FLOOR PIPE INSULATION WRAP	White/Silver Fibrous Homogeneous	80% Cellulose 10% Glass	10% Non-fibrous (Other)	None Detected
HA: 10					
10B <small>162215250-0029</small>	2ND FLOOR PIPE INSULATION WRAP	White/Silver Fibrous Homogeneous	80% Cellulose 10% Glass	10% Non-fibrous (Other)	None Detected
HA: 10					
10C <small>162215250-0030</small>	2ND FLOOR PIPE INSULATION WRAP	White/Silver Fibrous Homogeneous	80% Cellulose 10% Glass	10% Non-fibrous (Other)	None Detected
HA: 10					
11A <small>162215250-0031</small>	2ND FLOOR PIPE JOINT COMPOUND	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 11					
11B <small>162215250-0032</small>	2ND FLOOR PIPE JOINT COMPOUND	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 11					
11C <small>162215250-0033</small>	2ND FLOOR PIPE JOINT COMPOUND	White/Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 11					
12A <small>162215250-0034</small>	CAULKING	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 12					
12B <small>162215250-0035</small>	CAULKING	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 12					
12C <small>162215250-0036</small>	CAULKING	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 12					
13A <small>162215250-0037</small>	CARPET MASTIC	Black/Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 13					
13B <small>162215250-0038</small>	CARPET MASTIC	Black/Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 13					
13C <small>162215250-0039</small>	CARPET MASTIC	Black/Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 13					
14A <small>162215250-0040</small>	BASEMENT WHITE PIPE INSULATION WRAP	White Fibrous Homogeneous	90% Cellulose	10% Non-fibrous (Other)	None Detected
HA: 14					
14B <small>162215250-0041</small>	BASEMENT WHITE PIPE INSULATION WRAP	White Fibrous Homogeneous	90% Cellulose	10% Non-fibrous (Other)	None Detected
HA: 14					

Initial report from: 07/14/2022 14:54:19



# EMSL Analytical, Inc.

6340 CastlePlace Dr. Indianapolis, IN 46250

Tel/Fax: (317) 803-2997 / (317) 803-3047

<http://www.EMSL.com> / [indianapolislaboratory@emsl.com](mailto:indianapolislaboratory@emsl.com)

**EMSL Order:** 162215250  
**Customer ID:** KLIN50  
**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
14C 162215250-0042	BASEMENT WHITE PIPE INSULATION WRAP	White/Silver Fibrous Homogeneous	85% Cellulose 5% Glass	10% Non-fibrous (Other)	None Detected
HA: 14					
15A 162215250-0043	BASEMENT WHITE PIPE JOINT COMPOUND	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 15					
15B 162215250-0044	BASEMENT WHITE PIPE JOINT COMPOUND	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 15					
15C 162215250-0045	BASEMENT WHITE PIPE JOINT COMPOUND	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
HA: 15					
16A 162215250-0046	BASEMENT YELLOW PIPE INSULATION WRAP	Silver/Yellow Fibrous Homogeneous	80% Cellulose 10% Glass	10% Non-fibrous (Other)	None Detected
HA: 16					
16B 162215250-0047	BASEMENT YELLOW PIPE INSULATION WRAP	Silver/Yellow Fibrous Homogeneous	80% Cellulose 10% Glass	10% Non-fibrous (Other)	None Detected
HA: 16					
16C 162215250-0048	BASEMENT YELLOW PIPE INSULATION WRAP	Silver/Yellow Fibrous Homogeneous	60% Cellulose 10% Glass	30% Non-fibrous (Other)	None Detected
HA: 16					
17A 162215250-0049	BASEMENT BLUE PIPE INSULATION WRAP	Silver/Blue Fibrous Homogeneous	80% Cellulose 10% Glass	10% Non-fibrous (Other)	None Detected
HA: 17					
17B 162215250-0050	BASEMENT BLUE PIPE INSULATION WRAP	Silver/Blue Fibrous Homogeneous	80% Cellulose 10% Glass	10% Non-fibrous (Other)	None Detected
HA: 17					
17C 162215250-0051	BASEMENT BLUE PIPE INSULATION WRAP	Silver/Blue Fibrous Homogeneous	70% Cellulose 10% Glass	20% Non-fibrous (Other)	None Detected
HA: 17					
18A 162215250-0052	BASEMENT GREEN PIPE INSULATION WRAP	Silver/Green Fibrous Homogeneous	80% Cellulose 10% Glass	10% Non-fibrous (Other)	None Detected
HA: 18					
18B 162215250-0053	BASEMENT GREEN PIPE INSULATION WRAP	Silver/Green Fibrous Homogeneous	80% Cellulose 10% Glass	10% Non-fibrous (Other)	None Detected
HA: 18					
18C 162215250-0054	BASEMENT GREEN PIPE INSULATION WRAP	White/Green Fibrous Homogeneous	75% Cellulose 5% Glass	20% Non-fibrous (Other)	None Detected
HA: 18					

Initial report from: 07/14/2022 14:54:19



# EMSL Analytical, Inc.

6340 CastlePlace Dr. Indianapolis, IN 46250

Tel/Fax: (317) 803-2997 / (317) 803-3047

<http://www.EMSL.com> / [indianapolislaboratory@emsl.com](mailto:indianapolislaboratory@emsl.com)

EMSL Order: 162215250

Customer ID: KLIN50

Customer PO:

Project ID:

Analyst(s)

*Maggie Hayden (34)*

*Paul Rihm (17)*

Asbestos 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. Indianapolis, IN NVLAP Lab Code 200188-0, AZ0939, CA 2575, CO AL-15132, TX 300262

Initial report from: 07/14/2022 14:54:19



EMSL ANALYTICAL, INC.  
LABORATORY-PRODUCTS-TRAINING

**Asbestos Chain of Custody**  
**EMSL Order Number (Lab Use Only):**

162215250

EMSL ANALYTICAL, INC.  
200 ROUTE 130 NORTH  
CINNAMINSON, NJ 08077  
PHONE: (800) 220-3675  
FAX: (856) 786-5974

Company: Klingner & Associates, P.C.		EMSL-Bill to: <input checked="" type="checkbox"/> Same <input type="checkbox"/> Different If Bill to is Different note instructions in Comments**	
Street: 610 North 4th St. Suite 100		Third Party Billing requires written authorization from third party	
City: Burlington	State/Province: IA	Zip/Postal Code: 52601	Country: U.S.
Report To (Name): Skyler Troutman		Telephone #: 319-752-3603	
Email Address: stroutman@klingner.com		Fax #: 319-752-3605	Purchase Order:
Project Name/Number: Gw Carver Building 21-5055		Please Provide Results: <input type="checkbox"/> Fax <input checked="" type="checkbox"/> Email <input type="checkbox"/> Mail	
U.S. State Samples Taken: missouri		Connecticut Samples: <input type="checkbox"/> Commercial <input type="checkbox"/> Residential	

**Turnaround Time (TAT) Options\* - Please Check**

3 Hour  6 Hour  24 Hour  48 Hour  72 Hour  96 Hour  1 Week  2 Week

\*For TEM Air 3 hr through 6 hr, please call ahead to schedule. \*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.

