PROJECT MANUAL

Upgrade/Relocate Rooftop Units

Springfield DOLIR Office Building

Springfield, Missouri

Designed By: Interpres Building Solutions
1201 S Campbell Ave
Springfield, MO, 65807

Date Issued: September 30, 2025

Project No.: O2516-01

STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION

Facilities Management, Design and Construction

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

PROJECT NUMBER: O2516-01

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:

Brad Palmer, PE
Interpres Building Solutions
PE-2013039894

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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:

	TITLE	SHEET #	DATE	CAD #
1.	Cover Sheet	Sheet CVR	9/30/25	CVR
2.	Schedule of Manufacturers	Sheet MEP100	9/30/25	MEP100
3.	Demolition Plans	Sheet MEP200	9/30/25	MEP200
4.	Roof MEP Plan	Sheet MEP300	9/30/25	MEP300
5.	Mechanical Plan	Sheet M100	9/30/25	M100
6.	Mechanical Plan	Sheet M101	9/30/25	M101
7.	Mechanical Details	Sheet M200	9/30/25	M200
8.	Mechanical Schedules	Sheet M300	9/30/25	M300
9.	Electrical Plan	Sheet E100	9/30/25	E100
10.	Electrical Schedules and Details	Sheet E200	9/30/25	E200

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 / Upgrade Rooftop Units
Springfield DOLIR Office Building
Springfield, Missouri
Project No.: O2516-01

3.0 BIDS WILL BE RECEIVED:

A. Until: 1:30 PM, January 8, 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 the replacement of rooftop air cooled condensers and associated evaporators and refrigerant piping. Additional alternates are included as defined under alternate specification section and on drawings.

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 AM, December 22, 2025, at Springfield DOLIR Office Building; 505 E Walnut Street Springfield, MO 65806

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:

A. Designer: Interpres Building Solutions, Brad Palmer, (417) 350-8027, email: palmer@interpresbuild.com

B. Project Manager: Ryan Abbott, (573) 298-1967, email: Ryan.Abbott@oa.mo.gov

8.0 GENERAL INFORMATION:

A. The State reserves the right to reject any and all bids and to waive all informalities in bids. No bid may be withdrawn for a period of 20 working days subsequent to the specified bid opening time. The contractor shall pay not less than the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed, as determined by the Missouri Department of Labor and Industrial Relations and as set out in the detailed plans and specifications.

B. Bid results will be available at https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans after it is verified that at least one bid is awardable and affordable.

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 Designer and 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 Designer and 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 or 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 with your bid to FMDCBids@oa.mo.gov.

D. All bids shall be submitted without additional terms and conditions, modifications, or reservations. The completed forms should 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 should contain the full and correct legal name of the Bidder. If the Bidder is an entity registered with the Missouri Secretary of State, the Bidder's name on the bid form should appear as shown in the Secretary of State's records. 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 and bids received by the Owner 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. All revised bids must be submitted to FMDCBids@oa.mo.gov, revised bids sent any other way 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 a 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://missouribuys.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 - LIST OF SUBCONTRACTORS

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

12.0 - WORKING DAYS

A. Contract duration time is stated in working days and will use the following definition in determining the actual calendar date for contract completion:

1. Working days are defined as all calendar days except Saturdays, Sundays and the following State of Missouri observed holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday, Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day and Christmas Day.

13.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS

A. By signing the bid form and submitting a bid on this project, the Bidder certifies that it will use American and Missouri products as set forth in Article 1.7 of the General Conditions. Bidders are advised to review those requirements carefully prior to bidding.

B. A preference shall be given to Missouri firms, corporations or individuals, or firms, corporations or individuals that maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less.

C. Pursuant to Section 34.076, RSMo, a contractor or Bidder domiciled outside the boundaries of the State of Missouri shall be required, in order to be successful, to submit a bid the same percent less than the lowest bid submitted by a responsible contractor or Bidder domiciled in Missouri as would be required for such a Missouri domiciled contractor or Bidder to succeed over the bidding contractor or Bidder domiciled outside Missouri on a like contract or bid being let in the 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.

14.0 – 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.

15.0 - MBE/WBE/SDVE INSTRUCTIONS

A. Definitions:

1. **"MBE"** means a Minority Business Enterprise.

2. **"MINORITY"** has the same meaning as set forth in 1 C.S.R. 10-17.010.

3. **"MINORITY BUSINESS ENTERPRISE"** has the same meaning as set forth in section 37.020, RSMo.

4. **"WBE"** means a Women's Business Enterprise.

5. **"WOMEN'S BUSINESS ENTERPRISE"** has the same meaning as set forth in section 37.020, RSMo.

6. **"SDVE"** means a Service-Disabled Veterans Enterprise.

7. **"SERVICE-DISABLED VETERAN"** has the same meaning as set forth in section 34.074, RSMo.

8. **"SERVICE-DISABLED VETERAN ENTERPRISE"** has the same meaning as "Service-Disabled Veteran Business" set forth in section 34.074, RSMo.

B. MBE/WBE/SDVE General Requirements:

1. For all bids greater than $100,000, the Bidder shall obtain MBE, WBE and SDVE participation in an amount equal to or greater than the percentage goals set forth in the Invitation for Bid and the Bid Form, unless the Bidder is granted a Good Faith Effort waiver by the Director of the Division, as set forth below. If the Bidder does not meet the MBE, WBE and SDVE goals, or make a good faith effort to do so, the Bidder shall be 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://oeo.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 / Upgrade Rooftop Units**
Springfield DOLIR Office Building
Springfield, Missouri

Project Number: **O2516-01**

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 $700** 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 10% MBE and 10% WBE and 3% SDVE participation goals. The Contractor agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows: (OR)

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

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

Total $

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

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

ARTICLE 7. CONTRACT DOCUMENTS

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

1. Division 0 – Procurement and Contracting Information, including, but not limited to:
    a. Invitation for Bid (Section 001116)
    b. Instructions to Bidders (Section 002113)
    c. Supplementary Instructions to Bidders (if applicable) (Section 002213)
    d. The following documents as completed and executed by the Contractor and accepted by the Owner, if applicable:
        i. Bid Form (Section 004113)
        ii. Unit Prices (Section 004322)
        iii. Proposed Contractors Form (Section 004336)
        iv. MBE, WBE, SDVE Compliance Evaluation Form(s) (Section 004337)
        v. MBE, WBE, SDVE Eligibility Determination Form for Joint Ventures (Section 004338)
        vi. MBE, WBE, SDVE Good Faith Effort (GFE) Determination Form (Section 004339)
        vii. Missouri Service Disabled Veteran Business Form (Section 004340)
        viii. Affidavit of Work Authorization (Section 004541)
    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:

_____
Brian Yansen, Director
Division of Facilities Management,
Design and Construction

_____
Contractor's Authorized Signature

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

_____
Corporate Secretary

Bond No._____

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

PAY APP NO.	PROJECT NUMBER
CHECK IF FINAL ☐**FINAL**	DATE

MBE/WBE/SDVE PROGRESS REPORT

Remit with **ALL** Progress and Final Payments

(Please check appropriate box) ☐CONSULTANT ☐CONSTRUCTION

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

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 place data, shop drawings and air and water balance reports.

4. Service Instructions: Provide the following information for all pieces of equipment.

   a. Recommended spare parts including catalog number and name of local supplier or factory representative.

   b. Belt sizes, types, and lengths.

   c. Wiring diagrams.

5. Manufacturer's Certificate of Warranty as described in Article 3.4.

6. Prior to the final payment, furnish to the Designer three (4) copies of parts catalogs for each piece of equipment furnished by him/her on the project with the components identified by number for replacement ordering.

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

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

2. The manuals shall identify project name, project number, and include the name and address of the Contractor, subcontractors and manufacturers who were involved with the activity described in that particular manual.

3. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titles clearly printed under reinforced laminated plastic tabs.

4. Contents: Prepare a Table of Contents for each volume, with each product or system description identified.

ARTICLE 3.6 – OTHER CONTRACTOR RESPONSIBILITIES

A. The Contractor shall keep on site, during progress of the work, a competent superintendent satisfactory to the Construction Representative. The superintendent shall represent the Contractor and all agreements made by the superintendent shall be binding. The superintendent shall carefully study and compare all drawings, specifications and other instructions and shall promptly notify the Construction Representative and Designer, in writing, any error, inconsistency or omission which may be discovered. The superintendent shall coordinate all work on the project. Any change of the superintendent shall be approved by the Construction Representative.

B. Contractor shall, at all times, enforce strict discipline and good order among his employees, and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him/her.

C. The Contractor shall supply sufficient labor, material, plant and equipment and pay when due any laborer, subcontractor or supplier for supplies furnished and otherwise prosecute the work with diligence to prevent work stoppage and 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 <u>without</u> 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, 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 contact price, whichever is greater, with loss payable to Contractor and Owner as their respective interests may appear.

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

C. Minimum Limits of Insurance

1. General Liability

Contractor

$2,000,000	combined single limit per occurrence for bodily injury, personal injury, and property damage
$2,000,000	annual aggregate

2. Automobile Liability

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

3. Workers' Compensation and Employers Liability

Workers' Compensation limits as required by applicable State Statutes (generally unlimited) and minimum of $1,000,000 limit per accident for Employer's Liability.

General Liability and Automobile Liability insurance may be arranged under individual policies for the full limits required or by a combination of underlying policies with the balance provided by a form-following Excess or Umbrella Liability policy.

D. Deductibles and Self-Insured Retentions

All deductibles, co-payment clauses, and self-insured retentions must be declared to and approved by the Owner. The Owner reserves the right to request the reduction or elimination of unacceptable deductibles or self-insured retentions, as they would apply to the Owner, and their respective officers, officials, agents, consultants and employees. Alternatively, the Owner may request Contractor to procure a bond guaranteeing

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

E. Other Insurance Provisions and Requirements

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

1. General Liability

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

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

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

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

2. Automobile Insurance

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

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

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

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

3. Workers' Compensation/Employer's Liability

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

4. All Coverages

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

F. Insurer Qualifications and Acceptability

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

G. Verification of Insurance Coverage

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

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

ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT

ARTICLE 7.1 - FOR SITE CONDITIONS

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

ARTICLE 7.2 - FOR CAUSE

A. Termination or Suspension for Cause:

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

2. In the event the Owner suspends Contractor's right to proceed with the work or terminates the contract, the Owner may demand that the Contractor's surety take over and complete the work on this contract, after the surety submits a written proposal to the Owner and receives written approval and upon the surety's failure or refusal to do so within ten (10) consecutive calendar days after demand therefore, the Owner may take over the work and prosecute the same to completion by bid or negotiated contract, or the Owner may elect to take possession of and utilize in completing the work such materials, supplies, appliances and plant as may be on the site of the work, and all subcontractors, if the Owner elects, shall be bound to perform their contracts.

B. The Contractor and its surety shall be and remain liable to the Owner for any excess cost or damages occasioned to the Owner as a result of the actions above set forth.

C. The Contractor in the event of such suspension or termination shall not be entitled to receive any further payments under this contract until the work is wholly finished. Then if the unpaid balance under this contract shall exceed all expenses of the Owner as certified by the Director, such excess shall be paid to the Contractor; but, if such expenses shall exceed the unpaid balance as certified by the Director, the Contractor and their surety shall be liable for and shall pay the difference and any damages to the Owner.

D. In exercising Owner's right to secure completion of the work under any of the provisions hereof, the Director shall have the right to exercise Owner's sole discretion as to the manner, methods and reasonableness of costs of completing the work.

E. The rights of the Owner to suspend or terminate as herein provided shall be cumulative and not exclusive and shall be in addition to any other remedy provided by law.

F. The Contractor in the event of such suspension or termination may be declared ineligible for Owner contracts for a minimal period of twelve (12) months. Further, no contract will be awarded to any Contractor who lists in their bid form any subcontractor whose prior performance has contributed, as determined by the Owner, to a breach of a contract. In order to be considered for state-awarded contracts after this period, the Contractor/subcontractor will be required to forward acceptance reports to the Owner regarding successful completion of non-state projects during the intervening twelve (12) months from the date of default. No contracts will be awarded to a subcontractor/Contractor until the ability to perform responsibly in the private sector has been proven to the Owner.

ARTICLE 7.3 -- FOR CONVENIENCE

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

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

B. Upon receipt of notification, the Contractor shall:

1. Cease operations when directed.

2. Take actions to protect the work and any stored materials.

3. Place no further subcontracts or orders for material, supplies, services or facilities except as may be necessary to complete the portion of the Contract that has not been terminated. No claim for payment of materials or supplies ordered after the termination date shall be considered.

