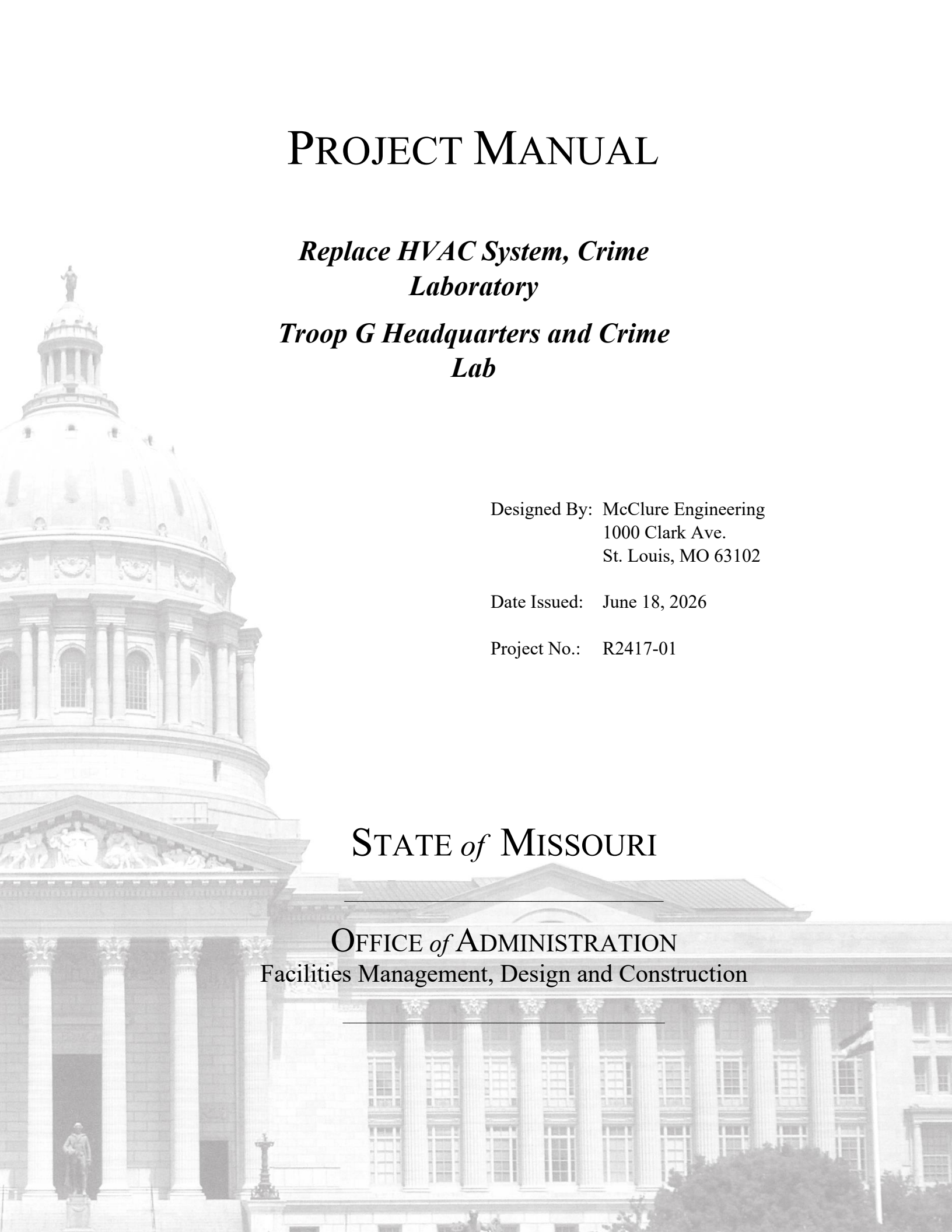




PROJECT MANUAL

Replace HVAC System, Crime Laboratory

Troop G Headquarters and Crime Lab

Designed By: McClure Engineering
1000 Clark Ave.
St. Louis, MO 63102

Date Issued: June 18, 2026

Project No.: R2417-01

STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION
Facilities Management, Design and Construction

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

PROJECT NUMBER: R2417-01

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

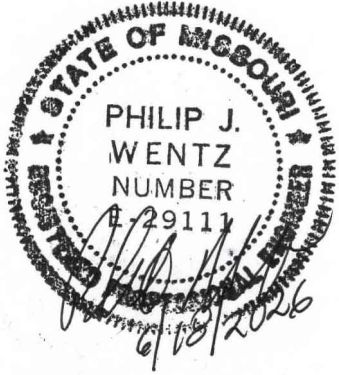
Mechanical / Electrical McClure Engineering 1000 Clark Ave. St. Louis, MO 63102 T (314) 645-6232 F (314) 645-4128  Phil J. Wentz E-29111	I hereby certify that Drawings: <u>CS0.1 – E3.1</u> and Specifications <u>Division 20- 26</u> have been prepared by me, or under my supervision. I further certify that to the best of my knowledge these drawing and/or specifications are as required by and in compliance with building codes of the State of Missouri Office of Administration Signature <u>Philip Wentz</u>
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NOTICE TO BIDDERS

The following procurement forms can be found on our website at:
<https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>
 and shall be submitted with your bid to FMDCBids@oa.mo.gov

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SECTION 000115 – LIST OF DRAWINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 LIST OF DRAWINGS

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

	<u>TITLE</u>	<u>SHEET #</u>	<u>DATE</u>	<u>CAD #</u>
1.	Cover Sheet	CS0.1	11/6/25	CS.1
2.	Mechanical Symbol, Abbreviations, and Details	M0.0	11/6/25	M0.0
3.	First Floor Mechanical Demolition Plan	MD3.0	11/6/25	MD3.0
4.	Roof Mechanical Demolition Plan	MD3.1	11/6/25	MD3.1
5.	First Floor Mechanical New Work Plan	M3.0	11/6/25	M3.0
6.	Roof Mechanical New Work Plan	M3.1	11/6/25	M3.1
7.	RTU-1 Air Flow Diagrams	M5.0	11/6/25	M5.0
8.	Natural Gas Flow Diagram, Points List, And Sequence	M5.1	11/6/25	M5.1
9.	Mechanical Schedules	M6.0	11/6/25	M6.0
10.	Electrical Symbols, Abbreviations Schedules and Details	E0.0	11/6/25	E0.0
11.	First Floor Electrical Demolition Plan	ED3.0	11/6/25	ED3.0
12.	Roof Electrical Demolition Plan	ED3.1	11/6/25	ED3.1
13.	First Floor Electrical New Work Plan	E3.0	11/6/25	E3.0
14.	Roof Electrical New Work Plan	E3.1	11/6/25	E3.1

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 System, Crime Laboratory
Troop G Headquarters and Crime Lab
Willow Springs, Missouri
Project No.: R2417-01

3.0 BIDS WILL BE RECEIVED:

- A. Until: 1:30 PM, October 13, 2026
- B. **Only electronic bids sent to FMDCBids@oa.mo.gov shall be accepted:** (See Instructions to Bidders for further detail)

4.0 DESCRIPTION:

- A. Scope: The project includes replacing existing DX RTU air handler. Alternate scope includes demo out existing exhaust fan, flexible duct (back to pvc assembly) and wall mounting bracket on exterior wall of building.
- B. MBE/WBE/SDVE Goals: MBE 0%, WBE 0%, 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: 10:30 AM, September, 23, 2026, at Conference Room at Troop G Headquarters, 1226 W. Business US – 60/63, Willow Springs, MO. 65793
- 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 \$30.00** 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:

Project Manager: Michael Schrader, 573-536-7105, email: michael.schrader@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.

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 one (1) party may be limited in accordance with available supply.
- B. For the convenience of contractors, subcontractors and suppliers, bidding documents are available on the Owner's website at <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 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 successful Bidder (contractor) to fulfill every detail of the requirements of the contract, nor accepted as a basis for any claims for extra compensation or time extension.
- B. Under no circumstances will Bidders give their plans and specifications to other Bidders. It is highly encouraged, but not required, that all Bidders be on the official planholders list to receive project updates including but not limited to any addenda that are issued during the bidding process.

4.0 - INTERPRETATIONS

- A. No Bidder shall be entitled to rely on oral or written representations from any person as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction.
- B. Bidders shall make all requests for interpretations in writing and submit all requests to the Project Manager identified in Section 007300 – Supplementary Conditions with all necessary supporting documentation no less than five (5) working days before opening of bids. Responses to requests for interpretation will be issued via a written addendum and will be sent as promptly as is practicable to all official planholders and posted on the Owner's website. All such addenda shall become part of the bid and contract documents.
- C. Bidders shall make all requests for an "Acceptable Substitution" on the Section 006325 Substitution Request Form. The request shall be emailed to the Project Manager identified in Section 007300 – Supplementary Conditions no less than five (5) working days before opening of bids. Responses to requests for substitutions will be issued via a written addendum and will be sent as promptly as is practicable to all official planholders and posted on the Owner's website. All such addenda shall become part of the bid and contract documents.
- D. An "Acceptable Substitution" requested after the award of bid will only be approved if proven to the satisfaction of the Owner and the Designer 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 and all requests of this nature must be submitted in accordance with Article 3.1 of the General Conditions.

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 on the bid documents or the bid will be rejected for being non-responsive.
- B. Depending on the specific project requirements, **the following is a GENERIC list** of all possible bid forms that may be due with bid submittals. Bidders must verify each specific project's requirements in Section 004113 to ensure they have provided all the required documentation with their submission.

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

- C. The Bidder shall submit its bid on the forms provided by the Owner in the same file format (PDF) with each space fully and properly completed, typewritten or legibly printed, including all amounts required for alternate bids, unit prices, cost accounting data, etc. The Owner will reject bids that are not on the Owner's forms and that do not contain all requested information. All forms can be found on the Owner's website at <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans> and shall be submitted to FMDCBids@oa.mo.gov.
- D. All bids shall be submitted without additional terms and conditions, modifications, or reservations. The completed forms shall not include interlineations, alterations, or erasures. Bids not in compliance with the requirements of this paragraph will be rejected as non-responsive.
- E. 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 in the bid documents in Section 004113. Failure of the Bidder to submit the duly authorized bid bond or 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 bid closing or if the Bidder, within ten (10) working days after notification of award, refuses or is unable to 1) execute the tendered contract, 2) provide an acceptable performance and payment bond, or 3) provide evidence of required insurance coverage.
- F. The bid bond 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.

6.0 - SIGNING OF BIDS

- A. A bid shall 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 shall appear as shown in the Secretary of State's records. If the Bidder is an entity organized in a state other than Missouri, the Bidder must provide a Certificate of Authority to do business in the State of Missouri.
- B. If the successful Bidder is doing business in the State of Missouri under a fictitious name, the Bidder 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.
- C. A bid from an individual shall be signed as noted on the Bid Form.
- D. 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.

- E. A bid from a limited liability company (LLC) shall be signed by a manager or a managing member of the LLC.
- F. A bid from a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation. Title of office held by the person signing for the corporation shall appear, along with typed name of said individual and the corporate license number shall be provided. In addition, for corporate proposals, the President or Vice-President listed per the current filing with the Missouri Secretary of State should sign as the Bidder. If the signatory is other than the corporate president or vice president, the bidder must provide satisfactory evidence that the signatory has the legal authority to bind the corporation.

7.0 - RECEIVING BID SUBMITTALS

- A. It is the Bidder's sole responsibility to ensure receipt of the bid submittals by Owner on or before the date and time specified in the Invitation for Bid or as modified via written addenda. Bids received after the date and time specified will not be considered by the Owner.
- B. All bids shall be received via email at FMDCBids@oa.mo.gov. A bid submitted through any other means, including hard copies, will not be considered and will be discarded by the Owner unopened.

8.0 - MODIFICATION AND WITHDRAWAL OF BIDS

- A. Bidder may withdraw a bid at any time prior to the 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. Bidder may modify a bid until the scheduled closing time by sending a revised bid to FMDCBids@oa.mo.gov with a note in the subject line and body of the email that it is a revised bid. A revised bid sent via any other method will not be considered.

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 limited to, contracts for the furnishing and installation of furniture, equipment, machinery, appliances and other apparatuses.
- C. The Owner will award a contract to the lowest, responsive, and 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 award shall be considered binding upon the Owner until the written contract has been properly executed and the following documentation has been provided: 1) performance and payment bond consistent with Article 6.1 of the General Conditions; 2) proof of the required insurance coverage; 3) an executed Section 004541 - Affidavit of Work Authorization form; and 4) documentation evidence enrollment and participation in a federal work authorization program.
- F. Failure to execute and return the contract and associated documents within the prescribed period 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.
- G. 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.

- H. 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. Bidders must also submit an E-Verify Memorandum before the Owner may award a contract to the Bidder. Information regarding E-Verify is located at <https://www.e-verify.gov/employers/enrolling-in-e-verify>. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.
- I. The successful Bidder must be registered in MissouriBUYS powered by MOVERS at <https://missouribuyss.mo.gov/supplier-registration#> as an approved vendor prior to being issued a contract.

10.0 - CONTRACT SECURITY

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

11.0 - 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.

12.0 - 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 Bidder'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.

13.0 – ANTI-DISCRIMINATION AGAINST ISRAEL ACT CERTIFICATION:

- A. 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 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 required to complete and submit the applicable portion of Section 004545 - Anti-Discrimination Against Israel Act Certification with its 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.

14.0 - 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 nonresponsive, and its bid shall be rejected.
2. The Bidder should submit with its bid all 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 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 Prime Bidder that qualifies as an SDVE shall receive a three-percentage 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 will become 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.

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.) 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 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 Equal Opportunity or by the Federal U.S. Small Business Administration directory.
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 Office of Equal Opportunity online SDVE directory at <https://o eo.mo.gov/sdve-certification-program/> or the Federal U.S. Small Business Administration directory <https://veterans.certify.sba.gov/#search>.
3. Additional information, clarifications, or other information regarding the MBE/WBE/SDVE listings in the directories may be obtained by contacting 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 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 granted a waiver and will be considered 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;

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 in the 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 nonresponsive 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 the 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 in writing.
4. The Contractor shall provide the Owner with regular reports on its progress in meeting its MBE/WBE/SDVE obligations. At a minimum, the Contractor shall report the dollar-value of work completed by each MBE, WBE, or SDVE during the preceding month and the cumulative total of work completed by each MBE, WBE or SDVE to date with each monthly application for payment. The Contractor shall also make a final report, which shall include the total dollar-value of work completed by each MBE, WBE, and SDVE during the entire contract.



State of Missouri 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 System, Crime Laboratory
Troop G Headquarters and Crime Lab
Willow Springs, Missouri

Project Number: R2417-01

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

ARTICLE 2. TIME OF COMPLETION

The contract performance time is **120 working days** from the transmittal date of this agreement. The contract completion date is **MONTH, DAY, YEAR**. This time includes ten (10) working days for the Contractor to receive, sign and return the contract form along with required bonding and insurance certificates. Failure of the Contractor to provide correct bonding and insurance within the ten (10) working days shall not be grounds for a time extension. Receipt of proper bonding and insurance is a condition precedent to the formation of the contract and if not timely received, may result in forfeiture of the Contractor's bid security. Work may not commence until the Owner issues a written Notice to Proceed and must commence within seven (7) working days thereafter.

ARTICLE 3. LIQUIDATED DAMAGES

Whenever time is mentioned in this contract, time shall be and is of the essence of this contract. The Owner would suffer a loss should the Contractor fail to have the work embraced in this contract fully completed on or before the time above specified. THEREFORE, the parties hereto realize in order to adjust satisfactorily the damages on account of such failure that it might be impossible to compute accurately or estimate the amount of such loss or damages which the Owner would sustain by reason of failure to complete fully said work within the time required by this contract. The Contractor hereby covenants and agrees to pay the Owner, as and for **liquidated damages, the sum of \$500** 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: \$

Accepted Alternates, if applicable to the Project and accepted by the Owner.

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 0% MBE and 0% 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)
 - 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), if applicable
 - 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.

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

APPROVED:

Crystal Wessing, Interim 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

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

LOCATION

DATE INSTALLED

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 ☒ FINAL	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
☐ MBE ☐ WBE ☐ SDVE	\$	\$	
☐ MBE ☐ WBE ☐ SDVE	\$	\$	
☐ MBE ☐ WBE ☐ SDVE	\$	\$	
☐ MBE ☐ WBE ☐ SDVE	\$	\$	
☐ MBE ☐ WBE ☐ SDVE	\$	\$	
☐ MBE ☐ WBE ☐ SDVE	\$	\$	

Revised 06/2023

INSTRUCTIONS FOR MBE/WBE/SDVE PROGRESS REPORT

CONTRACTOR OR CONSULTANT TO FILL OUT AND REMIT WITH EACH PAY APPLICATION:

The MBE/WBE/SDVE Progress Report for the project is issued with the contract comprising values reported in the consultant's Proposal or on the successful contractor's Section 004337 Compliance Evaluation Forms.

At Initial Pay Application fill in the following:

1. Pay App No. Start with 1.
2. Fill in the Project Number and Date.
3. Enter Project Title, Project Location, and Firm.
4. Fill in the "Original Contract Sum" and "Total Contract Sum To Date" (Reference applicable Line Items on Form A of Application for Payment).
5. Indicate the Total Participation Dollar Amount from the Original Contract.
6. Select MBE, WBE, or SDVE for each Consultant/Subconsultant or Contractor/Subcontractor/Supplier.
7. Enter the "Total Amount of Subcontract", "\$ Amount (Paid-To-Date)", and Company Name.

For all subsequent Pay Applications fill in the following:

1. Pay App No.
2. If Final Pay App, check box.
3. Fill in the Project Number and Date.
4. Enter Project Title, Project Location, and Firm
5. At each Pay App fill in the "Original Contract Sum" and "Total Contract Sum To Date" (reference applicable Line Items on Form A of Application for Payment).
6. Indicate the Total Participation Dollar Amount from the Original Contract.
7. Select MBE, WBE, or SDVE for each Consultant/Subconsultant or Contractor/Subcontractor/Supplier
8. Enter the "Total Amount of Subcontract", "\$ Amount (Paid-To-Date)", and Company Name.



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 EMBOSSER 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)

FILE: Closeout Documents

GENERAL CONDITIONS

INDEX

ARTICLE:

1. General Provisions

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

2. Owner/Designer Responsibilities

3. Contractor Responsibilities

- 3.1. Acceptable Substitutions
- 3.2. Submittals
- 3.3. As-Built Drawings
- 3.4. Guaranty and Warranties
- 3.5. Operation and Maintenance Manuals
- 3.6. Other Contractor Responsibilities
- 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, tools, 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 so that the project shall be complete and finished in the best manner known to each respective trade.
15. **"WORKING DAYS"**: are all calendar days except Saturdays, Sundays and the following holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday (observed), Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day (observed), Thanksgiving Day, Christmas Day.

ARTICLE 1.2 DRAWINGS AND SPECIFICATIONS

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

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

- A. Since the Owner is the State of Missouri, municipal or political subdivisions, zoning ordinances, construction codes (other than licensing of trades), and other like ordinances are not applicable to construction on Owner's property, and Contractor will not be required to submit drawings and specifications to any municipal or political subdivision, authority, obtain construction permits or any other licenses (other than licensing of trades) or permits from or submit to inspections by any municipality or political subdivision relating to the construction for this project. All permits or licenses required by municipality or political subdivision for operation on property not belonging to Owner shall be obtained by and paid for by Contractor. Each Contractor shall comply with all applicable laws, ordinances, rules and regulations that pertain to the work of this contract.
- B. Contractors, subcontractors and their employees engaged in the businesses of electrical, mechanical, plumbing, carpentry, sprinkler system work, and other construction related trades shall be licensed to perform such work by the municipal or political subdivision where the project is located, if such licensure is required by local code. Local codes shall dictate the level (master, journeyman, and apprentice) and the number, type and ratio of licensed tradesmen required for this project within the jurisdiction of such municipal or political subdivision.
- C. Equipment and controls manufacturers and their authorized service and installation technicians that do not maintain an office within the jurisdiction of the municipal or political subdivision but are a listed or specified contractor or subcontractor on this project are exempt from Paragraph 1.3 B above.
- D. The Contractor shall post a copy of the wage determination issued for the project and included as a part of the contract documents, in a prominent and easily accessible location at the site of construction for the duration of the project.
- E. Any contractor or subcontractor to such contractor at any tier signing a contract to work on this project shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction safety program for their on-site employees which includes a course in construction safety and health approved by OSHA or a similar program approved by the Department of Labor and Industrial Relations which is at least as stringent as an approved OSHA program. The contractor shall forfeit as a penalty to the public body on whose

behalf the contract is made or awarded, two thousand five hundred dollars plus one hundred dollars for each employee employed by the contractor or subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training.

ARTICLE 1.4 - NONDISCRIMINATION IN EMPLOYMENT

A. The Contractor and his subcontractors will not discriminate against individuals based on race, color, religion, national origin, sex, disability, or age, but may use restrictions which relate to bona fide occupational qualifications. Specifically, the Contractor and his subcontractors shall not discriminate:

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

The Contractor and his Subcontractors will ensure 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 under this clause to any labor union with which they have bargaining or other agreements.

B. 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 plate 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 ensure 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 two percent (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.

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, home addresses of all workers, 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
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\$2,000,000	annual aggregate
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2. Automobile Liability

\$2,000,000	combined single limit per occurrence for bodily injury and property damage
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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:

Project Manager: Michael Schrader
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, MO 65101
Telephone: 573-536-7105
Email: michael.schrader@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 1 complete sets of drawings and specifications at no charge.
- B. The Owner will furnish the Contractor with approximately 1 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.

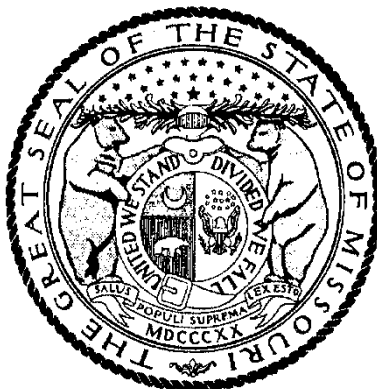
5.0 SAFETY REQUIREMENTS

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



MIKE KEHOE, Governor

Annual Wage Order No. 33

Section 046
HOWELL 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

Logan Hobbs, Director
Division of Labor Standards

Filed With Secretary of State: March 10, 2026

Last Date Objections May Be Filed: April 9, 2026

Prepared by Missouri Department of Labor and Industrial Relations

HOWELL COUNTY

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$26.59*
Boilermaker	\$26.59*
Bricklayer - Stone Mason	\$26.59*
Carpenter	\$26.59*
Lather	
Linoleum Layers & Cutter	
Millwright	
Pile Driver	
Cement Mason	\$26.59*
Plasterer	
Communication Technician	\$26.59*
Electrician (Inside Wireman)	\$52.30
Electrician (Outside Lineman)	\$26.59*
Outside - Groundman	
Outside - Groundman Tree Trimmer	
Outside - Lineman Operator	
Outside - Lineman Tree Trimmer	
Elevator Constructor	\$26.59*
Glazier	\$26.59*
Iron Worker	\$26.59*
Laborer	\$26.59*
Laborer - First Semi-Skilled	
Laborer - General	
Laborer - Second Semi-Skilled	
Laborer - Skilled	
Mason	\$26.59*
Marble Finisher	
Marble Mason	
Terrazzo Finisher	
Terrazzo Worker	
Tile Finisher	
Tile Setter	
Operating Engineer	\$26.59*
Operating Engineer - Group I	
Operating Engineer - Group II	
Operating Engineer - Group III	
Operating Engineer - Group III - A	
Operating Engineer - Group IV	
Operating Engineer - Group V	
Painter	\$26.59*
Plumber	\$26.59*
Pipe Fitter	
Roofer/WaterProofer	\$26.59*
Sheet Metal Worker	\$26.59*
Sprinkler Fitter - Fire Protection	\$26.59*
Truck Driver	\$26.59*
Truck Control Service Driver	
Truck Driver, Teamsters Group I	
Truck Driver, Teamsters Group II	
Truck Driver, Teamsters Group III	
Truck Driver, Teamsters 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.

HOWELL COUNTY

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$26.59*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$26.59*
Outside - Groundman	
Outside - Groundman Tree Trimmer	
Outside - Lineman Operator	
Outside - Lineman Tree Trimmer	
Laborer	\$51.82
Laborer - General	
Laborer - Skilled	
Operating Engineer	\$69.18
Operating Engineer - Group I	
Operating Engineer - Group II	
Operating Engineer - Group III	
Operating Engineer - Group IV	
Truck Driver	\$26.59*
Truck Control Service Driver	
Truck Driver, Teamsters Group I	
Truck Driver, Teamsters Group II	
Truck Driver, Teamsters Group III	
Truck Driver, Teamsters 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 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:
- Replacing existing DX RTU Air Handler
 - Alternate Scope Replace existing exhaust fan.
- B. Project Location:
1. Project Location: 1226 W. Business US-60/63
Willow Springs, MO 65793
 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.
- C. Contract Documents, dated 6/18/26 were prepared for the Project by **McClure Engineering** – 1000 Clark Ave. St. Louis, Mo 63102
- D. The Work will be constructed under a single prime contract.

1.3 DESIGNER'S ESTIMATE OF CONSTRUCTION COST RANGE

- A. The project designer has prepared this cost estimate range. The State of Missouri makes no guarantee regarding the accuracy of the estimate range nor does the State of Missouri intend to imply that the estimate range in any way reflects the actual cost required to perform the work represented by the specifications and drawings. The contractor should not rely on this estimate range in any way while preparing a bid for this project or otherwise.

1.4 WORK UNDER OTHER CONTRACTS

- A. Separate Contract: The Owner has awarded a separate contract for performance of certain construction operations at the site. Those operations are scheduled to be substantially complete before work under this Contract begins. The separate contract includes the following:
- 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 WORK SEQUENCE

- A. Work sequencing is noted on plans see general phasing notes.

1.6 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.
- B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
 - 1. Owner Occupancy: Allow for Owner occupancy and use by the public.
 - 2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. 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.

1.7 OCCUPANCY REQUIREMENTS

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

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.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. 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.
 - 2. Division 1 Section "Unit Prices" for procedures for using unit prices.

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.

1.4 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, Designer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Designer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Designer from the designated supplier.

1.5 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

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 5 “bad weather” days.

END OF SECTION 012100

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

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

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate the Alternate Work into the Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.
- B. Notification: The award of the Contract will indicate whether alternates have been accepted or rejected.
- C. Execute accepted alternates under the same conditions as other Work of this Contract.
- D. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials necessary to achieve the Work described under each alternate.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

Alternate No. 1: Remove and Replace Exhaust Fan EF-2. Provide Associated ductwork, electrical connections and controls.