<b>PCM - Air</b> <input type="checkbox"/> Check if samples are from NY <input type="checkbox"/> NIOSH 7400 <input type="checkbox"/> w/ OSHA 8hr. TWA <b>PLM - Bulk (reporting limit)</b> <input checked="" type="checkbox"/> PLM EPA 600/R-93/116 (<1%) <input type="checkbox"/> PLM EPA NOB (<1%) Point Count <input type="checkbox"/> 400 (<0.25%) <input type="checkbox"/> 1000 (<0.1%) Point Count w/Gravimetric <input type="checkbox"/> 400 (<0.25%) <input type="checkbox"/> 1000 (<0.1%) <input type="checkbox"/> NYS 198.1 (friable in NY) <input type="checkbox"/> NYS 198.6 NOB (non-friable-NY) <input type="checkbox"/> NIOSH 9002 (<1%)	<b>TEM - Air</b> <input type="checkbox"/> 4-4.5hr TAT (AHERA only) <input type="checkbox"/> AHERA 40 CFR, Part 763 <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> EPA Level II <input type="checkbox"/> ISO 10312 <b>TEM - Bulk</b> <input type="checkbox"/> TEM EPA NOB <input type="checkbox"/> NYS NOB 198.4 (non-friable-NY) <input type="checkbox"/> Chatfield SOP <input type="checkbox"/> TEM Mass Analysis-EPA 600 sec. 2.5 <b>TEM - Water: EPA 100.2</b> Fibers >10µm <input type="checkbox"/> Waste <input type="checkbox"/> Drinking All Fiber Sizes <input type="checkbox"/> Waste <input type="checkbox"/> Drinking	<b>TEM - Dust</b> <input type="checkbox"/> Microvac - ASTM D 5755 <input type="checkbox"/> Wipe - ASTM D6480 <input type="checkbox"/> Carpet Sonication (EPA 600/J-93/167) <b>Soil/Rock/Vermiculite</b> <input type="checkbox"/> PLM CARB 435 - A (0.25% sensitivity) <input type="checkbox"/> PLM CARB 435 - B (0.1% sensitivity) <input type="checkbox"/> TEM CARB 435 - B (0.1% sensitivity) <input type="checkbox"/> TEM CARB 435 - C (0.01% sensitivity) <input type="checkbox"/> TEM Qual. via Filtration Technique <input type="checkbox"/> TEM Qual. via Drop-Mount Technique <b>Other:</b> <input type="checkbox"/>
---	--	--

Check For Positive Stop - Clearly Identify Homogenous Group      Filter Pore Size (Air Samples):  0.8µm  0.45µm

Samplers Name: Skyler Troutman      Samplers Signature: *Skyler Troutman*

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
1	A, B, C, 9x9 Floor Tile	1	7.5.22
2	mastic for 1	2	
3	2x4' ceiling tile	3	
4	1st floor pipe insulation wrap	4	
5	1st floor pipe joint compound	5	
6	12x12 pink floor tile	6	
7	mastic for 6	7	
8	white 12x12 Floor tile	8	

Client Sample # (s): 1-18 (A, B, C)      Total # of Samples: 54

Relinquished (Client): *[Signature]*      Date: 7.6.22      Time: 1430

Received (Lab): Molly Wiley      Date: 7/14/22      Time: 9:50am

Comments/Special Instructions: *[Signature]*      *EFY*



EMSL ANALYTICAL, INC.  
LABORATORY • PRODUCTS • TRAINING

### Asbestos Chain of Custody

EMSL Order Number (Lab Use Only):

EMSL ANALYTICAL, INC.  
200 ROUTE 130 NORTH  
CINNAMINSON, NJ 08077  
PHONE: (800) 220-3675  
FAX: (856) 786-5974

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
9	A, B, C mastic for 8	9	7-5-22
10	2nd floor pipe insulation wrap	10	
11	2nd floor pipe joint compound	11	
12	<del>gap</del> caulking	12	
13	carpet mastic	13	
14	basement white pipe insulation wrap	14	
15	basement white pipe joint compound	15	
16	basement yellow pipe insulation wrap	16	
17	basement blue pipe insulation wrap	17	
18	basement green pipe insulation wrap	18	
/			
*Comments/Special Instructions:			





# EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077

Tel/Fax: (800) 220-3675 / (856) 786-5974

<http://www.EMSL.com> / [cinnaslab@EMSL.com](mailto:cinnaslab@EMSL.com)

EMSL Order: 042223621

Customer ID: KLIN62

Customer PO:

Project ID:

**Attention:** Skyler Troutman  
Klingner & Associates  
610 North 4th Street  
Suite 100  
Burlington, IA 52601

**Project:** 21-5055 GWC

**Phone:** (319) 752-3603

**Fax:** (319) 752-3605

**Received Date:** 09/21/2022 9:30 AM

**Analysis Date:** 09/22/2022

**Collected Date:** 07/19/2022

## 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
RF-1A 042223621-0001	Layered Linoleum Flooring	White Non-Fibrous Homogeneous	HA: 1	100% Non-fibrous (Other)	None Detected
RF-1B 042223621-0002	Layered Linoleum Flooring	White Non-Fibrous Homogeneous	HA: 1	100% Non-fibrous (Other)	None Detected
RF-1C 042223621-0003	Layered Linoleum Flooring	White Non-Fibrous Homogeneous	HA: 1	100% Non-fibrous (Other)	None Detected
RF-2A-Mastic 042223621-0004 <i>Result includes a small amount of inseparable attached material</i>	Mastic for 1	White/Yellow Non-Fibrous Heterogeneous	HA: 2	100% Non-fibrous (Other)	None Detected
RF-2A-Mastic 2 042223621-0004A <i>Result includes a small amount of inseparable attached material</i>	Mastic for 1	White/Black Non-Fibrous Heterogeneous	HA: 2	100% Non-fibrous (Other)	None Detected
RF-2B-Mastic 042223621-0005 <i>Result includes a small amount of inseparable attached material</i>	Mastic for 1	White/Yellow Non-Fibrous Heterogeneous	HA: 2	100% Non-fibrous (Other)	None Detected
RF-2B-Mastic 2 042223621-0005A <i>Result includes a small amount of inseparable attached material</i>	Mastic for 1	White/Black Non-Fibrous Homogeneous	HA: 2	100% Non-fibrous (Other)	None Detected
RF-2C-Mastic 042223621-0006 <i>Result includes a small amount of inseparable attached material</i>	Mastic for 1	White/Yellow Non-Fibrous Heterogeneous	HA: 2	100% Non-fibrous (Other)	None Detected
RF-2C-Mastic 2 042223621-0006A <i>Result includes a small amount of inseparable attached material</i>	Mastic for 1	White/Black Non-Fibrous Heterogeneous	HA: 2	100% Non-fibrous (Other)	None Detected
RF-3A 042223621-0007 <i>Inseparable paint / coating layer included in analysis</i>	Floor Leveler	White/Black Non-Fibrous Heterogeneous	HA: 3	100% Non-fibrous (Other)	None Detected
RF-3B 042223621-0008	Floor Leveler	White/Black Non-Fibrous Heterogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 09/22/2022 09:43:50



# EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077

Tel/Fax: (800) 220-3675 / (856) 786-5974

<http://www.EMSL.com> / [cinnasblab@EMSL.com](mailto:cinnasblab@EMSL.com)

**EMSL Order:** 042223621  
**Customer ID:** KLIN62  
**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
<i>Inseparable paint / coating layer included in analysis</i>					
			HA: 3		
RF-3C	Floor Leveler	White/Black Non-Fibrous Heterogeneous		100% Non-fibrous (Other)	None Detected
042223621-0009 <i>Inseparable paint / coating layer included in analysis</i>					
			HA: 3		
RF-4A	Alternate Carpet Mastic	Tan/Black Non-Fibrous Heterogeneous		100% Non-fibrous (Other)	None Detected
042223621-0010 <i>Result includes a small amount of inseparable attached material</i>					
			HA: 4		
RF-4B	Alternate Carpet Mastic	Tan/Black Non-Fibrous Heterogeneous		100% Non-fibrous (Other)	None Detected
042223621-0011 <i>Result includes a small amount of inseparable attached material</i>					
			HA: 4		
RF-4C	Alternate Carpet Mastic	Tan/Black Non-Fibrous Heterogeneous		100% Non-fibrous (Other)	None Detected
042223621-0012 <i>Result includes a small amount of inseparable attached material</i>					
			HA: 4		
RF-5A	Black Exterior Window Caulking	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
042223621-0013					
			HA: 5		
RF-5B	Black Exterior Window Caulking	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
042223621-0014					
			HA: 5		
RF-5C	Black Exterior Window Caulking	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
042223621-0015					
			HA: 5		

Analyst(s)

Andrew Borsos (12)

Andrea Doughty (6)

Samantha Rundstrom, 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 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. Cinnaminson, NJ NVLAP Lab Code 101048-0, AIHA-LAP, LLC-IHLAP Lab 100194, NJ DEP 03036, PA ID# 68-00367, LA #04127

Initial report from: 09/22/2022 09:43:50



EMSL ANALYTICAL, INC.  
Environmental Monitoring Systems Laboratory

**Asbestos Chain of Custody**  
**EMSL Order Number (Lab Use Only):**

042223621

EMSL ANALYTICAL, INC  
 200 ROUTE 130 NORTH  
 CINNAMINSON, NJ 08077  
 PHONE: (800) 220-3675  
 FAX: (856) 786-5974

Company: <u>Klingner &amp; Associates</u>		EMSL-Bill to: <input checked="" type="checkbox"/> Same <input type="checkbox"/> Different <small>If Bill to is Different note instructions in Comments**</small>	
Street: <u>610 W. 4th St. Suite 100</u>		Third Party Billing requires written authorization from third party	
City: <u>Burlington</u>	State/Province: <u>IA</u>	Zip/Postal Code: <u>52601</u>	Country: <u>U.S.</u>
Report To (Name): <u>Skyler Troutman</u>		Telephone #: <u>319-752-3603</u>	
Email Address: <u>stroutman@Klingner.com</u>		Fax #: <u>319-752-3605</u>	Purchase Order:
Project Name/Number: <u>21-5055 GWC</u>		Please Provide Results: <input type="checkbox"/> Fax <input checked="" type="checkbox"/> Email <input type="checkbox"/> Mail	
U.S. State Samples Taken: <u>Missouri</u>		Connecticut Samples: <input type="checkbox"/> Commercial <input type="checkbox"/> Residential	
<b>Turnaround Time (TAT) Options* - Please Check</b>			
<input type="checkbox"/> 3 Hour <input type="checkbox"/> 6 Hour <input checked="" type="checkbox"/> 24 Hour <input type="checkbox"/> 48 Hour <input type="checkbox"/> 72 Hour <input type="checkbox"/> 96 Hour <input type="checkbox"/> 1 Week <input type="checkbox"/> 2 Week			
<small>*For TEM Air 3 hr through 6 hr, please call ahead to schedule. There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.</small>			
PCM - Air <input type="checkbox"/> Check if samples are from NY <input type="checkbox"/> NIOSH 7400 <input type="checkbox"/> w/ OSHA 8hr. TWA		TEM - Air <input type="checkbox"/> 4-4.5hr TAT (AHERA only) <input type="checkbox"/> AHERA 40 CFR, Part 763 <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> EPA Level II <input type="checkbox"/> ISO 10312	
PLM - Bulk (reporting limit) <input checked="" type="checkbox"/> PLM EPA 600/R-93/116 (<1%) <input type="checkbox"/> PLM EPA NOB (<1%) Point Count <input type="checkbox"/> 400 (<0.25%) <input type="checkbox"/> 1000 (<0.1%) Point Count w/Gravimetric <input type="checkbox"/> 400 (<0.25%) <input type="checkbox"/> 1000 (<0.1%) <input type="checkbox"/> NYS 198.1 (friable in NY) <input type="checkbox"/> NYS 198.8 NOB (non-friable-NY) <input type="checkbox"/> NIOSH 9002 (<1%)		TEM - Bulk <input type="checkbox"/> TEM EPA NOB <input type="checkbox"/> NYS NOB 188.4 (non-friable-NY) <input type="checkbox"/> Chatfield SOP <input type="checkbox"/> TEM Mass Analysis-EPA 600 sec. 2.5 TEM - Water: EPA 100.2 Fibers >10µm <input type="checkbox"/> Waste <input type="checkbox"/> Drinking All Fiber Sizes <input type="checkbox"/> Waste <input type="checkbox"/> Drinking	
		TEM - Dust <input type="checkbox"/> Microvac - ASTM D 5755 <input type="checkbox"/> Wipe - ASTM D6480 <input type="checkbox"/> Carpet Sonication (EPA 600/J-93/167) Soil/Rock/Vermiculite <input type="checkbox"/> PLM CARB 435 - A (0.25% sensitivity) <input type="checkbox"/> PLM CARB 435 - B (0.1% sensitivity) <input type="checkbox"/> TEM CARB 435 - B (0.1% sensitivity) <input type="checkbox"/> TEM CARB 435 - C (0.01% sensitivity) <input type="checkbox"/> TEM Qual. via Filtration Technique <input type="checkbox"/> TEM Qual. via Drop-Mount Technique Other:	
<input checked="" type="checkbox"/> Check For Positive Stop - Clearly Identify Homogenous Group		Filter Pore Size (Air Samples): <input type="checkbox"/> 0.6µm <input type="checkbox"/> 0.45µm	
Samplers Name: <u>Skyler Troutman</u>		Samplers Signature: <u>[Signature]</u>	
Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
RF-1 (A,B,C)	Layered linoleum flooring	1	9.19.22
RF-2	mastic for 1	2	
RF-3	Floor leveler	3	
RF-4	alternate carpet mastic	4	
RF-5	black exterior window caulking	5	
Client Sample # (s): <u>RF1 - RF5 (A,B,C)</u>		Total # of Samples: <u>15</u>	
Relinquished (Client): <u>[Signature]</u>		Date: <u>9.20.22</u>	Time: <u>1200</u>
Received (Lab): <u>OMB-EX</u>		Date: <u>9-21-22</u>	Time: <u>9:00A</u>
Comments/Special instructions: <u>Add additional HA's if multiple layers present</u>			