4. Terminate all existing subcontracts, rentals, material, and equipment orders.

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

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

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

SECTION 007300 - SUPPLEMENTARY CONDITIONS

1.0 GENERAL:

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

2.0 CONTACTS:

Designer:
Brad Palmer
Interpres Building Solutions
1201 S Campbell Ave
Springfield, MO, 65807
Telephone: (417) 350-8027
Email: palmer@interpresbuild.com

Construction Representative:
David Burkett
Division of Facilities Management, Design and Construction
730 South Wall Street
Joplin, MO 64801
Telephone: (573) 644-2442
Email: David.Burkett@oa.mo.gov

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

Contract Specialist:
Mandy Roberson
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone:573-522-0074
Email: mandy.roberson@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 3 complete sets of drawings and specifications at no charge.

B. The Owner will furnish the Contractor with approximately 3 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. 32

Section 039
GREENE 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, 2025**

Last Date Objections May Be Filed: **April 9, 2025**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	$30.51
Boilermaker	$33.10*
Bricklayer-Stone Mason	$54.83
Carpenter	$50.77
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	$41.20
Plasterer	
Communication Technician	$33.25
Electrician (Inside Wireman)	**$47.28**
Electrician Outside Lineman	$33.10*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	$33.10*
Glazier	$50.07
Ironworker	$68.38
Laborer	$42.22
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	$63.70
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	$54.40
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	$42.36
Plumber	$53.58
Pipe Fitter	
Roofer	$46.12
Sheet Metal Worker	$52.43
Sprinkler Fitter	$69.12
Truck Driver	$33.10*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.
**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in RSMo Section 290.210.

Heavy Construction Rates for
GREENE County

Section 039

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	$56.22
Millwright	
Pile Driver	
Electrician (Outside Lineman)	$33.10*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	$47.13
General Laborer	
Skilled Laborer	
Operating Engineer	$54.60
Group I	
Group II	
Group III	
Group IV	
Truck Driver	$50.46
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

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

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

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

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

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OVERTIME
and
HOLIDAYS

OVERTIME

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

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

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

HOLIDAYS

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

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

SECTION 011000 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project consists of **replacement of rooftop air cooled condensers and associated evaporators and refrigerant piping. Additional alternates are included in scope as defined under Alternate specification section and on drawings.**

1. Project Location: **505 E Walnut Street, Springfield, MO 65803**
2. Owner: State of Missouri, Office of Administration, Division of Facilities Management, Design and Construction, Harry S Truman State Office Building, Post Office Box 809, 301 West High Street, Jefferson City, Missouri 65102.

B. Contract Documents, dated **9/30/25** were prepared for the Project by **Interpres Building Solutions 1201 S Campbell Ave**

C. The Work consists of HVAC equipment upgrades**.**

1. The Work includes **Condenser and evaporator replacement, boiler replacement, fan wall replacement, UV filter installation.**

D. The Work will be constructed under a single prime contract.

1.3 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. 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.

B. Use of the Existing Building: Maintain the existing building in a weathertight condition throughout the construction period. Repair damage cause by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period..

1.4 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.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF PRODUCTS ORDERED IN ADVANCE

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.

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 daily 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 FACILITY INTERRUPTION ALLOWANCE

A. Included within the completion period for this project are a specified number of "Facility Interruption" days (see Schedule of Allowances).

B. The Contractor's progress schedule shall clearly indicate the facility interruption day allowance as an "activity" or "activities". In the event facility interruptions 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 facility interruption and charged against the above allowance. Critical work activities will be determined by review of the Contractor's current progress schedule.

C. The Contractor's Representative and the Construction Representative shall agree monthly on the number of "facility interruption" days to be charged against the allowance. This determination will be documented in writing and be signed by the Contractor and the Construction Representatives. If there is a failure to agree on all or part of the "facility interruption" days for a particular month, that disagreement shall be noted on this written document and signed by each party's representative. Failure of the Contractor's representative to sign the "facility interruption" day documentation after it is presented, with or without the notes of disagreement, shall constitute agreement with the "facility interruption" day determination contained in that document.

D. There will be no modification to the time of contract performance due solely to the failure to deplete the "facility interruption" day allowance.

E. Once this allowance is depleted, a no cost Change Order time extension will be executed for "facility interruption days" days, as defined above, encountered during the remainder of the Project.

1.5 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 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

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

1. Alternate No. 1: REPLACE BOILER AND CONNECT TO EXISTING PIPING, FLUES AND ELECTRICAL CIRCUITING.

B. Alternate No. 2: *REPLACE FAN IN MULTIZONE AIR HANDLER WITH NEW FAN WALL AND VARIABLE FREQUENCY DRIVES*

C. Alternate No. 3 *PROVIDE NEW UV FILTERS IN EXISTING MULTIZONE AIR HANDLERS*

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 Contactor 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 location[1] with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.
2. Each of the above referenced computer systems shall have the following minimum system[2] 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) $1,000,000.00 (One million) and under – 2% of the total contract amount

        2) Over $1,000,000.00 (One million) – 1% of the total contract amount

    b. Close Out Documents

        1) $1,000,000.00 (One million) and under – 2% of the total contract amount

        2) Over $1,000,000.00 (One million) – 1% of the total contract amount

    c. General Conditions

        1) No more than 10%

B. The Contractor shall submit an updated Schedule for presentation at each Monthly Progress Meeting. The Schedule shall be updated by the Contractor as necessary to reflect the current Schedule and its relationship to the original Schedule. The updated Schedule shall reflect any changes in the logic, sequence, durations, or completion date. Payments to the Contractor shall be suspended if the Progress Schedule is not adequately updated to reflect actual conditions.

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

3.2 CONSTRUCTION PROGRESS SCHEDULE – BAR CHART SCHEDULE

A. Bar-Chart Schedule: The Contractor shall prepare a comprehensive, fully developed, horizontal bar chart-type Contractor's Construction Schedule. The Contractor for general construction shall prepare the Construction Schedule for the entire Project. The Schedule shall show the percentage of work to be completed at any time, anticipated monthly payments by Owner, as well as significant dates (such as completion of excavation, concrete foundation work, underground lines, superstructure, rough-ins, enclosure, hanging of fixtures, etc.) which shall serve as check points to determine compliance with the approved Schedule. The Schedule shall also include an activity for the number of "bad" weather days specified in Section 012100 – Allowances.

1. The Contractor shall provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.

    a. If practical, use the same Schedule of Values breakdown for schedule time bars.

2. The Contractor shall provide a base activity time bar showing duration for each construction activity. Each bar is to indicate start and completion dates for the activity. The Contractor is to place a contrasting bar below each original schedule activity time for indicating actual progress and planned remaining duration for the activity.

3. The Contractor shall prepare the Schedule on a minimal number of separate sheets to readily show the data for the entire construction period.

4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on schedule with other construction activities. Include minor elements involved in the overall sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.

5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other required schedules and reports.

6. Indicate the Intent to Award and the Contract Substantial Completion dates on the schedule.

B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by the following:

1. Requirement for Phased completion

2. Work by separate Contractors

3. Work by the Owner

4. Pre-purchased materials

5. Coordination with existing construction

6. Limitations of continued occupancies

7. Un-interruptible services
8. Partial Occupancy prior to Substantial Completion
9. Site restrictions
10. Provisions for future construction
11. Seasonal variations
12. Environmental control

C. Work Stages: Use crosshatched bars to indicate important stages of construction for each major portion of the Work. Such stages include, but are not necessarily limited to, the following:

1. Subcontract awards
2. Submittals
3. Purchases
4. Mockups
5. Fabrication
6. Sample testing
7. Deliveries
8. Installation
9. Testing
10. Adjusting
11. Curing
12. Startup and placement into final use and operation

D. Area Separations: Provide a separate time bar to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a "major area" is a story of construction, a separate building, or a similar significant construction element.

1. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    a. Structural completion.
    b. Permanent space enclosure
    c. Completion of mechanical installation
    d. Completion of the electrical portion of the Work
    e. Substantial Completion

3.3 SCHEDULE OF SUBMITTALS

A. Upon acceptance of the Construction Progress Schedule, prepare and submit a complete schedule of submittals. Coordinate the submittal schedule with Section 013300 SUBMITTALS, the approved Construction Progress Schedule, list of subcontracts, Schedule of Values and the list of products.

B. Prepare the schedule in chronological order. Provide the following information

1. Scheduled date for the first submittal
2. Related Section number
3. Submittal category
4. Name of the Subcontractor
5. Description of the part of the Work covered
6. Scheduled date for resubmittal
7. Scheduled date for the Designer's final release or approval

C. Distribution: Following the Designer's response to the initial submittal schedule, print and distribute copies to the Designer, Owner, subcontractors, and other parties required to comply with submittal dates indicated.

1. Post copies in the Project meeting room and temporary field office.
2. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned part of the Work and are no longer involved in construction activities.

D. Schedule Updating: Revise the schedule after each meeting or other activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

3.4 SCHEDULE OF INSPECTIONS AND TESTS

A. Prepare a schedule of inspections, tests, and similar services required by the Contract Documents. Submit the schedule with (15) days of the date established for commencement of the Contract Work. The Contractor is to notify the testing agency at least (5) working days in advance of the required tests unless otherwise specified.

B. Form: This schedule shall be in tabular form and shall include, but not be limited to, the following:

1. Specification Section number
2. Description of the test
3. Identification of applicable standards
4. Identification of test methods
5. Number of tests required
6. Time schedule or time span for tests
7. Entity responsible for performing tests
8. Requirements for taking samples
9. Unique characteristics of each service

C. Distribution: Distribute the schedule to the Owner, Architect, and each party involved in performance of portions of the Work where inspections and tests are required.

END OF SECTION 013200

013233 – PHOTOGRAPHIC DOCUMENTATION

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

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 the following:

1. Preconstruction photographs.
2. Periodic construction photographs.

1.3 INFORMATIONAL SUBMITTALS

A. Digital Photographs: Submit image files within three days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 12 (twelve) megapixels.
2. Identification: Provide the following information with each image description in file metadata tag:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect/Engineer.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Unique sequential identifier keyed to accompanying key plan.

1.4 USAGE RIGHTS

A. Obtain and transfer (as necessary) copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of twelve (12) megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect/Engineer.

1. Flag construction limits before taking construction photographs.
2. Take additional photographs as required to record imperfections and damage in the roofing system.
3. Maintain key plan with each set of construction photographs that identifies each photographic location
4. Date and Time: Include date and time in file name for each image

B. Additional Photographs: Architect/Engineer may request photographs in addition to periodic photographs specified.

1. Three days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:

a. Special events planned at Project site.
b. Immediate follow-up when on-site events result in construction damage or losses.
c. Photographs to be taken at fabrication locations away from Project site.
d. Substantial Completion of a major phase or component of the Work.
e. Extra record photographs at time of final acceptance.
f. Owner's request for special publicity photographs.

END OF SECTION 013233

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
230500	Common Work Results for HVAC	Major Material Suppliers
230514	Variable Frequency Drives	Product Data
230519	Meters and Gauges	Product Data
230523	Valves for HVAC Piping	Product Data
230529	Hangers, Supports and Vibration Isolation for HVAC Piping and Equipment	Product Data
230553	Identification for HVAC Piping and Equipment	Product Data
230593	Testing and Balancing	Product Data
230700	HVAC Insulation	Product Data
230701	HVAC Piping Insulation	Product Data
230901	Building Management Controls System	Product Data
232113	HVAC Piping and Specialties	Product Data
233113	HVAC Ductwork	Product Data
233300	Air Duct Accessories	Product Data
233713	Grilles, Registers and Diffusers	Product Data
235216	Gas Fired Condensing Boiler	Product Data
263426	Air Cooled Condenser	Product Data
260500	Common Work Results for Electrical	Product Data
260519	Conductors and Cables	Product Data
260533	Raceways and Boxes for Electrical Systems	Product Data
260553	Identification for Electrical Equipment and Wiring	Product Data
262416	Panelboards	Product Data

END OF SECTION 013300

SECTION 013513.10 - SITE SECURITY AND HEALTH REQUIREMENTS (OA)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general Institution rules.

B. This Section includes requirements for environments that employees are domiciled in, or public participation in program activities in or adjacent to the Scope of Work area:

1. The Contractor shall have the applicable measures specified below in-place any time demolition or construction activities occur in occupied or non-occupied project work areas.
2. The Contractor shall complete all specified cleaning procedures and receive clearance from the Construction Representative prior to removing any barriers and other precautionary measures – even for areas that the employees or public do not occupy during construction.

1.3 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 badges.