END OF SECTION 012300

SECTION 012600 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract Modifications.
- B. Related Sections include the following:
 - 1. Division 1, Section 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, Trimble Unity Construct® (Formerly eBuilder) 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 Trimble Unity Construct® (Formerly eBuilder) as provided by "Trimble Unity Construct®" 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: Trimble Unity Construct® (Formerly eBuilder) 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/BIM files, processes or design information distributed in this system is intended only for the project specified herein.
- D. Purpose: The intent of using Trimble Unity Construct®(Formerly eBuilder) 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 Trimble Unity Construct (Formerly eBuilder) 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.
 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 Trimble Unity Construct® (Formerly eBuilder) 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 Trimble Unity Construct® (Formerly eBuilder) web site by licensed users.
 - a. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Subcontractors 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 Subcontractors 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 Subcontractors 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 location¹ 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 system² 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

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

² 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 Trimble Unity Construct® (Formerly eBuilder) 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) Over \$1,000,000.00 (One million) – 1% of the total contract amount
 - b. Close Out Documents
 - 1) 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
013200	Schedules	Construction Schedule
013200	Schedules	Schedule of Values
013200	Schedules	List of Subcontractors
013200	Schedules	Major Material Suppliers
230593	Testing, Adjusting, and Balancing (Certification, Test Report)	Test Report
237416	Packaged Large Capacity Rooftop Air Conditioning Units (Product Data, Operation / Maintenance Manual, Warranty)	Shop Drawings
230713	Duct Installation	Shop Drawings
243100	Sheet Metal Ductwork	Shop Drawings
243300	Duct Accessories	Shop Drawings
250000	Control Systems	Shop Drawings
262416	Electrical Panelboards	Shop Drawings

END OF SECTION 013300

SECTION 013513.25 - SITE SECURITY AND HEALTH REQUIREMENTS (MSHP)

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, Marijuana (Cannabis) in any form, 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 MSHP SECURITY CLEARANCE REQUIREMENTS

- A. Contractor Background Screening Policy: As a normal business activity, the Missouri State Highway Patrol (MSHP) may contract with external companies to perform various duties for the Missouri State Highway Patrol. Any personnel working for a contractor, and who has access to criminal justice information is required to pass a background check prior to beginning work on the contract. A contractor's proposed candidate may also be required to undergo a MSHP approved drug screening. This background check requirement will be included as part of all PAQs or solicitations for bids. The contract/PAQ award is contingent upon the proposed candidate background checks being completed.
- B. This background check will include, but not be limited to, state of residency and national fingerprint-based record checks. If the proposed candidate lives outside the United States, the contractor will submit similar documentation from their respective country. Qualification to work on contract will be based upon the following criteria:

1. A felony conviction or guilty plea will be an automatic disapproval of the candidate.
 2. Any conviction whether misdemeanor or felony, involving violence, crimes against children, and all sexual crimes regardless of timeframe will be an automatic disapproval of the candidate.
 3. Candidates will be disqualified if it is confirmed there are outstanding arrest warrants for the candidate.
 4. Any other misdemeanor convictions and guilty pleas may be considered for automatic disapproval. The State CSO (CJIS Security Officer) has final authority regarding if the nature or severity of the misdemeanor offense(s) does or does not warrant a disqualification.
- C. For misdemeanors, consideration will be given to the relationship between the information obtained in the background check and the responsibilities of the position. Time and severity of crime may also be considered as factors in a disqualification. Candidates may submit a written request for waiver through their contracting company if they have been disapproved and wish to contest the decision. The request will need to explain the circumstances of the crime and justification for a waiver.
- D. Contractors will be required to undergo a background check at a minimum once every five years. If there is a significant gap between contracts, candidates may be required to undergo a background check before working under a new contract.
- E. The CSO or their designee will maintain a list of contractors who have been approved to work at the MSHP.
- F. If a candidate goes through a background check with one contractor and then goes to work at a different contractor, the candidate will not be required to undergo a separate background check unless the timeframe exceeds five-year limit.
- G. The CSO for the MSHP has the right to approve or disapprove any candidate and has the right to revoke a candidate's approval at any time.
- H. The FBI CJIS Security Policy requires the MSHP to conduct background checks on all contractors needing MSHP access.
- I. Contractors working on-site and/or need escorted access are required to provide name, date of birth and social security number to enable the MSHP to run a name-based background check prior to their arrival on-site.
1. The FBI CJIS Security Policy requires the Missouri State Highway Patrol to conduct fingerprint background checks on vendors and contractors who require, or may require, virtual and/or unescorted physical access to criminal justice information. Provided are background check instructions managed by the MSHP CJIS Security Audit and Compliance Unit. For further assistance please email securityaudit@mshp.dps.mo.gov or call 573-526-6153 x2622. 1)Fingerprint Submission - register online at www.machs.mo.gov
 - a. *Fingerprint instructions attached separately*Payment \$43.50 is due at registration*Required fingerprint card information below*
 - b. 4-digit Registration Number:-9120
 - c. Complete Name

- d. Date of Birth
 - e. Social Security Number
 - f. ORI: MOMHP2300
 - g. OCA Designation: CONTRACTOR
 - h. Agency Name: MSHP-SACU
- J. Security Awareness Certification - take online at www.cjisonline.com
 - 1. Vendor accounts and Vendor Admin profiles are created by the MSHP SACU, securityaudit@mshp.dps.mo.gov
 - 2. *Vendor Account - Provide company name, mailing address, and phone number of vendor/contractor.
 - 3. *Vendor Admin - Provide name, email address, and phone number you want designated as the Vendor Admin to manage user accounts.
- K. Security Addendum Certification - form is attached separately. Signature page may be downloaded to user's account under Certification Details Tab/Documents. If this is not an option, email signature form to securityaudit@mshp.dps.mo.gov.
- L. MSHP Required Security Forms - Forms attached separately. Please return signature pages to securityaudit@mshp.dps.mo.gov.
- M. The Missouri Central Vendor File: As a normal business activity, Missouri law enforcement agencies may contract with external companies to perform various duties for their agency. Any personnel working for a vendor or contractor, and who has access to criminal justice information, is required to pass a background check prior to beginning work on the contract per FBI CJIS Security Policy. To better streamline this process for vendors and contractors performing work at more than one Missouri law enforcement agency, the Missouri State Highway Patrol has implemented a program to manage these background check files centrally called the Missouri Central Vendor File. This allows contractors to perform fingerprint checks and complete security awareness training requirements one time rather than with each contracting agency. Unless otherwise notified, vendors and contractors who submit background checks using the MSHP Background Check Process will automatically be vetted and added to the MO Central Vendor File. Background results can be provided upon request sent to securityaudit@mshp.dps.mo.gov.

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.

3.5 PROTECTION OF PERSONS AND PROPERTY

A. SAFETY PRECAUTIONS AND PROGRAMS

1. The Contractor shall at all times conduct operations under this Contract in a manner to avoid the risk of bodily harm to persons or risk of damage to any property. The Contractor shall promptly take precautions which are necessary and adequate against conditions created during the progress of the Contractor's activities hereunder which involve a risk of bodily harm to persons or a risk of damage to property. The Contractor shall continuously inspect Work, materials, and equipment to discover and determine any such conditions and shall be solely responsible for discovery, determination, and correction of any such conditions. The Contractor shall comply with applicable safety laws, standards, codes, and regulations in the jurisdiction where the Work is being performed, specifically, but without limiting the generality of the foregoing, with rules, regulations, and standards adopted pursuant to the Williams-Steiger Occupational Safety and Health Act of 1970 and applicable amendments.
2. All contractors, subcontractors and workers on this project are subject to the Construction Safety Training provisions 292.675 RSMo.
3. In the event the Contractor encounters on the site, material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), lead, mercury, or other material known to be hazardous, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner's Representative and the Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner's Representative and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless by written agreement of the Owner's Representative and the Contractor. "Rendered Harmless" shall mean that levels of such materials are less than any applicable exposure standards, including but limited to OSHA regulations.

B. SAFETY OF PERSONS AND PROPERTY

1. The Contractor shall take reasonable precautions for safety of, and shall provide protection to prevent damage, injury, or loss to:
 - a. clients, staff, the public, construction personnel, and other persons who may be affected thereby;
 - b. the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor or the Contractor's Subcontractors of any tier; and
 - c. other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.
2. The Contractor shall give notices and comply with applicable laws, standards, codes, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury, or loss.
3. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, safeguards for safety and protection, including, but not limited to, posting danger signs and other warnings against hazards, promulgating safety

- regulations, and notifying owners and users of adjacent sites and utilities.
4. When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.
 5. The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in this Section caused in whole or in part by the Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, and for which the Contractor is responsible under this Section, except damage or loss attributable solely to acts or omissions of Owner or the Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's other obligations stated elsewhere in the Contract.
 6. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents, and the maintaining, enforcing and supervising of safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner's Representative and Architect. The Contractor shall hold regularly scheduled safety meetings to instruct Contractor personnel on safety practices, accident avoidance and prevention, and the Project Safety Program. The Contractor shall furnish safety equipment and enforce the use of such equipment by its employees and its subcontractors of any tier.
 7. The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.
 8. The Contractor shall promptly report in writing to the Owner all accidents arising out of or in connection with the Work which cause death, lost time injury, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately.
 9. The Contractor shall promptly notify in writing to the Owner of any claims for injury or damage to personal property related to the work, either by or against the Contractor.
 10. The Owner assumes no responsibility or liability for the physical condition or safety of the Work site, or any improvements located on the Work site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the Contract Sum or Contract Time concerning any failure by the Contractor or any Subcontractor to comply with the requirements of this Paragraph.
 11. In no event shall the Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences or procedures or for safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Documents.
 12. The Contractor shall maintain at his own cost and expense, adequate, safe and sufficient walkways, platforms, scaffolds, ladders, hoists and all necessary, proper, and adequate equipment, apparatus, and appliances useful in carrying on the Work and which are necessary to make the place of Work safe and free from avoidable danger for clients, staff, the public and construction personnel, and as may be required by safety provisions of applicable laws, ordinances, rules regulations and building and construction codes.

END OF SECTION 013513.25

SECTION 015000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes requirements for construction facilities and temporary controls including temporary utilities, support facilities, security, and protection.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution
 - 2. Temporary electric power and light
 - 3. Sanitary facilities, including drinking water
 - 4. Storm and sanitary sewer
- C. Support facilities include, but are not limited to, the following:
 - 1. Construction aids and miscellaneous services and facilities
- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Sidewalk bridge or enclosure fence for the site
 - 2. Environmental protection

1.3 SUBMITTALS

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- B. Implementation and Termination Schedule: Within (15) days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations including, but not limited to, the following:
 - 1. Building code requirements
 - 2. Health and safety regulations
 - 3. Utility company regulations
 - 4. Police, fire department, and rescue squad rules
 - 5. Environmental protection regulations
- B. Standards: Comply with NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations”. ANSI A10 Series standards for “Safety

Requirements for Construction and Demolition”, and NECA Electrical Design Library “Temporary Electrical Facilities”.

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 “National Electric Code”.
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. If acceptable to the Designer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Lumber and Plywood: Comply with requirements in Division 6 Section “Rough Carpentry”.
1. For job-built temporary office, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
 2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.
 3. For fences and vision barriers, provide minimum 3/9” (9.5mm) thick exterior plywood.
 4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8” (16mm) thick exterior plywood.
- C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.
- D. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary office, shops, and shed.
- E. 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.
- F. 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.
- G. Water: Provide potable water approved by local health authorities.
- H. Open-Mesh Fencing: Provide 0.120" (3mm) thick, galvanized 2" (50mm) chainlink fabric fencing 6' (2m) high with galvanized steel pipe posts, 1½" (38mm) ID for line posts and 2½" (64mm) ID for corner posts.

2.2 EQUIPMENT

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

portable, UL-rated, Class ABC, dry-chemical extinguishers, or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

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

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Change Order.
- B. Temporary Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
 1. Sterilization: Sterilize temporary water piping prior to use.
- C. Temporary Water Service: The Owner will provide water for construction purposes from the existing building system. All required temporary extensions shall be provided and removed by the Contractor. Connection points and methods of connection shall be designated and approved by the Construction Representative.
- D. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
 1. Install electric power service underground, except where overhead service must be used.
 2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125V,

AC 20ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

- E. Temporary 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.
- F. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
 - 1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- G. 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.
- H. Temporary Heating and Cooling: The normal heating and/or cooling system of the building shall be maintained in operation during the construction. Should the Contractor find it necessary to interrupt the normal HVAC service to spaces, which have not been vacated for construction, such interruptions shall be pre-scheduled with the Construction Representative.
- I. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities.
 - 1. Telephone Lines: Provide telephone lines for the following:
 - a. Where an office has more than two (2) occupants, install a telephone for each additional occupant or pair of occupants.
 - b. Provide a dedicated telephone for a fax machine in the field office.
 - c. Provide a separate line for the Owner's use.
 - 2. At each telephone, post a list of important telephone numbers.
- J. Temporary Telephones: The Owner will provide telephones within the facility. All construction personnel will be allowed access only to those specific telephones designated by the Construction Representative.
- K. 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.
- L. Temporary Toilets: Use of the Owner's existing toilet facilities will be permitted, so long as facilities are cleaned and maintained in a condition acceptable to the Owner. All construction personnel will be allowed access only to those specific facilities designed by the Construction Representative. At substantial completion, restore these facilities to the condition prevalent at the time of initial use.
- M. Temporary Toilets: The Owner will provide toilets and associated facilities within the building. All construction personnel will be allowed access only to those specific facilities designated by the Construction Representative.
- N. 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.
- O. Wash Facilities: The Owner will provide wash facilities within the building. All construction personnel will be allowed access only to those specific facilities designated by the Construction Representative.
- P. Drinking-Water Facilities: Provide drinking-water fountains where indicated, including paper cup supply.
- Q. 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).
- R. Drinking-Water Facilities: The Owner will provide drinking water facilities within the building. All construction personnel will be allowed access only to those specific facilities designated by the Construction Representative.
- S. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

- B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip office as follows:
1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase.
 2. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.
- C. Storage facilities: Install storage sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere onsite.
- D. Storage Facilities: Limited areas for storage of building materials are available onsite. Available storage areas are shown on the drawings. The Contractor shall provide his own security. Specific locations for storage and craning operations will be discussed at the Pre-Bid Meeting and the Pre-Construction Meeting.
- E. Storage Facilities: The Owner will provide storage onsite as designated by the Facility Representative or the Construction Representative. Areas for use by the Contractor for storage will be identified at the Pre-Bid Meeting.
- F. Storage Facilities: No areas for storage of building materials can be made available onsite except for on the roof. Loads shall not exceed the loading limits as stated on the drawings. Roofing materials must be craned onto the roof from dedicated parking spaces as arranged by the Contractor with the City; costs of all such arrangements shall be paid by the Contractor. The Contractor shall provide his own security as he finds necessary. Specific locations for storage and craning operations will be discussed at the Pre-Bid Meeting and the Pre-Construction Meeting.
- G. Storage Facilities: No areas for storage of building materials can be made available onsite. The Contractor shall provide for all storage offsite. All off-site storage locations shall be approved by the Construction Representative. The Contractor shall provide his own security as he finds necessary. The Construction Representative shall have access to the off-site storage at all times.
- H. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Designer.
1. Paving: Comply with Division 2 Section "Hot-Mixed Asphalt Paving" for construction and maintenance of temporary paving.
 2. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 3. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
 4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.

5. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.
- I. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.
- J. Construction Parking: Contractors must be prepared to discuss their storage and parking needs at the Pre-Bid Meeting. Parking for construction personnel cannot be provided onsite. All parking will be offsite. The Contractor will have to park on the street, in city-owned lots, or in commercial lots. Under no circumstances will any vehicle be parked in a fire lane. Parking on lawns shall be prohibited.
- K. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.
- L. 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.
- M. 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.
- N. Temporary Elevator Use: Refer to Division 14 for Elevators.
- O. 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.
- P. 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.
- Q. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.
- R. 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.
- S. Rodent Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures are regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- T. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Designer.
- B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonable predictable and controllable fire losses. Comply with NFPA 10 “Standard for Portable Fire Extinguishers” and NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations”.
1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one (1) extinguisher on each floor at or near each usable stairwell.
 2. Store combustible materials in containers in fire-safe locations.
 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project complete installation of the permanent fire-protection facility including connected services and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected

against. Where appropriate and needed, provide lighting including flashing red or amber lights.

- E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.
 - 1. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.
 - 2. Provide plywood fence, 8' (2.5m) high, framed with (4) 2"x4" (50mm x 100mm) rails, and preservative-treated wood posts spaced not more than 8' (2.5m) apart.
- F. Covered Walkway: Erect a structurally adequate, protective covered walkway for passage of persons along the adjacent public street. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
 - 1. Construct covered walkways using scaffold or shoring framing. Provide wood plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage. Extend the back wall beyond the structure to complete the enclosure fence. Paint and maintain in a manner acceptable to the Owner and the Designer.
- G. 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.
- H. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

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

- C. Termination and Removal: Unless the Designer requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances as required by the governing authority.
 3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
 - a. Replace air filters and clean inside of ductwork and housing.
 - b. Replace significantly worn parts and parts subject to unusual operating conditions.
 - c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 015000

SECTION 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><twice> each month, and more often if necessary, completely remove all scrap, debris, and waste material from the jobsite.
 - 4. Provide adequate storage for all items awaiting removal from the jobsite, observing all requirements for fire protection and protection of the ecology.
- B. Site
 - 1. Daily, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
 - 2. Weekly, inspect all arrangements of materials stored onsite. Re-stack, tidy, or otherwise service all material arrangements.

3. Maintain the site in a neat and orderly condition at all times.

C. Structures

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

3.2 FINAL CLEANING

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

obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

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

END OF SECTION 017400

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 INFORMATIONAL SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
 - 2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.

3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Coordination". Review methods and procedures related to demonstration and training including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

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

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

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

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

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 007213 "General Conditions".
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

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

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

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

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

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

END OF SECTION 017900

SECTION 20 00 00 – BASIC MECHANICAL, PLUMBING, AND FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 21-25 of these Specifications.
- C. The following sections of the Specifications apply to Work under this Section.
 - 1. Division 23 – HVAC Piping and Equipment
 - 2. Division 24 – Air Distribution
 - 3. Division 25 – Temperature Control System
 - 4. Section 20 05 48 – Seismic Control
 - 5. Section 20 05 49 – Vibration Control
 - 6. Section 20 10 00 – Basic Mechanical Methods
 - 7. Section 20 10 10 – Basic Piping Materials
 - 8. Section 20 10 20 – Valves and Strainers
 - 9. Section 20 10 30 – Hangers, Shields, Supports, and Anchors
 - 10. Section 20 10 50 – Basic Mechanical Methods – Related Work
 - 11. Section 20 10 60 – Testing Adjusting and Balancing
 - 12. Section 20 10 70 – Identification
 - 13. Section 20 20 10 – Electrical Requirements
 - 14. Section 20 20 10 – Drives and Guards
 - 15. Section 20 20 25 – Insulation

1.2 SUMMARY

- A. Section Includes: Vibration Control for the work of Divisions 20 - 25.
 - 2. Identification of piping and equipment for the work of Divisions 20 - 25.
 - 3. Testing, adjusting and balancing of systems for the work of Divisions 20 - 25.
 - 4. Cleaning of piping and equipment for the work of Divisions 20 - 25.
 - 5. Painting of piping and equipment for the work of Divisions 20 - 25.
 - 6. Demolition for the work of Divisions 20 - 25.

1.3 ACTION SUBMITTALS

- A. Refer to Division 1 and each section of Division 20.

1.4 INFORMATIONAL SUBMITTALS

- A. Refer to Division 1 and each section of Division 20.

1.5 CLOSEOUT SUBMITTALS

- A. Refer to Division 1 and each section of Division 20.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 20 00 00

SECTION 20 05 48 – SEISMIC CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Restraints - cable type.
 - 2. Restraint accessories.
- B. Related Requirements:
 - 1. Section 20 00 00 BASIC MECHANICAL, PLUMBING, AND FIRE PROTECTION

1.2 DEFINITIONS

- A. Designated Seismic System: A Fire Protection, Plumbing, or HVAC component that requires design in accordance with ASCE/SEI 7, Ch. 13 – Seismic Design for Nonstructural Components, and as required by local code, and as required on the Drawings.
- B. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is the edition intended as reference throughout the Section Text is ASCE/SEI 7-16 .
- C. IBC: International Building Code.
- D. ICC-ES: ICC Evaluation Service, LLC. A Subsidiary of the International Code Council.
- E. Seismic Listing Agency: ICC-ES product listing, UL product listing, FM Approvals, an evaluation service member of ICC-ES, an agency acceptable to authorities having jurisdiction.
- F. OSHPD: Office of Statewide Health Planning and Development (State of California).
- G. Professional Engineer: Professional Engineer registered in the state of Missouri.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic restraint component.
 - 3. Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by a Seismic Listing Agency.
 - 4. Annotate to indicate application of each product submitted and compliance with requirements.
 - 5. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

- B. Shop Drawings:
1. Detail fabrication and assembly of equipment bases.
 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated Design Submittals:
1. For each seismic-restraint device, including seismic-restrained mounting, seismic-restraint accessory, and restrained isolation roof-curb rail that is required by this Section or is indicated on Drawings, submit the following:
 2. Seismic and Vibration Isolation Base Selection: Select vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data.
 3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.
 4. Concrete Anchors and Inserts: Include calculations showing anticipated seismic and wind loads. Include certification that device is approved by an NRTL for seismic reinforcement use.
 5. Seismic Design Calculations: Submit all input data and loading calculations prepared under "Seismic Design Calculations" Paragraph in "Performance Requirements" Article.
 6. Qualified Professional Engineer: All designated-design submittals for seismic- and wind-restraint calculations are to be signed and sealed by qualified Professional Engineer responsible for their preparation.
 7. Seismic Restraint Detail Drawing:
 - a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.
 8. All delegated design submittals for seismic- and wind-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.
 9. Product Listing, Preapproval, and Evaluation Documentation: By a Seismic Listing Agency, showing maximum ratings of restraint items and basis for approval (tests or calculations).
 10. Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.
 11. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.

1.4 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.
- B. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for Fire Protection, Plumbing, and HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- C. Seismic Qualification Data: Provide special certification for designated seismic systems as indicated in ASCE/SEI 7, Paragraph 13.2.2, "Special Certification Requirements for Designated Seismic Systems" for all Designated Seismic Systems identified as such on Drawings or in the Specifications.
 - 1. Provide equipment manufacturer's written certification for each designated active mechanical seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7 and AHRI 1270 (AHRI 1271), including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to authorities having jurisdiction or experience data as permitted by ASCE/SEI 7.
 - 2. Provide equipment manufacturer's written certification that components with hazardous contents maintain containment following the design earthquake by methods required in ASCE/SEI 7.
 - 3. Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by a licensed professional engineer.
 - 4. The following HVAC systems and components are Designated Seismic Systems and require written special certification of seismic qualification by manufacturer:
 - a. —
- D. Wind-Force Performance Certification: Provide special certification for HVAC components subject to high wind exposure and impact damage and designated on Drawings or in the Specifications to require wind-force performance certification.
 - 1. Provide equipment manufacturer's written certification for each designated HVAC device, stating that it will remain in place and operable following the design wind event and comply with all requirements of authorities having jurisdiction.
 - 2. Provide manufacturer's written certification for each designated louver, damper, or similar device, stating that it will remain in place and protect opening from penetration of windborne debris and comply with all requirements of authorities having jurisdiction.
 - 3. Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.
- C. As-built seismic drawings with sealed letter from Seismic engineer stating that the completed installation meets the design.

1.6 QUALITY ASSURANCE

- A. Seismic-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified Professional Engineer, to design seismic and wind-load control system.
 - 1. Seismic Performance: Equipment to withstand the effects of earthquake motions and high wind events determined in accordance with ASCE/SEI 7.
- B. Seismic Design Calculations:
 - 1. Perform calculations to obtain force information necessary to properly select seismic-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7.
 - 2. Data indicated below to be determined by Delegated Design Contractor must be obtained by Contractor and must be included in individual component submittal packages.
 - 3. Coordinate seismic design calculations with wind-load calculations for equipment mounted outdoors. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.
 - 4. See drawings for Building Occupancy Category, Building Risk Category, Building Site Classification and component or system importance factor.
 - 5. See structural drawings for calculation factors.
- C. Consequential Damage: Provide additional seismic restraints for suspended HVAC components or anchorage of floor-, roof-, or wall-mounted HVAC components as indicated in ASCE/SEI 7 so that failure of a non-essential or essential HVAC component will not cause failure of any other essential architectural, mechanical, or electrical building component.
- D. Fire/Smoke Resistance: Seismic- and wind-load-restraint devices that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.
- E. Component Supports:
 - 1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
 - 2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7.

2.2 MANUFACTURERS

- A. Seismic Restraints and Accessories
 - 1. Amber/Booth

2. Eaton
3. Gripple
4. Isotech
5. Kinetics Noise Control
6. Loos & Co., Inc.
7. Mason Industries
8. Approved equivalent

- B. Post-installed concrete anchors.
1. Concrete Fastening Systems
 2. Hilti
 3. ITW Red Head
 4. MKT
 5. Powers
 6. Simpson Strong-Tie
 7. Approved equivalent

2.3 RESTRAINTS - RIGID TYPE

- A. Source Limitations: Obtain rigid-type restraints from single manufacturer.
- B. Description: Shop- or field-fabricated bracing assembly made of AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe as per NFPA 13, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.4 RESTRAINTS - CABLE TYPE

- A. Source Limitations: Obtain cable-type restraints from single manufacturer.
- B. Seismic-Restraint Cables: Pre-stretched galvanized-steel aircraft cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic-restraining cable service; with fittings attached by means of poured socket, swaged socket or mechanical (Flemish eye) loop.
- C. Restraint cable assembly with cable fittings must comply with ASCE/SEI 19. All cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.

2.5 RESTRAINT ACCESSORIES

- A. Source Limitations: Obtain restraint accessories from single manufacturer.
- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod. Non-metallic stiffeners are unacceptable.

- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.6 POST-INSTALLED CONCRETE ANCHORS

- A. Mechanical Anchor Bolts:
 1. Source Limitations: Obtain mechanical anchor bolts from single manufacturer.
 2. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.
- B. Adhesive Anchor Bolts:
 1. Source Limitations: Obtain adhesive anchor bolts from single manufacturer.
 2. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.
- C. Provide post-installed concrete anchors that have been prequalified for use in wind-load applications. Post-installed concrete anchors must comply with all requirements of ASCE/SEI 7-16, Ch. 13.
 1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
 2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.

2.7 CONCRETE INSERTS

- A. Source Limitations: Obtain concrete inserts from single manufacturer.
- B. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC466 testing.
- C. Comply with ANSI/MSS SP-58.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by a Seismic Listing Agency.
- B. Hanger-Rod Stiffeners: Install where indicated or scheduled on the Seismic Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static, wind load, and seismic loads within specified loading limits.