# **EXHIBIT E**

---

## **ASBESTOS LOCATION MAP**

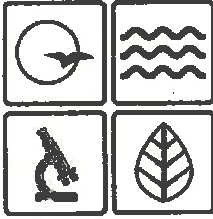


# **EXHIBIT F**

---

## **MISSOURI ASBESTOS INSPECTOR LICENSE**





Missouri Department of [dnr.mo.gov](http://dnr.mo.gov)

NATURAL RESOURCES

Michael L. Parson, Governor

Dru Buntin, Director

January 13, 2022

Skyler T Troutman  
1026 S Leebrick  
Burlington, IA 52601

**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: 7118010522MOII21991  
Course Training Date: January 05, 2022  
Missouri Certification Approval Date: January 14, 2022  
Missouri Certification Expiration Date: January 14, 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 Performance Requirements; and*
  - 10 CSR 10-6.250 *Asbestos Projects-Certification, Accreditation and Business Exemption Requirements.*
- To keep your occupation certification up-to-date, you must complete an annual refresher course and submit a renewal application each year.
- In order to be eligible to renew your certification, you must successfully complete a refresher course with a Missouri-accredited training provider within 12 months of the expiration date of your current training certificate. If you exceed this grace period, you will be required to retake a Missouri-accredited initial course in order to be eligible for Missouri certification.

To obtain a copy of the certification renewal application, or review regulations and requirements, please visit our website at <http://dnr.mo.gov/env/apcp/asbestos/index.htm>.

The holder of this card is certified to conduct the specified occupation in conjunction with an asbestos abatement project under the certification requirements, in RSMo, 10 CSR 10-6.250.

It is unlawful for any person to use this card other than the individual to whom it is issued or in any manner inconsistent with the law.

Violations of Missouri State Rule 10 CSR 10-6.080, "Emission Standards for Hazardous Air Pollutants," which adopts by reference 40 CFR, Part 61, Subpart M, the "National Emission Standards for Asbestos," are subject to fines of not more than \$10,000 per day per violation. This Missouri State Certification is subject to review and the director may deny, suspend or revoke this certification per RSMo, chapter 643.230.

If found, please return to:



Air Pollution Control Program  
P.O. Box 176  
Jefferson City, MO 65102  
Phone: (573)751-4817 Fax:(573)751-2706  
[www.dnr.mo.gov/env/apcp](http://www.dnr.mo.gov/env/apcp)

Air Pollution Control P

GRAM

CERTIFICATION NUMBER.

7118010522MOII21991

THIS CERTIFIES

Skyler T Troutman

HAS COMPLETED THE CERTIFICATION

REQUIREMENTS FOR

Inspector



APPROVED: 01/14/2022

EXPIRES: 01/14/2023

TRAINING DATE: 01/05/2022

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

# APPENDIX B

---



# LEAD INSPECTION REPORT

1616 Missouri Blvd  
Jefferson City, MO.

September 26, 2022

*Prepared for:*

## STATE OF MISSOURI DEPARTMENT OF AGRICULTURE

1616 Missouri Blvd  
Jefferson City, MO

*Prepared by:*

## KLINGNER & ASSOCIATES, P.C.

610 N. 4<sup>th</sup> Street, Suite 100  
Burlington, IA 52601

Project No. 21-5055

## TABLE OF CONTENTS

---

1.0	INTRODUCTION.....	1
2.0	SITE DESCRIPTION.....	1
3.0	LEAD PAINT INSPECTION.....	1
3.1	Introduction.....	1
3.2	Testing Results.....	1
3.3	Lead-Based Paint Disposal.....	2
4.0	RECOMMENDATIONS.....	3

### EXHIBITS:

EXHIBIT A – SAMPLE LOCATION MAP

EXHIBIT B – PHOTOGRAPHS

EXHIBIT C – LABORATORY REPORT

## 1.0 INTRODUCTION

---

The purpose of the lead paint testing was to determine if paint on the basement's floor and equipment bases contains lead prior to renovation activities.

## 2.0 SITE DESCRIPTION

---

Property Address: 1616 Missouri Boulevard, Jefferson City, MO

The limited lead paint testing was performed as part of HVAC upgrades for the structure located at 1616 Missouri Blvd in Jefferson City, Missouri. The purpose of the testing was to determine if paint on the basement's floor and equipment bases contains lead prior to renovation activities.

## 3.0 LEAD PAINT INSPECTION

---

### 3.1 Introduction

The American Society for Testing Materials defines lead paint as paint containing 2 parts per million of lead. The Consumer Products Safety Commission determined that paint with greater than 600 parts per million of lead may not be used in household applications. Such paint is still sold for marine and other uses. The U.S. Department of Housing and Urban Development (HUD) defines lead paint as having greater than 1 microgram per square centimeter of surface or 0.5% by weight. OSHA does not define lead paint based on content. Any detectable lead in a paint makes it lead paint for purposes of complying with OSHA regulations to worker exposure. The Missouri Department of Health & Senior Services through the Missouri Revised Statutes (Title XLI Chapter 701) defines lead-bearing substance as any paint or other surface coating materials that contain lead equal to or in excess of one (1) milligram per square centimeter, or more than 0.5% by weight.