3.2 FIRE PROTECTION, SAFETY, AND HEALTH CONTROLS

A. The Contractor shall take all necessary precautions to guard against and eliminate possible fire hazards.

1. Onsite burning is prohibited.
2. The Contractor shall store all flammable or hazardous materials in proper containers located outside the buildings or offsite, if possible.
3. The Contractor shall provide and maintain, in good order, during construction fire extinguishers as required by the National Fire Protection Association. In areas of flammable liquids, asphalt, or electrical hazards, 15-pound carbon dioxide or 20-pound dry chemical extinguishers shall be provided.

B. The Contractor shall not obstruct streets or walks without permission from the Owner's Construction Representative and Facility Representatives.

C. The Contractor's personnel shall not exceed the speed limit of 15 mph while at the Facility unless otherwise posted.

D. The Contractor shall take all necessary, reasonable measures to reduce air and water pollution by any material or equipment used during construction. The Contractor shall keep volatile wastes in covered containers and shall not dispose of volatile wastes or oils in storm or sanitary drains.

E. The Contractor shall keep the project site neat, orderly, and in a safe condition at all times. The Contractor shall immediately remove all hazardous waste and shall not allow rubbish to accumulate. The Contractor shall provide onsite containers for collection of rubbish and shall dispose of it at frequent intervals during the progress of the Work.

F. Fire exits, alarm systems, and sprinkler systems shall remain fully operational at all times, unless written approval is received from the Owner's Construction Representative and the appropriate Facility Representative at least twenty-four (24) hours in advance. The Contractor shall submit a written time schedule for any proposed shutdowns.

G. For all hazardous materials brought onsite, Material Safety Data Sheets shall be on site and readily available upon request at least a day before delivery.

H. Alcoholic beverages or illegal substances shall not be brought upon the Facility premises. The Contractor's workers shall not be under the influence of any intoxicating substances while on the Facility premises.

3.3 SECURITY CLEARANCES AND RESTRICTIONS

A. FMDC CONTRACTOR BACKGROUND AND ID BADGE PROCESS

1. All employees of the Contractor are required to submit fingerprints to the Missouri State Highway Patrol to enable the Office of Administration, Division of Facilities Management, Design and Construction (FMDC) to receive state and national criminal background checks on such employees. FMDC reserves the right to prohibit any employee of the Contractor from performing work in or on the premises of any facility owned, operated, or utilized by the State of Missouri for any reason.
2. The Contractor shall ensure all of its employees submit fingerprints to the Missouri State Highway Patrol and pay for the cost of such background checks. The Contractor shall submit to FMDC via email to FMDCSecurity@oa.mo.gov a list of the names of the Contractor's employees who will be fingerprinted and a signed Missouri Applicant Fingerprint Privacy Notice, Authorization For Release Of Information Confidentiality Oath and State Identification Badge Agreement for each employee. All employees of the Contractor approved by FMDC to work at a State facility must obtain a contractor ID badge from FMDC prior to beginning work on-site, unless the Director of FMDC, at the Director's discretion, waives the requirement for a contractor ID badge. The Contractor and its employees must comply with the process for background checks and contractor ID badges found on FMDC's website at: https://oa.mo.gov/fmdc-contractor-id-badges.
3. Pursuant to section 43.540, RSMo, FMDC participates in the Missouri Rap Back and National Rap Back programs as of August 28, 2018. This means that the Missouri State Highway Patrol, Central Records Repository, and the Federal Bureau of Investigation will retain the fingerprints submitted by each of the Contractor's employees, and those fingerprints will be searched against other fingerprints on file, including latent fingerprints. While retained, an employee's fingerprints may continue to be compared against other fingerprints submitted or retained by the Federal Bureau of Investigation, including latent fingerprints.
4. As part of the Missouri and National Rap Back programs, FMDC will receive notification if a new arrest is reported for an employee whose fingerprints have been submitted for FMDC after August 28, 2018. If the employee is performing work on a State contract at the time of the arrest notification, FMDC will request and receive the employee's updated criminal history records. If the employee is no longer performing work on a State contract, FMDC will not obtain updated criminal records.
5. Pursuant to section 43.540, RSMo, the Missouri State Highway Patrol will provide the results of the employee's background check directly to FMDC. FMDC may NOT release the results of a background check to the Contractor or provide the Contractor any information obtained from a background check, either verbally or in writing. FMDC will notify the Contractor only whether an employee is approved to work on State property.
6. Each employee who submits fingerprints to the Missouri State Highway Patrol has a right to obtain a copy of the results of his or her background check. The employee may challenge the accuracy and completeness of the information contained in a background check report and obtain a determination from the Missouri State Highway Patrol and/or the FBI regarding the validity of such challenge prior to FMDC making a final decision about his or her eligibility to perform work under a State contract.
7. The Contractor shall notify FMDC via email to FMDCSecurity@oa.mo.gov if an employee is terminated or resigns from employment with the Contractor. If the Contractor does not anticipate performing work on a State contract in the future, the Contractor may request that FMDC remove its employees from the Rap Back programs. However, if removed from the Rap Back programs, employees will be required to submit

new fingerprints should the contractor be awarded another State contract.

8. Upon award of a Contract, the Contractor should contact FMDC at FMDCSecurity@oa.mo.gov to determine if its employees need to provide a new background check. If a Contractor's employee has previously submitted a fingerprint background check to FMDC as part of the Missouri and National Rap Back programs, the employee may not need to submit another fingerprint search for a period of three to six years, depending upon the circumstances. The Contractor understands and agrees that FMDC may require more frequent background checks without providing any explanation to the Contractor. The fact that an additional background check is requested by FMDC does not indicate that the employee has a criminal record.

3.4 DISRUPTION OF UTILITIES

A. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and the Facility Representative before disconnecting electric, gas, water, fire protection, or sewer service to any building.

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

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 013513.10

SECTION 015000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for construction facilities and temporary controls including temporary utilities, support facilities, security, and protection.

B. Temporary utilities include, but are not limited to, the following:

1. Water service and distribution
2. Temporary electric power and light
3. Temporary heat
4. Ventilation
5. Telephone service
6. Sanitary facilities, including drinking water
7. Storm and sanitary sewer

C. Support facilities include, but are not limited to, the following:

1. Field offices and storage sheds
2. Temporary roads and paving
3. Dewatering facilities and drains
4. Temporary enclosures
5. Hoists and temporary elevator use
6. Temporary project identification signs and bulletin boards
7. Waste disposal services
8. Rodent and pest control
9. Construction aids and miscellaneous services and facilities

D. Security and protection facilities include, but are not limited to, to following:

1. Temporary fire protection
2. Barricades, warning signs, and lights
3. Sidewalk bridge or enclosure fence for the site
4. Environmental protection

1.3 SUBMITTALS

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

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

1.4 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations including, but not limited to, the following:

1. Building code requirements
2. Health and safety regulations
3. Utility company regulations
4. Police, fire department, and rescue squad rules
5. Environmental protection regulations

B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations". ANSI A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities".

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code".

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to the Designer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry".

1. For job-built temporary office, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.

2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.

3. For fences and vision barriers, provide minimum 3/9" (9.5mm) thick exterior plywood.

4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8" (16mm) thick exterior plywood.

C. 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 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.

H. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers, or a combination of extinguishers of NFPA-recommended classes for the exposures.

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

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each Facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.

2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.

3. Obtain easements to bring temporary utilities to the site where the Owner’s easements cannot be used for that purpose.

4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Change Order.

B. Temporary Water Service: The Owner will provide water for construction purposes from the existing building system. All required temporary extensions shall be provided and removed by the Contractor. Connection points and methods of connection shall be designated and approved by the Construction Representative.

C. Temporary Electric Power Service: The Owner will provide electric power for construction lighting and power tools. Contractors using such services shall pay all costs of temporary services, circuits, outlet, extensions, etc.

D. Temporary Lighting: Provide temporary lighting as required that will provide adequate illumination for construction operations and traffic conditions.

E. 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.

F. 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.

G. 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.

H. 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.

I. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

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

1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. 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.

C. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.

D. 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.

E. 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.

F. 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.

G. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.

H. 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.

I. 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.

J. 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. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

1. Storage: Where materials and equipment must be stored and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

F. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near the site.

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 impending 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 220500 – COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 CODE SECTIONS & INDUSTRY STANDARDS

A. 2024 International Mechanical Code

B. 2024 International Building Code

C. 2024 International Plumbing Code

D. 2023 National Electric Code

E. 2024 International Energy Code

F. ADA – American Disabilities Act

G. ANSI – American National Standards Institute

H. ASHRAE – American Society of Heating Refrigerating and Air Conditioning Engineers

I. ASTM – American Society of Testing Materials

J. NFPA – National Fire Protection Association

K. NEMA – National Electrical Manufactures Association

L. OSHA – Occupational Safety and Health Act

M. UL – Underwriter's Laboratories

N. All codes listed on architectural Code Reference Sheet or project cover sheet.

1.2 GENERAL

A. Provide all work in accordance with applicable codes, rules, ordinances, and regulations of local, State, and Federal Governments and other Authorities Having Jurisdiction (AHJ).

B. This Division requires the furnishing and installing of complete functioning systems, and each element thereof, as specified or indicated on the drawings and specifications or reasonably inferred; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system functioning as indicated by the design and the equipment specified. Elements of the work include materials, supervision, supplies, equipment, transportation, and utilities.

C. The drawings have been prepared diagrammatically intended to convey the scope of work, indicating the intended general arrangement of the equipment, fixtures, piping, etc. without showing all the exact details as to elevations, offsets, control lines, and other installation requirements. The contractor shall use the drawings as a guide when laying out the work and shall verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers requirements, will ensure a complete, coordinated, satisfactory and properly operating system. Plans shall not be scaled

D. Contractor shall coordinate with all other trades to ensure that all required project components are included in project bid.

E. If in any case the plans or specifications conflict with either manufacturer's requirements or minimum code requirements the information on plans and specifications shall be superseded by manufacturers and code requirements.

F. All change order requests shall be accompanied with itemized tabular breakdown of all materials and labor associated with installation of all associated materials for review of the design team. Lump sum pricing will not be accepted.

G. Contractor shall refer to each drawing and specification section in construction document set. No bids shall be submitted without review of all construction documents.

H. Contractor shall provide heat trace cable for all piping installed in areas subject to freezing temperatures.

I. All water lines serving flush valves or quick closing water device shall be equipped with hammer arrestors. A single hammer arrestor shall be allowed to be installed on piping main serving a group of flush valves. Arrestors shall be sized for each specific use application.

J. All pipe sizes indicated in this specification are nominal pipe sizes (NPS).

1.3 LOCAL CONDITIONS

A. Visit site and determine existing local conditions affecting work in contract.

B. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

1.4 ALLOWABLE MANUFACTURERS

A. Allowable manufactures for all products listed in division 22 are listed on “Schedule of Manufacturers” on plans.

1.5 SUBMITTAL REQUIREMENTS

A. See section 013300.

1.6 WARRANTY REQUIREMENTS

A. All work shall be warrantied for a period of not less than one year from the date of substantial completion. The contractor shall provide work at no additional cost to correct any deficiencies in their work that were identified to have been present during the warrantied period.

B. The following additional items shall be guaranteed:

1. Piping shall be free from obstructions, holes or breaks of any nature.

2. Insulation shall be effective.

3. Proper circulation of fluid in each piping system.

C. The above guarantees shall include both labor and material; and repairs or replacements shall be made without additional cost to the Owner.

D. Any remedial work as a result of the above-mentioned items shall be performed promptly, upon written notice from the Architect or Owner.

1.7 DEMOLITION

A. Where demolition work is required contractor shall disconnect, demolish and remove plumbing systems, equipment and components indicated to be removed.

B. All patching of piping and other fixtures shall be performed with materials matching existing conditions and reinsulated to maintain performance of previous conditions.

C. All equipment to be removed and reinstalled shall be disconnected, with services capped, cleaned and stored for reconnection.

D. Owner shall have first right of refusal for all materials being removed.

E. If pipe, insulation, or equipment to remain is damaged or unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

F. Where demolition process has caused damage to equipment, fixtures, piping and other devices to remain, these items shall be repaired at contractor's expense to the approval of the Architect.

1.8 INSTALLATION

A. All equipment in division 22 shall be installed according to manufacturer's requirements and minimum code requirements. If an any case the plans or specifications are in conflict with either manufacturer's requirements or minimum code requirements the information on plans and specifications shall be superseded by manufacturers and code requirements.

B. Apply firestopping to penetrations of fire rated floor and wall assemblies for electrical installations to restore original fire resistance rating of assembly.