3.3 INSTALLATION OF SEISMIC- RESTRAINT DEVICES

- A. Provide seismic-restraint devices for systems and equipment where indicated on the Drawings, where indicated on the Seismic Drawings, where Specifications indicate they are to be installed on equipment and systems, and where required by applicable codes.
- B. Install seismic-restraint devices using methods approved in accordance with their listing and manufacturer's instructions.
- C. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- D. Installation of seismic, wind-load restraints, must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- E. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- F. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 3. Install seismic-restraint, and wind-load-restraint devices using methods approved by an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- G. Piping Restraints:
1. Comply with requirements in MSS SP-127.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 3. Brace a change of direction longer than 12 feet.
- H. Ductwork Restraints:
1. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems." and ASCE/SEI 7.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 3. Brace a change of direction longer than 12 feet.
 4. Select seismic-restraint devices with capacities adequate to carry static and seismic loads.
 5. Install cable restraints on ducts that are suspended with vibration isolators.
- I. Install seismic restraint cables so they do not bend across edges of adjacent equipment or building structure.
- J. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- K. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- L. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- M. Mechanical Anchor Bolts:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors to be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

N. Aircraft cable installation:

1. Cable tails shall not exceed 2x manufacturers minimum requirements.
2. In finished spaces exposed to view
 - a. Top connection shall be integrated fastener or tab. Hooks, loops, ring anchor, carabiner types shall not be used.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Provide flexible connections in piping systems where they cross structural seismic joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7. Comply with requirements for piping flexible connections.

END OF SECTION 20 05 48

SECTION 20 05 49 – VIBRATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Restrained isolation roof-curb rails.
- B. Related Requirements:
 - 1. Section 20 00 00 BASIC MECHANICAL, PLUMBING, AND FIRE PROTECTION

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.3 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Where vibration isolation products are Restrained Type used on equipment or systems that are required to be seismically restrained, follow the additional requirements of 20 05 48 Seismic Controls.

2.2 MANUFACTURERS

- A. Vibration Isolation Products:
 - 1. Amber/Booth
 - 2. Isotech

3. Kinetics Noise Control
4. Korfund
5. Mason Industries
6. Thybar
7. Vibra Systems
8. VMC Group
9. Approved equivalent

2.3 RESTRAINED ISOLATION ROOF-CURB RAILS

- A. Source Limitations: Obtain restrained isolation roof-curb rails from single manufacturer.
- B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.
- C. Upper Frame: To provide continuous support for equipment and to be captive to resiliently resist seismic and wind forces.
- D. Lower Support Assembly: To be formed sheet metal section containing adjustable and removable steel springs that support the upper frame. Lower support assembly to have a means for attaching to building structure and a wood nailer for attaching roof materials, and to be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly. Mount adjustable, restrained-spring isolators on elastomeric vibration isolation pads and provide access ports, for level adjustment, with removable waterproof covers at all isolator locations. Locate isolators so they are accessible for adjustment at any time during the life of the installation without interfering with integrity of roof.
- E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.
- F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF VIBRATION-CONTROL DEVICES

- A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Devices Schedules, where indicated on Drawings, or where Specifications indicate they are to be installed on specific equipment and systems.
- B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork.
- C. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- D. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- F. Mechanical Anchor Bolts:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors to be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

END OF SECTION 20 05 48

SECTION 20 10 00 – BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Arrangement of Work
 - 2. Coordination
 - 3. Delivery, Storage and Handling
 - 4. General Cleaning
 - 5. Cleaning of Piping Systems
 - 6. Pressure Testing
- B. Related Requirements:
 - 1. Section 20 00 00 BASIC MECHANICAL, PLUMBING, AND FIRE PROTECTION

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ARRANGEMENT OF WORK

- A. All Work shall be arranged so that hangers and supports for the mechanical equipment and materials shall be within the load limitations of the structure and the respective hanger and/or support.
- B. Contractor shall not scale from drawings to determine the exact locations for devices, piping, ductwork, etc., but shall follow the architectural drawings, the structural drawings and the actual building conditions, in establishing dimensions and lines of run. The work shall be adjusted to accommodate interferences anticipated and encountered. The Contractor shall verify the exact material quantities and lengths required.
- C. Piping that is required to pitch shall have priority over piping that does not pitch. Work which cannot be changed in elevation shall have priority over that which can be moved. Offsets, transitions and changes in direction shall be made in piping and ductwork to maintain headroom and pitch whether or not indicated on the Plans. The Contractor shall provide air vents, traps, dirt legs, drains, lifts, sanitary vents, mechanical vent lines, etc. as required to install the mechanical systems for proper operation and maintenance.
- D. Do not install work in the immediate proximity of electrical components (e.g. - panels, switches, controls, boxes, etc.) in equipment rooms. Drip pans above and/or around electrical equipment are not permitted.
- E. Aluminum and copper products shall not be encased in concrete.

- F. Work in “finished spaces” shall be concealed within walls, chases or above the ceiling unless specifically indicated otherwise. Install the Work to coordinate with other trades and to conform to the architectural reflected ceiling plan.
- G. The work shall be installed parallel with the building lines unless specifically shown or noted otherwise.

3.2 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
 - 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 to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. It shall be the Contractor's responsibility to coordinate their work with the work of other trades, and with the architectural and structural drawings. Where physical interferences cannot be resolved between the trades, or when encountered in the field, the Contractor shall prepare composite drawings at a scale of not less than $3/8" = 1'-0"$ clearly showing the Work of Divisions 20 - 29 in relation to the Work of others to identify the conflict. Submit a proposed resolution to the Architect/Engineer for approval in accordance with Sub-sections 20 00 01, GENERAL (Project Documents) and 20 10 06, SUBMITTALS.
 - 1. Do not proceed with Work in question until the matter is mutually resolved among the involved parties, and adequate information has been submitted to the Architect/Engineer for review. No additional compensation shall be granted for modifications and execution of the resolution(s). Modifications are to be incorporated in the “as-built” drawings.
- C. Contractor shall review the Project Documents, site conditions, and the requirements of other disciplines, and shall report any discrepancies between them to the Architect/Engineer and obtain from him written permission for changes necessary in the Mechanical Work. Subsequent clarification(s) by the Architect/Engineer will not be a change in scope of the Work. The Contractor at no addition in the contract price shall perform any such modifications required.
- D. Contractor shall verify tie-in locations to verify sizes, direction of flow (via pressure or physical tracing, not labels), materials, elevations, etc. prior to commencing new work. Contractor shall notify Architect/Engineer upon discovery of discrepancy. Work performed prior to verification will be corrected at no cost to Owner.
- E. The drawings shall not be scaled; obtain detailed information, shop drawings, installation and maintenance bulletins, etc. to determine exact requirements and to satisfactorily achieve the intent of the Project Documents.
- F. The Contractor shall furnish and properly install all sleeves, slots, chases, openings, recesses, supports, anchors and anchor bolts required for his Work in coordination with the other trades as the building is erected.

- G. The expenses for changes required by neglect in executing, coordinating or scheduling the Work properly or avoiding conflicts shall be borne by the Contractor precipitating the issue requiring the changes.

3.3 DELIVERY, STORAGE AND HANDLING

- A. Delivery, storage and handling of equipment and material are the Contractor's responsibilities. The Contractor shall perform the Work in accordance with the following criteria:
 - 1. Delivery shall be arranged by the Contractor (including Owner furnished items) for the expeditious and economical pursuit of the Work and to meet the scheduling requirements of the Contract.
 - 2. The Contractor will be assigned a "lay-down" area at the job site and shall confine temporary storage to this area.
 - 3. The Contractor may take delivery of equipment and material at his "shop" or an off-site location as suits the performance and schedule of the Work.
 - 4. Regardless of where and how equipment and material are temporarily stored prior to installation, or if installed at the job site prior to acceptance, the Contractor is responsible for the following:
 - a. All equipment and material shall be accessible to the Architect/Engineer for inspection.
 - b. All equipment and material shall be protected adequately and properly from the weather, dirt and water, chemical, mechanical or comprehensive damages.
 - c. The Contractor shall be liable for the repair and/or replacement (including labor) of any equipment and material lost, damaged or defective prior to acceptance.
 - 5. The Contractor shall arrange all labor, tools, services and scheduling to perform the handling of equipment and material for his Work.

3.4 GENERAL CLEANING

- A. Each Contractor and Subcontractor shall be responsible for progress and final clean-up of his respective Work in accordance with the Contract Documents, requisite ordinances and regulations. Clean-up and legal disposal of debris from the Work, excess refuse and presence at the job site shall be performed in a timely and satisfactory manner. If not, the Contractor shall be notified of the unsatisfactory condition. If the matter persists, the Contractor will be back charged for the clean-up performed by others.
- B. Clean exposed exteriors and limited access interior surfaces of all equipment, piping and ductwork of foreign matter to provide an "as new" condition.

3.5 CLEANING OF PIPING SYSTEMS

- A. The Contractor shall clean the respective piping system(s) that are included in his scope of work. All systems shall be flushed with water or air (depending on ultimate use) to relieve any congestion and internally cleanse the respective piping system. The Contractor shall provide all flushing media in sufficient quantity, inlet connections, discharge or drainage outlets and any temporary provisions to protect components, or remove it, to facilitate the flushing. Clean and replace all strainer screens and filters. Flush clean and drain all low points in the piping.

- B. Owner's representative shall be present for flushing, cleaning, and rinsing. Water treatment representative must check water after rinsing to insure all chemical cleaner has been removed and the Alkalinity of the rinse water is equal to that of the make-up water. Prepare written report of testing.

3.6 PRESSURE TESTING

- A. Entire piping systems shall be pressure tested at one time unless it is not possible or practical. When partial testing is required, the Contractor shall submit a test plan.
- B. All piping to be insulated or concealed shall be pressure tested prior to the application of the insulation or concealment.
- C. A representative of the Architect/Engineer shall witness all pressure testing. The Contractor shall notify the Architect/Engineer at least three (3) days prior to the test date.
- D. Each piping system shall be tested per the method, test pressure, and test duration as specified in the Piping Application Schedules.
- E. The Contractor shall provide all test media, measuring devices, inlet connections, test measurement connections, and disposal of test media. The Contractor shall protect, isolate and/or remove piping system components that can not be subjected to test pressures.
- F. Hammer each joint in welded or soldered piping while under test. Leaks shall be repaired and the test(s) repeated until the respective piping system is tight.
- G. Prepare written report of testing.

END OF SECTION 20 10 00

SECTION 20 10 10 – BASIC PIPING MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Copper tube and fittings.
- B. Related Requirements:
 - 1. Section 20 00 00 BASIC MECHANICAL, PLUMBING, AND FIRE PROTECTION

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.
- B. Welding certificates.
- C. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.

1.5 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators in accordance with ASME Boiler and Pressure Vessel Code: Section IX.
 - 1. Comply with ASME B31.9 for materials, products, and installation.
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.6 WARRANTY

Grooved fittings and couplings Manufacturer's Warranty: Manufacturer agrees to repair or replace couplings and fittings that fail in materials or workmanship within 20 years from date of Substantial Completion.

1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.
2. Warranty is to be in effect only upon submission by Contractor to manufacturer of valid pressure/leak documentation indicating that the system was tested and passed manufacturer's pressure/leak test and any other manufacturer requirements.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tube: ASTM B88 types K & L.
- B. Solder Filler Metals: ASTM B32, lead-free alloys.
- C. Flux: ASTM B813, water flushable.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A53/A53M black steel with plain ends; welded and seamless, Grade B, and schedule number 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 Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3, "Piping Applications" Article.
- D. 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 "Piping Applications" Article.
- E. Wrought-Steel Fittings: ASTM A234/A234M; wall thickness to match adjoining pipe.
- F. Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 1. Material Group: 1.1.
 2. End Connections: Butt welding.
 3. Facings: Raised face.
- G. Grooved Mechanical-Joint Fittings and CouplingsSource Limitations: Obtain grooved mechanical-joint fittings and couplings from single manufacturer.
 2. Joint Fittings: ASTM A536, Grade 65-45-12 ductile iron; ASTM A47/A47M, Grade 32510 malleable iron; ASTM A53/A53M, Type F, E, or S, Grade B fabricated steel; or ASTM A106/A106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts and bolts to secure grooved pipe and fittings. Segmentally welded fittings are not acceptable.

3. Couplings: Ductile- or malleable-iron housing and EPDM gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 4. Only the following fittings will be accepted: Long radius (1.5 x diameter) 90° and 45° elbows, tee, reducing tee, concentric/eccentric reducers, and flange adapter nipples. Flange rings, reducing couplings, saddle/mechanical/clamp branch tee, outlet coupling, and others not listed above are prohibited.
- H. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

PART 3 - EXECUTION

3.1 PIPING APPLICATION

- A. Refer to Div 22 and Div 23 Pipe Application Schedules for service, pipe size range, joining methods per system application.

3.2 INSTALLATION OF PIPING

- A. 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.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

- L. Install drains, consisting of a tee fitting, NPS 3/4" ball valve, with hose end and cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce horizontal pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install valves according to Section 20 10 20 "Valves and Strainers".
- P. Install unions, flanges, or couplings in piping at final connections of equipment, and elsewhere as indicated.
- Q. Comply with requirements in Section 20 "Common Work Results for HVAC" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.
- R. Comply with requirements in Section 20 10 70 "Identification" for identifying piping.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 20 10 40 "Sleeves and Seals."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 20 10 40 "Sleeves and Seals."

3.3 JOINT CONSTRUCTION - GENERAL

- 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. For specialty systems and join according to pipe manufacturer's written instructions.

3.4 JOINT CONSTRUCTION - THREADED

- A. Threaded Joints: Thread pipe with tapered pipe threads in accordance with 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.

END OF SECTION 20 10 10

SECTION 20 10 30 – HANGERS, SHIELDS, SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Pipe stands.
 - 2. Equipment supports.
- B. Related Requirements:
 - 1. Section 20 00 00 BASIC MECHANICAL, PLUMBING, AND FIRE PROTECTION

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Equipment supports.
 - 2. Pipe Racks.

1.3 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic per Section 20 05 48 Vibration and Seismic Controls.

2.2 MANUFACTURERS

- A. Acceptable manufacturers of hanger products that comply with the specifications.
 - 1. Anvil (ASC Engineered Solution)
 - 2. Eaton B-Line Systems
 - 3. Tolco
 - 4. PHD Manufacturing
 - 5. National Pipe Hanger Corp

2.3 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Beam Clamps and devices used to attach to structure:

2.4 MANUFACTURED METAL FRAMING SYSTEMS (UNISTRUT)

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Channels: Continuous slotted carbon-steel, stainless steel, Type 304, stainless steel, Type 316, extruded-aluminum channel with inturned lips.
 - 4. Channel Width: Selected for applicable load criteria.
 - 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 6. Metallic Coating: Pregalvanized G90 (Z275), Electroplated zinc or Gold (yellow zinc dichromate) galvanized., Hot-dip galvanized.
 - 7. Paint Coating: Green epoxy, acrylic, or urethane

PART 3 - EXECUTION

3.1 APPLICATION

- A. 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 lbs.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. 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
- C. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. 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.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. 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.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
 - 1. Use thermal-hanger shield insert with pipe hanger / clamp sized to match OD of insert.
 - 2. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 3. Install MSS SP-58, Type 40, protective shields. Shields shall span an arc of 180 degrees.
 - 4. 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.
 - 5. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - f. Pipes NPS 8 and Larger: Include insulation inserts per Section 20 20 25 "Insulation" of 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 1" minimum grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

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/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 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 a 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 A780/A780M.

3.6 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 maximum.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specialty hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- E. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- F. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

- G. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- H. Use padded hangers for un-insulated piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Singular, horizontal, suspended piping above grade shall be hung with pipe hangers sized for the outside diameter of the insulation per the following schedule, unless noted otherwise:
 - 1. Systems without anchors and guides for expansion control
 - a. NPS 3 inch and smaller: Adjustable ring, Figure 69
 - b. NPS 4 inch and larger: Adjustable clevis, Figure 260
 - 2. Systems with anchors and guides for expansion control
 - a. All sizes: Adjustable steel yoke Figure 182 with protection saddle Figure 160 thru 165.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel piping: Figure 261
 - 2. Copper piping: Figure CT-261
- L. Finish shall per location and environment.
 - 1. Indoor, dry, non-corrosive: Cadmium or zinc electro-plated
 - 2. Outdoor: Hot dipped galvanized

END OF SECTION 20 10 30

SECTION 20 10 50 – BASIC MECHANICAL METHODS - RELATED WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Demolition
 - 2. Cutting and Patching
 - 3. Painting
 - 4. Lubrication
 - 5. Draining, Filling, and Venting Systems
- B. Related Requirements:
 - 1. Section 20 00 00 BASIC MECHANICAL, PLUMBING, AND FIRE PROTECTION

1.2 ACTION SUBMITTALS

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

1.3 SHOP DRAWINGS

- A. Detailed and dimensioned drawings of size, location, reinforcing and hardware contained therein of concrete work to be provided.

1.4 INFORMATIONAL SUBMITTALS

- A. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include: name, license number, and address of technician; date refrigerant was recovered; the machine and serial number of the reclaim equipment used, type and quantity of reclaimed refrigerant, and all other required data.

1.5 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

PART 2 - PRODUCTS

2.1 NONE

PART 3 - EXECUTION

3.1 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.2 DEMOLITION

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Coordinate with Owner for shut off of private utility of indicated services/systems.
 - 2. Arrange to shut off public utilities with utility companies.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - c. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - d. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - e. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 4. Dead legs of branch piping are not permitted unless a cap is specifically shown on the drawings. Where a cap is not shown and the drawings indicate to cap piping, the Contractor shall remove branch piping back to the main and cap at that point.

3.3 CUTTING AND PATCHING

- A. The basic premise of this Sub-section is that the cutting and patching (where required) are performed in existing building components. In “new” construction, the premise is that the building component is already in place.
- B. The Contractor requiring the penetration of or the access way in the building structure to fulfill the intent of the Project Documents for his Work shall be responsible for the cutting and the subsequent patching in accordance with the following criteria:

1. No structural component of the building shall be cut or violated without express approval of the Architect/Engineer.
 2. The Contractor shall verify the presence of any concealed utility or service within the structure (walls, roof, floor, etc.) in question, and shall be responsible for maintaining continuity and/or replacing it.
- C. Cutting of work-in-place in “new” construction because of error, neglect or damage inflicted shall be the responsibility of the Contractor precipitating the issue.
- D. “Patching” shall be construed as the repairing or replacing of the building structure to return it to an original or new condition, in the opinion of the Owner and/or Architect/Engineer, as existed prior to the cutting.
- E. Patching and finishing work shall be the responsibility of the Contractor requiring the cutting. The patching shall match all the substantive and visual aspects of the structure and adjacent surfaces. Restoration and finishes shall be as specified and executed in the respective sections, schedules and/or details of the Project Documents for the general construction work. Completed work and any special requirements shall be subject to approval by and satisfaction of the Architect/Engineer.

3.4 DRAINING, FILLING AND VENTING SYSTEMS

- A. The Contractor shall provide all required labor for draining, filling and venting of new or modified systems as many times as required during construction and for all phasing activities.
- B. Where draining and filling systems affects other systems or the Owner’s normal operations, then they shall be scheduled at least 24 hours in advance with the Owner and shall be carried out to minimize such disruptions.

3.5 LUBRICATION

- A. Provide all oil and grease for the operation of all equipment until acceptance. The Mechanical Contractor and Subcontractors shall be held responsible for all damage to bearing while the equipment is being operated by them up to the date of acceptance of the equipment. Protect all bearings during installation and thoroughly grease steel shafts and other unpainted steel surfaces to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction. For equipment that is received void (dry) of lubrication the Contractor shall lubricate the equipment before storing to prevent internal damage to the equipment.

END OF SECTION 20 10 50

SECTION 20 10 60 – TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Testing, Adjusting, and Balancing of Air Systems:
 - 2. Testing, adjusting, and balancing of equipment.
 - 3. Procedures for exhaust hoods.
 - 4. Duct leakage tests verification.
 - 5. HVAC-control system verification.
- B. Related Requirements:
 - 1. Section 20 00 00 BASIC MECHANICAL, PLUMBING, AND FIRE PROTECTION

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.
- G. UFAD: Underfloor air distribution.

1.3 REFERENCES

- A. National Standards for Total System Balance, by the Associated Air Balance Council (AABC), latest edition.
- B. Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems, by the National Environmental Balancing Bureau (NEBB), latest edition.
- C. 2019 Application Handbook, Chapter 39, Testing, Adjusting and Balancing by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.4 ACTION SUBMITTALS

- A. "Pencil copy" of TAB report.
- B. Certified TAB reports.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation:
 - 1. Name and address of the proposed Balancing Contractor and that the TAB specialist and this Project's TAB team members meet the qualifications specified.
 - 2. Name of the Mechanical Contractor's representative responsible for the balancing work.
- B. Contract Documents Examination Report: Within 60 days of Contractor's Notice to Proceed, submit the Contract Documents review report, as specified in Part 3.
- C. Within 60 days Contractor's Notice to Proceed, submit the name of Balancing Contractor's representative for coordination with the Mechanical Contractor.
- D. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures.
- E. System Readiness Checklists: Within 90 days of Contractor's Notice to Proceed, submit system readiness checklists.
- F. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - a. Serial number.
 - b. Application.
 - c. Dates of use.
 - d. Dates of calibration.

1.6 QUALITY ASSURANCE

- A. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.
- B. Work shall be conducted under the supervision of an individual certified by NEBB, or AABC, or TABB by trained technicians. All test results shall be documented per the previously approved procedure and transmitted to the Architect/Engineer for review as a requisite for final acceptance and payment. Final inspection shall follow completion and acceptance of the test results.
- C. The balancing contractor shall review plans and specifications for balancing dampers, balancing valves, gauge connections, airflow/pitot sections. The Contractor shall notify the Engineer if the Contractor cannot perform the Work because of inadequate provisions so that the inadequacy can

be corrected by change order during project construction without any cost over and above the device itself. No excuses during the testing and balancing procedure will be accepted for Contractor's lack of performance, and the Contractor shall be responsible for the additional cost of adding the required device(s) into the completed systems.

- D. Employment of a Balancing Subcontractor by the Contractor shall not relieve him of obligations to perform Work in accordance with the Project Documents.

1.7 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.
- F. Examine equipment performance data, including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in

AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design."
Compare results with the design data and installed conditions.

- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine operating safety interlocks and controls on HVAC equipment.
- K. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
- 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 RESPONSIBILITIES AND COORDINATION

- A. Work by Contractor, which installed the respective system to be tested, shall include the following:
 - 1. Schedule, coordinate and sequence the testing, adjusting and balancing of the respective systems. Prepare and distribute a schedule.
 - 2. Verify that the respective equipment, ductwork, piping and temperature control systems have been provided, each is operable and apparently functioning all in accordance with and to the intent of the Project Documents. In particular, the following shall be checked and noted as having been accomplished prior to the testing, adjusting and balancing:
 - a. Initial checkout and start-up of all equipment.
 - b. Pressure and leak testing, and cleaning of all systems.
 - c. Alignment and adjustment of motor drives, and lubrication of bearings.
 - d. Air filters replaced.
 - e. All dampers, manual line valves, control valves and balancing valves are in the "open" position.
 - 3. Verify that all instruments, measuring devices, meters, immersion wells, taps, valves, specialties, dampers, measuring and sensing elements, access openings, etc. have been provided in correct quantities and locations to permit commencement of the testing, adjusting and balancing of the Work. Correct deficiencies and/or modify the Work, as required.
 - 4. Provide the Balancing Contractor with all pertinent shop drawings on equipment to be tested, adjusted and balanced.
 - 5. Provide the Balancing Contractor with a set of "as-built" drawings or the Mechanical Contractor's marked-up "record" set showing all changes to the mechanical systems.
- B. Work by Balancing Contractor shall include the following:
 - 1. Perform a total system balance in accordance with NEBB, or AABC, or TAAB.
 - 2. Direct measurement of temperatures, pressures, air and fluid quantitative flow rates and any other values necessary to establish the status of each system in comparison with the Project Documents.

3. Adjust components and devices to achieve design operating conditions within acceptable tolerances for each system. Do not use shut-off devices for balancing unless indexed. Lock memory stops or mark set points of balancing devices. Replace all system components removed temporarily during the testing and balancing effort, set all temperature controls properly and generally leave the systems in working order and “as-new” condition.
4. Report to the Architect/Engineer any existing installed or operating condition that deviates from the design or intent of the Project Documents, and that the Balancing Subcontractor believes to be beyond the scope of his work.
5. Furnish fixed sheaves to the Owner, upon acceptance of the balancing report, for fans furnished with adjustable sheaves where the balancing contractor was able to make the required speed adjustments with the factory sheave.
6. Furnish and install fixed sheaves for fans furnished with adjustable sheaves where a speed change, beyond that obtainable with the adjustable sheave, is required to obtain design airflow. The system shall be proportionally balanced, then the required fan speed shall be calculated based upon the fan laws. Contractor shall also calculate the required brake horsepower at the design airflow, if this exceeds the nameplate horsepower the Architect/Engineer shall be notified.
7. Furnish and install fixed sheaves for fans furnished with fixed sheaves where a speed change is required to obtain design airflow. The system shall be proportionally balanced, then the required fan speed shall be calculated based upon the fan laws. Contractor shall also calculate the required brake horsepower at the design airflow, if this exceeds the nameplate horsepower the Architect/Engineer shall be notified.

3.3 PREPARATION

- A. Prepare a TAB plan that includes the following:
 1. Equipment and systems to be tested.
 2. Strategies and step-by-step procedures for balancing the systems.
 3. Instrumentation to be used.
 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Windows and doors are installed.
 - j. Suitable access to balancing devices and equipment is provided.

3.4 PROCEDURES

- A. The procedures listed herein are presented to enhance the procedures of the referenced agencies and the lack of a procedure being presented herein does not relieve the Contractor from following the procedures of the referenced agencies.
- B. In general, balancing dampers shall not be used to adjust the cfm quantity of fans but rather only to adjust the proportion of the airflow within the system. The fan speed shall be adjusted, with all of the dampers open, to a cfm slightly greater than design cfm. Then the dampers shall be adjusted to move more air towards the end of the system. The balancing damper at the furthest points of the system should be nearly full open. If these furthest dampers are not open then the fan speed shall be reduced and the process repeated until a satisfactory result is achieved.
- C. Prior to testing and adjusting VAV boxes the Balancing Contractor shall verify that the controllers are functioning properly and with the proper sequence of operation. If any inadequacies are encountered, they shall be reported for correction prior to testing and adjusting.
- D. Systems with diversity shall be tested in accordance to a method agreed upon by Engineer and is to be established when the Contractor submits his procedures to the Engineer for approval. Typically, this may be: to force the East zones to operate design capacity while west zones are left to operate at their given load; or that some air handling units would be forced to operate at design capacity while other units may be off or left to operate at their given load.
- E. Systems with air economizer cycles shall be adjusted to provide near linear flow as the amount of outdoor varies. Three (3) conditions to be tested are minimum outdoor air, 50% outdoor air, and 100% outdoor air. Record the values of total supply, return, relief, and building differential pressure at each of these conditions. Systems with return fans shall have the return damper adjusted to provide a change from positive to negative gauge pressure to provide a negative mixed air plenum pressure.
- F. When the Contractor has any questions regarding how the systems operate or cannot obtain design performance, they should contact the Engineer for clarifications or further instruction. The work shall not be considered complete until all systems and components achieve design performance unless the Engineer issues written direction otherwise.
- G. All systems shall be adjusted between 10% above the design value as a maximum, to the design value as a minimum.