### 3.2 Testing Results

Skyler Troutman, of Klingner & Associates, P.C. collected paint samples from the areas of concern in the building located at 1616 Missouri Boulevard, Jefferson City, MO on September 19, 2022. During the paint testing, two (2) samples were collected, one (1) from grey paint on the floor of the basement area, and one (1) from the red paint on the equipment bases located in the basement area (see Exhibit C – Paint Chip Laboratory Report). The content of lead

ranged from <0.0080% to 0.15 % concentration by weight. The following table shows the concentration of paint for each sample.

**TABLE 1 – LEAD CONTAINING PAINT SAMPLES**

Sample ID	Location	Color	Lead Concentration by Weight
P-1	Basement Floor	Grey	<0.0080%
P-2	Equipment Bases in basement	Red	0.15%

### 3.3 Lead-Based Paint Disposal

A generator of lead-containing waste that is not exempt as household hazardous waste is obligated to make a waste determination prior to disposal. Lead-bearing waste may be managed as either a solid waste or a hazardous waste depending upon the results of Toxicity Characteristic Leaching Procedure (TCLP) tests for lead.

The TCLP maximum contaminant concentration for lead is 5.0 mg/L (5.0 ppm). Wastes with 5.0 ppm or greater TCLP exhibit the toxicity characteristic for lead and require management as a hazardous waste. Total constituent analysis can be performed as a screening tool in lieu of TCLP if the waste is a solid. Wastes containing less than 20 times the maximum contaminant concentration of 5.0 ppm for lead (less than 100 ppm) using total constituent analysis will not fail TCLP due to the dilution factor of the TCLP test. In cases where total lead content is approaching 100 ppm or greater, a TCLP test should be completed or the waste handler may assume the waste is hazardous and manage it accordingly. Please note, that the results do not currently indicate the material would be considered a hazardous waste.

If the waste consists of lead-based paint as an integral part of demolition debris, the appropriate way to collect samples is by coring a representative portion of the material to be disposed (i.e. core through the wall, including both paint and wood). Because of the relatively small amount of lead present in the paint film, these wastes may not fail TCLP, and many can be disposed of as solid waste. If the material to be disposed is lead-based paint chips or blasting wastes, TCLP should be used on the waste to determine if it is a hazardous waste. Due to the more concentrated nature of these wastes, they may fail TCLP analysis and require management as a hazardous waste.

## 4.0 RECOMMENDATIONS

---

The paint sampled is not defined as lead paint according to the American Society for Testing Materials, the U.S. Department of Housing and Urban Development, or the Missouri Department of Health & Senior Services. OSHA does not define lead paint based on content. Any detectable lead in a paint makes it lead paint for purposes of complying with OSHA regulations to worker exposure.

# **EXHIBIT A**

---

## **SAMPLE LOCATION MAP**

KEYNOTE LEGEND	DESCRIPTION
VALUE	

STATE OF MISSOURI  
MICHAEL L. PARSON,  
GOVERNOR

NOT FOR CONSTRUCTION  
DESIGN DEVELOPMENT  
REVIEW SET

**KLINGNER & ASSOCIATES, P.C.**  
Engineers • Architects • Surveyors

Columbia, Missouri      www.klingner.com  
907 East Ash Street      Quincy, IL, Galesburg, IL  
573.355.5988      Burlington, IA, Peoria, IA, Hannibal, MO

KLINGNER & ASSOCIATES, P.C. - ENGINEERING  
MISSOURI STATE CERTIFICATE OF AUTHORITY #000866

OFFICE OF ADMINISTRATION  
DIVISION OF FACILITIES  
MANAGEMENT,  
DESIGN AND CONSTRUCTION

GEORGE WASHINGTON  
CARVER BUILDING

STATE OF MISSOURI

1616 MISSOURI BLVD  
JEFFERSON CITY, MO 65109

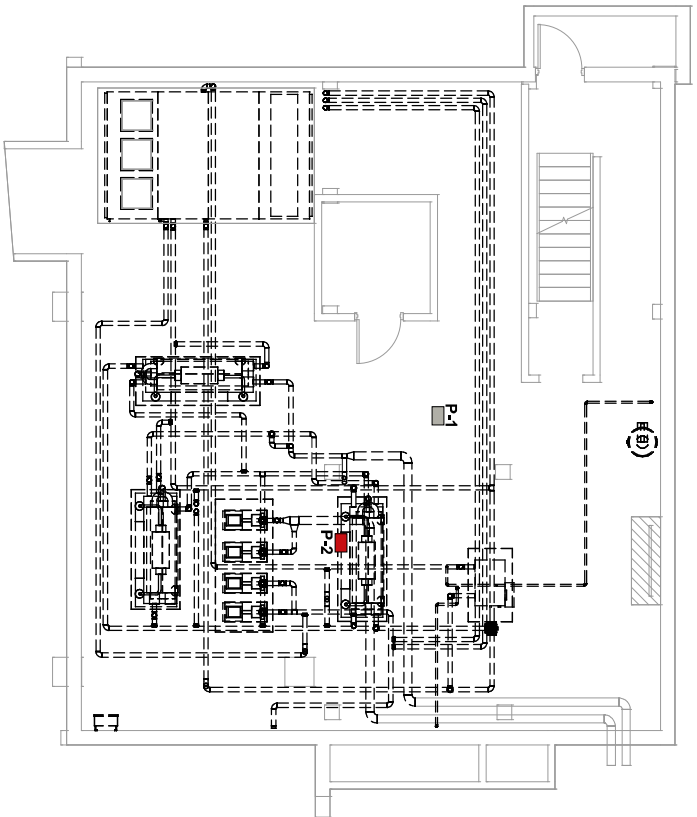
PROJECT # 02222-01  
SITE # 1010  
ASSET # 3101010001

REVISIONS:  
DATE: \_\_\_\_\_  
BY: \_\_\_\_\_  
REVISION: \_\_\_\_\_  
DATE: \_\_\_\_\_  
BY: \_\_\_\_\_  
REVISION: \_\_\_\_\_  
DATE: \_\_\_\_\_

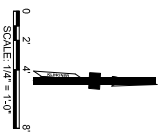
CAD DWG FILE:  
CREATED BY: AMB  
CHECKED BY: AMB  
DESIGNED BY: AMB  
SHEET TITLE:  
**BASEMENT  
DEMOLITION  
FLOOR PLAN**

SHEET NUMBER:  
**D104**

JULY 14, 2022



① BASEMENT DEMOLITION FLOOR PLAN  
1/4" = 1'-0"