C. No combustible materials shall be allowed in return air plenum regardless of indication on plans.

D. If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

E. Install all equipment to facilitate service, maintenance and repair or replacement of components of both plumbing equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

1.9 TEMPORARY FACILITIES

A. See section 015000.

PART 2 – PRODUCTS

2.1 DIELECTRIC FITTINGS

A. Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180 deg F.

C. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for minimum working pressure as required to suit system pressures.

D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300 psig minimum working pressure at 225 deg F.

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

2.2 SLEEVES

A. Sleeves shall be constructed from the following materials at contractor's option.

1. Galvanized steel round tubing, closed with welded longitudinal joint.

2. Schedule 40 Steel Pipe.

3. DUCTED RETURN ONLY – Schedule 40 PVC pipe.

2.3 ESCUTCHEONS

A. Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. Options:

1. One-Piece, deep-drawn, box-shaped brass with polished chrome-plated finish.

2. One-Piece, Cast-Brass with set screw with polished chrome plated finish.

3. Split-Casting, Cast-Brass with concealed hinge and set screw and polished chrome plated finish.

2.4 GROUT

A. ASTM C 1107, grade B, nonshrink and nonmetallic, dry hydraulic-cement grout

B. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

C. Design Mix: 5000 psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

END OF SECTION 220500

SECTION 220529 – PLUMBING HANGERS AND SUPPORTS

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic restraint hangers and supports for piping and equipment. Obtain approval from authorities having jurisdiction where required by local requirements.

1.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers, supports, clamps and attachments to support piping properly from building structure. Do not attached to ceilings, equipment, ductwork, conduit or other non-structural elements such as floor or roof decking.

B. Hangers, supports, clamps and attachments shall comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible. Install supports with maximum spacing specified within Division 22 piping sections. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe as specified above for individual pipe hangers.

C. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length specified in Division 22 piping sections. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping as specified in Division 22 piping sections. Install concrete inserts before concrete is placed; fasten insert to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through openings at top of inserts.

D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Provide two nuts on threaded supports to securely fasten the support.

E. Field fabricated heavy duty steel trapeze supports shall be fabricated from steel shapes selected for loads required. Weld steel in accordance with AWS D-1.1.

F. Install appropriate types of hangers and supports to allow control 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 hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

H. Install hangers to provide indicated pipe slopes and so that maximum deflection of piping allowed by ASME B31.9 is not exceeded.

I. Insulated piping:

1. Riser Clamps: Attach riser clamps, including spacers, to piping with riser clamps projecting through insulation. Do not exceed pipe stresses allowed by ASME B31.9. Do not use riser clamps to support horizontal, insulated piping. Seal insulation for hot piping and protect vapor barrier for cold piping as specified in Division 23 “HVAC Insulation”.

2. Insulation protection shield: Install insulation protection shield and high density insulation, sized for the insulation thickness used as specified in insulation schedule. Install a minimum 8” long section at each support point, top and bottom halves or the pipe of same thickness of insulation used.

J. Pre-engineered Support Strut Systems: Channel strut systems can be used at the Contractors option in lieu of individual hangers for horizontal pipes. Space channel strut systems at the required distance for the smallest pipe supported. Provide channel gauge and hanger rods per the manufacturer’s recommendations for the piping supported. Where strut systems are attached to walls, install anchor bolts per manufacturer’s recommendations.

1. Uninsulated copper pipe: Install with plastic galvanic isolators.

2. Insulated Tube or Pipe: Install with 360 degree insulation protection shields or pre-engineered thermal hanger shield inserts.

1.3 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ASME B 31.9 and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchors by welding steel shapes, plates and bars to piping and to structure. Comply with ASME B 31.9 and with AWS Standards D1.1.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer’s written instructions to control movement to compensators.

D. Anchor spacing: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

1.4 INSTALLATION OF PIPE ALIGNMENT GUIDES

A. Install pipe alignment guides on piping that adjoins expansion joints as required by expansion joint manufacturer and elsewhere as indicated on plans and specification sections to eliminate binding and torsional stress on piping systems. Where not otherwise indicated, install guides as required by ASME B 31.9. Anchor guides to building substrate.

1.5 EQUIPMENT SUPPORTS

A. Fabricate structural steel supports to suspend equipment from structure above or support equipment from floor. Place grout under supports for piping and equipment.

1.6 INSTALLATION OF VIBRATION ISOLATORS

A. Piping runs connected to equipment requiring vibration isolation shall be isolated from building structure at connection to equipment using isolators inserted in supporting piping rods.

B. All floor mounted equipment shall be erected on concrete equipment pads over the complete floor area of the equipment, unless otherwise specified.

C. Provide neoprene mounting sleeves for hold-down bolts to prevent any metal to metal contact.

D. All equipment shall be provided with lateral restraining isolators as required to limit horizontal motion to 0.25” maximum, under all operating conditions.

E. All equipment shall be installed on vibration isolators and shall have a minimum operating clearance of 2” between the bottom of the equipment or inertia base and the concrete equipment pad or bolt heads beneath the equipment unless indicated otherwise.

F. Piping or plumbing equipment shall be supported from building structure and not other equipment, pipes or ductwork.

G. All wiring connections to plumbing equipment on isolators shall be made with a minimum 18” long flexible conduit in a “U” shaped loop.

H. Elastomeric isolators that will be exposed to temperatures below 32 degrees F shall be fabricated from natural rubber instead of neoprene.

I. Springs shall be designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.

J. Springs shall be sized to be non-resonant with equipment forcing frequencies or support structure natural frequencies.

1.7 MOUNTING OF CENTRIFUGAL PUMPS:

A. Pumps with their driving motor installed on slab on grade shall be bolted and grouted to equipment pads

B. Pumps with their driving motor installed on suspended slabs shall be bolted and grouted to a spring supported concrete inertia base reinforced.

C. Each concrete base (rectangular or "T" shape) for horizontally split pumps shall include supports and base elbows for the suction and discharge connections. Base elbows shall be bolted and grouted to the concrete foundation.

1.8 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Clean all welds and touch up paint to match factory finish of all materials or color and finish of adjacent materials when supports and adjacent elements are painted.

C. Adjust vibration isolators after piping system is at operating weight.

D. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

E. Adjust active height of spring isolators and adjust restraints to permit free movement of equipment within normal mode of operation.

PART 2 – PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

A. Comply with MSS SP-58 types 1-58 factory fabricated components. Hangers shall be pre-galvanized or hot dipped. Where non-metallic coatings area indicated provide plastic coating, jacket or liner.

B. Where hangers are installed in a corrosive environment or outdoors, hangers and supports shall be type 304 stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Trapeze hangers shall comply with MSS SP-69 and shall be type 59 shop or field fabricated pipe support assembly made from structural steel shapes with MSS SP-58 hanger rods, nuts, saddles and U-bolts.

2.3 THERMAL HANGER SHIELD INSERTS

A. Inserts shall have 100 PSI minimum compressive strength and shall be encased in sheet metal shield.

B. For trapeze and clamped systems, insert and shield shall cover entire circumference of pipe.

C. For clevis hangers, insert and shield shall cover lower 180 degrees of pipe.

D. Insert length shall extend 2” beyond sheet metal shield for piping operating below ambient air temperature.

2.4 EQUIPMENT SUPPORTS

A. Provide welded, shop or field fabricated equipment supports made from structural steel shapes.

2.5 ROOF EQUIPMENT RAILS

A. Rooftop equipment rails shall be constructed with 18 gauge galvanized steel unitized construction with an integral base plate, continuous welded corner seams, pressure treated wood nailer, counterflashing and screws. Rails shall be internally reinforced as required to support equipment loading. Rails shall be furnished with height as required to support equipment a minimum of 8” above top of finished roof elevation.

2.6 PIPE STANDS

A. Pipe stands shall be shop or field fabricated assemblies made of manufactured corrosion resistant components to support roof mounted piping. Provide one piece plastic unit with integral rod roller, pipe clamps or V-Shaped cradle to support pipe. Pipe stand shall be suitable for roof installation without membrane protection.

2.7 VIBRATION ISOLATORS

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

B. Mounts: Mounts shall be double deflection type with molded oil resistant rubber, hermetically sealed compressed fiberglass or neoprene isolator elements with factory drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Identify capacity range by color coding or other means.

C. Free Standing Spring Isolators: Free standing spring isolators shall be laterally stable, open spring isolators. Outside diameter shall be not less than 80 percent of the compressed height of the spring at rated load. Minimum additional travel shall be 50 percent of the required deflection at rated load. Isolators shall be capable of supporting 200 percent of the rated load, fully compressed without deformation or failure. Provide factory drilled baseplates and top plates for bolting to equipment and structure.

D. Housed Spring Mounts: Housed spring isolators shall be equipped with ductile iron or steel housing. Mounts shall be equipped with vertically adjustable snubbers allowing 1/4” travel up or down before contacting a resilient collar. Base and top shall have factory drilled holes for bolting to equipment and structure.

E. Elastomeric Hangers: Elastomeric Hangers shall be single or double deflection type fitted with molded, oil resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Identify capacity range by color coding or other means.

F. Spring Hangers: Spring hangers shall be combination coil-spring and elastomeric insert hanger with spring and insert in compression. Frame shall be steel and shall be fabricated for

connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency. Outside spring diameter shall be not less than 80 percent of the compressed height of the spring at rated load. Hanger shall be capable of supporting 200 percent of the rated load, fully compressed, without deformation or failure and shall be equipped with self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

G. Steel Equipment Base: Equipment Base isolators shall be constructed of factory fabricated welded structural steel. Bases shall have shape to accommodate supported equipment. Support brackets shall be factory welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support. Bases shall use steel shapes, plates, and bars complying with ASTM A 32/A 36M.

END OF SECTION 220529

SECTION 220700 – PLUMBING INSULATION

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 GENERAL

A. Provide necessary materials and accessories for installation of insulation for plumbing and mechanical systems as specified and/or detailed on drawings. Insulation type, jacket, and thickness for specific piping systems or equipment shall be as listed in this specification section.

B. Products or their shipping cartons shall bear label indicating their flame and smoke ratings. Treatments of jackets or facings for impart flame and smoke safety shall be permanent. Use of water soluble treatments such as corn paste or wheat paste is prohibited. This does not exclude approved lagging adhesives.

C. Install insulation over clean dry surfaces with joints firmly butted together. Insulation at equipment, flanges, fittings, etc. shall have straight edges with box type joints with corner beads as required. Where plumbing and heating insulation terminates at equipment or unions, taper insulation at 30 degree angle to pipe with one coat finishing cement and finish same as fittings. Total insulation system shall have neat smooth appearance with no wrinkles, or folds in jackets, joint strips, or fitting covers. Seal butt joints at maximum intervals of 45 feet to prevent vapor barrier failures from being transmitted to adjoining insulations sections.

D. Undamaged insulation systems on cold surface piping and equipment shall perform their intended functions as vapor barriers and thermal insulation without premature deterioration or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.

E. Products shall not contain asbestos, lead, mercury or mercury compounds.

1.2 QUALITY ASSURANCE

A. Flame/Smoke Ratings: Provide composite Plumbing insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1. Exception: Outdoor Plumbing insulation may have flame spread index of 75 and smoke developed index of 150.

B. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

C. Insulation installer shall advise contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

D. All exterior piping insulation shall be painted with ultraviolet-resistant paint. Color as selected by architect.

E. Provide an aluminum jacket over all exterior piping.

1.3 PIPING INSULATION INSTALLATION

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps.

C. All pipe clamps and other support fittings shall be insulated.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on cold pipe insulation, and protect insulation with shields to prevent puncture or other damage. Provide high density insulation of material as specified herein and of length equivalent to pipe shield. Provide pipe hangers sized for the pipe outside diameter plus insulation thickness. Seal butt joint between insulation and high density insulation with wet coat of vapor barrier lap cement.

1. Exception for vertical piping: Provide clamps sized for the outside diameter of the vertical pipe and extend clamp through insulation. Seal penetrations of insulation and vapor barrier with wet coat of vapor barrier lap cement.

F. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

G. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

H. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

I. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

1.4 EQUIPMENT INSULATION

A. Cold equipment (below ambient temperature):

1. Insulate drip pans under chilled equipment and roof drain bodies with either 1” elastomeric flexible insulation or 2” fiberglass for surfaces above 35 deg F or 3” fiberglass for surfaces 35 deg F or lower.

B. Hot equipment (above ambient temperature):

1. Insulate hot water storage tanks and expansion/compression tanks with 1” flexible elastomeric insulation.

C. Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

D. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

E. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

F. Do not apply insulation to equipment, breechings, or stacks while hot.

G. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

H. Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

I. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.

J. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

K. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

L. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by the manufacturer.

1.5 INSULATION APPLICATION SCHEDULE

A.	Domestic Cold Water (Up to 1.25”)	Elastomeric	0.5” Thickness
B.	Condensate Drain	Elastomeric	0.5” Thickness

PART 2 - PRODUCTS

2.1 ELASTOMERIC INSULATION

A. Flexible Elastomeric insulation shall be closed-cell, sponge or expanded-rubber materials and comply with ASTM C 534, type I for tubular materials and type II for sheet products. Maximum insulation conductive value shall be 0.22 BTU-in/(h-sqft-°F). Insulation values shall comply with energy code minimum requirements. See common work results for current code edition.

2.2 ADHESIVES AND TAPES

A. Insulating cements and adhesives shall be compatible with the insulation materials, jackets and substrates for bonding insulation to itself and to surfaces to be insulated.

B. Mastics shall be compatible with insulation materials, jackets, and substrates and shall comply with MIL-A-24179A Type II. Vapor-barrier mastic shall be water based suitable for indoor and outdoor use on below ambient services.

C. Tapes shall be white, vapor-retarder tape matching factory-applied jacket with acrylic adhesive and shall comply with ASTM C 1136.

D. All insulation finishes shall be compatible with the insulation product being finished and shall be in a color as selected by architect.

END OF SECTION 220700

SECTION 221100 – FACILITY PIPING AND SPECIALTIES

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 GENERAL

A. Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing, slope, expansion, and other design considerations. So far as practical, install piping as indicated.

B. Use fittings for all changes in direction and all branch connections.

C. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

D. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

E. Seal pipe penetrations through exterior walls using sleeves and sealer.

F. Seal pipe penetrations through underground exterior walls using sleeves and mechanical sleeve sealers.

G. Where pipes pass through fire rated walls, partitions, ceilings and floors, maintain the fire rated integrity.

H. Provide sleeves and seal pipes that pass through waterproof floors, non-fire rated walls, partitions and ceilings or concrete slab on grade.

I. Where pipes pass through foundation walls above strip footings or under strip footings, protect pipes from building load with cast iron soil pipe sleeves two pipe sizes larger than the pipe. Sleeves installed under the strip footing shall be encased in concrete.

J. Piping exposed to interior dry environment shall have a minimum of (1) primer and (1) finish coat of paint. Piping installed in exterior locations shall have a minimum of (1) primer and (2) finish coats of paint with total thickness of at least 5 mils. Finish coat colors in finish areas shall be as selected by architect.

1.2 FIELD QUALITY CONTROL

A. Inspect Water Distribution Piping as follows:

1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.

2. During the progress of the installation, notify the plumbing official having jurisdiction at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.

   a. Arrange for inspection of the piping system before concealed or closed in after system is roughed in and prior to setting fixtures.

   b. Arrange for a final inspection by the plumbing official to observe the tests specified below and to ensure compliance with the requirements of the plumbing code.

   c. Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for re-inspection by the plumbing official.

d. Prepare inspection reports signed by the plumbing official and turn over to the Architect upon completion of the project.

B. Perform one of the following tests on all piping:

1. Hydrostatic Test:

a. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

b. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.

c. Isolate expansion tanks and determine that hydronic system is full of water.

d. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."

e. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

2. Procedures required by authority having jurisdiction that exceed requirements of tests listed above shall be performed by contractor to obtain system acceptance.

C. Inspect Waste & Vent Piping as follows:

1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.

2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.

a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

c. Reinspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for reinspected by the plumbing official.

3. Piping System Test, Test drainage and vent system in accordance with the procedures of the authority having jurisdiction, or in the absence of a published procedure, as follows:

a. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

b. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.

c. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open jointed drain tile, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.

d. Final Plumbing Test Procedure: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.

e. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

1.3 WATER PIPING AND SPECIALTIES INSTALLATION

A. Provide piping material for use as listed in piping materials schedule shown on plans.

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. Select system components with pressure rating equal to or greater than system operating pressure.

G. Install groups of pipes parallel to each other spaced to permit application of insulation and servicing of valves.

H. Install drains, consisting of a tee fitting, NPS 0.75” ball valve and short NPS 0.75” threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

I. Install piping at uniform grade of 0.2 percent upward in direction of flow.

J. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

K. Install branch connections to mains using mechanically formed tee fittings in main pipe with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

L. Install unions in piping 2” and smaller, adjacent to valves, at final connections of equipment and at other locations noted on plans.

M. Install flanges in piping 2.5” and larger at final connections of equipment and elsewhere as indicated

N. Install strainers on inlet side of each control valve, pressure reducing valve, solenoid valve, in-line pump and at other locations noted on plans. Install 0.75” nipple and ball valve in

blowdown connection of strainers 2” and larger. Match size of strainer blowoff connection for strainers smaller than 2”.

O. Identify piping as specified in Division 22.

P. Do not interrupt service to facilities occupied by owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to the following:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of water-distribution service without Architects and owners written permission.

Q. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with Authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application. Do not install bypass piping around backflow preventers unless directed by local jurisdiction.

R. Connection to Utility Mains

1. Tap utility mains according to requirements of the local utility companies and of size and in location indicated.

1.4 WASTE & VENT PIPING AND SPECIALTIES INSTALLATION

A. Provide piping material for use as listed in piping materials schedule shown on plans.

B. Install piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

C. Install horizontal piping as high as possible allowing for proper slope and coordination with other components. Install vertical piping tight to columns or walls. Provide space to permit insulation applications where required, with 1-inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

D. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, combination wye and eighth bend, or long sweep, quarter, sixth, eighth, or sixteenth bends. Sanitary tees or quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn pattern combination wye and eighth bends where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper sized standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

E. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other

special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

F. Install drainage piping pitched down at a minimum slope of 1/8 inch per foot unless otherwise required by International Plumbing Code. Install vent piping pitched to drain back by gravity to the sanitary drainage piping system.

G. Install backwater valves in sanitary building drain piping as indicated, and as required by the plumbing code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service.

H. Install expansion joints on stacks or horizontal piping as indicated, and as required by the plumbing code.

I. Install above ground cleanouts in above ground piping and building drain piping as indicated, and:

1. as required by plumbing code;
2. at each change in direction of piping greater than 45 degrees;
3. at minimum intervals of 50' for piping 4" and smaller and 100' for larger piping;
4. at base of each vertical soil and waste stack.

J. Install floor and wall cleanout covers for concealed piping, types as indicated.

K. Install floor cleanouts in below floor building drain piping at minimum intervals of 50' for piping 4" and smaller and 75' for larger piping.

L. Install exterior cleanouts as detailed on drawings.

M. Install frost-proof vent caps.

N. Installation of Floor Drains, Floor Sinks and Floor Troughs

1. Install floor drains, floor sinks and floor troughs in accordance with manufacturer's written instructions and in locations indicated.
2. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor. Set floor sinks and floor troughs flush with the level finish floor.
3. Refer to architectural documents for floor slope requirements and set floor drain elevation to match.
4. Provide P-traps for drains connected to the sanitary sewer.
5. Install floor drains, floor sinks and floor troughs in waterproof floors with waterproof membrane securely flashed with drain flashing clamp so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
6. Position drains so that they are level, accessible and easy to maintain.

O. Preparation of Foundation for Underground Sanitary Building Drains

1. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.
2. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.

3. Pipe Beds:

    a. Cast Iron Soil Pipe: Shape bottom of trench to fit bottom of pipe for 90-degrees (bottom 1/4 of the circumference). Fill unevenness with tamped sand backfill. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.. For piping with rock trench bottoms, provide sand pipe bed 6" underneath and around sides of pipe, including fittings.

    b. Provide backfill above top of pipe bed as required for field conditions. Refer to Division 22 Section "General Plumbing Requirements" for materials and methods for backfill.

P. Pipe Applications - Above Ground, Within Building

1. See piping materials schedule for piping and fitting materials.

Q. Pipe Applications - Below Ground, Within Building

1. See piping materials schedule for piping and fitting materials.

1.5 HANGERS AND SUPPORTS

A. Copper and Steel Pipe hangers shall be installed with the following maximum spacing and minimum rod sizes.

1. 0.75" Pipe - Max Span 5' - Minimum Rod Size 3/8"
2. 1" Pipe - Max Span 6' - Minimum Rod Size 3/8"
3. 1.25" Pipe - Max Span 7' - Minimum Rod Size 3/8"
4. 1.5" Pipe - Max Span 8' - Minimum Rod Size 3/8"

B. Plastic piping hangers shall be spaced according to pipe manufacturer's written instructions for service conditions. Avoid point loading and space and install hangers with the fewest practical rigid anchor points.

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

1.6 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt and debris from inside and outside of pipe and fittings before assembly.

C. Soldered joints: Apply ASTM B813 water-flushable flux to tube end unless otherwise indicated. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook." Using lead free solder allow complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook", "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full interior diameter. Join pipe fittings as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Do not used pipe of pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to ASW D10.12/D10.12M, using qualified processes and welding operators according to specified quality assurance requirements.

G. Flanged Joints: Select appropriate gasket material, size, type and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following.

1. Comply with ASTM F402 for safe handling practice of cleaners, primers and solvent cements.

2. CPVC piping: Join according to ASTM D 2846/D 2846M Appendix.

3. PVC Pressure Piping: Join schedule 40, 80 and 120 according to ASTM D 2672. Join other-than-schedule number 40, 80 and 120 PVC pipe and socket fittings according to ASTM D 2855.

4. 4. PVC Non-pressure Piping: Join according to ASTM D 2855.

I. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions

J. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings

K. Mechanically Formed, Copper Tube Outlet Joints: Use manufacturer-recommended tool and procedure and brazed joints.

L. Pressure Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

M. Copper Tubing: Solder joints in accordance with the procedures specified in AWS "Soldering Manual."

N. Cast-Iron Soil Pipe: Make hubless joints in accordance with the Cast-Iron Soil Pipe & Fittings Handbook, Chapter IV. Install Couplings as followings:

1. Coordinate requirement for heavy duty no-hub couplings with Owner and Architect for installation on sanitary piping 3” and larger. Coordinate with section 3 of this text and general notes.

2. Install hubless couplings complying with CISPI 310 on soil, waste and vent piping.

3. Install hubless couplings complying with CISPI 310 on and soil and waste piping 3” and smaller and all vent piping.

4. Install heavy duty hubless couplings on soil or waste stacks, soil and waste piping connections to soil or waste stacks and all soil and waste piping 5” and larger.

5. Install No-Hub fitting restraints on joints 5” and larger at:

a. Changes of direction from vertical to horizontal

b. Branches, including wyes and wye combination fittings 4” and larger

c. Horizontal changes of direction 22-1/2 degrees and greater

O. PVC DWV Pipe: Joining and installation of PVC drainage pipe and fittings shall conform to ASTM D2665.

P. ABS to PVC Transition Joints: When joining ABS to PVC components (such as an ABS building drain to PVC sewer pipe) make joints using solvent cements conforming to ASTM D3138.

Q. Cast Iron to PVC Below Grade: Join cast iron to PVC with underground shielded adapter couplings.

R. Gas Joint Construction

1. Welded Joints: Comply with the requirements in ASME Boiler and Pressure Vessel Code, Section IX.

2. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."

   a. WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.

   b. CAUTION: Remove stems, seats, and packing of valves, and accessible internal parts of piping specialties before brazing.

   c. Fill the tubing and fittings during brazing with an inert gas (nitrogen or carbon dioxide) to prevent formation of scale.

   d. Heat joints to proper and uniform temperature.

3. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:

   a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint. Refer to NFPA 54, for guide for number and length of threads for field threading steel pipe.

   b. Align threads at point of assembly.

   c. Apply appropriate tape or thread compound to the external pipe threads.

   d. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.

   e. Damaged Threads: Do not use pipe with threads which are corroded, or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

4. Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.

5. Fusion Welded: Joints shall be made by a qualified and approved operator in accordance with Title 49, CFR, Part 192.283 and be made in accordance with pipe manufacturer’s recommendations.

6. Semi-rigid Corrugated Stainless Steel Tubing: Joints shall be made by a qualified and approved operator in accordance with pipe manufacturer’s recommendations.

1.7 PIPE EXPANSION

A. Provide expansion joints, expansion loops, anchors and guides as required for proper control of expansion and contraction of piping. Piping from mains to equipment branches and risers shall be provided with swing, swivel joints or offsets to relieve stresses due to expansion or contraction of piping.