3.5 REPORTS

- A. Reports shall be submitted in 9" x 12" binder complete with cover identification, index page, and indexing tabs. Reports shall not contain footnotes explaining why the system was not balanced to the required performance.
- B. The form of the testing and the report shall be submitted and approved prior to testing work. Reports shall be submitted on pre-approved forms.
- C. Diagrams, as required, to clarify locations of measurements and/or reading shall be included in the report.

D. Final acceptance and payment of the contract shall not be issued before final report is approved.

E. Air handling unit forms shall contain the following minimum information:

1. Unit Name.
2. Make/Model.
3. Type/Size.
4. Serial Number.
5. Fan Arrangement/Class/Rotation
6. Discharge Location.
7. Sheave Make and No.
8. Sheave Diameter and Bore.
9. No. Belts/Make/Size.
10. Motor Make/Frame.
11. Motor Horsepower.
12. Motor Volts/Phase/Amps.
13. Motor Full Load Amps/S.F.
14. Motor Sheave Make and No.
15. Motor Sheave Diameter and Bore.
16. Sheave Centerline Distance.
17. Design and Actual Supply CFM.
18. Design and Actual Total S.P.
19. Design and Actual Fan RPM.
20. Design and Actual Motor Volts (each phase).
21. Design and Actual Motor Amps (each phase).
22. Design and Actual Discharge S.P.
23. Design and Actual Suction S.P.
24. Design and Actual Pressure Drops Across Components.
25. Design and Actual Minimum Outside Air CFM.
26. Design and Actual Return Air CFM.
27. Coil Condition Wet/Dry.
28. Filter Condition Clean/Dirty.
29. Minimum Outside Air Damper Position (degrees 90° open; 0° closed)
30. Maximum Outside Air Damper Position (degrees 90° open; 0° closed)
31. Return Air Damper Position (degrees 90° open; 0° closed) for Positive Pressure on Upstream Side and Negative Pressure on Downstream Side

F. Air Outlet forms shall contain the following minimum information:

1. Area Served.
2. Grille Type.
3. Grille Size.
4. Design, Preliminary and Final CFM.
5. Damper Position (degrees 90° open - 0° closed).

G. Exhaust, return/relief fan forms shall contain the following minimum information:

1. Unit Name.
2. Make/Model.
3. Type/Size.
4. Serial Number.
5. Fan Arrangement/Class/Rotation
6. Discharge Location.
7. Sheave Make and No.

8. Sheave Diameter and Bore.
9. No. Belts/Make/Size.
10. Motor Make/Frame.
11. Motor Horsepower.
12. Motor Volts/Phase/Amps.
13. Motor Full Load Amps/S.F.
14. Motor Sheave Make and No.
15. Motor Sheave Diameter and Bore.
16. Sheave Centerline Distance.
17. Design and Actual CFM.
18. Design and Actual Total S.P.
19. Design and Actual Fan RPM.
20. Design and Actual Motor Volts (each phase).
21. Design and Actual Motor Amps (each phase).
22. Design and Actual Discharge S.P.
23. Design and Actual Suction S.P.

H. Packaged Gas Fired Rooftop Unit forms shall contain the following information:

1. Unit Name.
2. Make/Model.
3. Type/Size.
4. Serial Number.
5. Type Fuel/Input
6. Output
7. Ignition Type
8. Burner control
9. Motor Volts/Phase/Hertz
10. Motor Horsepower
11. Motor Full Load Amps/S.F.
12. Motor Drive Data
13. Design and Actual CFM.
14. Design and Actual Supply CFM at Minimum Outside Air Setting.
15. Design and Actual Return CFM at Minimum Outside Air Setting.
16. Design and Actual Outside Air CFM at Minimum Setting.
17. Design and Actual Supply CFM in Economizer Mode.
18. Design and Actual Return CFM in Economizer Mode.
19. Design and Actual Outside Air Setting in Economizer Mode.
20. Design and Actual Entering and Leaving Air Temperature.
21. Design and Actual CFM Air Temperature ☐ T.
22. Design and Actual Entering and Leaving Air Pressure.
23. Design and Actual Air Pressure ☐ P.
24. Design and Actual Low Fire Input.
25. Design and Actual High Fire Input.
26. Design and Actual Manifold Pressure/CFH.
27. Design and Actual High Limit Setting.
28. Design and Actual Operating Setpoint.
29. Coil Condition Wet/Dry.
30. Filter Condition Clean/Dirty.

END OF SECTION 20 10 60

SECTION 20 10 70 – IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Equipment labels.
 - 2. Pipe labels.
- B. Related Requirements:
 - 1. Section 20 00 00 BASIC MECHANICAL, PLUMBING, AND FIRE PROTECTION
 - 2. The materials specified herein Section 20 10 70 shall apply to Division 25 Temperature Control Systems. Additional identification work is specified in Division 25

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Submit an Identification Product Schedule consisting of the following minimum information:
 - 1. Material - type of identification product.
 - 2. System - indicate which system or equipment materials will be used for.
 - 3. Manufacturer - Manufacturer's name, product name and model numbers.
 - 4. Accessories - Miscellaneous materials used in affixing identification.
- C. Submit a valve tag list for approval prior to ordering or making valve tags.
- D. Submit legends, background color, letter color, lettering sizes for pipe markers, and engraving wording for each equipment nameplates.

1.3 CLOSEOUT SUBMITTALS

- A. Valve tag information is required on “as-built” drawing submittals.
- B. List tagged valves in a valve schedule in the operating and maintenance manual.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufactures:
 - 1. Seton Nameplate Corp.
 - 2. Brady Signmark Division
 - 3. Craftmark Identification Systems
 - 4. D & G Sign and Label
 - 5. Or approved equipment

2.2 PERFORMANCE REQUIREMENTS

- A. Current and accepted edition of the following codes and standards shall apply to the Work of this section:
 - 1. ANSI/ASME A 13.1 - "Scheme for the Identification of Piping Systems".
 - 2. ANSI Z535.1 – "Standards for Safety Signs and Color"

2.3 EQUIPMENT LABELS

- A. Metal Labels for Outdoor Equipment:
 - 1. Material and Thickness: stainless steel, 0.025 inch
 - 2. Letter and Background Color: Black filled lettering on brushed stainless steel.
 - 3. Minimum Label Size: Length and width vary for required label content, but not less than 3 by 1 inch.
- B. Fasteners: Stainless steel rivets or self-tapping screws.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules).
 - 1. First line: Description (i.e. Exhaust Fan, Chilled Water Pump, etc.)
 - 2. Second Line: Unit designation (i.e. EF-1)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

- A. Permanently fasten labels on each item of mechanical equipment.
- B. Sign and Label Colors:
 - 1. White letters on an ANSI Z535.1 safety-blue background.

- C. Locate equipment labels where accessible and visible.
- D. Nameplates shall be installed with corrosion-resistant mechanical fasteners. Do not use adhesives.
- E. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.
- F. Attach warning tags, with proper message, to equipment and other items where indicated on Drawings, and herein.
- G. Equipment that is controlled by the Building Automation Control System shall be labeled with a 2" x 5" label reading:
CAUTION – THIS EQUIPMENT IS UNDER COMPUTER CONTROL AND MAY CYCLE AT ANY TIME.

3.4 INSTALLATION OF WARNING TAPE

- A. Warning Tape Color and Pattern: Yellow background with black diagonal stripes
- B. Install warning tape on pipes and ducts, at walkways or isles providing less than 6 ft. of clearance above finished floor including items located near the floor that are trip hazards.
- C. Locate tape so as to be readily visible from the point of normal approach.

END OF SECTION 20 10 70

SECTION 20 20 10 – ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Motors
 - 2. Motor Controls
 - 3. Disconnect Switches
 - 4. Multi-speed Motors and Controls
 - 5. Variable Speed Drives
 - 6. Control Panel
- B. Related Requirements:
 - 1. Section 20 00 00 BASIC MECHANICAL, PLUMBING, AND FIRE PROTECTION

1.2 GENERAL

- A. This Subsection specifies the basic requirements for electrical components which are an integral part of “packaged” mechanical equipment. These components include, but are not limited to, factory installed motors, starters, disconnect switches, control panels and related prewiring of power and control wiring for a single external electrical service connection. All material and equipment shall be provided for the application and service intended.
- B. Specific electrical requirements (e.g. horsepower, electric characteristics, etc.) for mechanical equipment shall be specified within the respective equipment specifications or shall be scheduled on the Plans.
- C. The Contractor shall verify that electrical characteristics of material and equipment furnished for Divisions 20 - 25 equipment are in accordance with the electric service and comply with the specifications and requirements of Division 26 - 29.
- D. Unless otherwise specified as an integral part of packaged mechanical equipment, motor control centers, motor starters and disconnect switches and the power wiring from power source to motor starting equipment (including variable frequency drive packages) and wiring from that equipment to the respective motors including final connections shall be performed as Electrical Work of Division 26 - 29.
- E. The field installation of electrical components, not included in Division 26 - 29, that are specified to be provided with the mechanical equipment and are shipped separately shall be the responsibility of the Contractor furnishing the base equipment.
- F. All electrical components and material shall be UL labeled.
- G. Submittals for the applicable electrical equipment shall include the following: identification of the equipment which the electrical material is to serve, application, voltage, phases, full load amperage, wattage and NEMA enclosure. For motors: horsepower, RPM, full load power factor and efficiency, frame size and service factor.

- H. Identification of electrical components of mechanical equipment shall be in accordance with Subsection 20 10 90, "Basic Mechanical Methods - Identification".

1.3 REFERENCES

- A. Electrical material and equipment provided for Divisions 20 - 29 shall meet the applicable requirements of the latest accepted edition of the following codes and standards:
 - 1. ANSI American National Standards Institute
 - 2. EEI Edison Electrical Institute
 - 3. IEEE Institute of Electrical and Electronic Engineers
 - 4. NEC National Electrical Code
 - 5. NEMA National Electrical Manufacturers Association
 - 6. UL Underwriter's Laboratories, Inc.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 MANUFACTURERS

- A. Motors
 - 1. Baldor
 - 2. General Electric
 - 3. Gould
 - 4. Marathon
 - 5. Magnetek
 - 6. Reliance
 - 7. Siemens

8. Toshiba
9. U.S. motors

- B. Motor Controls
 1. Allen-Bradley
 2. Eaton
 3. General Electric
 4. Siemens
 5. Square D

2.3 MOTORS

- A. The following are basic minimum requirements for all motors. Additional motors, more detailed and specific requirements may be specified with the respective equipment.
- B. Single-phase motors shall be provided for all motors 1/2 HP or less, except as specified or scheduled otherwise and shall be of the permanent split capacitor (PSC) type.
- C. Polyphase motors shall be provided for all motors 3/4 HP or larger, except as specified or scheduled otherwise with a minimum power factor of .85 at 65% of full load or shall be power factor corrected.
- D. Multi-speed motors shall have dual windings wound to the speeds scheduled or specified.
- E. Torque characteristics shall be sufficient to satisfactorily accelerate the driven load(s) with low in rush current.
- F. Motor horsepower sizes shall be large enough so that the driven load shall not require the motor to operate in the service factor range.
- G. Temperature rating: Rated for 40 deg. C environment with maximum temperature rise for continuous duty at full load of 40°C for open dripproof motors, 50°C for splash proof motors, and 55°C for totally enclosed motors (Class B insulation). Motors used with variable frequency drives/inverters shall be NEMA MG1, Part 31 Compliant and have a Class B temperature rise with Class F insulation design to resist transient spikes, high frequencies, and short rise time pulses produced by inverters.
- H. Starting capability: Frequency of starts as specified by the automatic control system. For manually controlled motors, not less than five (5) evenly time spaced starts per hour.
- I. Service factor: 1.15 for polyphase motors and 1.35 for single-phase motors.
- J. Motor construction:
 1. NEMA standard frame sizes, general-purpose open dripproof (unless otherwise specified), continuous duty, Design "B" (unless "C" is required for high starting torque). Motor frame, end bells and conduit box shall be cast iron; stator windings shall be copper. Aluminum is unacceptable for any parts. Provide grounding lug in motor terminal box.
 2. Motors located outdoors or otherwise exposed to water, dust, etc where an open motor would not be suited, shall be totally enclosed fan-cooled (TEFC).

3. Bearings: Ball or roller bearings with inner and outer shaft seals. Externally accessible inlet/outlet grease fittings. Where motors are enclosed within equipment, extend grease tubing to exterior of the enclosure. Bearings designed to resist thrust loading for drives producing lateral or axial thrust. Fractional horsepower, light duty motors may have sleeve bearings.
4. Overload protection: Built-in thermal overload protection.
5. Noise rating: Motors shall meet IEEE, Standard 85.
6. Efficiency: Motors shall be NEMA Premium Efficiency per NEMA Standards Publication MG 1-2021.
7. Nameplate: Indicate full identification of manufacturer's name, model number, serial number, horsepower, speed, voltage, characteristics, construction, special features, etc. Nameplates in harsh environments such as for cooling towers, or in pool equipment rooms, etc. shall be suited to the specific application.
8. Comply with IEEE 841 for severe-duty motors

2.4 MOTOR CONTROLS

- A. Motor Starters: NEMA 1, general-purpose enclosures with padlock ears, unless specified otherwise. Type, size and duty shall be as specified or as recommended by the motor manufacturer and the requirements of the driven equipment for applicable protection and start-up conditions.
- B. Manual Starters: Pilot light and extra positions for multi-speed motors. Melting alloy type thermal overload relay protection.
- C. Magnetic Starters: Hand-off-Auto selector switches, pilot lights, interlock contacts, switches and other devices as required for control requirements. Trip-free thermal overload relays for each phase. Built-in 120 volt control circuit transformer, fused from line side, where power service exceeds 240 volts. Externally operated manual reset; under-voltage release of protection.

2.5 DISCONNECT SWITCHES

- A. Fusible: For 3/4 horsepower and larger. Disconnect switch shall be horsepower rated, heavy duty, spring reinforced fuse clips each phase, quick-make/quick-break mechanism with arc quenchers, dead front line side shield, solderless lugs, silver electroplated current carrying parts, lockable hinged door, capacity and electric characteristics as specified.
- B. Non-fusible: For 1/2 horsepower motor and smaller. Disconnect switch shall be horsepower rated, toggle switch type, quantity of poles and voltage rating as specified.

2.6 MULTI-SPEED MOTORS AND CONTROLS

- A. Multi-speed motors, when required, shall be specified under the heading of the respective equipment to be driven.
- B. Motor controls for multi-speed applications shall be specified, also, under the heading of the respective equipment, if said equipment is a "packaged" type unit.
- C. Otherwise, multi-speed motor controls shall be specified in Division 26.

2.7 VARIABLE SPEED DRIVES

- A. Motor controls for variable speed drives shall be specified under the heading of the respective equipment, if said equipment is a “packaged” type unit.
- B. Otherwise, variable speed drives shall be specified in Division 26.

2.8 CONTROL PANEL

- A. NEMA 1 general-purpose enclosure for indoor application; NEMA 3R weather resistant enclosure for exterior location.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide motors, motor controls and accessories as specified and scheduled on the drawings.
- B. Control Panel
 - 1. Factory mount panel(s) and internal power and control devices. Pre-wire all devices for the operation of the related equipment so that only one main power connection shall be required in the field.
 - 2. Provide internal protection for each circuit, maximum 120-volt secondary control transformer(s), terminal strips for wiring terminations, identification of components and wiring diagram inside the cover.

END OF SECTION 20 20 10

SECTION 20 20 20 – DRIVES and GUARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: V-Belt Drives
 - 2. Direct-coupled Drives
 - 3. Guards
- B. Related Requirements:
 - 1. Section 20 00 00 BASIC MECHANICAL, PLUMBING, AND FIRE PROTECTION

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. All drives shall be selected for 150% of specified motor nameplate horsepower.

2.2 MANUFACTURERS

- A. V-Belt Drives
 - 1. Browning
 - 2. Eaton
 - 3. Gates

adjustment.

2.3 DIRECT DRIVES

- A. Wherever available, motors and related direct driven equipment shall be mounted on a common base.

2.4 GUARDS

- A. Guards shall be designed and arranged in accordance with OSHA requirements.
- B. Guards shall completely enclose the drive, shall be secured to the respective equipment and shall be removable for servicing. Wherever available from the manufacturer, guards shall be provided with the equipment. If not, these shall be field fabricated.
- C. Provide reinforced openings with removable cover plates for access to motor and driven shafts for speed measurement.
- D. Extend tubing for grease fittings inside the guard to accessible locations outside the guard.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide drives of the type scheduled and specified with the associated equipment.
- B. Provide OSHA guards on each rotating equipment with exposed rotating parts.
- C. Install, balance and align all drives in accordance with the respective manufacturer's instructions and recommendations.
- D. The balancing and alignment of drives including pinning, doweling and grouting shall be the responsibility of the Contractor furnishing the equipment. Any adversities arising from executing the Work shall be resolved/remedied by the Contractor.
- E. Verify all electrical characteristics prior to running electric motor driven equipment. Check motor amperage draw and rotation for proper operation.

END OF SECTION 20 20 20

SECTION 20 20 25 – INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Glass Fiber Insulation (aka Fiberglass)
 - 2. Elastomeric Foam Insulation
 - 3. Fasteners
- B. Related Requirements:
 - 1. Section 20 00 00 BASIC MECHANICAL, PLUMBING, AND FIRE PROTECTION
- C. Provide appropriate size calcium silicate/cellular glass/pipe shield manufactured inserts to the trade contractor for installation between the pipes and oversized hangers as specified in this section.
- D. Fire wrap piping system located in occupied spaces or plenum spaces that do not meet flame spread 25 and smoke development 50.

1.2 DEFINITIONS

- A. The term “fitting” where used in this Section of the Specifications shall be construed as an elbow, tee or reducer. Unions, flanges and valves shall not be considered as fittings.
- B. The term “cold” shall be defined as the temperature of a surface that may result in the formation of condensation.
- C. The term “accessory” shall include staples, bands, wire, mesh, clips, pins, studs, tape, anchors, corner angles, cements, adhesives, coatings, sealers, mastics, finishes, etc.
- D. The term “ASJ” where used in this Section of the Specifications shall mean a reinforced vapor retarding All Service Jacket.
- E. The term “SSL” where used in this Section of the Specifications shall mean Self-sealing Lap Joint closure system for longitudinal jacket joints.
- F. The term “supply air” where used in this Section of the Specifications shall mean downstream of a coil.
- G. The term “outdoor air” where used in this Section of the Specifications shall mean ambient air that has not been conditioned.
- H. The term “return air” where used in this Section of the Specifications shall mean conditioned air that is returned from the space.
- I. The term “mixed air” where used in this Section of the Specifications shall mean air streams that are a mixture of “outdoor air” and “return air”.

- J. The term “relief air” where used in this Section of the Specifications shall mean excess return air that is relieved from the building.
- K. The term “exhaust air” where used in this Section of the Specifications shall mean air that is removed due to contaminants, odors, or heat.

1.3 REFERENCES, REGULATORY REQUIREMENTS

- A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20 in addition to the following:
 - 1. State and local Air Pollution Codes and Regulations.
 - 2. UL 723/ASTM E-84 Surface Burning Characteristics of Building Materials.
 - 3. UL 1479/ASTM E-814 Fire Test of Through-Penetration Firestops.
 - 4. ASTM C547 Standard Specification for Mineral Fiber Pipe Insulation.
 - 5. ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - 6. ASTM C1071 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
 - 7. ASTM C1290 Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
 - 8. ASTM C1136 Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
 - 9. NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - 10. NFPA 90B Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - 11. North American Commercial and Industrial Insulation Standards. 9th Edition or Latest Edition. Published by Midwest Insulation Contractors Association (MICA).
 - 12. ASTM C1393 Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Provide manufacturer's technical product data of each material and accessory item with engineering support information and recommended installation procedure. Indicate product number, “K” value, thickness and required accessories for each application.
- B. Provide an insulation product schedule consisting of the following minimum information:
 - 1. Material - type of insulation material, jackets, or covers.
 - 2. Manufacturer - manufacturers name, product name, and K-value where applicable.
 - 3. Accessories - tapes, staples, coatings, adhesives including manufacturer's name and product name.
 - 4. Systems - indicate systems where product is used
 - 5. System - indicate which system insulation is installed.
 - 6. Location - inside, outside, concealed, exposed, etc.
 - 7. Size - indicate size range of pipe, insulation type used.
 - 8. Thickness - indicate insulation thickness in inches.

1.5 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.

1.6 CLOSEOUT SUBMITTALS

- A. Self-Adhesive Outdoor Jacket warranty information and copy of sales receipt and other information required for warranty claim.

1.7 QUALITY ASSURANCE

- 1. Contracting company shall be one specializing in insulation application and have a minimum of three (3) years experience in this work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers are to be marked with the manufacturer's name, appropriate ASTM standard designation, type and grade, and maximum use temperature.
- B. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.
- C. The Contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The Contractor shall also use all means necessary to protect work and materials installed by other trades.
- D. If any insulation material has become wet because of transit or job site exposure to moisture or water, the Contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the Contractor is able to demonstrate that wet insulation when fully dried out (either before installation, or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in all respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance and provide the Architect/Engineer with a copy of manufacturer's recommendation for approval.

1.9 WARRANTY

- A. Self-Adhesive Outdoor Jacket shall have a 10 year manufacturer warranty.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Materials and accessories furnished for this Section of the Specifications shall be standard cataloged products, new, commercially available and suitable for the service specified.

- B. Insulations materials shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or polybrominated diphenyl ether fire retardants.
- C. Fiberglass insulations shall be constructed of bio-soluble fiber, certified by EUCB.
- D. Fiberglass insulations shall have a minimum of 50 percent recycled glass content; certified and validated in accordance with UL 2809.
- E. Fiberglass insulations shall have a bio-based, formaldehyde-free binder and be UL GREENGUARD Gold certified.
- F. All insulation material shall have composite fire and smoke hazard ratings in accordance with NFPA 255 and UL 723 not exceeding the following values as tested by the latest procedures of ASTM E-84: flame spread of 25; smoke developed of 50.
- G. Accessories such as adhesives, mastics, cements, tapes and cloths for seams, joints and fittings shall have the same ratings as hereinbefore listed. All products and their respective shipping cartons shall have indications that flame and smoke ratings meet the aforementioned requirements. Any treatment of jackets or facings to impart acceptable flame and smoke safety values shall be permanent; water-soluble applications are prohibited. The Insulation Contractor shall bear responsibility that all products to be used meet the foregoing criteria

2.2 MANUFACTURERS

- A. Metal jackets
 - 1. RPR Products, Inc.
 - 2. Ideal Products
 - 3. Johns Manville
 - 4. Shur-Fit Products
- B. Self-adhesive Exterior Jacket
 - 1. AlumaGuard All Weather by Polyguard Products
 - 2. FlexClad 400 by MTM Building Products
 - 3. VentureClad 1577CW Natural Aluminum Finish by 3M
- C. Mastics, Coatings, Sealants, & Adhesives
 - 1. Miracle Adhesives
 - 2. Vimasco Corporation
 - 3. Childers Products / H.B. Fuller Construction Products
 - 4. Foster Products / H.B. Fuller Construction Products
 - 5. Mon-Eco Industries
- D. Fasteners
 - 1. ACS Industries
 - 2. GEMCO
 - 3. Midwest Fasteners
- E. Fire Stop
 - 1. 3M
 - 2. Metacaulk

3. Specified Technologies, Inc.
4. USG Interior, Inc.
5. Alkegen Unifrax
6. Morgan Advanced Materials - Thermal Ceramics

F. Glass Fiber Insulation (aka Fiberglass):

1. Knauf Insulation
2. Manson Insulation
3. Owens Corning
4. Johns Manville
5. CertainTeed

G. Elastomeric Foam Insulation:

1. Armacell North America
2. Aeroflex USA
3. K-Flex USA

H. Cellular Glass Insulation:

1. Owens Corning (Rigid Foamglas)

2.3 GLASS-FIBER RIGID BOARD (Type GF2)

A. Glass fibers bonded with a bio-based thermosetting resin, non-combustible, complying with ASTM C612 (Type IA, IB).

1. Provide insulation with factory-applied white ASJ+ facing complying with ASTM C1136.
2. Thermal conductivity (k-value) at 75 degrees F mean temperature shall be 0.24 Btu x in. /h x sq. ft. x degrees F, or less.
3. Maximum service temperature of 450 degrees F.
4. Nominal density shall be 3.0 PCF.
5. Maximum Flame spread rating of 25 and Smoke developed rating of 50 when tested in accordance with ASTM E84 or UL 723.
6. Must be NFPA 90A and 90B compliant, UL Environment GREENGUARD Gold certified, UL Validated Formaldehyde-free, and UL Validated Recycled Glass Content of 50% minimum.

B. Knauf Insulation Earthwool Insulation Board with ECOSE, Manson Insulation; AK Board™ with ECOSE, Owens Corning Type 703 Insulation Board, Johns Manville; 800 Series Spin-Glas Insulation Board, or CertainTeed CertaPro Commercial Insulation Board.

2.4 GLASS-FIBER FLEXIBLE BLANKET (Type GF3)

A. Glass fibers bonded with a bio-based thermosetting resin, non-combustible, complying with ASTM C1290 and ASTM C553, Type I, II, and III.

1. Provide insulation with factory-applied white ASJ+ vapor retarding facing complying with ASTM C1136.
2. Thermal conductivity (k-value) at 75 degrees F mean temperature shall be 0.27 Btu x in. /h x sq. ft. x degrees F, or less.
3. Maximum service temperature of 250 degrees F with facing, 350 degrees F for unfaced material. Nominal density shall be 1.0 PCF and thickness to achieve required R-Value.