## **EXHIBIT B**

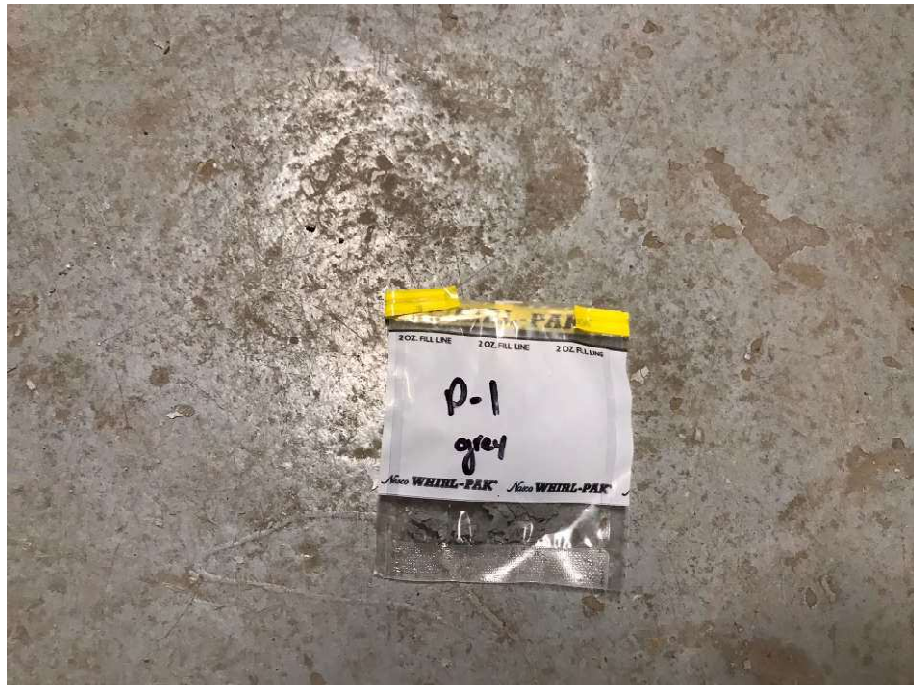
---

## **PHOTOGRAPHS**





1	Description	Basement area	
	Date	9/19/2022	



2	Description	Sample P-1 – Grey Basement floor paint	Lead Concentration  <0.0080%
	Date	9/19/2022	



3	Description	Sample P-2 – Red equipment base paint	Lead Concentration 0.15%
	Date	9/19/2022	

# **EXHIBIT C**

---

## **LABORATORY REPORT**



# EMSL Analytical, Inc.

200 Route 130 North, Cinnaminson, NJ 08077

Phone/Fax: (856) 303-2500 / (856) 786-5974

<http://www.EMSL.com>

[cinnaminsonleadlab@emsl.com](mailto:cinnaminsonleadlab@emsl.com)

EMSL Order: 202208456

CustomerID: KLIN62

CustomerPO:

ProjectID:

Attn: **Skyler Troutman**  
**Klingner & Associates**  
**610 North 4th Street**  
**Suite 100**  
**Burlington, IA 52601**

Phone: (319) 752-3603  
Fax: (319) 752-3605  
Received: 9/21/2022 11:00 AM  
Collected: 7/19/2022

Project: 21-5055 GWC

## Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)\*

<i>Client Sample Description</i>	<i>Lab ID</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Weight</i>	<i>Lead Concentration</i>
P-1	202208456-0001	7/19/2022	9/21/2022	0.2806 g	<0.0080 % wt
Site: Gray Basement Floor Paint					
P-2	202208456-0002	7/19/2022	9/21/2022	0.2591 g	0.15 % wt
Site: Red Equipment Base Paint					

Owen Mckenna, Lead Laboratory Director  
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.

\* Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 09/22/2022 11:27:08





EMSL ANALYTICAL, INC.  
LABORATORY - PARSIPPANY, NJ 07054

**Lead Chain of Custody**  
EMSL Order Number / Lab Use Only

202208456

EMSL Analytical, Inc.  
200 Route 130 North

Cinnaminson, NJ 08077  
PHONE: 1-800-220-3675  
EMAIL: c@emsl.com

<p><b>Customer Information:</b></p> <p>Customer ID: _____</p> <p>Company Name: <b>Klingner and Associates, PC</b></p> <p>Contact Name: <b>Skyler Troutman</b></p> <p>Street Address: <b>610 North 4th Street Suite 100</b></p> <p>City, State, Zip: <b>Burlington IA 52601</b> Country: <b>US</b></p> <p>Phone: <b>3196712574</b></p> <p>Email(s) for Report: <b>stroutman@klingner.com</b></p>	<p><b>Billing Information:</b></p> <p>Billing ID: _____</p> <p>Company Name: <b>Klingner and Associates, PC</b></p> <p>Billing Contact: <b>Skyler Troutman</b></p> <p>Street Address: <b>610 North 4th Street Suite 100</b></p> <p>City, State, Zip: <b>Burlington IA 52601</b> Country: <b>US</b></p> <p>Phone: <b>3196712574</b></p> <p>Email(s) for Invoice: <b>Sam-e</b></p>
---	--

**Project Information**

Project Name/No: **21-5055 GWC**

EMSL LIMS Project ID: \_\_\_\_\_

US State where samples collected: **MO**

Conceded (CT) must have correct location:  Commercial (Taxable)  Residential (Non-Taxable)

Sampled By Name: **Skyler Troutman** Sampled By Signature: *[Signature]*

Turn-Around-Time (TAT):  3 Hour  6 Hour  24 Hour  32 Hour  48 Hour  72 Hour  96 Hour  1 Week  2 Week

Please call ahead for large projects and/or turnaround times 6 hours or less. \*32 hour TAT available for select tests only; samples must be submitted by 10:30am