B. Provide pipe loops as shown on drawings or specified. Where pipe loop dimensions are not shown on plans they shall be as recommended by pipe manufacturer based on thermal expansion.

C. Expansion Joints Specified below shall comply with the following:

1. Install expansion joints of sizes matching sizes of piping in which they are installed

2. Install packed type expansion joints with packing suitable for fluid service

3. Install metal bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturer's Association, Inc."

4. Install rubber packless joints according to FSA-NMEJ-702.

5. Install grooved joint expansion joints to grooved-end steel piping.

D. Expansion loops shall comply with the following:

1. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

E. Alignment guide anchors specified below shall comply with the following:

1. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

2. Install two guides on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

3. Install anchors at locations required to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of location and stresses to connected equipment.

1.8 ADJUSTING AND CLEANING

A. Clean and disinfect water distribution piping as follows:

1. Purge all new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired prior to use.

2. Use the purging and disinfecting procedure proscribed by the authority having jurisdiction or, in case a method is not prescribed by that authority, the procedure described in either AWWA C651, or AWWA C652, or as described below:

a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.

b. Fill the system or part thereof with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system or part thereof and allow to stand for 24 hours.

c. Drain the system or part thereof of the previous solution and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.

d. Following the allowed standing time, flush the system with clean, potable water until chlorine residual is lowered to incoming city water level.

e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

3. Prepare disinfection reports signed by the authority having jurisdiction and turn over to the Architect upon completion of the project.

A. Fill the system. Check compression tanks to determine that they are not air bound and that the system is completely full of water.

B. Before operating the system, perform these steps:

1. Close drain valve, hydrants, and hose bibbs.

2. Open valves to full open position.

3. Remove and clean strainers.

4. Check pumps for proper direction of rotation. Correct improper wiring.

5. Lubricate pump motors and bearings.

PART 2 – PRODUCTS

2.1 PIPING

A. Copper Tube:

1. Provide hard temper copper water tubing conforming to ASTM B 88. Tubing shall be type K, L or M as listed in schedule.

2. Tubing joints shall be soldered or brazed as indicated in schedule.

2.2 FITTINGS

A. Provide piping fittings for use as listed in piping materials schedule shown on plans.

B. Wrought Copper Fittings:

1. Provide wrought solder joint copper tube fitting conforming to ANSI B 16.22

C. Nickel Copper Alloy Steel Welding Fittings:

1. Provide nickel copper alloy steel welding fittings conforming to ANSI B16.9 and ASTM A234.

2.3 JOINING MATERIALS

A. Pipe flange gasket materials shall be suitable for chemical and thermal conditions of piing system contents. Provide 1/8” maximum thickness, nonmetallic, flat, asbestos free material conforming to ASME B 16.21.

B. Flange bolts and nuts shall conform to ASME B18.2.1 and shall be carbon steel unless otherwise noted.

C. Plastic pipe flange gasket bolts and nuts shall be type and material recommended by piping system manufacturer.

D. Solder filler metals shall conform to ASTM B 32 and shall be lead free alloys that include water flushable flux according to ASTM B 813.

E. Brazing filler metals shall conform to AWS A 5.8 BCuP series and shall be copper phosphorus alloys for joining copper with copper or Bag-1 silver alloy for joining copper with bronze or steel.

F. Welding filler materials shall comply with ASW D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Pipe:

1. CPVC piping cements shall conform to ASTM F 493.

2. PVC piping solvent cements shall conform to ASTM D 2564. Include primer complying with ASTM F 656.

H. Gasket material thickness, material and type shall be suitable for fluid to be handled and working temperatures and pressures.

2.4 TRANSITION FITTINGS

A. Plastic to Metal Transition Fittings:

1. Provide one piece fitting with one threaded brass or copper insert and one Schedule 80 solvent-cement-joint end.

B. Plastic to Metal Transition Unions:

1. Provide MSS SP-107 union. Include brass or copper end, schedule 80 solvent cement joint end, rubber gasket and threaded union.

2.5 DIELECTRIC FITTINGS

A. Fittings shall be combination fitting of copper alloy and ferrous materials with threaded solder joint plain or weld neck end connections that match piping system materials.

B. Insulating material shall be suitable for system fluid, pressure and temperature

C. Dielectric unions:

1. Provide factory fabricated union assembly with pressure and temperature rating suitable for system operating range.

D. Dielectric Flanges:

1. Provide factory fabricated companion flange assembly with pressure and temperature rating suitable for system operating range.

E. Dielectric Coupling:

1. Provide galvanized steel coupling with inert and non-corrosive thermoplastic lining and threaded ends. Coupling shall have pressure and temperature rating suitable for system operating range.

F. Dielectric Nipples:

1. Provide electroplated steel nipple with inert and noncorrosive, thermoplastic lining, plain, threaded or grooved ends. Nipples shall have pressure and temperature rating suitable for system operating range.

2.6 ALIGNMENT GUIDES AND ANCHORS

A. Provide steel, factory fabricated alignment guide with bolted two-section outer cylinder and base for attaching to structure; with two section guiding spider for bolting to pipe.

B. Anchors shall be mechanically fastened with tension and shear capacities appropriate for application.

2.7 DRAINAGE WASTE AND VENT SPECIALTIES

A. Cleanouts

1. Floor Cleanouts

a. For Hard Flooring areas provide a cast iron level cleanout assembly with round, adjustable, scoriated, nickel bronze top, and no hub outlet.

b. For Carpeted Flooring areas provide a cast iron floor level cleanout assembly with round, adjustable, scoriated, nickel bronze top and carpet clamping frame, and no-hub outlet.

2. Wall Cleanouts

a. For finished areas provide cast iron cleanout tee and cast iron countersunk plug with chrome round cover and screw.

b. For unfinished areas provide cast iron cleanout tee and cast iron countersunk plug.

2.12 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers

1. Provide 1”-3” vacuum breaker as required to match connected piping.

2. Vacuum Breaker shall have a bronze body with threaded connections and bronze finish and be constructed to ASSE 1001 standard.

B. Hose-Connection Vacuum Breakers

1. Vacuum Breaker shall be nonremovable and have a bronze body with manual drain. It shall be threaded for connection to garden hose and be constructed to ASSE1001 standard.

2.13 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers (provide accessories as required)

1. For 2” and smaller applications, backflow preventer shall have Bronze body and be constructed to ASSE 1013 standard for continuous-pressure applications. Backflow preventer shall have threaded end connections and be selected for configuration required by project. Preventer shall be designed for maximum 12psig pressure loss through the middle 1/3 of flow range.

2. For 2.5” and larger applications, backflow preventer shall have Cast Iron or Steel body with FDA approved interior lining and be constructed to ASSE 1013 standard for continuous-pressure applications. Backflow preventer shall have flanged end connections and be selected for configuration required by project. Preventer shall be designed for maximum 12psig pressure loss through the middle 1/3 of flow range.

2.14 STRAINERS

A. Y-Pattern Strainers

1. Strainers shall have a minimum pressure rating of 125psig (unless otherwise indicated).

2. 2” and smaller strainers shall have a Bronze body, a stainless steel screen with round perforations, threaded end connections and a drain.

3. 2.5” and larger strainers shall have a Cast Iron body with epoxy coated FDA approved liner, a stainless steel screen with round perforations, flanged end connections and a drain.

END OF SECTION 221100

SECTION 230500 – COMMON WORK RESULTS FOR HVAC

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 CODE SECTIONS

A. 2024 International Mechanical Code

B. 2024 International Building Code

C. 2024 International Plumbing Code

D. 2024 International Energy Code

E. ADA – American Disabilities Act

F. ANSI – American National Standards Institute

G. ASHRAE – American Society of Heating Refrigerating and Air Conditioning Engineers

H. ASTM – American Society of Testing Materials

I. NFPA – National Fire Protection Association

J. NEMA – National Electrical Manufactures Association

K. OSHA – Occupational Safety and Health Act

L. UL – Underwriter's Laboratories

M. SMACNA – Sheet Metal Air Conditioning National Association

N. All codes listed on architectural Code Reference Sheet or project cover sheet.

1.2 GENERAL

A. Provide all work in accordance with applicable codes, rules, ordinances, and regulations of local, State, and Federal Governments and other Authorities Having Jurisdiction (AHJ).

B. This Division requires the furnishing and installing of complete functioning systems, and each element thereof, as specified or indicated on the drawings and specifications or reasonably inferred; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system functioning as indicated by the design and the equipment specified. Elements of the work include materials, supervision, supplies, equipment, transportation, and utilities.

C. The drawings have been prepared diagrammatically intended to convey the scope of work, indicating the intended general arrangement of the equipment, fixtures, piping, etc. without showing all the exact details as to elevations, offsets, control lines, and other installation requirements. The contractor shall use the drawings as a guide when laying out the work and shall verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers requirements, will ensure a complete, coordinated, satisfactory and properly operating system. Plans shall not be scaled

D. Contractor shall coordinate with all other trades to ensure that all required project components are included in project bid.

E. If in any case the plans or specifications conflict with themselves, the most stringent of the conflicting information shall be the basis for bid. Contractor shall seek clarification of all conflicts prior to bid.

F. All change order requests shall be accompanied with itemized tabular breakdown of all materials and labor associated with installation of all associated materials for review of the design team. Lump sum pricing will not be accepted.

G. Contractor shall refer to each drawing and specification section in construction document set. No bids shall be submitted without review of all construction documents.

H. Contractor shall provide heat trace cable for all condensate drains located in attics, through exterior walls or any other areas subject to freezing temperatures.

I. Contractor shall provide heat trace cable for all piping installed in areas subject to freezing temperatures.

J. All pipe sizes indicated in this specification are nominal pipe sizes (NPS).

1.3 LOCAL CONDITIONS

A. Visit site and determine existing local conditions affecting work in contract.

B. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

1.4 ALLOWABLE MANUFACTURERS

A. Allowable manufactures for all products listed in division 23 are listed on “Schedule of Manufacturers” on plans.

1.5 SUBMITTAL REQUIREMENTS

A. See section 013300

1.6 WARRANTY REQUIREMENTS

A. All work shall be warrantied for a period of not less than one year from the date of substantial completion. The contractor shall provide work at no additional cost to correct any deficiencies in their work that were identified to have been present during the warrantied period.

1.7 DEMOLITION

A. Where demolition work is required contractor shall disconnect, demolish and remove HVAC systems, equipment and components indicated to be removed.

B. All patching of ductwork and piping shall be performed with materials matching existing conditions and reinsulated to maintain performance of previous conditions.

C. All equipment to be removed and reinstalled shall be disconnected, with services capped, cleaned and stored for reconnection.

D. Owner shall have first right of refusal for all materials being removed.

E. If duct, pipe, insulation, or equipment to remain is damaged or unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

1.8 COMMISSIONING

A. The operation of new equipment installed in this project scope will be tested by a A/E commissioning agent. Contractor shall include the following items in project scope to assist in the commissioning process:

1. Completion of pre functional checklist – This checklist will consist of all items noted by equipment manufacturer that are to be completed prior to the commencement of the startup process.
2. Completion of functional checklist – This checklist will consist of all functional items required by equipment manufacturer that are to be observed in order to verify proper unit operation. This checklist will also include verification that control points are properly configured and are visible at the building management user interface.
3. Adjustment and operation for functional testing – While on site, the Commissioning Agent will require operation of the equipment in all modes defined in sequences of operation indicated on the plans and in the building management system submittal documents. The contractor shall provide on site personnel during this testing to operate and adjust setpoints, control sequences, actuators, dampers and other components in order to verify proper operation of all equipment sequences.
4. Seasonal remobilization – An additional site visit may be required during appropriate weather conditions if all sequences are not able to be tested during the initial functional testing phase. For example, if a project is completed during the summer, a second testing phase may be required to verify proper operation of the heating equipment. The contractor shall provide remobilization of personnel to provide support for the functional testing performed during this visit.

1.9 INSTALLATION

A. All equipment in division 23 shall be installed according to manufacturer's requirements and minimum code requirements. If an any case the plans or specifications are in conflict with either manufacturer's requirements or minimum code requirements the information on plans and specifications shall be superseded by manufacturers and code requirements.

B. Apply firestopping to penetrations of fire rated floor and wall assemblies for electrical installations to restore original fire resistance rating of assembly.

C. No combustible materials shall be allowed in return air plenum regardless of indication on plans.

D. If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements. Contractor shall coordinate scope of work with fire sprinkler system installation where applicable to ensure no sprinkler piping is installed in a fashion that will limit installation height of ductwork.