4. Maximum Flame spread rating of 25 and Smoke developed rating of 50 when tested in accordance with ASTM E84 or UL 723.
 5. Must be NFPA 90A and 90B compliant, UL Environment GREENGUARD Gold certified, UL Validated Formaldehyde-free, and UL Validated for Recycled Glass Content of 50% minimum.
- B. Knauf Insulation Performance+ Duct Wrap with ECOSE, Manson Insulation; Alley Wrap™ B Duct Wrap with ECOSE, Owens Corning SoftR Duct Wrap, Johns Manville Microlite Duct Wrap, or CertainTeed; SoftTouch Duct Wrap.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Furnish and install insulation, jacketing, adhesives, sealants, and necessary accessories for the following systems where shown on the Plans and as hereinafter specified. Include all necessary considerations in the related sections of the Specifications (Subsection 20 25 03) to perform the Work completely.
 1. Condensate drain piping.
 2. Ductwork/sheetmetal systems.
- B. To ensure that it will achieve its highest possible performance and serve its intended purpose, install all mechanical insulation materials in accordance with manufacturer's published instructions and industry practices detailed by the North American Commercial and Industrial Insulation Standards Manual (latest edition), published by Midwest Insulation Contractors Association (MICA).
- C. Respective piping system, duct system and/or equipment shall be pressure tested, proved tight and accepted, as specified in section for installation of such, before insulation is applied. Sheet metal ductwork joints shall be sealed prior to insulating. Coordination among the respective contractors is essential.
- D. Insulation materials and accessories shall be applied in accordance with respective manufacturer's recommendations and recognized industry practice for the insulation to serve its intended purpose. All surfaces to receive insulation shall be clean, dry, free of oxidation and prepared as required.
- E. The insulation work shall be subject to inspection during the various applications and construction phases. Material, accessories, finishes, methods and workmanship that are not in compliance with

these Specifications and/or approved submittals may lead to rejection of the Work and replacement at the Contractor's expense.

- F. Tie-ins to existing systems and all new work shall be insulated to provide a complete and functional system. Finishes shall be compatible wherever possible.
1. When existing insulation thickness is different than the specified thickness herein, the Contractor shall notify the Architect/Engineer. It is the intent that the existing piping would be restored to its original condition (thickness and finish) as if new work had not been performed.
 2. Special requirements for fiberglass pipe insulation:
 - a. Fiberglass pipe insulation, All Service Jacket/Self Sealing Lap (ASJ w/SSL) type, shall be installed with laps positioned to shed water, position at either 10 o'clock or 2 o'clock and shall not be visible to view. End joint butt strips shall be installed on all piping with ½" adhesive to adhesive overlap.
 - b. For piping systems using fiberglass insulation, the fittings shall be insulated with: double thickness molded fiberglass fittings, or preformed cellular glass fittings secured with twine or wire; or with flexible elastomeric foamplastic; at the Contractor's option. The pre-molded PVC fitting covers shall be installed over the fiberglass inserts and secured with SS tacks. Victaulic fittings or couplings shall be insulated with sheet elastomeric foam plastic insulation formed to the fitting and formed "collars" over all couplings encountered.
 - c. For piping systems using fiberglass insulation, butt joints in hot piping shall be made with 2" wide vapor barrier tape over butt joints. Butt joints in cold piping shall be made with a wet coat of vapor barrier lap cement on butt joints and seal joints with 2" vapor barrier tape. All pipe insulation ends shall be tapered and sealed.
 - d. On "cold" applications only, the following additional requirements shall apply: the premolded fittings shall be sealed with an approved vapor barrier retardant prior to installing the jacket materials. Premolded PVC fitting covers shall then be installed over the premolded inserts, all joints shall be sealed with vapor barrier cement and 2" vapor barrier tape on lap joints. Premolded stainless steel or aluminum fitting covers shall be installed per the manufacturer's instructions and a bead of clear silicon caulk applied to all joints. Straight lengths of insulation abutting all fittings shall have both ends sealed with vapor barrier cement to prevent "wicking" or moisture migration. The vapor dams shall be placed at a maximum of twenty-one foot (21') intervals, joining ends of the butt joints shall be sealed with vapor barrier cement prior to butting together to prevent "wicking" or moisture migration.
 3. For piping systems using elastomeric foamplastic insulation, joints and seams shall be sealed with manufacturer's recommended contact adhesive. Fittings shall be insulated from segments fabricated from pipe insulation or sheet material, secured and sealed with contact adhesive. Termination points and ends shall be sealed to the pipe to prevent backflow of condensation on the inside of the insulation. Any piping outdoors or otherwise exposed to UV or ozone provide two (2) coats of WB Armaflex or equivalent.
 4. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- G. Field-applied Insulation for Ductwork
1. Ductwork systems shall be insulated in accordance with the insulation schedules. Insulate each duct section with single thickness full length pieces. Do not use scraps abutting each other.

2. Extend insulation without interruptions through walls, floors, and similar penetration, except where otherwise specified.
3. "Cold" duct systems shall have insulation with a continuous vapor retarder through all fittings, hangers, supports, air devices, fire dampers, duct mounted coils, dampers, and other devices in the ductwork system, etc.
4. In "cold" duct systems, using rigid board or sheet elastomeric foam insulation, support angles, stiffener angles, ductmate flanges, etc. they shall be covered with an oversized insulation strip sized to provide the same insulation thickness as on the duct. Provide a minimum of 2" of overlap on each side of the obstruction.
5. Board insulation shall be properly cut and dry fitted to the surface to be insulated. Edges shall be neat and clean cut. No intermediate cut pieces shall be allowed on the bottom and sides of the ductwork. Insulation board shall be secured in place using mechanical fasteners such as welded pins or speed clips. Locate not less than 3" from each edge or corner and approximately 12" on centers on all sides. There shall be a minimum of two (2) rows of pins on the bottom of the duct and one (1) on the sides. Additional pins may be needed on the bottom to prevent sagging. All seams, joints, penetrations and breaks in the vapor retarder jacket shall be sealed with pressure sensitive tape matching insulation facing. Edges shall be provided with 28 ga. 1" x 1" aluminum corner beading properly secured and shall have the same facing material as the insulation board.
6. Flexible duct wrap insulation shall be cut properly and fitted to "stretchout" dimensions and a 2" piece of insulation removed from the facing at the end of the piece to form an overlapping staple and tape flap. Insulation shall be installed with facing outside so tape flap overlaps facing at the other end. Insulation shall be butted tightly. Seams shall be stapled on 6" centers with outward clinching staples. Adjacent sections of duct wrap insulation shall be butted tightly with the 2" tape flap overlapping and stapled. For horizontal oval ducts over 30" wide, duct wrap insulation shall be secured additionally to the bottom of the duct with mechanical fasteners such as pins and speed clip washers spaced on 18" centers to prevent sagging. All seams, joints, tears, punctures and other penetrations in the vapor retarder jacket shall be sealed with FRK backing pressure sensitive tape.
7. Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation.
8. Where a duct run changes from interior lining to exterior application (or vice versa), there shall be a 6" overlap of insulation.
9. In "cold" duct system with internal duct insulation, with 1 1/2 " thickness flexible duct wrap, insulate air devices, fire dampers, duct mounted coils, dampers, and other devices in the ductwork system that are not internally insulated.

H. Field-applied Protective Finish Jackets

1. Aluminum stainless steel jackets with moisture barrier shall be cut and fitted to size required.
2. Fold a 1/2" safety edge on exposed side, roll to diameter required and secure with 1/2" x 0.020" aluminum or 1/2" x 0.015" stainless steel bands respectively on 9" centers (4 bands per 3 foot section of jacketing).
3. Provide appropriate seals, and shed water toward low end of pitched piping.
4. Install lap on top quadrant (2 or 10 o'clock position) of outside diameter of insulation and line up bands and seals to present neat and workmanlike appearance.
5. Fitting covers shall be consistent with piping insulation jacketing.
6. Secure in place with SS screws or banding.
7. Seal with approved caulking.
8. Sharp edges shall be turned under or otherwise protected.

I. Field-applied Protective Finish Jackets

1. PVC jacketing for pipe shall be applied with the SSL lap positioned properly to facilitate solvent welding of the seam.
2. PVC fitting covers shall be installed with proper watershed and all joints sealed with solvent welding.
3. Penetrations in the jacketing for hangers, supports and other openings shall be sealed with silicone caulk to be weather, vapor and watertight.

J. Field-applied Self-Adhesive Jackets

1. Ensure that all surfaces are clean and dry; free from dust, oil and grease/silicone.
2. Install per manufacturer's instructions.
3. When applying, partly peel back and crease the liner so enough adhesive is available to attach the jacketing in the correct position.
4. Apply with 12" minimum offset from ductwork joints.
5. Apply with 3" overlap to provide weatherproof seal.
6. Position jacket so the edge of the sealing lap faces down.

3.3 INSULATION MATERIAL SCHEDULE I-4 (DUCTWORK 0 to 250 degrees F Conditioned Spaces and Return Air Plenums.

1. Shall have minimum installed R-value: R-4
2. Rectangular Supply Air, Heated or Cooled Make-up/Ventilation Air
 - a. Type: GF2
 - b. Thickness - 1"
3. Round or Oval Supply Air, Heated or Cooled Make-up/Ventilation Air
 - a. Type: GF3
 - b. Thickness - 1"
 - c. (Refer to Division 24 and drawings for location of K-27 double wall ducts)
4. VAV box coil return bends, Duct mounted coils
 - a. Type: GF3
 - b. Thickness - 1"
5. Return Air N/A
6. Rectangular Return Air, Outdoor Air, Mixed Air, associated plenums and Filter Sections
 - a. Type: GF2
 - b. Thickness - 1"
7. Round or Oval Return Air, Outdoor Air, and Mixed Air
 - a. Type: GF3
 - b. Thickness - 1"
 - c. (Refer to Division 24 and drawing for location of K-27 double wall ducts)
8. Relief Air N/A
9. Exhaust Air N/A

END OF SECTION 20 20 25

SECTION 23 00 00 – HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 23 of these Specifications.
 - 1. Section 23 10 00 – Flammable Gas and Liquids Piping and Equipment
 - 2. Section 23 21 00 – Hydronic Piping and Equipment
 - 3. Section 23 74 00 – Packaged HVAC Equipment
- C. Related Requirements:
 - 1. Division 20 - Basic Mechanical, Plumbing, and Fire Protection
 - 2. Division 25 - Temperature Control
 - 3. Division 26 – Electrical

1.2 SUMMARY

- A. Section Includes:
 - 1. Air handling equipment including, but not limited to, packaged DX rooftop air handling units, and exhaust fans.
 - 2. All seismic restraints for the above work (Refer to Section 20 05 48).]
 - 3. Cleaning and pressure testing equipment, piping, and accessories installed under this section of the specification. (Refer to Section 20 10 60).]
 - 4. Provide sufficient labor and resources required for the testing and balancing Refer to Section 20 10 60.

1.3 QUALITY ASSURANCE

- A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20.
- B. Specific requirements for materials shall be as listed in Division 20 Basic Materials and Methods.
- C. Manufacturer's mill reports and applicable documents to certify the validity of the procured piping materials shall be on file at the Contractor's office.
- D. Install all piping with pitch to vent or drain. Provide drain valves at low points and air vents at high points. Drain valves and air vents shall be ¾" bronze 2 piece body ball valves with ¾" hose end adapter, cap and chain. In ½" through 2" pipe, contractor may use Webstone model T-drain. Use eccentric reducing fittings (installed top level) as required to avoid air pockets.

- E. Gaskets and packings containing asbestos are not acceptable.
- F. Where pipe and accessories installed under this section of the specification tie-in to existing systems, Contractor shall verify existing for: sizes, direction of flow (via pressure or physical tracing of piping, not labels), materials, and elevations before installing new work. Contractor shall notify Architect/Engineer upon discovery of discrepancy. Work performed prior to verification will be corrected at no cost to Owner.
- G. Prior to excavation, best efforts shall be made to locate existing lines with cameras, locating sondes, ground penetrating radar, etc.

1.4 ACTION SUBMITTALS

- A. Contractor shall submit coordination drawings to the Engineer for review prior to any fabrication or installation. (Refer to Section 20 10 50).
- B. Refer to Division 1, Division 20, and each section of Division 23.
- C. At the point where the mechanical system has been installed and checked by the Contractor and the systems are ready for testing and adjusting, submit a letter to the Architect/Engineer stating such. Refer to Section 20 10 85.

1.5 INFORMATIONAL SUBMITTALS

- A. Refer to Division 1, Division 20, and each section of Division 23

1.6 CLOSEOUT SUBMITTALS

- A. Refer to Division 1, Division 20, and each section of Division 23.
- B. As-built drawings of underground piping or equipment shall include dimensions from building walls/columns and elevations.
- C. At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 00 00

SECTION 23 10 00 – FLAMMABLE GAS AND LIQUIDS PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. NATURAL GAS SPECIALTIES
 - 2. ABOVEGROUND FUEL-OIL PIPING
- B. Related Requirements:
 - 1. Section 23 00 00 HVAC Piping and Equipment

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 MISCELLANEOUS PIPING REQUIREMENTS

- A. Itemization of the piping materials for specific system application are enumerated in the following sub-sections for the respective PIPING MATERIAL SCHEDULE. Specific requirements for materials shall be as listed in Division 20 10 00 Basic Materials and Methods.

2.3 NATURAL GAS SPECIALTIES

A. Weatherproof Vent Cap:

1. 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.

2.4 MANUAL GAS SHUTOFF VALVES

A. See Division 20 for general valve specifications.

B. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.
4. Stem Seal: Compatible with natural gas.
5. Ends: Threaded or flanged as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig.
8. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

C. 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 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; flanged for regulators NPS 2-1/2 and larger.

B. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: NBR.
5. Seal Plug: UV-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

8. Maximum Inlet Pressure: 2 psig.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall
1. examine existing conditions prior to bidding for any defects, deterioration, or damage.
 2. Contractor shall prep existing piping ready for connection to new piping.

3.2 PIPING APPLICATIONS

A. NATURAL GAS PIPING MATERIAL SCHEDULE NG-1

1. Service
 - a. Natural Gas Piping, above grade
2. Design Pressure Rating: 2 PSIG
3. All piping methods and materials shall be in accordance with NFPA 54, National Gas Code.

4. Pipe (Refer to Section 20 10 10):

SIZE	MATERIAL	THICKNESS
All Sizes	Black Carbon Steel ASTM-A53, ERW	Schedule 40

5. Fittings (Refer to Section 20 10 10):

SIZE	MATERIAL	Joining Method
2" and Smaller	Malleable Iron	Screwed
2½" to Larger	Black Carbon Steel	Buttwelded

- a. All piping concealed in chases or walls or above inaccessible ceilings shall be welded.

6. Valves (Refer to Section 20 10 20):

SERVICE	SIZE	MATERIAL/CONSTRUCTION	TYPE
Shut-off	All Sizes	Relubable and U.L. listed for natural gas service installed where shown and within 6 feet of the equipment served.	Plug

7. Purging

- a. Prior to being placed in service, all piping shall be purged with gas until completely air free. A moderately rapid and continuous flow of gas shall be introduced at the one end of the gas line and air vented at the other end. The gas flow shall be continued without interruption until vented gas is free from air.

8. Pressure Test

- a. New piping shall be install, capped, and pressure tested with Nitrogen at 50 psi for two (2) hours. After the piping has passed the above pressure test the final tie-ins shall be made, then the system will filled with natural gas and the final joints will be checked with soap.

3.3 INSTALLATION

- A. Provide piping, valves fittings and accessories for a complete system.

3.4 INSTALLATION OF OUTDOOR PIPING

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.

3.5 INSTALLATION OF VALVES

- A. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.6 CLEANING AND PROTECTION

- A. Clean

END OF SECTION 23 10 00

SECTION 23 21 00 – HYDRONIC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Air handling equipment including, but not limited to, packaged DX rooftop air handling units, and exhaust fans.
2. Natural gas piping, service valves, and gas pressure regulators.

B. Related Requirements:

1. Section 23 00 00 HVAC Piping and Equipment

1.2 ACTION SUBMITTALS

A. Product Data: The Contractor shall submit the following for approval.

1. Piping materials, valves, and accessories as specified in Piping Materials Schedule(s) in this section of the specification.
2. All general items specified under Division 20 utilized in the installation of work required by this section of the specification.

1.3 INFORMATIONAL SUBMITTALS

A. Installation manual: For each type of product.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product.

B. Parts List: For each type of product that has replaceable parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 MISCELLANEOUS PIPING REQUIREMENTS

- A. Itemization of the piping materials for specific system application are enumerated in the following sub-sections for the respective PIPING MATERIAL SCHEDULE. Specific requirements for materials shall be as listed in Division 20 "Basic Mechanical Conditions".
- B. Install all piping with pitch to vent or drain.
- C. Gaskets and packings containing asbestos are not acceptable.
- D. Where Pipe and accessories installed under this section of the specification tie-in to existing systems, Contractor shall verify existing for: sizes, direction of flow (via pressure or physical tracing of piping, not labels), materials, and elevations before installing new work. Contractor shall notify Architect/Engineer upon discovery of discrepancy. Work performed prior to verification will be corrected at no cost to Owner.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. PIPING MATERIAL SCHEDULE M-1

- 1. Service: Condensate Drain Piping
- 2. Design Rating: Atmospheric
- 3. Material Specifications (Refer to Section 20 10 10):

COMPONENT	MATERIAL
Pipe	Copper
Pipe Wall Thickness	Type L
Fittings	Wrought Copper
Joining Method	Solder Ends

- a. 90° elbows are not permitted, use (2) 45° elbows or 'Y' provided with cap in unconnected straight run.
 - b. Extend piping from all cooling coil drain pans to the location of discharging indirectly to the building drain system. Pipe size shall be unit connection size unless indicated larger on the plans.
 - c. Connections to the drain pans shall be made through a water seal trap with the downstream side vented to atmosphere.
- 4. Pressure Test (Refer to Section 20 10 00):
 - a. Pressure test at not less than 15 feet static head of water for two (2) hours minimum.

3.2 INSTALLATION

- A. Install all piping with pitch to vent or drain. .
- B. Gaskets and packings containing asbestos are not acceptable.
- C. Where Pipe and accessories installed under this section of the specification tie-in to existing systems, Contractor shall verify existing for: sizes, direction of flow (via pressure or physical

tracing of piping, not labels), materials, and elevations before installing new work. Contractor shall notify Architect/Engineer upon discovery of discrepancy. Work performed prior to verification will be corrected at no cost to Owner.

END OF SECTION 23 21 00

SECTION 23 74 00 – PACKAGED OUTDOOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Packaged small capacity rooftop units
- B. Related Requirements:
 - 1. Section 23 00 00 HVAC Piping and Equipment

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 PACKAGED SMALL CAPACITY ROOFTOP UNITS 0 – 25 TONS

- A. Furnish and install packaged rooftop units of the capacities scheduled. The units shall be factory assembled, wired, refrigerant charged and tested prior to shipment. Units shall be UL listed and labeled.
- B. The rooftop unit shall have supply and return connections located as shown on the plans to align with the existing ductwork. Any deviation from this configuration requiring ductwork modifications shall be the responsibility of the contractor, including all associated costs.

- C. Unit shall be casing constructed of all galvanized materials with the exterior surfaces painted. The entire cabinet shall be insulated and sealed watertight.
- D. Compressors shall be hermetic reciprocating or scroll type. Compressors shall have current overloads, temperature overloads, and crank case heaters. The compressor shall be in separate cabinet from the fan section and shall have spring vibration isolators and additional sound proofing. Compressor shall operate down to 0°F ambient.
- E. The evaporator and condensing coils shall be copper tubes with mechanically bonded aluminum plate fins. The refrigeration circuit shall have filter drier, sight glass, and service ports.
- F. The supply fan shall be a non-overloading forward curve fan sized for high efficiency within the range of normal airflows. The motor and drive shall be selected to provide the design airflow and external static pressure as scheduled on the plans. The motor shall contain overload protection.
- G. The unit shall contain a terminal strip for customer interface. The following shall be provided as a minimum: Fan start/stop and compressor enable/disable.
- H. The unit shall be supplied with a down flow roof curb factory matched to the unit and allow direct ductwork connections. The finished height of the roof curb shall be 10" – 12" above the finished roof. The Contractors shall coordinate the curbs with the roof insulation thickness.
- I. The unit shall have a single point connection and shall not exceed the scheduled power consumption.
- J. All warranties that are scheduled on the drawings should be provided by manufacturer and mechanical contractor.
- K. Manufacturers: Aeon RN, Trane Precedent, Daikin, or Approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Furnish and install rooftop units as shown and scheduled on the drawings.

- B. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction. Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.

3.3 DUCT CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
- B. Install ducts to termination at top of roof curb.
- C. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
- D. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
- E. Install return-air duct continuously through roof structure.

3.4 ELECTRICAL CONNECTIONS

- A. Connect electrical wiring according to Division 26.
- B. Ground equipment according to Division 26.
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Division 25 and 26.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions.
 - 1. Inspect for visible damage to unit casing.
 - 2. Inspect for visible damage to furnace combustion chamber.
 - 3. Inspect for visible damage to compressor, coils, and fans.
 - 4. Inspect internal insulation.
 - 5. Verify that labels are clearly visible.
 - 6. Verify that clearances have been provided for servicing.
 - 7. Verify that controls are connected and operable.

8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Remove packing from vibration isolators.
13. Inspect operation of barometric relief dampers.
14. Verify lubrication on fan and motor bearings.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.
 - a. Measure gas pressure on manifold.
 - b. Inspect operation of power vents.
 - c. Measure combustion-air temperature at inlet to combustion chamber.
 - d. Measure flue-gas temperature at furnace discharge.
 - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.

3.7 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 CLEANING

- A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems and after completing startup service, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

END OF SECTION 23 74 00

SECTION 24 00 00 – AIR DISTRIBUTION

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.
- B. Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 24 of these Specifications.
 - 1. Section 24 31 00 – Sheetmetal Ductwork
 - 2. Section 24 33 00 – Air Duct Accessories
 - 3. Section 24 33 50 – Internal Acoustical Duct Lining
 - 4. Section 24 34 00 – Fans
- C. The following sections of the Specifications apply to Work under this Section
 - 1. Division 20 - Basic Mechanical, Plumbing, and Fire Protection
 - 2. Division 23 – HVAC Piping and Equipment
 - 3. Division 25 – Temperature Controls

1.2 SUMMARY

- A. Section Includes:
 - 1. Sheetmetal ducts, sheet metal plenums, duct linings, flexible ductwork, dampers, and accessories.
 - 2. Fans and accessories.
 - 3. Air Devices, including adjusting the pattern controllers.
 - 4. Installation of all mentioned above.
- B. Applicable requirements of the current and accepted edition of the following industry standards, codes and specifications shall apply to the Work for Division 22
 - 1. ASHRAE, “Handbook 1997 Fundamentals”; Chapter 32 - Duct Design.
 - 2. ASHRAE, “Handbook 1996 Equipment”; Chapter 16 - Duct Construction.
 - 3. ASTM A90-81 (1991), “Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles”.
 - 4. ASTM A525-91b, “Spec for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process”.
 - 5. ASTM A527/A527M-90, “Spec for Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality”.
 - 6. NFPA 90A, “Installation of Air Conditioning and Ventilating Systems.”
 - 7. SMACNA “HVAC Duct Construction Standard – Metal and Flexible” – Second Edition.
 - 8. UL 33, “Heat Responsive Links for Fire Protection Service.”
 - 9. UL 555, “Fire Dampers and Ceiling Dampers.”
 - 10. UL 181, “Factory Made Air Ducts and Connectors.”

1.3 DEFINITIONS

1. The size of the ducts shown on the drawings and in this Section of the Specifications shall be the outside dimension of the ductwork which will take into account any internal acoustical lining thickness specified for duct system or sub-system.
2. The term "supply air" where used in this Section of the Specifications shall mean downstream of a coil.
3. The term "outdoor air" where used in this Section of the Specifications shall mean ambient air that has not been conditioned.
4. The term "return air" where used in this Section of the Specifications shall mean conditioned air that is returned from the space.
5. The term "mixed air" where used in this Section of the Specifications shall mean air streams that are a mixture of "outdoor air" and "return air".
6. The term "relief air" where used in this Section of the Specifications shall mean excess return air that relieved from the building.
7. The term "exhaust air" where used in this Section of the Specifications shall mean air that is removed due to contaminants, odors, or heat.

1.4 QUALITY ASSURANCE

- A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20.
- B. Gaskets containing asbestos are not acceptable.
- C. Where duct and accessories installed under this section of the specification tie-in to existing systems, Contractor shall verify existing for: sizes, direction of flow (via pressure or physical tracing of piping, not labels), materials, and elevations before installing new work. Contractor shall notify Architect/Engineer upon discovery of discrepancy. Work performed prior to verification will be corrected at no cost to Owner.

1.5 INFORMATIONAL SUBMITTALS

- A. Refer to Division 1, Division 20, and each section of Division 24.

1.6 CLOSEOUT SUBMITTALS

- A. Refer to Division 1, Division 20, and each section of Division 24.
- B. At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 24 00 00

SECTION 24 31 00 – SHEETMETAL DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings
 - 2. Duct liner.
 - 3. Sealants and gaskets.
 - 4. Hangers and supports.
- B. Related Requirements:
 - 1. Section 24 00 00 Air Distribution

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Refer to Division 20 for seismic delegated design requirements.

2.2 MATERIAL

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, unless otherwise indicated. Sheet metal materials are to be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel:
 - 1. Comply with ASTM A653/A653M.
 - 2. Galvanized Coating Designation: G90.
 - 3. Finishes for Surfaces Exposed to View: Mill phosphatized.

2.3 CONSTRUCTION

- A. General Construction Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for material thicknesses, and construction methods unless otherwise indicated.
 - 1. Where local code requires gauges heavier than required by SMACNA then the local code shall govern.
- B. Rectangular ducts unless specified otherwise shall be "Pittsburgh Lock" longitudinal joints. Snaplock is not acceptable.
- C. Transverse joints in rectangular ductwork 24" and larger shall be Ductmate, SMACNA T-25, or approved equivalent. All flanged ductwork, regardless of pressure class, shall use gaskets, corner closures, and be TEK screwed or riveted on 10" centers with a minimum of two (2) per side. Transverse joints in rectangular ductwork smaller than 24" shall be made in accordance with SMACNA suitable with the pressure class.
- D. Transverse joints in round and oval ductwork:
 - 1. Less than 24" shall be beaded sleeve joints, or connectors with integral EPDM gaskets.
 - 2. 24" and larger shall be Ductmate, or connectors with integral EPDM gaskets, or approved equivalent.
- E. Panels in all ducts 12" and larger shall be cross-broken or beaded on 12" centers.

2.4 SEALING

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets are to be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
- B. Sealing system components shall be water, mold and mildew resistant.

2.5 FITTINGS

- A. Rectangular duct branch take-offs, or rectangular to round, shall be 45°-boot fittings, spin in fittings are not acceptable.