MATRIX	METHOD	INSTRUMENT	REPORTING LIMIT	SELECTION
<input checked="" type="checkbox"/> Soil <input type="checkbox"/> Air <input type="checkbox"/> Water <small>*Reporting Limit based on a minimum 0.25g sample weight</small>	SW 846-7000B	Flame Atomic Absorption	0.005% (50ppm)	<input checked="" type="checkbox"/>
	SW 846-6010D*	ICP-OES	0.0004% (4ppm)	<input type="checkbox"/>
AIR	NIOSH 7082	Flame Atomic Absorption	4µg/filter	<input type="checkbox"/>
	NIOSH 7300M / NIOSH 7303M NIOSH 7300M / NIOSH 7303M	ICP-OES ICP-MS	0.5µg/filter 0.05µg/filter	<input type="checkbox"/>
WATER <input type="checkbox"/> ASTM <input type="checkbox"/> NON-ASTM	SW 846-7000B	Flame Atomic Absorption	10µg/cup	<input type="checkbox"/>
	SW 846-6010D*	ICP-OES	1.0µg/cup	<input type="checkbox"/>
TCLP	SW 846-1311 / 7000B / SM 3111B SW 846-1311 / SW 846-6010D*	Flame Atomic Absorption ICP-OES	0.4 mg/L (ppm) 0.1 mg/L (ppm)	<input type="checkbox"/>
	SW 846-1312 / 7000B / SM 3111B SW 846-1312 / SW 846-6010D*	Flame Atomic Absorption ICP-OES	0.4 mg/L (ppm) 0.1 mg/L (ppm)	<input type="checkbox"/>
SPLP	22 CFR App. II, 7000B	Flame Atomic Absorption	4(mg/kg (ppm)	<input type="checkbox"/>
	22 CFR App. II, SW 846-6010D*	ICP-OES	2mg/kg (ppm)	<input type="checkbox"/>
TTLC	22 CFR App. II, 7000B	Flame Atomic Absorption	0.4 mg/L (ppm)	<input type="checkbox"/>
	22 CFR App. II, SW 846-6010D*	ICP-OES	0.1 mg/L (ppm)	<input type="checkbox"/>
STLC	SW 846-7000B	Flame Atomic Absorption	40mg/kg (ppm)	<input type="checkbox"/>
	SW 846-6010D*	ICP-OES	2mg/kg (ppm)	<input type="checkbox"/>
Soil	SM 3111B / SW 846-7000B	Flame Atomic Absorption	0.4 mg/L (ppm)	<input type="checkbox"/>
	EPA 200.7	ICP-OES	0.020 mg/L (ppm)	<input type="checkbox"/>
Unpreserved Preserved with HNO3 <input type="checkbox"/> PH-2	EPA 200.5	ICP-OES	0.005 mg/L (ppm)	<input type="checkbox"/>
	EPA 200.8	ICP-MS	0.001 mg/L (ppm)	<input type="checkbox"/>
Washing Water Unpreserved Preserved with HNO3 <input type="checkbox"/> PH-2	40 CFR Part 50	ICP-OES	12 µg/filter	<input type="checkbox"/>
TOPS/PM Filter				<input type="checkbox"/>
Other:				<input type="checkbox"/>

Sample Number	Sample Location	Volume / Area	Date / Time Sampled
P-1	Carex basement floor paint	1	9.19.22
P-2	Red equipment base paint	2	J

Method of Shipment: \_\_\_\_\_ Sample Condition Upon Receipt: \_\_\_\_\_

Relinquished by: *[Signature]* Date/Time: **9.20.22/1200** Received by: *[Signature]* Date/Time: **9/21/22 11:00**

Relinquished to: \_\_\_\_\_ Received by: \_\_\_\_\_ Date/Time: \_\_\_\_\_

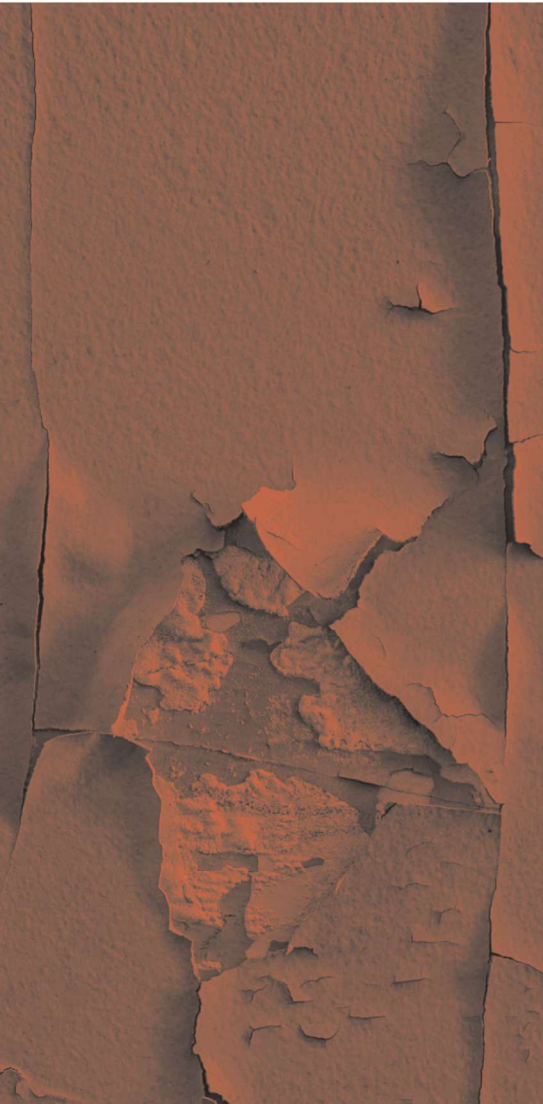




National Institutes  
of Health



# LEAD: WORKER AND EMPLOYER GUIDE TO HAZARDS AND RECOMMENDED CONTROLS



## WHAT IS LEAD?

Lead is a soft, blue-gray metal that occurs naturally in the Earth's crust. Because of its very useful properties, lead was one of the first metals used by humans, and, consequently, the cause of the first recorded occupational disease. In the past, lead was used regularly in paint, batteries, ceramics, caulk, pipes, and solder for pipes.

## WHAT ARE THE HAZARDS OF LEAD?

Lead overexposure is one of the leading causes of workplace illness. In adults, lead enters the body primarily through breathing in lead-containing dust, along with accidental ingestion (e.g., eating, drinking, smoking). Lead passes from the lungs or the digestive tract into the blood where it can harm many of the body's systems. Workers exposed to lead on the job may develop a variety of health problems, such as nervous system, digestive tract, blood, kidney, heart, and brain damage. Poor personal hygiene practices, such as workers handling items contaminated with lead or lead-containing dust and then touching their eyes, nose, or mouth before washing their hands can lead to exposure. When lead in the air or lead on contaminated surfaces comes into contact with clothes, hair and/or skin, workers can unknowingly bring lead home and expose family members.

**Workers exposed to lead on the job may develop a variety of health problems, such as nervous system, digestive tract, blood, kidney, heart, brain, and reproductive system damage in both men and women.**

The Occupational Safety and Health Administration (OSHA) has requirements to protect workers from the hazards of lead, and the National Institute for Occupational Safety and Health (NIOSH) has recommendations to protect workers from the hazards of lead. The Department of Housing and Urban Development (HUD) and

the Environmental Protection Agency (EPA) also have requirements and guidelines pertaining to lead hazards in housing. We strongly recommend using a certified lead-safe contractor or a certified lead abatement contractor to perform any work involving lead or lead-based paint in homes built before 1978.