E. Install all equipment to facilitate service, maintenance and repair or replacement of components of both mechanical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

1.10 EXECUTION REQUIREMENTS

A. No combustible materials shall be allowed in return air plenum regardless of indication on plans.

1.11 TEMPORARY FACILITIES

A. See section 015000.

PART 2 – PRODUCTS

2.1 HOUSEKEEPING PADS

A. All equipment shall be installed on concrete housekeeping pads. Pad shall extend beyond equipment perimeter 4” and shall elevate equipment off of finish floor 4”.

B. Contractor shall have option to provide prefabricated housekeeping pad or pour pad in place.

2.2 FILTERS

A. The contractor shall provide one set of new filters in each of the multizone air handlers. And shall deliver one spare set to owner.

2.3 SLEEVES

A. Sleeves shall be constructed from the following materials at contractor’s option.

1. Galvanized steel round tubing, closed with welded longitudinal joint.

2. Schedule 40 Steel Pipe.

3. DUCTED RETURN ONLY – Schedule 40 PVC pipe.

2.4 DIELECTRIC FITTINGS

A. Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180 deg F.

C. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for minimum working pressure as required to suit system pressures.

D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300 psig minimum working pressure at 225 deg F.

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

2.5 GROUT

A. ASTM C 1107, grade B, nonshrink and nonmetallic, dry hydraulic-cement grout

B. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

C. Design Mix: 5000 psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

END OF SECTION 230500

SECTION 230514 – VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 GENERAL

A. High performance PWM (pulse-width-modulated) AC drive. Three-phase input line power is converted to a sine-coded, variable frequency output, which provides optimum speed control of any conventional squirrel cage induction motor. The use of IGBTs (Insulated Gate Bipolar Transistors), with a carrier frequency range of 2 kHz to 12.5 kHz, permits quiet motor operation.

B. This drive has one control logic board for all horsepower ratings. Printed circuit boards employ surface-mount technology, providing both high reliability, and small physical size of the printed circuit assemblies. The microprocessor delivers the computing power necessary for complete three-phase motor control in building automation systems.

C. Operating Principle: Input three-phase AC line voltage is first rectified to a fixed DC voltage. Using pulse width modulation (PWM) inverter technology, the DC voltage is processed, to produce an output waveform in a series of variable-width pulses. Unique firmware algorithms optimize motor magnetization through control of voltage, current, and frequency applied to generate a nearly sinusoidal output waveform.

D. STANDARDS

1. UL 508A (Industrial Control Panels)
2. BTL Listed
3. UL, cUL listed
4. CBC, IBC, ASCE7, ICC-ES 156
5. HCAI (OSHPD)

E. ENVIRONMENTAL & SERVICE CONDITIONS

1. Ambient service temperature: Narrow Bypass UL Type 1: -10°C to 40°C
2. Ambient storage temperature: Narrow Bypass UL Type 1: -20°C to 70°C
3. Humidity: 0% to 95%, non-condensing
4. Altitude: to 1,000 meters (3,300 feet); higher by derating
5. Service factor: 1.0
6. RoHS 2 Compliant

1.2 QUALITY ASSURANCE

A. In-circuit testing of all printed circuit boards is conducted to ensure proper manufacturing. Final printed circuit board assemblies are functionally tested via computerized test equipment. All fully assembled controls are computer tested with induction motor loads to assure unit specifications are met. The average MTBF (Mean Time Between Failure) is 28 years.

1.3 CONSTRUCTION

A. Input Section of the VFD - VFD power input stage converts three-phase AC line power into a fixed DC voltage via a solid-state, full-wave diode rectifier with MOV (Metal Oxide Varistor)

surge protection. An internal 5% split choke built in both positive and negative DC bus reduces harmonics for cleaner power.

B. Intermediate Section of the VFD - DC bus maintains a fixed DC voltage with filtering and short circuit protection as a DC supply to the VFD output section. It is interfaced with the VFD diagnostic logic circuit to continuously monitor and protect the power components.
C. Output Section of the VFD - Insulated Gate Bipolar Transistors (IGBTs) convert DC bus voltage to a variable frequency and voltage, utilizing a PWM sine-coded output to the motor. Motor noise at 60 Hz is less than 2 dB above the motor noise from across-the-line operation when measured at a distance of one meter.

1.4 POWER AND CONTROL ELECTRONIC HOUSINGS

A. UL Type 1 wall-mounted enclosure: 208 V, 0.5 through 25 HP; 480 V, 0.5 through 60 HP
B. Microprocessor-based control circuit
C. Non-volatile memory (EEPROM); all programming memory is saved when the VFD is disconnected from power.
D. Digital operator keypad and display provide local control and readout capability:

1. Hand/Off/Auto commands
2. Speed Reference command
3. Reset command

E. Easy to remove heat sink cooling fan with programmable on/off control.
F. USB mini-B port for quick and easy PC connection

1.5 PROTECTION

A. Output current overload rating of 110% for 60 seconds, 140% for 2 seconds, 175% instantaneous
B. Output short circuit protection
C. Current limited stall prevention (overload trip prevention) during acceleration, deceleration, and run conditions
D. Optically isolated operator controls
E. Fault display
F. “Hunting” prevention logic
G. Electronic ground fault protection
H. Electronic motor overload relay protects the motor while operating in drive and bypass mode
I. Motor current display in both drive and bypass modes of operation as well as verification that the motor is running
J. Proof of flow/loss of flow detection in both drive and bypass modes
K. DC bus charge indication
L. Heatsink overtemperature protection
M. Cooling fan operating hours recorded
N. Input/output phase loss protection
O. Line voltage sensors to monitor for brownout and blackout conditions with adjustable fault levels to ensure the proper settings pursuant to each application.
P. Reverse prohibit selectability
Q. Short circuit withstand rating of 100 KA RMS with customer provided branch circuit protection.
R. Multiple emergency override modes (across-the-line or speed selectable via the drive)

1.6 OPERATION

A. Output frequency and speed display can be programmed for other speed-related and control indications, including: RPM, CFM, GPM, PSI, in WC, % of maximum RPM, or custom.
B. Power loss ride-through (2 seconds capable)
C. Time delay on start; peak avoidance for smooth generator switchover
D. VFD accepts either a direct acting or a reverse acting speed command signal.
E. Bi-directional “Speed Search” capability to start into a rotating load. Two types: current detection and residual voltage detection
F. DC injection braking, to prevent fan “windmilling”
G. Remote Run/Stop command input
H. Eight programmable HVAC specific application presets
I. Over 100 programmable functions, resettable to factory HVAC presets
J. User parameter initialization to re-establish project specific parameters
K. Ramp-to-stop or coast-to-stop selection
L. Auto restart capability: 0 to 10 attempts with adjustable delay time between attempts
M. One custom selectable Volts/Hertz pattern and multiple preset Volts/Hertz patterns
N. Auto speed reference input signal, adjustable for bias and gain
O. While the VFD is running, operational changes in control and display functions are possible, including:

1. Acceleration time (0 to 6000 seconds)
2. Deceleration time (0 to 6000 seconds)
3. Frequency reference command
4. Hand/Off/Auto commands
5. Monitor display
6. Removable digital operator

1.7 Automatic energy saving, reduced voltage operation in VFD modeCODE SECTIONS

PART 2 – PRODUCTS

2.1 UNIT FEATURES

A. Unit shall be equipped with the following features:

1. Provide rating as required to support connected equipment shown on plans.
2. Provide all features indicated on plans.
3. Coordinate with control vendor to ensure proper operation of drive for all required control sequences.
4. Displacement power factor of .98 throughout the motor speed range
5. Internal EMI/RFI filter complies with IEC 61800-3 restricted distribution for first environment
6. Built-In real time clock for time and date stamping events along with timer functions for starting, stopping and speed changes without the need for external controls
7. Voltmeter, ammeter, kilowatt meter, elapsed run time meter, and heatsink temperature monitoring functions
8. Drive internal PI closed-loop control with selectable engineering units
9. Independent PI control for use with external device
10. Differential PID feedback feature
11. Direct or reverse acting speed signal

12. Sleep function in both closed loop and open loop control
13. Feedback signal low pass filter
14. Feedback signal loss detection and selectable response strategy
15. Feedback signal inverse and square root capability
16. 24 VDC, 150 mA transmitter power supply
17. Eight programmable multi-function input terminals (24 VDC) providing 36+ programmable features, including:
18. Customer Safeties
19. BAS / Damper Interlock
20. Emergency Override – BAS interlock mode
21. min/max speed setting
22. 16 preset speeds
23. PI control enable / disable
24. Two programmable 0 to 10 VDC or 4-20 ma analog outputs on VFD control board, proportional to drive monitor functions including output frequency, output current, output power, PI feedback, output voltage and others
25. Four programmable multi-function output relays (Form C rated 2 amps @ 250 VAC & 30 VDC) providing 29+ functions, including: “Motor Run,” “Damper Control,” “Auto Transfer,” “Drive Run,” “Hand Mode,” “Auto Mode,” “System Fault,” “Bypass Run,” ”Serial Com Run,” “Ready/Run/Fault status,” and numerous other options.
26. Input and output terminal status indication
27. Analog input speed reference on bypass printed circuit board
28. Nine preset speeds
29. Diagnostic fault indication
30. VFD efficiency: 96% at half-speed; 98% at full-speed
31. “S-curve” soft start / soft stop capability
32. Run/Fault output contacts
33. Serial communication loss detection and selectable response strategy
34. Controlled speed range of 40:1
35. Critical frequency rejection capability: three selectable, adjustable bandwidths
36. 140% starting torque capability, available from 3 Hz to 60 Hz
37. Adjustable carrier frequency, from 2 kHz to 12.5 kHz
38. Analog/Digital Virtual I/O – internally sends an output to an input (no wiring needed)
39. Dynamic noise control for quiet motor operation
40. Programmable security code
41. Cloud service (Yaskawa Drive Cloud) for product registration and parameter storage
42. Store up to four additional parameter sets in keypad
43. Integrated PLC (DriveWorks EZ)
44. Rotational as well as Stationary motor auto-tuning
45. Temperature controlled fans
46. LCD keypad with Hand/Off/Auto and Copy keypad functions
47. Motor preheat function
48. Self-regulating lead/lag control for multiple drives (up to 4)
49. Drive/motor alternation control (share motor run time for lead drive/motor)
50. Up to four PID setpoints
51. Draw down level selection for PID setpoint
52. Anti-no-flow control for deadhead protection
53. Pre-charge pump functionality
54. Low city alarm digital input
55. State/de-state control – add/remove drive based on feedback or output frequency
56. Single phase foldback

57. Flash upgradeable firmware
58. Heatsink overtemperature speed fold-back feature
59. “Bumpless” transfer between Hand and Auto modes
60. Emergency override can be used as “smoke purge” function
61. Fan failure detection and selectable drive action
62. Programming and firmware upgrade without three-phase main power using DriveWizard HVAC software tool
63. Bypass and drive are factory assembled.
64. Input disconnect switch with a lockable, through-the-door operating mechanism
65. Drive output and Bypass contactors are both electrically and software interlocked.
66. BACnet, Siemens APOGEE FLN, Metasys N2, and Modbus RTU communication protocols as standard, with the ability to configure controller parameters, view controller monitors, control I/O, clear faults, and view controller status in both drive and bypass modes. EtherNet/IP, Modbus TCP/IP and LonWorks are optionally available.
67. BACnet Health monitors including Net Health, Tokens Received/Transmitted, Messages Received/Transmitted, Next/Previous Node Address, Max/Min Master Found, number of Nodes on Network, COV, MSTP Loop Time, CRC Errors, MSTP Tokens Lost/Retry, Deadtime Average.
68. Door mounted control keypad with HOA LCD display for “Control Power,” “Drive Ready,” “Drive Run,” “Drive Selected,” “Drive Fault,” “Drive Test,” “Bypass Selected,” “Bypass Run,” “Motor OL”, ”Safety Open” “BAS Interlock,” “Auto Run”, Auto Transfer,” “Emergency Override,” “Hand Mode,” “Off Mode”, and “Auto Mode.”
69. Damper control circuit with end-of-travel feedback capability including two adjustable wait time functions. One is a run delay time, where the drive will operate at a preset speed before the damper opens to pressurize the system. The other time function is an interlock wait time, so if the damper has not fully opened within the specified time, a fault will be declared.
70. Selectable energy savings and harmonic reduction mode. Drive automatically switches to Bypass (across-the-line) when motor is running 60 Hz for a set time and automatically switches back when frequency reference changes.
71. Green Contactor mode when enabled will keep unneeded contactors from being closed when not needed.

END OF SECTION 230514

SECTION 230519 – METERS AND GAUGES

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 INSTALLATION

A. Install connector plugs with socket extending one-third of pipe diameter and in a vertical position in piping.

B. Install connector plugs of sizes required to match thermometer connectors. Provide bushings if required to match sizes.