- B. Rectangular duct proportional splits shall be made the sizes as shown on the drawings. Where duct sizes are changed from the original design, Contractor shall proportion split equal to the split in airflow.
- C. Rectangular duct changes in direction:
 - 1. 90 degree elbows, refer to plans, shall be mitered with turning vanes; or radiused with centerline radius to width ratio of 0.75 (inside radius/width ratio 0.25 with curve ratio 0.585) with 2 splitter vanes.
 - 2. 45 degree and less elbows shall be mitered without vanes.
 - 3. Elbows other than above shall be radiused with centerline radius to width ratio of 1 without splitter vanes.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct." Under no case will less than double thickness 1" x #24-gauge galvanized metal be allowed. Cable hangers are not allowed.
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- D. Steel Cable End Connections: Galvanized-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. All ductwork shall be neatly constructed, stiffened, on the outside surfaces where necessary to prevent perceptible vibration or buckling. All ducts, housings, etc., shall be fabricated as detailed on the drawings and in the SMACNA Duct Construction Manual –Latest Edition.
- C. All supply ductwork, unless specified otherwise, shall be constructed of gauges and reinforcement to 4" w.g. static pressure in SMACNA Duct Construction Standard – Latest Edition.

- D. All return, exhaust, outdoor air, relief, and supply ductwork downstream of terminal units shall be constructed of gauges and reinforcement to 2" w.g. static pressure in SMACNA Duct Construction Standard – Latest Edition. As a minimum, panels in all ducts 12" and larger shall be cross-broken or beaded on 12" centers.
- E. Install ducts in maximum practical lengths with fewest possible joints.
- F. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- G. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- J. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- K. 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.
- L. When approved by the Engineer ducts may be notched at structural steel. The converging angle shall be no greater than 30°, the diverging angle shall be no greater than 15°.
- M. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 SEALING

- A. Duct sealant shall be flexible, water-based, adhesive sealant designed for use in 4" static pressure systems. Sealer shall be UL listed and conform to ASTM E84 or UL 723. Sealer shall be equal to Ductmate PROseal, United McGill Uni-Mastic, Duro-Dyne DSW, or equivalent.
- B. All supply ductwork unless specified otherwise shall be SMACNA's seal class A.
- C. All return, exhaust, outdoor air, relief and supply ductwork downstream of terminal units shall be SMACNA's seal class B.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Hangers Exposed to View: Threaded rod and angle or aircraft cable.

- C. Ducts that are to be externally insulated shall not be supported on unistrut channel unless it required based upon loading. Hanger rods for trapeze bars shall be spaced to allow for insulation installation.
- D. 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 DUCTWORK CONNECTIONS

- A. Make connections to equipment with flexible connectors.
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 CLEANING AND PROTECTION

- A. Contractor shall implement procedures to maintain an "Advanced Level" of ductwork cleanliness per the latest addition of the SMACNA Duct Cleanliness for New Construction Guidelines.
 - 1. Production and Site Delivery:
 - a. Self-adhesive labels for part of identification are to be applied to the external surfaces only.
 - b. During transportation, ductwork and air distribution components shall be sealed either by blanketing or capping the duct ends, bagging small fittings, surface wrapping or shrink wrapping.
 - 2. Site Storage:
 - a. Temporary storage shall be located away from high dust generating processes such as masonry, tile cutters, saws, drywall sanding, mortar and plaster mixers, roof pitch kettles, portable electric generators, and main walkways that will be constantly broom swept.
 - b. Temporary storage shall include pallets or blocking to keep ductwork and air distribution components above floor surface to prevent water damage.
 - c. Coverage should be used to protect stored materials at all times.
 - d. Duct open ends and air side of air distribution components shall be securely sealed at all times.
 - e. Seals shall be visually examined and if damaged, resealed with an appropriate material.
 - 3. Installation:
 - a. Before installation of individual duct sections and air distribution components, they are to be inspected to ensure that they are free from debris and shall be wiped clean if debris exists.
 - b. The working area shall be clean, dry, and the airside of ductwork and air distribution components protected from dust and moisture.
 - c. Protective coverings shall only be removed immediately before installation and inspected to determine if additional wipe down is necessary.
 - d. Open ends on completed ductwork shall be sealed immediately if left for an extended period of time (work breaks, overnight, etc.).
 - 4. Clean new duct system(s) before testing, adjusting, and balancing.
 - 5. For cleaning of existing ductwork, see "Existing HVAC Air Distribution System Cleaning."

6. Use service openings for entry and inspection.
 - a. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
 - b. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - c. Remove and reinstall ceiling to gain access during the cleaning process.
7. Particulate Collection and Odor Control:
 - a. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - b. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
8. Clean the following components by removing surface contaminants and deposits:
 - a. Air outlets and inlets (registers, grilles, and diffusers).
 - b. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - c. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - d. Coils and related components.
 - e. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - f. Supply-air ducts, dampers, actuators, and turning vanes.
 - g. Dedicated exhaust and ventilation components and makeup air systems.
9. Mechanical Cleaning Methodology:
 - a. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - b. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - c. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - d. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 - e. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 - f. Provide drainage and cleanup for wash-down procedures.
 - g. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.6 DUCT SCHEDULE

- A. Fabricate ducts except as otherwise indicated shall be constructed from sheets or rolls of G-90 or better-galvanized steel. Fiberglass ductboard is prohibited.

- B. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
- C. Supply ducts:
1. Pressure Class: Positive 4 inch wg (Pa).
 2. Minimum SMACNA Seal Class: A.
 3. SMACNA Leakage Class for Rectangular: 4.
 4. SMACNA Leakage Class for Round and Flat Oval: 2.
 5. Natatorium supply ducts:
 - a. Aluminum
 - b. Exposed to View: No. 3 finish.
 - c. Concealed: No. 2D finish.
- D. Return ducts:
1. Pressure Class: Negative 3 inch wg.
 2. Minimum SMACNA Seal Class: B.
 3. SMACNA Leakage Class for Rectangular: 8.
 4. SMACNA Leakage Class for Round and Flat Oval: 4.
 5. Natatorium return ducts:
 - a. Aluminum
 - b. Exposed to View: No. 3 finish.
 - c. Concealed: No. 2D finish.
- E. Exhaust ducts
1. Pressure Class: Negative 3 inch wg.
 2. Minimum SMACNA Seal Class: B.
 3. SMACNA Leakage Class for Rectangular: 8.
 4. SMACNA Leakage Class for Round and Flat Oval: 4.
 5. Hazardous exhaust from fume hoods
 - a. 316 stainless steel
 - b. Minimum SMACNA Seal Class A **OR** Welded seams and joints

END OF SECTION 24 31 00

SECTION 24 33 00 – DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Flexible Connectors
 - 2. Flexible Ductwork
- B. Related Requirements:
 - 1. Section 24 00 00 Air Distribution

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 MANUFACTURERS

- A. Flexible connectors: Duro Dyne Corporation, Elgen, or Vent-Fabrics.
- B. Flexible Ductwork: Flexmaster, Thermaflex, or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories in conformance with applicable SMACNA standards.
- 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. Flexible Connector Installation
 - 1. Furnish and install flexible connections at the connections to air handling equipment as indicated on the plans. The flexible connectors shall be fastened to ductwork and equipment by screws, rivets or spot welding.
 - 2. For fans developing static pressures of 5 inches wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
 - 3. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

- A. Life Safety Damper Testing
 - 1. Fire and fire/smoke dampers are to be witness tested by the Owner. The Contractor shall remove the fusible link and demonstrate that the damper closes freely. After acceptance by the Owner, the Contractor shall reset the damper and replace the fusible link.
 - 2. Inspect life safety damper access to verify the size is adequate to perform the required operation.
 - 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and that proper heat-response device is installed.
- B. Air Duct Accessory Tests and Inspections
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors, and verify that size and location of access doors are adequate to perform required operation.
 - 3. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
 - 4. Operate remote damper operators to verify full range of movement of operator and damper.
 - 5.
- C. Flexible Ductwork
 - 1. Flexible duct length shall not exceed 8' for diffusers and 3' at VAV box inlets.
 - 2. Support flexible duct on 4' centers maximum.
 - 3. Flexible duct shall be attached with zinc plated or stainless steel worm drive duct hose clamps
 - 4. Install ducts fully extended.
 - 5. Do not bend ducts across sharp corners.
 - 6. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
 - 7. Avoid contact with metal fixtures, water lines, pipes, or conduits.

8. Install flexible ducts in a direct line, without sags, twists, or turns.

3.3 CLEANING AND PROTECTION

- A. Clean and protect duct accessories to the same requirements for ductwork.

END OF SECTION 24 33 00

SECTION 24 34 00 – FANS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Backward-inclined centrifugal fans, including airfoil and curved blade fans.
 - 2. Roof Exhausters
- B. Related Requirements:
 - 1. Section 24 00 00 Air Distribution

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- 1. Provide fans as scheduled on the drawings.
- 2. Provide accessories as scheduled on the drawings.
- 3. Provide hangers, supports, isolators, curbs, etc. as necessary for the installation of the fans.

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.3 ROOF EXHAUSTERS

- A. Furnish and install where indicated on the drawings centrifugal roof exhaust fans of the sizes and capacities as scheduled. Centrifugal impeller is to be of heavy aluminum construction with backward inclined or curved hollow airfoil blades. Hoods shall be constructed of aluminum with rolled bead for additional strength and shall be easily removable for servicing. Overall height from the curb shall not exceed that of the models scheduled. Motor and drive assembly shall be vibration isolated from the base and housing. All units shall have U.L. wired safety disconnect switch, sound attenuating roof curb and backdraft damper, in addition to any other accessories listed in the schedule.
- B. Sidewall fans shall be Cook ACW, Greenheck CUE, Penn-Barry PRU, ACME PNN, Twin City Fan VCU/.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Accessories shall be provided as scheduled on the drawings.
- B. Install fans level and plumb.
- C. Lift equipment with manufacturer's designated lifting points.
- D. Equipment Mounting
 - 1. Secure roof mounted fans to roof curbs.
 - 2. Install floor -mounted centrifugal fans on cast-in-place concrete equipment base(s).
 - 3. Ceiling units shall be suspended from structure; use steel wire or metal straps. Suspend equipment from manufacturer's designated supporting points.
 - 4. Maintain manufacturer's recommended service clearance.
 - 5. Equipment shall be labeled in compliance with specifications.
- E. Comply with requirements for vibration isolation.
- F. Comply with requirements for seismic restraint.
- G. Comply with manufacturer's recommended startup requirements.

3.2 DUCTWORK CONNECTIONS

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

3.3 ROOF EXHAUSTER INSTALLATION

- A. Install a vinyl coated steel cable from the motor cover to the base to allow the motor cover to be removed for service, but will not permit the cover to be blown away. Cable shall have eyelet or swagged ends with aluminum or galvanized fasteners.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation where applicable.
- B. Adjust belt tension for belt driven fans.
- C. Lubricate bearings.
- D. Comply with requirements for Testing, Adjusting and Balancing.

3.5 FIELD QUALITY CONTROL

- A. Perform fan operational test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- B. Test and adjust controls and safeties.

3.6 CLEANING AND PROTECTION

- A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

END OF SECTION 24 34 00

SECTION 25 00 00 – TEMPERATURE CONTROL SYSTEM

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.
- B. Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 25 of these Specifications.
 - 1. Section 25 10 00 – Control System Requirements
 - 2. Section 25 20 00 – Airside Control Equipment
 - 3. Section 25 50 00 – Wiring Materials and Methods
- C. The following sections of the Specifications apply to Work under this Section
 - 1. Division 20 - Basic Mechanical, Plumbing and Fire Protection
 - 2. Division 23 – HVAC Piping and Equipment
 - 3. Division 24 – Air Distribution
 - 4. Division 26 – Electrical

1.2 SUMMARY

- A. This Section specifies an Automation/Energy Management System to control and monitor HVAC systems.

1.3 REFERENCES

- A. Applicable requirements of the current and accepted edition of the following industry standards, codes and specifications shall apply to the Work for Division 25
 - 1. ASHRAE 36 – High-Performance Sequences of Operation for HVAC Systems
 - 2. ASHRAE Standard 135-2016, BACnet – A Data Communication Protocol for Building Automation and Control Networks.
 - 3. BACnet Testing Laboratories (BTL) for product testing and certification.
 - 4. FCC rules, Part 15, Subpart J, regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.
 - 5. NFPA 70 – National Electrical Code
 - 6. UL 916 Underwriters Laboratories Standard for Energy Management Equipment.

1.4 DEFINITIONS

- A. Adjustable (Adj.): Where used in this Section of the Specifications shall be defined as values that are adjustable at the GUI without the need for any software. This adjustment may be password protected to limit access to an appropriate user level and may use an adjustment mechanism similar to point overrides.

- B. Control Loop or Loop: Used generically for all control loops. These will typically be PID loops, but proportional plus integral plus derivative gains are not required on all loops. Unless specifically indicated otherwise, the guidelines in the following subsections shall be followed.
- C. Control Wiring: All wiring, 120 VAC line voltage or lower other than power wiring, required for the proper operation of the mechanical system and the BAS. This includes applications where line voltage serves as the control circuit such as a line voltage thermostat or involves interlocking with a damper.
- D. Deadband: The difference between two setpoint or configuration values during which no output function is performed.
- E. Dewpoint Temperature or Dewpoint: The saturation temperature of water in moist air, as evidenced by the temperature at which water will condense out of air. Dewpoint temperature is an evaluation of the absolute water content of moist air, so for control applications, it is used where moisture content of air needs to be maintained, such as humidification or dehumidification processes.
- F. Differential: The range or units of measure that separate the enable point from the disable point.
- G. DDC or Direct Digital Control: A control technique through which the process variable is continuously monitored by a digital computer which accomplishes loop control by calculating a control solution for output to a control device.
- H. Discharge Temperature: The temperature discharged from a piece of equipment, but not necessarily to an end use consumer.
- I. EMS Energy Management System, BAS Building Automation System: May be used interchangeably in this Section of the Specifications to mean a system to control mechanical equipment using DDC. This definition includes both hardware and software components that are integrated to form a working system.
- J. Enthalpy: The psychrometric quantity equivalent to the total heat content of air. It is usually used to evaluate if the outside air contains less heat than the return air and determine whether to enable economizer.
- K. Hard Wired Control: A control method using relays to enable and interrupt signals without the use of a controller.
- L. Proportional: A set of signals that vary in a continuously linear relationship with each other. They may be direct or reverse acting.
- M. Power Wiring: All line voltage wiring to the mechanical and BAS equipment that is required for proper operation of the equipment. Typically, this wiring will support voltage at or above 120 VAC and is connected to the equipment for the purpose of providing motive power.
- N. Proven (i.e., “proven ON”/“proven OFF”): The equipment’s DI status point (where provided, e.g., current switch, DP switch, or VFD status) matches the state set by the equipment’s DO command point.
- O. Relative Humidity: The psychrometric property that is an evaluation of how much water vapor is present in air relative to the capacity of air at the current temperature and pressure to hold water.

While it is a good measure of comfort levels, the temperature dependence of this value can make it an unstable control variable.

- P. Software Point: An analog variable, and “software switch” shall mean a digital (binary) variable, that are not associated with real I/O points. They shall be read/write capable (e.g., BACnet analog variable and binary variable).
- Q. Supply Temperature: The temperature supplied to an occupied zone or terminal equipment point of use.
- R. Temperature: The psychrometric value dry bulb temperature.
- S. Wet Bulb Temperature: The psychrometric property wet bulb temperature is the equilibrium temperature at which liquid water evaporates into the air at saturation. It can be measured with a thermometer that has a wick saturated in water. For control processes, it is typically used for the control of cooling towers since it is related to the evaporation of water in air. This is a different value from dewpoint temperature.
- T. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.
- U. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.
- V. BACnet Specific Definitions:
 - 1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data and services over a network.
 - 2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
 - 3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
 - 4. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.
- W. Binary: Two-state signal where a high signal level represents "ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.
- X. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: network controllers, programmable application controllers, and application-specific controllers.
- Y. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.
- Z. COV: Changes of value.
- AA. DDC System Provider: Authorized representative of, and trained by, DDC system manufacturer and responsible for execution of DDC system Work indicated.

- BB. Distributed Control: Processing of system data is decentralized and control decisions are made at subsystem level. System operational programs and information are provided to remote subsystems and status is reported back. On loss of communication, subsystems to be capable of operating in a standalone mode using the last best available data.
- CC. E/P: Voltage to pneumatic.
- DD. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.
- EE. HLC: Heavy load conditions.
- FF. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI) and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.
- GG. I/P: Current to pneumatic.
- HH. LAN: Local area network.
- II. LNS: LonWorks Network Services.
- JJ. LON Specific Definitions:
1. FTT-10: Echelon Transmitter-Free Topology Transceiver.
 2. LonMark International: Association comprising suppliers and installers of LonTalk products. Association provides guidelines for implementing LonTalk protocol to ensure interoperability through a standard or consistent implementation.
 3. LonTalk: An open standard protocol developed by Echelon Corporation that uses a "Neuron Chip" for communication. LonTalk is a register trademark of Echelon.
 4. LonWorks: Network technology developed by Echelon.
 5. Node: Device that communicates using CTA-709.1-D protocol and that is connected to a CTA-709.1-D network.
 6. Node Address: The logical address of a node on the network, consisting of a Domain number, Subnet number, and Node number. "Node number" portion of an address is a number assigned to device during installation, is unique within a subnet, and is not a factory-set unique Node ID.
 7. Node ID: A unique 48-bit identifier assigned at factory to each CTA-709.1-D device. Sometimes called a "Neuron ID."
 8. Program ID: An identifier (number) stored in a device (usually, EEPROM) that identifies node manufacturer, functionality of device (application and sequence), transceiver used, and intended device usage.
 9. Standard Configuration Property Type (SCPT): Pronounced "skip-it." A standard format type maintained by LonMark for configuration properties.
 10. Standard Network Variable Type (SNVT): Pronounced "snivet." A standard format type maintained by LonMark used to define data information transmitted and received by individual nodes. "SNVT" is used in two ways. It is an acronym for "Standard Network Variable Type" and is often used to indicate a network variable itself (i.e., it can mean "a network variable of a standard network variable type").

11. Subnet: Consists of a logical grouping of up to 127 nodes, where logical grouping is defined by node addressing. Each subnet is assigned a number, which is unique within a Domain. See "Node Address."
 12. TP/FT-10: Free Topology Twisted Pair network defined by CTA-709.3 and is most common media type for a CTA-709.1-D control network.
 13. TP/XF-1250: High-speed, 1.25 Mbps, twisted-pair, doubly terminated bus network defined by "LonMark Interoperability Guidelines" and typically used only to connect multiple TP/FT-10 networks.
 14. User-Defined Configuration Property Type (UCPT): Pronounced "u-keep-it." A Configuration Property format type that is defined by device manufacturer.
 15. User-Defined Network Variable Type (UNVT): Network variable format defined by device manufacturer. UNVTs create non-standard communications that other vendors' devices may not correctly interpret and may negatively impact system operation. UNVTs are not allowed.
- KK. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- LL. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.
- MM. Modbus TCP/IP: An open protocol for exchange of process data.
- NN. MS/TP: Master-slave/token-passing, ISO/IEC/IEEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.
- OO. MTBF: Mean time between failures.
- PP. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.
- QQ. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.
- RR. Peer to Peer: Networking architecture that treats all network stations as equal partners.
- SS. POT: Portable operator's terminal.
- TT. RAM: Random access memory.
- UU. RF: Radio frequency.
- VV. Router: Device connecting two or more networks at network layer.
- WW. Server: Computer used to maintain system configuration, historical and programming database.
- XX. TCP/IP: Transport control protocol/Internet protocol.
- YY. UPS: Uninterruptible power supply.
- ZZ. USB: Universal Serial Bus.

AAA. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.

BBB. VAV: Variable air volume.

CCC. WLED: White light emitting diode.

1.5 QUALITY ASSURANCE

- A. Work for this Section of the Specifications shall be performed in accordance with the Codes, Standards, etc. as identified in Division 20.
- B. All operable devices and features of the BAS, accessories, equipment and specialties provided for in the Scope of Work of this Section shall be operated and proved to function satisfactorily for a period of number (30) days. Adjust, balance, lubricate as required, and instruct the Owner in the proper operation and maintenance of each device.
- C. Equipment and devices shall be protected against damage in the period between installation and acceptance. Any item damaged shall be removed, repaired and/or replaced at no additional compensation.

1.6 ACTION SUBMITTALS

- A. Refer to Division 1, Division 20, and each section of Division 25.

1.7 INFORMATIONAL SUBMITTALS

- A. Refer to Division 1, Division 20, and each section of Division 25.

1.8 CLOSEOUT SUBMITTALS

- A. Refer to Division 1, Division 20, and each section of Division 25.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 25 00 00

SECTION 25 10 00 – CONTROL SYSTEM REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Automation/Energy Management System to control and monitor HVAC systems.
- B. Related Requirements:
 - 1. Section 25 00 00 TEMPERATURE CONTROL SYSTEM

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Include number-coded identification system for unique identification of wiring, cable, and tubing ends.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's installation manual: For each type of product.
- B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 MANUFACTURERS

- A. Johnson Controls Metasys Controls System Metasys – No Exceptions. Project is to be installed by a Johnson Controls Branch - Web based third party systems are not permitted.

2.3 METASYS GRAPHICS

- A. Quality Control for Metasys Graphics and User Interface
 - 1. Missouri State Highway Patrol (MSHP) utilizes central server that will house all Metasys User Interface graphics across the State. All MSHP locations must push back graphics to main server located in Jefferson City to ensure consistency and accessibility.
 - 2. MSHP requires uniform graphics format across all troops and building locations. Johnson Controls Inc. (JCI) has a dedicated graphics team responsible for implementing standardized graphics, equipment relationships, and interface across all sites.
 - 3. MSHP mandates standard naming conventions for all hardware, equipment, and points. BAS contractor to include at least one (1) day to review naming conventions with MSHP's facilities division and JCI's graphics team to ensure proper implementation.
 - 4. To ensure seamless collaboration across all MSHP sites, contact Johnson Controls Representative Dustin Brown at
Phone: 417-234-2384
Email: dustin.w.brown@jci.com
- B. Dedicated Web Based User Interface
 - 1. Where indicated on plans the BMS Contractor shall provide and install a personal computer for command entry, information management, network alarm management, and database management functions. Real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation Engines and Data Server(s) to facilitate greater fault tolerance and reliability.
 - 2. Dedicated User Interface Architecture – The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically, it must be implemented to conform to the following interface standards.
- C. Mobile, Web Based, User Interface (MUI)
 - 1. General
 - a. The mobile, web-based, user interface shall be HTML5-compliant and provide access to the system from smartphones, tablets, portable and desktop computers. User Interfaces that require software installation on the client device (e.g. Java, MicrosoftSilverlight®, Adobe® Flash®), or software downloads from an online app store shall not be acceptable for these purposes.
 - b. The mobile user interface shall provide system operators with a simple location-based navigation approach to finding information, including the ability to search for any location by name and to bookmark a location in a standard browser.
 - c. The mobile user interface shall organize and display information using customer specific locations and spaces. At a minimum, the user interface shall provide:
 - d. Organization of all space, equipment and point information in a familiar way (using standard equipment names and location descriptions), reducing the need for extensive training prior to use.

- e. A navigation mechanism or tree for users to select the specific location or space for accessing information – only spaces and locations in the navigation tree or equipment serving that space, nothing more.
 - f. The ability to search for and/or bookmark any location, space, or equipment by name for quick access to critical or troublesome areas.
 - g. Application of the same navigation mechanisms across any client device (e.g. Smart phone, tablet, personal computer) for consistency and ease of use.
 - h. The same user interface elements shall be accessible from any type of personal computer or mobile device running any type of operating system supported (e.g. iOS, Android, Windows®). It shall automatically adapt and optimize the display for the screen size and touch screen navigation.
 - i. The user interface shall provide support for up to 50 concurrent users from individuals with defined access to the system.
2. Navigation Trees
- a. A dedicated location based navigation tree shall be provided as part of the user interface in order to navigate to specific places within the facility on a hierarchical basis (typ. Facility, Building, Wing, Floor, Room).
 - b. The location-based tree shall use place names familiar to the operator without training or familiarization regarding special codes and conventions utilized in the generation of the BMS.
 - c. Clicking or tapping on a location name in the tree shall display the home page associated with the space and simultaneously expand the tree to display the next level of spaces below the one selected.
 - d. It shall be possible for qualified users to view a navigation tree of devices connected to the BMS network in order to enable troubleshooting of equipment and communications. Clicking or tapping on the Network Icon at the top of the Navigation Tree will access this alternate view. Users without the necessary access rights shall not see the Network Icon.
 - e. A click or tap on a device in the network tree shall display a dashboard for that device including information regarding related equipment and access to a separate focus view of commandable points associated with the piece of hardware. A click or tap on such a point shall display a control dialogue box allowing the user to modify or command that point as indicated. The dialog box shall contain an annotation box for describing why the action was taken or special circumstances that apply.
 - f. Specific hardware and software types in the Network tree shall also include access to one or more the following views in their dashboard depending on hardware type or network element (e.g. MS/TP trunk):
 - 1) Summary View
 - 2) Diagnostic View
 - 3) Network View
 - 4) Trend View
 - g. It shall be possible to hide the Network Tree and return to the Spaces Tree at any time by clicking on the Spaces Icon above the tree.
 - h. It shall be possible to restrict user access to any space in the Spaces Tree and thereby prevent manipulation of equipment associated with the space.
3. Dashboard Displays
- a. The user interface shall provide the ability to view equipment visualizations, floor plans, and/or other graphics on mobile or desktop client devices in a browser environment, without the need for additional plugins or software. Graphics shall be accessible via a space (for floorplans, campus maps, etc.) or equipment dashboard.

4. Standard dashboards shall be configured for each defined space including one of the following predefined or custom elements:
 - a. Equipment Serving Space
 - b. Potential Problem Areas
 - c. Equipment Summary
 - d. Graphic Display (if specified)
 - e. Schedule
5. Standard dashboards shall be configured for each system or device (typ. mechanical or electrical equipment) including the following predefined or custom elements:
 - a. Trend
 - b. Equipment Activity Summary
 - c. Equipment Relationships Summary
 - d. Equipment Data
 - e. Graphic Display (if specified)
 - f. Schedule
6. Users with appropriate permissions shall have access to a Dashboards Manager that can change the display order of Summaries and Data elements, add or remove elements and apply custom dashboards layouts to equipment and space by type.
7. Dashboard Manager shall apply dashboards to spaces or equipment based on the viewing platform (Desktop/Tablet or Phone) in order to tailor the user experience to the needs of the specific user base.
8. Default dashboard displays by space and equipment type shall be created per the guidelines in this specification or by mutual agreement with the owner's representative.
9. Alarm Management
 - a. The user interface shall provide a single display of all potential issues in a facility including items currently in alarm, warning, override, out-of-service and offline.
 - b. The user interface shall provide notification of new alarms, visually and audibly.
 - c. The user interface shall provide the ability to view a summary of alarms, including a chart of the number of alarms in each of the defined alarm priority ranges. The priority ranges should be filterable.
 - d. The user interface shall provide the capability to view multiple occurrences of the same alarm, ultimately providing the ability to acknowledge or discard all occurrences of the alarm in a single action.
 - e. The user interface shall provide the capability to view, and filter on, all alarms present in a well-defined mechanical system using the equipment serving equipment relationships.
 - f. The user interface shall provide the capability to acknowledge and discard all occurrences of at least 1000 alarms in one operation.
 - g. The user interface shall provide the user with the understanding of what physical space is being affected when an alarm occurs. The user interface shall provide the ability to filter alarms by physical space affected when the alarm occurred.
 - h. The user interface shall provide the capability to monitor alarms 24/7 without requiring an active login to the system, accessible via segregated web page. The user interface shall provide the capability to enable or disable the 24/7 alarm monitor mode if desired.
 - i. The user interface shall provide the capability to annotate alarms using a pre-defined selection list or by providing custom text.
 - j. The user interface shall provide the capability to filter down alarm list and bookmark the filtered list, allowing automatic filtering to be applied when the bookmark is accessed.
 - k. It shall be possible to export a .csv or .pdf copy of the currently displayed alarm list.