## WHERE IS LEAD FOUND IN HOMES AND RESIDENTIAL BUILDINGS?

Lead dust is produced when lead metal is cut or when lead-based paint is cut, sanded, chipped, scraped, or crushed. Workers may be exposed to lead during the removal, renovation, or demolition of structures painted with lead-based paints. Workers also may be exposed during installation, maintenance, or demolition of lead pipes and fittings, lead linings in tanks, and other work involving lead metal. Lead paint was not banned from use in residential paint until 1978; therefore, homes painted prior to 1978 have the potential to contain lead-based paint. The older a home or a building is, the more likely it has some lead-based paint.

## PROTECTING WORKERS

Employers are required to protect workers from lead exposure under OSHA lead standards covering general industry ([29 CFR 1910.1025](#)) and construction ([29 CFR 1926.62](#)). The lead standards establish a Permissible Exposure Limit (PEL) of 50 micrograms of lead per cubic meter of air ( $\mu\text{g}/\text{m}^3$ ) sampled over an eight-hour time-weighted average for all workers covered. These standards also include an action level of  $30 \mu\text{g}/\text{m}^3$ , where the employer must implement specific compliance activities.

Worker protection involves engineering controls, work practices and personal protective equipment (PPE). Engineering controls include isolating the exposure source and/or using other engineering methods, such as general room or local exhaust ventilation on power tools such as sanders, grinders, and saws, to minimize exposure to lead. When lead exposures are above the PEL, employers are required to provide, at no cost to the workers, protective clothing and equipment as well as cleaning, laundering, or disposal of that protective clothing and equipment.





## METHODS TO PREVENT OR REDUCE WORKER LEAD EXPOSURE

- Per OSHA lead standards, employers must conduct an exposure assessment to initially determine if any worker may be exposed to lead at or above the action level.
  - Leave lead where it is. For example, it may be safer to seal old lead-containing paint underneath new, non-lead-containing paint.
  - Remove and replace items with lead-containing paint rather than trying to chip, sand, or otherwise remove the paint.
- Wet surfaces (e.g. painted surfaces) before and during work (e.g., scraping, sanding) that might create lead-containing dust to help prevent workers from inhaling or ingesting lead (this reduces but does not completely prevent exposures).
  - Ensure work areas are well ventilated. This may be accomplished simply by opening doors and windows when working inside a closed structure. Local ventilation equipment may also be needed.
  - Avoid dry and wet sweeping, shoveling or brushing dust that may contain lead. Only use a vacuum that is equipped with a high efficiency particulate air (HEPA) filter for cleanup activities
  - Conduct air monitoring to ensure workers are not exposed above the OSHA PEL. Take appropriate actions if worker exposures exceed the action level ( $30 \mu\text{g}/\text{m}^3$ ) for more than 30 days per year.
  - Provide workers with appropriate PPE, including fit-tested, NIOSH-approved respirators, and ensure workers clean contaminated PPE after each use. The use of respirators requires compliance with the OSHA respiratory protection standard ([29 CFR 1910.134](#)).
  - Wear outer clothing that can be disposed of or washed (separately) after completing work.
  - Provide training for workers on the hazards of lead and how they can protect themselves before being exposed.
  - Ensure that food or beverages are not present or consumed, tobacco products are not present or used, and cosmetics are not applied in areas where workers may be exposed to lead.
  - Ensure that workers wash their hands and face prior to eating, drinking or applying cosmetics.
  - Inform medical professionals of work activities involving lead or potential lead exposure.

## METHODS TO PREVENT TAKING LEAD HOME FROM WORK

- Wash hands and face often and shower at the end of the work shift.
- Change out of work clothes and shoes before going home. Always wear clean, uncontaminated clothing and shoes home.
- Do not take contaminated work clothing or shoes home. If necessary, put contaminated clothing/shoes in a plastic bag or other closable container. Do NOT wash contaminated work clothes with personal clothing.

## DECONTAMINATION

Hand washing with standard soap and water is recommended by OSHA and NIOSH. However, specialized lead removal products should also be considered by employers, particularly if dust or paint is found to have high lead concentrations. Products are available that reveal lead contamination on hands/surfaces, and that remove lead residues from skin.



Employers must provide workers with a way to discard disposable work clothing or store contaminated clothing in a closable container that will prevent lead dust from getting outside of the container. If work clothing is heavily contaminated with lead-containing dust, a vacuum equipped with a HEPA filter can be used to vacuum workers' clothes before removal to prevent dust being shaken off during removal of clothing. Respirators must not be removed until entering a clean area. Respirators must also be cleaned after every use. If workers may be exposed to higher levels of lead, shower facilities and a change-out room that has a separate storage for clean street clothes and soiled work clothing must be made available. There are products available to prevent lead dust from being tracked through clean areas, like sticky mats that remove dust and dirt from the bottom of workers' shoes.

## OTHER SAFETY AND HEALTH HAZARDS

Recovery workers involved in demolition and rebuilding may face additional hazards on the job site. Common hazards include downed electrical wires, carbon monoxide and electrical hazards from portable generators, fall and "struck-by" hazards from tree limbs or working at heights, working in unprotected excavations or confined spaces, burns, lacerations, musculoskeletal injuries, being struck by traffic or heavy equipment, and encountering contaminated water during cleanup and recovery efforts.

## ADDITIONAL RESOURCES

- Occupational Safety and Health Administration (OSHA) Safety and Health Topics page on Lead: <http://www.osha.gov/SLTC/lead/>
- National Institute for Occupational Safety and Health (NIOSH) Workplace Safety and Health Topics page on Lead: <http://www.cdc.gov/niosh/topics/lead/>
- National Institute for Occupational Safety and Health (NIOSH) "Protecting Workers Exposed to Lead-Based Paint Hazards: A Report to Congress". Publication No. 98-112 (January 1997) at: [www.cdc.gov/niosh/docs/98-112/](http://www.cdc.gov/niosh/docs/98-112/)
- Environmental Protection Agency (EPA) Lead Renovation, Repair and Painting Program: <http://www2.epa.gov/lead/renovation-repair-and-painting-program>
- OSHA's lead standard for general industry (29 CFR 1910.1025) at: [https://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10030](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10030)
- OSHA's lead standard for construction (29 CFR 1926.62) at: [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10641](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10641)

## ASSISTANCE FOR EMPLOYERS

OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site Consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing safety and health management systems. To locate the OSHA On-site Consultation Program nearest you, call 1-800-321-6742 (OSHA) or visit <http://www.osha.gov/dcsp/smallbusiness/index.html>.

**This guidance document creates no new legal obligations. It contains recommendations as well as descriptions of OSHA safety and health standards. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available by the OSHA Office of Communications to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.**