- l. If an alarm is not acknowledged or discarded by recipients within a user-selected time, the alarm shall be sent to an additional set of recipients.
10. Equipment Activity Summary
 - a. The user interface shall provide a filterable, single display, of all activity related to a specific piece of equipment including user changes, discarded user changes, pending alarms, discarded alarms, and acknowledged alarms for at least one year of historical data.
 - b. Items shall be listed in timed order with the latest activity at the top of the list.
 - c. Filters shall allow only specific activities for specific data points occurring within a specific time and date window to be displayed.
 - d. It shall be possible to export a .csv copy of the currently displayed summary by clicking or tapping on the export icon.
 - e. It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by tapping or clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.
 - f. Clicking on the information icon in front of any displayed activity listed in the summary shall expand the display to include the name of the user, server time, value prior to the activity, the ability to annotate the activity and a user selectable icon for displaying a trend graph of the point.
11. Equipment Relationships Summary
 - a. The user interface shall provide a summary of all equipment and spaces related to the operation of the system or device currently selected for viewing.
 - b. The user interface shall include the capability to navigate to the home page of any related piece of equipment or space with a single click or tap on the desired element.
12. Equipment Data Summary
 - a. The user interface shall provide a summary of all data pertaining to a particular piece of mechanical or electrical equipment in a tabular format.
 - b. Clicking or tapping on any value in the summary shall display a related command panel allowing the user to command, override, or change service condition of the point selected and to annotate such actions for future reference.
 - c. It shall be possible to export a .pdf copy of the report with a single click on the associated export icon.
13. Equipment Serving Space Summary
 - a. The user interface shall provide a summary of all mechanical and electrical equipment as defined in the points list that serves a selected space from the navigation tree.
 - b. The summary shall be capable of including a subset of the viewable points for each system representing the key elements of interest to operators without subjecting them to long lists of points irrelevant to basic operation.
 - c. Clicking or tapping on any item in the summary shall navigate to the item's assigned home page in the user interface.
 - d. It shall be possible to view a custom trend of information contained in the summary with a single click of the trend icon residing in the title header.
 - e. It shall be possible to display specific systems and points by filtering equipment types desired.
 - f. Because the data is intended to be a snapshot of the current conditions in the space it shall not dynamically update but a click or tap on the update icon at any time performs that function.
14. Potential Problem Areas

- a. The user interface shall provide a summary of all points in the system related to the space that are not operating correctly (e.g. alarm, off normal or not communicating correctly) in order to provide the operator with a quick update on current conditions.
 - b. The information shall include:
 - 1) Point status (via color)
 - 2) Point name
 - 3) Value of the point when the summary was taken
 - 4) Equipment that contains the offending point
 - 5) Space that is served by that equipment
 - c. Data points in the summary may be filtered by one or more types of off-normal condition (e.g. above setpoint, offline and overridden).
 - d. The summary may be exported in .csv format for inclusion in spreadsheets or other documents.
15. Equipment Summary
- a. The user interface shall provide a summary that allows the user to compare all similar equipment that serves the space as well as downstream (child) spaces in order to evaluate conditions quickly and determine patterns for troubleshooting purposes.
 - b. Each unique equipment type shall be selectable and display a representative set of values along with the space(s) being served by the device. Equipment types can be selected from a dropdown menu in the summary.
 - c. Clicking or tapping on a selected device in the summary shall navigate to the home page for that piece of equipment while clicking or tapping a data point shall display the command panel for that point.
 - d. It shall be possible to export a .pdf copy of the currently displayed summary by clicking or tapping on the export icon.
 - e. It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.
16. User Defined Summaries
- a. Provide the capability to view, command, and modify large quantities of similar data in summaries without the use of a secondary application (e.g. a spreadsheet). These summaries shall be generated automatically or user defined. User defined summaries shall allow up to seven user defined columns describing attributes to be displayed including custom column labels with up to 100 rows per summary.
17. Trend
- a. The user interface shall provide the capability to view historical trend data from multiple pieces of equipment in both bar and line formats.
 - b. The user shall have the ability to navigate to a selection list of frequently viewed trends.
 - c. Trend graphs shall have to ability to be smartly auto-generated based on equipment and space relationships.
 - d. The user shall have the ability to view up to 3 graphs in a single screen and select which data points to plot on each to help with readability.
 - e. Each graph shall include a dedicated selection icon to export a copy of the graphic and data in .pdf format or the data only as a .csv file.
18. Operator Access
- a. The user interface shall provide the ability to segment access to building data based on the space(s) or location(s) the user is physically located in and/or manages. The user interface shall provide the capability to assign “inherited” space permissions and the ability to assign user’s space based access in bulk.

- b. The user interface shall provide the ability to segment access to building data based on the space(s) or location(s) the user is physically located in and/or manages. The user interface shall provide the capability to assign “inherited” space permissions and the ability to assign user’s space based access in bulk.
- 19. Graphics
 - a. The user interface shall display an equipment visualization or graphic within the context of its associated space (building, floor, room, etc.) or equipment dashboard.
 - b. Graphics shall include the ability to define individual information layers for operator selection in order to clarify systems status and simplify operation on mobile devices. Where desired a master layer may be defined to include important information about the facility on all graphic screens.
 - c. Graphics shall support the use of photo-realistic symbols as well as color change and animation to match the status of the related system control point.
 - d. It shall be possible to export a time stamped .pdf file of the graphic being viewed in order to communicate the current conditions in the space or the equipment being viewed and to provide a historic record.
 - e. An integral graphic manager shall be provided including the following features and capabilities:
 - f. Creation and modification of graphics from any HTML5 capable browser without the need for additional plug-ins or software packages.
 - g. Access to a full suite of pre-defined templates for air and water sourced HVAC applications as well as the ability to add custom templates as created for other use. Pre-aliased graphic templates may be defined and saved for repetitive representations of common mechanical and electrical equipment.
 - h. A full suite of pre-defined three dimensional symbols for mechanical and electrical systems as well as all line, text and shape tools required for integration into a graphic with zoom and pan capabilities on multiple platforms and in multiple browsers.
 - i. The ability to search and replace items in multiple graphics with a single command.
 - j. The ability to import and insert photos and images into the graphic.
 - k. The ability of the graphics manager to create and edit graphics including the ability to bind graphic elements to the values and conditions of system points in both an on-line and off-line mode.
 - l. The ability to create and import custom SVG symbols that can be selectable from the graphical palette and rendered at runtime.
 - m. As required, the BMS Contractor shall provide software licenses in the name of the owner for programming, configuration and graphics building tools to allow designated representatives to make changes, modifications or additions to the system. While future updates or revisions may require an update fee, the owner shall incur no additional cost if they choose not to update. Systems that require any annual or time-limited licensing fees shall not be permitted.
- 20. Scheduling
 - a. The user interface shall provide the capability to display, in a singular view, all of the effective schedules in the context of the space (building/floor/room, etc.) or equipment that the schedule effects. The software should have the ability to display an effective schedule, for the present, or a future date.
 - b. The user interface shall provide a report of all schedules affecting a space or equipment. The report shall provide the user details of events that comprise the weekly schedule and exception schedule(s). The report shall provide a means of viewing individual breakout scheduling elements for Weekly Schedule, Exceptions and Default Commands.

- c. The user interface shall provide the capability to efficiently change or modify schedules in mass quantities. This includes the capability to add, in bulk, exceptions to schedules, in addition to assigning, in bulk, weekly schedules.

2.4 INSTALLATION

- A. Install products level, plumb, parallel, and perpendicular with building construction.
- B. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.
- C. Graphical User Interface
 - 1. The Graphical User Interface (GUI) computer shall be a network computer provided and maintained by the Owner on their Local Area Network. Interface to the BAS GUI shall be through a web browser installed on that computer (Safari, Microsoft Edge, or Chrome), native and compatible with the Operating System installed on that computer.
 - 2. Basic Interface Description
 - a. GUI shall be English language prompting, English language point identification, on-line help, and industry standard PC application software. The software shall provide, as a minimum, the following functionality:
 - 1) Real-time graphical viewing and control of environment.
 - 2) Scheduling and override of building operations.
 - 3) Collection and analysis of historical data.
 - 4) Definition and construction of dynamic color graphic displays.
 - 5) Editing, programming, storage and downloading of controller databases.
 - 6) Alarm reporting, routing, messaging, and acknowledgment.
 - 7) Display of dynamic trend data plot.
 - b. Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via user-sized windows:
 - 1) Dynamic color graphics and graphic control.
 - 2) Alarm management, routing to designated locations, and customized messages.
 - 3) Week at a Glance Time-of-day scheduling.
 - 4) Trend data definition and presentation.
 - 5) Graphic definition and construction.
 - 6) Program and point database editing on-line.
 - c. Operator specific password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall "follow" the operator to any workstation that they log onto.
 - d. Operator Activity Tracking - An audit trail report to track system changes, accounting for operator initiated actions, changes made by a particular person or changes made to a specific piece of equipment over a designated time frame shall be printable and archived for future use. The operator activity tracking shall be in a tamperproof buffer file.
 - e. Reports shall be generated on demand or via pre-defined schedule and directed to either displays, printers, email recipient, or disk. As a minimum, the system shall allow the user to easily obtain the following types of reports:
 - 1) A general listing of all or selected points in the network.

- 2) List of all points currently in alarm.
- 3) List of all points currently in override status.
- 4) List of all disabled points.
- 5) List of user accounts and access levels.
- 6) List all weekly schedules.
- 7) List of holiday programming.
- 8) System diagnostic reports including a list of DDC panels on line and communicating and status of all DDC terminal unit device points.
- 9) List of programs.
- f. Scheduling and override shall be accomplished via a graphical format for simplification of time-of-day scheduling and overrides of building operations.
- g. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals or change of value, both of which shall be user-definable. Archival trend data may be stored at the Enterprise Server for future diagnostics and reporting. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.
 - 1) Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of at least six points. Provide additional functionality to allow predefined groups of up to 50 trended points to be easily exported in CSV format.
3. Dynamic Color Graphic Displays
 - a. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands.
 - b. Dynamic values, with the specified units and precision, for temperature, humidity, flow, position, and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention and without predefined screen refresh rates.
 - c. Provide the user the ability to display blocks of point data by defined point groups.
 - d. Alarm conditions shall be identified graphically unique from other monitor points, with the use of flashing, text color, text background color, or other indication native to the DDC software platform.
 - e. Equipment state can be changed by clicking on the point block or graphic symbol and selecting the new state (on/off) or setpoint.
4. Accessibility
 - a. Users shall be able to access points, values and graphics via local desktop station and remotely via the capitol complex.

END OF SECTION 25 10 00

SECTION 25 40 00 – AUXILIARY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Current Operated Switches
 - 2. Control Power Transformers
 - 3. Relays
 - 4. Damper End Switches
- B. Related Requirements:
 - 1. Section 25 00 00 TEMPERATURE CONTROL SYSTEM

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 MANUFACTURERS

- A. Refer to each individual product specification.

2.3 CURRENT OPERATED SWITCHES

A. Adjustable Trip Current Switch

1. General: Adjustable trip current switches shall be used on belt driven or coupled equipment. Switches shall be provided with mounting hardware, and securely mounted and located such that they are easily adjustable without the possibility of shock from the starter components.
2. Current operated switch shall be capable of changing the state of an isolated dry contact or switch when a flow of current is sensed in the wire they are monitoring. The isolated output must be rated at 1 A at 30 VAC or VDC, they shall incorporate a status LED, and shall be UL listed. Trip points shall be between 0.5 A to 135 A, depending on motor size and application. Acceptable manufacturers and models are Veris H308, Veris H908, Functional Devices RIBXGH Series.

B. Fixed Trip Current Switch

1. General: Fixed trip current switches shall be used on direct drive equipment. Switches shall be securely mounted and located such that they are easily adjustable without the possibility of shock from the starter components.
2. Current operated switch shall be capable of changing the state of an isolated dry contact or switch when a flow of current is sensed in the wire they are monitoring. The isolated output must be rated at 1 A at 30 VAC or VDC, they shall incorporate a status LED, and shall be UL listed. Trip points shall be between 0.5 A to 135 A, depending on motor size and application. Acceptable manufacturers and models are Veris H300, Veris H900, Functional Devices RIBXGH Series.

C. Current Switch Integral Command Relay: Current operated switches may be provided with integral command relays as required to perform the indicated functions in the sequences of operation at the contractor's option. In addition to the requirements set forth above for the current switch, relay contacts shall be SPST, rated for 5 A at 250 VAC minimum, sized for the application.

2.4 CONTROL POWER TRANSFORMERS

A. 24 VAC Control Power Transformers

1. Transformers shall be NEC Class 2 general purpose transformers with primary windings as required by the application and 24 VAC secondary windings rated for 40 VA at 100% power factor. Transformers shall be installed in a suitable enclosure to prevent contact with the primary and/or secondary terminals when the cover is on the enclosure. Where transformers are provided for installation by others, the transformers shall be provided mounted in the enclosure. The mounting arrangement shall be such that the terminals are accessible for connection without removing the transformer from the enclosure.
2. Transformers with higher VA ratings may be supplied but must be designed and installed to meet all requirements of NEC article 725 when used to serve Class 1, Class 2, or Class 3 low voltage circuits.
3. Where fuses are provided, a minimum of two (2) spare fuses of the same type and rating at each location.

B. 24 VAC Control Power Load Centers

1. Control Power Load Centers are used for distributed 24 VAC power supply of terminal control devices.

2. Load Centers shall have NEC Class 2 rated secondary winding circuit distribution. General purpose transformers up to 500 VA shall have 480/277/240/120 VAC primary windings and 24 VAC secondary windings. Primary input terminals shall be finger-safe. Secondary winding distribution shall have circuit breakers to provide 4 Amp overcurrent protection on isolated circuits. Each secondary winding distribution circuit shall have an isolation switch, status indicator light, and screw terminals for termination. Load Center shall be provided with NEMA 1 metal enclosure.
3. Load Center shall be Function Devices model PSH500A or approved equivalent.
4. Load Centers are provided by the Division 25 Contractor, secondary wiring is provided and performed by the Division 25 Contractor, primary wiring and conduit is provided and performed by the Division 26 Contractor.

2.5 RELAYS

A. Plug-In General Purpose Relays

1. Application: Plug-in general purpose relays shall be used in auxiliary panels and in controlled device power enclosures. Application may be for duplication of a signal for multiple devices, or for segregation of operating voltage of controlled devices.
2. Description: Blade style 3PDT relay with socket and LED or mechanical indicator. Coil nominal (rated) voltage shall be dictated by application requirements, shall withstand 110% rated voltage continuous, have pull-in voltage of 80% of rated voltage, drop-out voltage of 30% rated voltage, and resistance of 103 ohms at 24 VAC / 10,800 ohms at 120 VAC. Contacts shall be silver cadmium oxide, rated for 7.5A at 120 VAC resistive load. Relays shall be Idec RH series with SH series socket or approved equal.

B. Track Mounted Relays

1. Application: Track mounted relays are allowed for use in controlled device power enclosures whose space limitations prevent the use of plug-in relays, or for whose configuration prevent the use of enclosed relays.
2. Description: Track mounted relay with LED indicator, dual voltage coil for 24 VAC or 120 VAC, SPDT contact rated for 10A at 120 VAC resistive load. Relays shall be Air Products and Controls MR-800 series, Functional Devices RIMMNU1C, or approved equal.

C. Enclosed Relays

1. Application: Enclosed relays shall be used at controlled device power enclosures for remote operation of equipment.
2. Description: Enclosed relay with LED indicator, dual voltage coil for 24 VAC or 120 VAC, SPDT contact rated for 10A at 277 VAC resistive load. Relays shall be Functional Devices RIBU1C or approved equal.

D. Fan Safety Alarm Circuit Relays

1. Application: Fan safety alarm circuit relays are permitted for use of fan hardwired interlocks at the contractor's option. If used, they shall be mounted in the auxiliary panel in which the air handling unit's controller is mounted.
2. Description: Track mounted relay with LED indicators for power, master relay on, and status of input safeties, 24 VAC supply power (at 4A), SPST actuator control contact rated for 3A at 24 VAC, SPST fan safety control contact rated for 750 mA at 24 VAC, and one SPST dry contact for each monitored safety. Relays shall be Functional Devices RIBMNLB or approved equal.

- a. For application with automatic reset low limit thermostats (see section 25 21 01), set board jumpers to enable latching circuit and manual reset button on low limit thermostat relay input.
- E. Network Compatible Relays
 - 1. Application: Network compatible relays are permitted for use only as specifically identified on the drawings, points list, or as expressly allowed by the engineer.
- F. Time Delay Relays
 - 1. Application: Time delay relays should normally be avoided, time delays shall be accommodated in programming where possible. In the event that time delay relays are required for a specific application, they shall be mounted in the auxiliary panel that has the controller for the controlled equipment, or in a specifically fabricated panel for the controlled equipment that is approved by the engineer.
 - 2. Description: 11-blade style plug in relays requiring 24 VAC power supply, signal-triggered timing circuit, selectable timing functions (on-delay, off-delay, one-shot), adjustable time delay setting between 0.1 s – 600 hours, Form C output contacts, power and timer LED indicators, and UL listed. Relays shall be Idec RTE-B2 series or approved equal.
- G. Latching Relays
 - 1. Application: Latching relays are normally not used, except in applications where automatic reset low limit thermostats are allowed (see section 25 21 01) and the Fan Safety Alarm Circuit Relay is not used, where specifically required by the points list or sequence, or as specifically approved by the engineer.
 - 2. Description: Blade style plug-in latching relay with permanent magnet self-holding function, with set and reset coils, check button, 3 A at 250 VAC. Relays shall be Idec RY2KS-UC or approved equal.
- H. Relay & AC Current Switch Combo
 - 1. Application: Enclosed relays & AC current switch combos shall be used at controlled device power enclosures for remote operation of equipment when status feedback is required.
 - 2. Description: Enclosed relay/ac switch combination with adjustable threshold and override switch, solid state contact output, 24 VAC coil, SPDT contact rated for 20A at 277 VAC resistive load. Relays shall be Functional Devices RIBX24SBA or approved equal.

2.6 DAMPER END SWITCHES

- A. Damper End Switches
 - 1. End switches used for damper permissive fan safety circuits shall be safety limit switches, heavy-duty NEMA style, plug-in body. Enclosure shall be NEMA 4, 13 with ½" EMT conduit connection and ambient temperature rating 0°F to 230°F. Actuator head shall be rotary style, CW and CCW actuation, spring return, 4 in-lb operating torque, 13° max travel to operate contacts, 7° max travel to reset contacts, 90° max travel. Switch shall have two snap-acting contacts, 1 N.O. and 1 N.C., 30A make at 120 VAC, 3.0A break at 120 VAC, 5A at 120 VAC continuous operating current. Operating lever shall be adjustable lever, 1.19 in. to 3 in. radius, with 0.63" diameter by 0.25" thick nylon roller (min.). End switch shall be Allen-Bradley 802T-AP or Square D 9007C54B2.
 - 2. End switch and operating lever shall be installed such that contacts prove when damper blade is at 95% open. Operating lever roller shall contact damper blade directly, no contact

with damper seal is acceptable. Where end switch cannot be directly mounted to duct wall, provide 12 gauge galvanized steel mounting bracket. Operating lever shall be Allen-Bradley 802T-W2 or Square D 9007HA23.

PART 3 - EXECUTION

3.1 CONTROL DEVICES FOR INSTALLATION BY INSTALLERS

- A. Deliver selected control devices, specified in indicated HVAC instrumentation and control device Sections, to identified equipment and systems manufacturers for factory installation and to identified installers for field installation.
- B. Deliver the products specified in this section and related accessories to duct fabricator and Installer for installation in ductwork. Include installation instructions to Installer and supervise installation for compliance with requirements.
- C. Deliver the products specified in this section and related accessories to plumbing and HVAC piping installers for installation in piping. Include installation instructions to Installer and supervise installation for compliance with requirements.

3.2 INSTALLATION OF CURRENT SWITCHES

- A. For variable speed applications, trip point shall be set with motor at full speed under normal loading conditions (connected to system of service).
- B. For variable speed applications, following trip point set at motor full speed, verify proof of operation at motor minimum speed. If current range between minimum and maximum speed prevents reliable proof indication in a single current switch, provide two switches (one for minimum speed and one for maximum speed) and program logic to accommodate proper status indication.
- C. Split core current switches are preferred due to their ability to be changed without removal of phase conductors when the equipment has been placed into service. Solid core current transformers will be considered if there are space constraint considerations.
- D. If motor current draw is less than listed minimum trip point for the current switch, wrap phase conductor around current switch the minimum number of passes to reach threshold trip current.

END OF SECTION 25 40 00

SECTION 25 50 00 – WIRING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Raceways
 - 2. Wiring
- B. Related Requirements:
 - 1. Section 25 00 00 TEMPERATURE CONTROL SYSTEM
 - 2. Section 26 00 00 ELECTRICAL

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's installation manual: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Manufacturer's Operation and Maintenance instruction: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 CONTROL WIRE AND CABLE

- A. A. Wire: Single conductor control wiring above 24 V.
 - 1. Branch Circuits: Minimum 12 AWG.
 - 2. Motor Interlock Wiring: Minimum 14 AWG.
 - 3. Conductors: 7/24 soft annealed copper strand with 2- to 2.5-inch lay.
 - 4. Conductor Insulation: 600 V, Type THWN or Type THHN, and 90 deg C in accordance with UL 83.

5. Conductor Insulation Colors: Black (hot), white (neutral), and green (ground).
 6. Furnish on spools.
- B. Single, Twisted-Shielded, Instrumentation Cable above 24 V:
1. Wire Size: Minimum 18 AWG.
 2. Conductors: Twisted, 7/24 soft annealed copper strand with a 2- to 2.5-inch lay.
 3. Conductor Insulation: Type THHN/THWN or Type TFN rating.
 4. Conductor Insulation Colors:
 - a. Twisted Pair: Black and white.
 - b. Twisted Triad: Black, red, and white.
 5. Shielding: 100 percent type, 0.35/0.5-mil aluminum/Mylar tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
 6. Outer Jacket Insulation: 600 V, 90 deg C rating, and Type TC cable.
 7. Furnish on spools.
- C. Single, Twisted-Shielded, Instrumentation Cable 24 V and Less:
1. Wire Size: Minimum 22 AWG.
 2. Conductors: Twisted, 7/24 soft annealed copper stranding with a 2- to 2.5-inch (50- to 65-mm) lay.
 3. Conductor Insulation: Nominal 15-mil thickness, constructed from flame-retardant PVC.
 4. Conductor Insulation Colors:
 - a. Twisted Pair: Black and white.
 - b. Twisted Triad: Black, red, and white.
 5. Shielding: 100 percent type, 1.35-mil aluminum/polymer tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
 6. Outer Jacket Insulation: 300 V, 105 deg C rating, and Type PLTC cable.
 7. Furnish on spools.
- D. LAN and Communication Cable: Comply with DDC system manufacturer requirements for network being installed.
1. Comply with following requirements for balanced twisted pair cable:
 - a. Category 6
 - b. Plenum rated.

Unique color that is different from other cables used on Project.

2.3 RACEWAYS

- A. Comply with Section 26 05 33 "Raceway for Electrical Systems," Section 26 05 34 "Boxes for Electrical Systems," for installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify compatibility with and suitability of substrates.

- B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
- C. Examine roughing-in for instruments installed in duct and piping systems to verify actual locations of connections before installation.
- D. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CONTROL WIRE, CABLE, AND RACEWAY

- A. Comply with NECA 1.
- B. Wire and Cable Installation:
 - 1. Comply with installation requirements in Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables" for Power wiring and grounding.
 - 2. Install cables with protective sheathing that is waterproof and capable of withstanding continuous temperatures of 90 deg C with no measurable effect on physical and electrical properties of cable.
 - a. Provide shielding to prevent interference and distortion from adjacent cables and equipment.
 - 3. Terminate wiring in a junction box
 - a. Clamp cable over jacket in a junction box.
 - b. Individual conductors in the stripped section of cable is to be slack between the clamping point and terminal block.
 - 4. Terminate field wiring and cable not directly connected to instruments and control devices having integral wiring terminals using terminal blocks.
 - 5. Install signal transmission components in accordance with IEEE C2, REA Form 511a, NFPA 70, and as indicated.
 - 6. Use shielded cable to transmitters.
 - 7. Use shielded cable to temperature sensors.
 - 8. Motor Interlock Wiring:
 - a. Stranded control wire shall be provided with crimp type spade terminators. Interlock circuit wiring shall be color-coded or numbered using an identical number on both ends of the conductor. Wire numbers shall be installed before conductors are pulled.
- C. Conduit Installation
 - 1. Comply with Section 26 05 33 "Raceway for Electrical Systems," Section 26 05 34 "Boxes for Electrical Systems," for installation.
- D. Cable Tray Installation
 - 1. Comply with Section 26 05 36 "Cable Trays for Electrical Systems".

3.3 CONDUIT SCHEDULE

- A. Provide conduit and type per below
 - 1. Power wiring greater than 24 Volts – Conduit type per locations below
 - 2. Thermostat / sensor rough-in – EMT conduit
 - 3. Below 8' AFF in unfinished spaces – EMT conduit
 - 4. Exposed to view in finished spaces – EMT conduit to be painted to match
 - 5. Connection to rotating equipment – jacketed flexible liquid tight (sealtite)
 - 6. Exterior above grade – Aluminum rigid conduit
 - 7. Exterior below grade – electrical PVC
- B. Open wiring permitted with J-hook supports, maximum spacing 6 feet, for the following applications:
 - 1. Above lay-in ceilings
 - 2. Above 8' AFF in unfinished spaces, unless noted otherwise.
 - 3. Bridal rings can be used when supporting a maximum of 6 wires.

END OF SECTION 25 50 00

SECTION 26 00 00 – ELECTRICAL WORK

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.
- B. Provisions and conditions cited in this Section shall apply to Work for other sections of Divisions 26 of these Specifications:
 - 1. Section 26 05 19 – Low-Voltage Electrical Power Conductors And Cables
 - 2. Section 26 05 26 – Grounding And Bonding For Electrical Systems
 - 3. Section 26 05 33 – Raceway For Electrical Systems
 - 4. Section 26 05 34 – Boxes For Electrical Systems
 - 5. Section 26 05 48 – Seismic Restraint
 - 6. Section 26 05 53 – Identification For Electrical Systems
 - 7. Section 26 24 16 – Panelboards
 - 8. Section 26 27 26 – Wiring Devices

1.2 QUALITY ASSURANCE

- A. Where work installed under this section of the specification tie-in to existing systems, Contractor shall verify existing for: sizes, voltage (via voltage meter reading, not labels), materials, and elevations before installing new work. Contractor shall notify Architect/Engineer upon discovery of discrepancy. Work performed prior to verification will be corrected at no cost to Owner.

1.3 ACTION SUBMITTALS

- A. Refer to Division 1 and each section of Division 26.

1.4 INFORMATIONAL SUBMITTALS

- A. Refer to Division 1 and each section of Division 26.

1.5 CLOSEOUT SUBMITTALS

- A. Refer to Division 1 and each section of Division 26.
- B. At the completion of the project, submit a letter stating all materials are asbestos free, and meet the specified ASTM E-84 flame/smoke rating of 25/50, and that all piping and duct penetrations are smoke or fire stopped as required by the Code.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

3.1 OWNER FURNISHED EQUIPMENT

- A. The Contractor shall be responsible for coordinating the delivery, receiving and installing the equipment as if the purchase had been made by him. If there is a problem with the equipment regarding compliance with the order or the submittals, start-up, or warranty, then the Contractor shall act for the Owner and arrange for the necessary corrections, replacement parts, back charges, technical support, etc. The installed equipment shall carry the warranty specified herein and as specified in other portions of the specifications. It shall be the responsibility of the Contractor during the warranty period to respond to the evident malfunction or failure of the equipment as though they had directly purchased the equipment. This includes conducting the necessary diagnostic efforts and, if the malfunction is deemed by the Contractor to be an equipment liability issue, to so resolve the problem with the supplier as the Owner's agent.

Note that installation of this equipment is contingent upon the completion of much of the general construction work which provides structural support and/or access. If the equipment arrives prior to the completion of the general construction work, the Contractor shall receive, store and temporarily protect the equipment until it can be set in place. Temporary staging and storage locations shall be brought to the Owner for review and approval at least two weeks before they are required.

END OF SECTION 26 00 00

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copper building wire rated 600V or less
 - 2. Aluminum building wire rated 600V or less
 - 3. Type MC metal-clad cable rated 600V or less
- B. Related Requirements:
 - 1. Section 26 00 00 ELECTRICAL WORK

1.2 ACTION SUBMITTALS

- A. Product data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 MATERIAL

- A. All wire and cable shall be new soft drawn copper and shall conform to all the latest requirements of the National Electrical Code IPCEA, and meet the specifications of the ASTM.
- B. Control Conductors: Control circuit wiring shall be No. 12 AWG or smaller stranded wire. Stranded control wire shall be provided with crimp type spade terminators. Control circuit wiring shall be color-coded or numbered using an identical number on both ends of the conductor.
- C. Type MC cable, if permitted, shall contain an insulated copper equipment grounding conductor. Type MC-AP cable is not permitted.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits:
1. 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. General
1. Minimum conductor size is No. **12** AWG except for control circuits or low voltage wiring.
 2. Minimum insulation rating is 90°C
 3. Conductor rating:
 - a. For 100 amps and below: Conductor shall be rated per the 60°C table
 - b. For greater than 100 amps: Conductor shall be rated per the 75°C table
 4. All 120V and 277V single phase circuits require a dedicated neutral conductor. The neutral conductor shall be numbered and identified with associated phase conductor at the panelboard as well as all junction boxes.
 5. Where circuit runs are combined, upsize conduit and conductors to accommodate for conduit fill and conductor derating respectively.
- B. Not Permitted
1. Type BX/AC (armored cable) cable
 2. Type NM (nonmetallic-sheathed cable)
- C. Application per the following:
- All locations, unless noted otherwise: Type THHN/THWN-2, single conductors
1. Indoor feeder or branch circuit in raceway: Type THHN/THWN-2, single conductors
 2. Exterior feeder or branch circuit, above grade: Type THHN/THWN-2, single conductors
- D. Metal Clad (MC) Cable application
1. Type MC cable is permitted as allowed by the National Electrical Code.
 2. Type MC cable is not permitted in the following locations:
 - a. Where subject to physical damage.
 - b. In damp or wet locations.
 - c. Underground.
 - d. In masonry or concrete walls.
 - e. Where exposed to corrosive fumes or vapors
 - f. Above hard ceiling or in drywall chases
 3. Type MC cable is permitted for wiring the final portion of light fixture branch circuits from fixture to fixture within a room or area. The MC cable may be supported by the light fixture bracing wires but shall not be supported by the ceiling grid support wires. Type MC cable is permitted for wiring from local distribution junction boxes to devices or equipment in nearby walls or ceiling space. The local distribution junction boxes should be located within 20 feet of the device or equipment served. Conduit and wiring shall be used for branch circuiting between the local distribution junction boxes and for the "homeruns" from the panels. Type MC cable is permitted to route from receptacle to receptacle through walls and through the ceiling space for the final portion of branch circuit

wiring between receptacles in adjacent walls of the same room or area. Type MC cable shall not be installed where exposed.

3.3 INSTALLATION, GENERAL

- A. 20A Branch Circuit Homeruns shall be sized as follows:
 - 1. 120V:
 - a. 0 – 100 feet shall be #12AWG wire minimum
 - b. 101 – 200 feet shall be #10AWG wire minimum
 - c. In excess of 200 feet shall be #8AWG wire minimum
 - 2. 277V:
 - a. 0 – 250 feet shall be #12AWG wire minimum
 - b. In excess of 250 feet shall be #10AWG wire minimum
- B. Where conductors are upsized to account for deratings or voltage drop and are too large for the termination lugs, provide reducer pins equivalent to Burndy AYP or AYPO (offset pin). Reducer pins shall be compression type, dual rated for aluminum/copper conductors, and include an insulating cover.
- C. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- D. Complete raceway installation between conductor and cable termination points in accordance with Section 260533.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.
- E. 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.
- F. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- G. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- H. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. System grounding
 - 2. Equipment grounding
- B. Related Requirements:
 - 1. Section 26 00 00 ELECTRICAL WORK

1.2 ACTION SUBMITTALS

- A. Product data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Not required

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 MATERIAL

- A. Contractor shall install 1) a system grounding system and 2) an equipment grounding system in accordance with the National Electrical Code and shall use only UL listed grounding clamps and connectors.
- B. Contractor shall extend the existing equipment grounding system in accordance with the National Electrical Code and shall use only UL listed grounding clamps and connectors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The grounding system grounding electrode conductor shall be connected to the neutral bar inside the main panel.

3.2 FIELD QUALITY CONTROL FOR GROUNDING AND BONDING

- A. Test completed grounding system at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before conductors are connected.
 - 1. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - 2. Perform tests by fall-of-potential method in accordance with IEEE Std 81.
 - 3. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.
- B. Prepare dimensioned Drawings locating each ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to record of tests and observations. Include number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

END OF SECTION 26 05 26

SECTION 26 05 33 – RACEWAY FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electrical metallic tubing conduit (EMT)
 - 2. Galvanized rigid steel conduit (GRS)
 - 3. Rigid aluminum conduit
 - 4. Liquid-tight flexible metal conduit
 - 5. Flexible metal conduit
- B. Related Requirements:
 - 1. Section 26 00 00 ELECTRICAL WORK

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Not required
- B. Shop Drawings:
 - 1. Not required

1.3 INFORMATIONAL SUBMITTALS

- A. Not required

1.4 CLOSEOUT SUBMITTALS

- A. Not required

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 MANUFACTURERS

- A. Surface mounted raceway
 - 1. Wiremold

2. Panduit
3. Hubbell
4. MonoSystems

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Minimum conduit size shall be $\frac{3}{4}$ " trade size for branch circuits **except for switch legs which may be $\frac{1}{2}$ " trade size.**
- B. A bushing shall be used where conduit enters a panel box or equipment enclosure.
- C. Grounding Bushings shall be used to bond conduits entering a panel box or equipment that are not mechanically connected.
- D. All raceways for equipment and devices located within or on the building are to be routed through the interior of the building. Do not route conduits on the roof, surface mounted on the building exterior walls or via exterior trenches or directional bores between areas of the building, unless noted otherwise or prior approval is provided by the Architect/Engineer. (Engineer note: Per NEC 300.7(B), expansion fitting is required for raceways exposed to different temperatures.)
- E. Expansion fittings shall be provided at all conduits across building expansion joints. Fittings shall be Type "AX" or "TX" as made by O Z Electric Company, or approved equal. Provide copper bonding jumper at each expansion fitting.
- F. Conduit bends shall be made with standard benders of proper size; radius of bends to be at least 6 times the diameter of the conduit. Runs between outlets shall not contain more than the equivalent of three 90-degree bends. Conduit runs shall be continuous from outlet to outlet, outlet to cabinet, etc.
- G. All exposed conduits shall be installed parallel or perpendicular to the building walls or floors.
- H. Conduits shall be securely fastened to or supported from the building structure. Conduits not fastened directly to building structure shall be supported by a rigid assembly, free of sway and adequately braced, connected directly to the building structure. The use of 'pencil' wire, ceiling wire, and cable hangers shall not be permitted.
- I. Anchor or stake down all direct burial conduits to prevent shifting during grading and concrete pours. Spacers shall be provided for trenches with 2 or more conduits with any conduit 2" or larger.
- J. Install #12AWG pull wires for tracing for all underground non-metallic empty conduits with a minimum of 12 inches of slack on each end. Pull strings shall be used for empty above grade or metallic conduits.
- K. All raceways installed within $1\frac{1}{2}$ " of the roof deck shall be GRS or IMC. Boxes shall be offset below the $1\frac{1}{2}$ ".

- L. All exposed raceways installed in a finished space will be painted to match the background, unless noted otherwise. Finished spaces include all areas open to the general public. Spaces such as storage, mechanical, IT, and electrical rooms and other similar areas only accessible to qualified personnel are considered unfinished.
- M. All penetrations through not rated walls shall be sealed for draft stopping with caulk, putty, etc. designed for this use.
- N. Fire / Smoke seals:
 - 1. All penetrations through fire rated walls and floors shall be fire sealed in accordance with ASTM E814/UL1479 or manufacturer's recommendations.
 - 2. Materials and installation details shall be submitted for approval.

3.2 ELECTRICAL METALLIC TUBE CONDUIT (EMT)

- A. EMT conduit shall be installed for all work concealed in partitions or in concrete block walls and for all conduits run in ceiling plenums and exposed runs, except where noted otherwise. Aluminum EMT is not approved. **EMT conduit shall not be used outdoors, in wet locations, in floor crawl spaces, or below 5' AFF.**
- B. EMT couplings and connectors shall be steel or diecast, set screw or compression type.

3.3 GALVANIZED RIGID STEEL CONDUIT (GRS)

- A. Galvanized rigid steel conduits shall be installed for all exposed outdoor conduit, and for all indoor medium voltage cable runs.
- B. All GRS couplings and threaded hubs shall have no less than five threads of the coupling engaged. Running threads shall not be used. All GRS conduits shall be reamed.
- C. All GRS conduits shall have two locknuts and a bushing at each termination outlet box, junction box, etc., except where terminated in a threaded hub.

3.4 RIGID ALUMINUM CONDUIT

- A. Rigid aluminum conduits shall be installed for all exterior conduits supplying cooling towers.

3.5 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

- A. Liquid-tight flexible steel conduit ('Sealtite') shall be used in wet areas where flexible conduit connections are required and on all motorized equipment and motors in all locations.
- B. Liquid-tight flexible metal conduit ('Sealtite') is not permitted for roof penetrations.

3.6 FLEXIBLE METAL CONDUIT

- A. Flexible steel conduit ('Greenfield') shall be used where vibration isolation is required, including all transformers and uninterruptible power systems.

END OF SECTION 26 05 33

SECTION 26 05 34 – BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Junction boxes
 - 2. Outlet boxes
 - 3. Outdoor boxes
- B. Related Requirements:
 - 1. Section 26 00 00 ELECTRICAL WORK

1.2 ACTION SUBMITTALS

- A. Product Data including all accessories, parts, and components required for a complete installation:
 - 1. Outdoor boxes

1.3 INFORMATIONAL SUBMITTALS

- A. Not required

1.4 CLOSEOUT SUBMITTALS

- A. Not required

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Mounting: Outlets must be centered with regard to paneling, furring, trim, etc. Outlets shall be set plumb or horizontal and shall extend to finished surface of wall, ceiling, or floor without projecting beyond or behind finished surface. Outlet boxes shall not be installed “back-to-back”. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually

indicated, give priority to ADA requirements. Install boxes with height measured to **center** of box unless otherwise indicated.

1. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
 2. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
 3. Locate boxes so that cover or plate will not span different building finishes.
 4. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
 5. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
 6. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
 7. Set metal floor boxes level and flush with finished floor surface.
 8. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
 9. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
 10. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 - a. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 - b. Provide gaskets for wallplates and covers.
- B. Attaching: Boxes shall be attached by fastener designed for the purpose and shall provide adequate mechanical strength for future maintenance.
1. Boxes installed in metal stud partitions shall be secured to the metal studs using appropriate clips, fasteners, hangers, or supports as required, and shall provide adequate far side box support to fulfill the intent of all applicable codes.
- C. In fire rated drywall walls, 24" spacing must be maintained between boxes on opposite sides of walls. Moldable fire protective putty pads, firestopping coverplate gaskets, internal fire rated pads or other acceptable fire sealing means shall be installed on outlet boxes where the 24" spacing cannot be maintained.

3.2 DEGREE OF PROTECTION

- A. Indoors:
1. Type 1 unless otherwise indicated.
 2. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
 3. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 4.
 4. Locations Exposed to Corrosive Agents: Type 4X
- B. Exterior:
1. Type 3R unless otherwise indicated.
 2. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.

3.3 OUTLET BOXES, JUNCTION BOXES, FITTINGS

- A. Pull boxes and junction boxes shall be installed where indicated on the drawings or where required to facilitate wire installation.
 - 1. Size: Outlet, junction, and pull boxes not dimensioned shall be 4-inch square by 2-1/8" deep minimum and comply with sizing as required by Article 314 of the National Electrical Code.
- B. Steel faceplates must be used on fire rated drywall walls and painted to match device color. Faceplates shall be Mulberry Metal Products or equivalent.
- C. All outdoor junction boxes and condulets shall be gasketed.

END OF SECTION 26 05 34

SECTION 26 05 44 – SLEEVES AND SEALS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves without waterstop.
 - 2. Sleeves with waterstop.
 - 3. Modular link-seal systems.
 - 4. Grout.
 - 5. Silicone sealants.
 - 6. Escutcheons.
 - 7. Penetration firestop
- B. Related Requirements:
 - 1. Section 26 00 00 ELECTRICAL WORK

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sleeve Schedule
- C. Penetration firestop Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1.3 INFORMATIONAL SUBMITTALS

- A. Installation manual: For each type of product.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES WITHOUT WATERSTOP

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends.
- B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.

- C. Steel Sheet Sleeves: ASTM A653/A653M, 0.0239-inch minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.
- D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 SLEEVES WITH WATERSTOP

- A. Molded HDPE with integral waterstop, furnish with nailer end caps.
- B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, 2" steel collar, welded on both sides, hot-dip galvanized, with plain ends.

2.3 MODULAR LINK-SEAL SYSTEMS

- A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Designed to form a hydrostatic seal of 20 psig minimum.
 - 2. Sealing Elements: Material as indicated below, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - a. Normal, except noted below: EPDM-rubber
 - b. Steam and other service temperatures between 200°F-450°F: High-temperature-silicone
 - c. Non-metallic piping: Low Durometer EPDM, Shore 40 ± 5
 - 3. Pressure Plates: Reinforced Nylon Polymer.
 - 4. Connecting Bolts and Nuts: Stainless steel, Type 316 of length required to secure pressure plates to sealing elements.
- B. Sleeves and seals manufactured by Garlock-LINK-SEAL, Flexicraft Industries, Advance Products & Systems, Metraflex, or approved equivalent.

2.4 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000 psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealant, S, P, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant. b. Standard: ASTM C920.

2.6 ESCUTCHEONS

- A. Escutcheon Types:
 - 1. One-Piece, Stainless Steel Type: With polished stainless steel finish.
 - 2. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.7 PENETRATION FIRE STOP

- A. All penetrations through rated assemblies, walls, shafts, floors, roofs, etc., shall be firestopped in accordance with Local Building Codes, NFPA, U.L. Fire Resistant Directory, and manufacturer's instructions.
- B. Obtain penetration firestopping systems for each type of opening indicated from single manufacturer.
- C. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.
- D. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.
- E. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined in accordance with UL 1479.
- F. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84 or UL 72

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine existing conditions for partition types and execute work per the requirements herein.

3.2 INSTALLATION OF SLEEVES AND CORE DRILLING - GENERAL

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes, except where noted. Prior to core drilling structure shall be scanned with X-ray, Redar, or other means to locate rebar and verify that conduit/pipes

are not imbedded in the concrete, Submit scans with an overlay of the proposed core drills for approval.

- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 - 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 3. Using silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.3 INSTALLATION OF SLEEVES WITH WATER STOP

- A. Install sleeve with water stop as new walls and slabs are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water stop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.

3.4 INSTALLATION OF LINK-SEAL SYSTEMS

- A. Install link-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.
 - 1. Locate the bolts in accessible position to allow tightening.

3.5 SLEEVE SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. New Exterior Concrete Walls below Grade:
 - a. Link seal system. Molded HDPE sleeves with water stops.
2. New Exterior Concrete Walls above Grade:
- 3.
4. Existing Exterior Concrete Walls below Grade:
 - a. Link seal system. Core drilled hole
5. Existing Exterior Concrete Walls above Grade:
 - a.
6. New Concrete Slabs-on-Grade:
 - a. Sleeves with water stops.
 - 1) Select sleeve size to allow for 2-inch annular clear space between piping and sleeve for installing sleeve-seal system.
7. Existing Concrete Slabs-on-Grade:
 - a. Sleeves with water stops.
 - 1) No Sleeve: Core drill to allow for 2-inch annular clear space between piping and sleeve for installing sleeve-seal system.
8. New Concrete Slabs above Grade:
 - a. Mechanical rooms and wet areas: Sleeves with water stops
 - b. Dry areas: Molded Sleeve
9. Existing Concrete Slabs above Grade:
 - a. Mechanical rooms and wet areas: Sleeves with water stops
 - b. Dry areas: Core Drill
10. Interior Partitions:
 - a. Masonry: Sheet steel
 - b. Drywall: neatly field cut round holes with hole saws

3.6 INSTALLATION OF ESCUTCHEONS

- A. Install escutcheons for piping penetrations of finished walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
- C. Use one-piece escutcheons for all sizes available on new piping. Use spit type on existing piping and large piping where one-piece not available.

3.7 INSTALLATION OF PENETRATION FIRESTOP

- A. Install penetration firestopping systems in accordance with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.8 INSTALLATION OF DRAFTSTOP

- A. All penetrations through non-rated walls, floors, etc., shall be sealed for draft stopping with sealant, grout, etc., designed for this use.
- B. Accommodate movement, such as pipe vibration, water hammer, thermal expansion, and other normal building movement without damage.

END OF SECTION 26 05 44

SECTION 26 05 48 – SEISMIC RESTRAINT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Seismic restraints for electrical systems.
- B. Related Requirements:
 - 1. Section 26 00 00 ELECTRICAL WORK

1.2 ACTION SUBMITTALS

- A. Seismic restraint submittals shall be provided for engineer review and include, but not be limited to, detailed drawings showing seismic restraint types, anchor type and attachment details, calculations and spacing requirements of unique equipment and conduit for this specific project. Submittals shall include floor plan drawings indicating equipment, ductwork and piping to be restrained, restraint locations and restraint component types. All submittals and floor plan drawings shall bear the seal of a licensed structural engineer of the State of Missouri.

1.3 INFORMATIONAL SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

- A. As-built and field modifications shall be submitted.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. All materials and workmanship shall specifically comply with the above listed Building Code with respect to seismic requirements for the support and anchorage of all electrical, communications and electronic safety and security systems and equipment as installed on this project. Lateral forces to be restrained shall be as required by IBC Section 1621 Architectural, Mechanical, and Electrical Component Seismic Design Requirements and ASCE 7-02 Section 9.6 Architectural, Mechanical, and Electrical Components and Systems with the following design parameters with the design parameters as shown on the drawings:
 - 1. Site Class as Defined in the IBC: **D**.

2. In subparagraph below, retain Seismic Use Group or Building Category for Project structure from three classifications defined in the IBC.
 3. Assigned Seismic Use Group or Building Category as Defined in the IBC: **III**.
- C. All conduit support and restraint details and practices shall conform to the publication “Seismic Restraint Systems Guidelines” by Cooper B-line-TOLCO.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Submittals shall reflect the actual site conditions as verified by the Contractor.
- B. Examine areas and equipment to receive seismic devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- C. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install all required seismic restraints per the provided submittals.
- B. Install seismic restraint cables so they do not bend across edges of adjacent equipment or building structure.
- C. Mechanical Anchor Bolts:
 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors to be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

END OF SECTION 26 05 48

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Labels.
 - 2. Extruded insulating tubing.
 - 3. Bands.
 - 4. Tapes.
 - 5. Tags.
 - 6. Signs.
 - 7. Cable ties.
- B. Related Requirements:
 - 1. Section 26 00 00 ELECTRICAL WORK

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Identification Schedule: For each piece of electrical equipment and electrical system components to be index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 LABELS

- A. Plastic Labels for Indoor Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
 - 2. Letter and Background Color: As indicated for specific application under Part 3.
 - 3. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
 - 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 1 inch.
 - 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for

greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

6. Fasteners: Stainless steel rivets or self-tapping screws.

B. Metal Labels for Outdoor Equipment:

1. Material and Thickness: stainless steel, 0.025 inch
2. Letter and Background Color: Black filled lettering on brushed stainless steel.
3. Minimum Label Size: Length and width vary for required label content, but not less than 3 by 1 inch.
4. Fasteners: Stainless steel rivets or self-tapping screws.

C. UL PGDQ2 - Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

2.3 EXTRUDED INSULATING TUBING

- A. UL YDPU2 - Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at maximum of 200 deg F.

2.4 BANDS

- A. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

2.5 TAPES

- A. Floor Marking Tape: 2 inch wide, 5 mil pressure-sensitive vinyl tape, with yellow and black. stripes and clear vinyl overlay.

2.6 TAGS

2.7 SIGNS

2.8 CABLE TIES

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine existing conditions....

3.2 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.3 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

- A. Comply with 29 CFR 1910.144 for color identification of hazards, and the following:
 - 1. Fire-protection and fire-alarm equipment must be finished, painted, or suitably marked safety red.
 - 2. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than 7.7 feet above finished floor.
- B. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below.
 - 1. Color must be factory applied.
 - 2. Colors for 208Y/120 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 240 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 4. Colors for 480Y/277 V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 5. Color for Neutral (Grounded Conductor): White
 - a. Color for Equipment Ground: Bare copper or Green
 - b. Color for Isolated Ground: Green with two or more yellow stripes.
- C. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:
 - 1. Branch Circuits: Source panel designation, circuit numbers
 - 2. Feeder: Source panel designation, item being fed
- D. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- E. Cover Plates: Label individual cover plates with self-adhesive labels. Label cover plate with the following information, in the order listed:
 - 1. Panelboard designation.
 - 2. Colon or dash.
 - 3. Branch circuit number.
 - 4. Location: Refer to 26 27 26 "Wiring Devices".
- F. Workspace Indication: In unfinished spaces apply floor marking tape or tape and stencil to finished surfaces. Show working clearances in direction of access to live parts. Workspace must comply

with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

- G. Equipment Identification Labels:
 - 1. Black letters on white field, unless noted otherwise.
 - 2. Fasteners: Stainless steel rivets or self-tapping screws.
 - 3. Indoor Equipment: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
 - 4. Outdoor Equipment: stainless steel, 0.025 inch. Black filled lettering on brushed stainless steel.
 - 5. Lettering: Refer to specific equipment

3.4 INSTALLATION

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Verify identity of item before installing identification products.
- E. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- F. Apply identification devices to surfaces that require finish after completing finish work.
- G. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- H. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.
- I. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.
- J. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.
- K. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.
- L. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.

- M. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.
- N. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.
- O. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- P. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's instructions.

END OF SECTION 26 05 33

SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Circuit breaker panelboards
- B. Related Requirements:
 - 1. Section 26 00 00 ELECTRICAL WORK

1.2 ACTION SUBMITTALS

- A. Product Data
- B. Shop Drawings

1.3 INFORMATIONAL SUBMITTALS

- A. Installation manual

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product.
- B. Parts List: For each type of product that has replaceable parts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

2.2 MANUFACTURERS

- A. Schneider Electric
- B. General Electric by ABB
- C. Siemens

- D. Eaton Cutler Hammer.

2.3 CIRCUIT BREAKER PANELBOARDS

- A. The circuit breakers shall be of the molded case, bolt on type suitable for voltage and ampere ratings indicated on drawings and in schedules and shall have a minimum interrupting capacity of 10,000 amperes (120/208V) or 14,000 amperes (277/480V) or as noted on the drawings.
- B. Provide lockable red circuit breakers on all circuits serving the fire alarm system.
- C. Provide labeling indicating Available Fault Current with calculation date Per NEC 2020 408.6.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards in accordance with NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
 - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver in accordance with manufacturer's published instructions.
- B. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- C. Install filler plates in unused spaces.
- D. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Provide labeling indicating Available Fault Current with calculation date Per NEC 2020 408.6.
- C. Device Nameplates: Label each branch circuit device in power panelboards with nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Provide a 3" wide x 1" high phenolic nameplate for each switch as follows:
EQUIPMENT IDENTIFICATION (3/8" Lettering)
__AS/ __AF (XX AMPS WITH/XX AMP FUSE) (1/4" Lettering)
- D. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.
- E. Circuit Directory:
 - 1. The directory card shall be neatly typed to identify circuits. A transparent plastic facing shall protect the directory card. Room numbers shall be included in directory descriptions. Furnish a copy of each panel directory to the Architect/Engineer. Where existing panelboard loads are modified, the panel directories shall be updated.

END OF SECTION 26 24 16