C. Provide extension of thermowells as required for access beyond piping insulation.

D. Install thermometers in thermowells and adjust position for readability.

E. Install meters and gauges adjacent to machines and equipment to allow service and maintenance of meters, gauges, machines and equipment.

F. After installation calibrate meters according to manufacturer's written instructions.

1.2 SCALE

A. Provide scale range of meters and gauges as required for flow rates indicated on drawings and schedules.

PART 2 – PRODUCTS

2.1 BIMETALLIC DIAL THERMOMETER

A. Thermometer shall have stainless steel case and stem, glass window, permanently etched scale markings on dial, dark metal pointer and bimetal coil temperature sensing element.

B. Provide probe suitable for insertion in connector plug with length as required for insertion into gauge connector plug.

C. Thermometer shall have accuracy of plus or minus one percent of scale range.

D. Provide each thermometer with separable well for installation pipe connections.

2.2 THERMOWELL

A. Thermowell shall be constructed in accordance with ASME B40.200 with pressure-tight, socket-type fitting made for insertion into piping tee fitting. Length shall match thermometer bulb or stem and extensions shall be provided to accommodate insulation.

B. Provide thermowell bushings as required to convert internal screw thread to size of thermometer connection.

2.3 PRESSURE GAUGES

A. Pressure gauge shall have stainless steel case and stem, glass window, permanently etched scale markings on dial, dark metal pointer and bourdon type pressure element assembly with copper alloy construction and brass tip.

B. Gauge shall be equipped with mechanical link between pressure element and connection to pointer.

C. Provide probe assembly suitable for insertion in connector plug.

D. Gauge shall have grade 'A' accuracy plus or minus one percent of middle half of scale range.

E. Gauge shall be furnished with snubber rated for pressure of system.

2.4 TURBINE FLOW METERS

2.5 CONNECTOR PLUGS

A. Provide connector plugs for all pressure gauges and thermometers rated for 500 psi and 200 degrees Farenheit. Plug shall be solid brass construction with two valve cores of neoprene.

END OF SECTION 230519

SECTION 230523 – VALVES FOR HVAC PIPING

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 INSTALLATION REQUIREMENTS

A. Prior to installation, examine valve interior for cleanliness. Operate valves to ensure proper operation. Examine guides, seats, threads and flanges to ensure there are no conditions that could cause valve malfunction or leakage. Do no attempt to repair defective valves; replace with new valves.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance and equipment removal without system shutdown. Locate valves for easy access and provide separate support where necessary.

C. Install valves in position to allow full stem movement. Install valves in horizontal piping with stem at or above center of pipe.

D. Install chain wheels on operators for valves 4” and larger and more than 96 inches above finished floor. Extend chains to 60 inches above finished floor.

E. Install necessary valves within piping systems to provide required flow control and to allow isolation for inspection, maintenance and repair of each piece of equipment of fixture and on each main and branch service loop.

F. Valves 2” and smaller have solder, socket weld flanged or screwed end connections as required by associated piping materials unless otherwise noted. Valves 2.5” and larger shall have flanged or butt weld ends as scheduled.

G. Non-rising stem valves shall not be installed at any point in the piping systems unless space is restricted. If a restricted area is identified, contractor shall obtain A/E approval before installation of non-rising stem valve.

H. Valves shall be the same size as adjacent piping. Reduced valve size will not be allowed unless specifically noted.

I. Provide 2.5” and larger gate valves on steam supply line with by-pass valves. Bypass valves shall have same trim as is specified for main valve.

J. Provide butterfly valves 6” and smaller with latch lock handles for shutoff service.

K. Install globe valves with pressure on top of disc unless prohibited by code. Globe valves requiring drainage for inspection, maintenance or winterization shall be installed with stem in horizontal position to allow complete drainage of piping.

1.2 GENERAL VALVE APPLICATIONS

A. If valve applications are not noted, use the following:

1. Shutoff service: Ball, Butterfly or Gate valves

B. Valves in Insulated Piping: (shall be provided with 2” stem extensions and the following)

1. Gate Valves shall be provided with rising stem

2. Ball Valves shall be provided with an extended operating handle of non-thermal-conductive material and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

3. Butterfly Valves shall be provided with extended neck

PART 2 – PRODUCTS

2.1 BALL VALVES

A. Bronze Ball Valve: Valve shall conform to standard MSS SP-110. Body design shall be two piece, bronze with threaded ends, stainless steel ball and stem, Teflon seats and full porting.

END OF SECTION 230523

SECTION 230529 – HANGERS AND SUPPORTS

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic restraint hangers and supports for piping and equipment. Obtain approval from authorities having jurisdiction where required by local requirements.

1.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers, supports, clamps and attachments to support piping properly from building structure. Do not attached to ceilings, equipment, ductwork, conduit or other non-structural elements such as floor or roof decking.

B. Hangers, supports, clamps and attachments shall comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible. Install supports with maximum spacing specified within Division 23 piping sections. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe as specified above for individual pipe hangers.

C. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length specified in Division 23 piping sections. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping as specified in Division 23 piping sections. Install concrete inserts before concrete is placed; fasten insert to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through openings at top of inserts.

D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Provide two nuts on threaded supports to securely fasten the support.

E. Field fabricated heavy duty steel trapeze supports shall be fabricated from steel shapes selected for loads required. Weld steel in accordance with AWS D-1.1.

F. Install appropriate types of hangers and supports to allow control 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 hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

H. Install hangers to provide indicated pipe slopes and so that maximum deflection of piping allowed by ASME B31.9 is not exceeded.

I. Insulated piping:

1. Riser Clamps: Attach riser clamps, including spacers, to piping with riser clamps projecting through insulation. Do not exceed pipe stresses allowed by ASME B31.9. Do not use riser clamps to support horizontal, insulated piping. Seal insulation for hot piping and protect vapor barrier for cold piping as specified in Division 23 “HVAC Insulation”.

2. Insulation protection shield: Install insulation protection shield and high density insulation, sized for the insulation thickness used as specified in insulation schedule. Install a minimum 8" long section at each support point, top and bottom halves or the pipe of same thickness of insulation used.

J. Pre-engineered Support Strut Systems: Channel strut systems can be used at the Contractors option in lieu of individual hangers for horizontal pipes. Space channel strut systems at the required distance for the smallest pipe supported. Provide channel gauge and hanger rods per the manufacturer's recommendations for the piping supported. Where strut systems are attached to walls, install anchor bolts per manufacturer's recommendations.

1. Uninsulated copper pipe: Install with plastic galvanic isolators.

2. Insulated Tube or Pipe: Install with 360 degree insulation protection shields or pre-engineered thermal hanger shield inserts.

1.3 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ASME B 31.9 and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchors by welding steel shapes, plates and bars to piping and to structure. Comply with ASME B 31.9 and with AWS Standards D1.1.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to control movement to compensators.

D. Anchor spacing: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

1.4 INSTALLATION OF PIPE ALIGNMENT GUIDES

A. Install pipe alignment guides on piping that adjoins expansion joints as required by expansion joint manufacturer and elsewhere as indicated on plans and specification sections to eliminate binding and torsional stress on piping systems. Where not otherwise indicated, install guides as required by ASME B 31.9. Anchor guides to building substrate.

1.5 EQUIPMENT SUPPORTS

A. Fabricate structural steel supports to suspend equipment from structure above or support equipment from floor. Place grout under supports for piping and equipment.

1.6 INSTALLATION OF VIBRATION ISOLATORS

A. Mount mechanical equipment on vibration isolators as specified. Isolator manufacturer shall supply all unit isolators, complete rails, fan and motor bases as required, except for isolation system supplied for equipment by equipment manufacturer

B. Wherever rotational speed is the disturbing frequency (i.e. fans and pump impellers) the lowest such speed in the system shall be used. Isolation devices shall be selected for uniform deflections accounting for distribution of equipment weight.

C. Piping runs connected to equipment requiring vibration isolation shall be isolated from building structure at connection to equipment using isolators inserted in supporting piping rods.

D. Contractor shall have option to use isolation equipment custom designed by equipment manufacturer provided that the proposed equipment meets or exceeds all standards outlines in this specification.

1.7 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Clean all welds and touch up paint to match factory finish of all materials or color and finish of adjacent materials when supports and adjacent elements are painted.

C. Adjust vibration isolators after piping system is at operating weight.

D. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

E. Adjust active height of spring isolators and adjust restraints to permit free movement of equipment within normal mode of operation.

PART 2 – PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

A. Comply with MSS SP-58 types 1-58 factory fabricated components. Hangers shall be pre-galvanized or hot dipped. Where non-metallic coatings area indicated provide plastic coating, jacket or liner.

B. Where hangers are installed in a corrosive environment or outdoors, hangers and supports shall be type 304 stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Trapeze hangers shall comply with MSS SP-69 and shall be type 59 shop or field fabricated pipe support assembly made from structural steel shapes with MSS SP-58 hanger rods, nuts, saddles and U-bolts.

2.3 THERMAL HANGER SHIELD INSERTS

A. Inserts shall have 100 PSI minimum compressive strength and shall be encased in sheet metal shield.

B. For trapeze and clamped systems, insert and shield shall cover entire circumference of pipe.

C. For clevis hangers, insert and shield shall cover lower 180 degrees of pipe.

D. Insert length shall extend 2” beyond sheet metal shield for piping operating below ambient air temperature.

2.4 EQUIPMENT SUPPORTS

A. Provide welded, shop or field fabricated equipment supports made from structural steel shapes.

2.5 ROOF EQUIPMENT RAILS

A. Rooftop equipment rails shall be constructed with 18 gauge galvanized steel unitized construction with an integral base plate, continuous welded corner seams, pressure treated wood nailer, counterflashing and screws. Rails shall be internally reinforced as required to support equipment loading. Rails shall be furnished with height as required to support equipment a minimum of 8” above top of finished roof elevation.

2.6 PIPE STANDS

A. Pipe stands shall be shop or field fabricated assemblies made of manufactured corrosion resistant components to support roof mounted piping. Provide one piece plastic unit with

integral rod roller, pipe clamps or V-Shaped cradle to support pipe. Pipe stand shall be suitable for roof installation without membrane protection.

2.7 VIBRATION ISOLATORS

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

B. Mounts: Mounts shall be double deflection type with molded oil resistant rubber, hermetically sealed compressed fiberglass or neoprene isolator elements with factory drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Identify capacity range by color coding or other means.

C. Free Standing Spring Isolators: Free standing spring isolators shall be laterally stable, open spring isolators. Outside diameter shall be not less than 80 percent of the compressed height of the spring at rated load. Minimum additional travel shall be 50 percent of the required deflection at rated load. Isolators shall be capable of supporting 200 percent of the rated load, fully compressed without deformation or failure. Provide factory drilled baseplates and top plates for bolting to equipment and structure.

D. Housed Spring Mounts: Housed spring isolators shall be equipped with ductile iron or steel housing. Mounts shall be equipped with vertically adjustable snubbers allowing 1/4" travel up or down before contacting a resilient collar. Base and top shall have factory drilled holes for bolting to equipment and structure.

E. Elastomeric Hangers: Elastomeric Hangers shall be single or double deflection type fitted with molded, oil resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Identify capacity range by color coding or other means.

F. Spring Hangers: Spring hangers shall be combination coil-spring and elastomeric insert hanger with spring and insert in compression. Frame shall be steel and shall be fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency. Outside spring diameter shall be not less than 80 percent of the compressed height of the spring at rated load. Hanger shall be capable of supporting 200 percent of the rated load, fully compressed, without deformation or failure and shall be equipped with self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

G. Steel Equipment Base: Equipment Base isolators shall be constructed of factory fabricated welded structural steel. Bases shall have shape to accommodate supported equipment. Support brackets shall be factory welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support. Bases shall use steel shapes, plates, and bars complying with ASTM A 32/A 36M.

END OF SECTION 230529

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 VALVE IDENTIFICATION

A. Provide valve tag on every valve, cock and control devices in each piping system. Exclude check valves, valves within factory fabricated equipment units, HVAC terminal devices and similar rough-in connections of end-use fixtures and units.

B. List each tagged valve in valve schedule for each piping system. And provide valve schedule to owner in operations and maintenance manuals.

1.2 MECHANICAL EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
2. Meters, gauges, thermometers and similar units.
3. Fuel burning units including boilers, furnaces, heaters, stills and absorbtion units.
4. Pumps, compressors, chillers, condensers and similar motor driven units.
5. Heat exchangers, coils, evaporators, cooling towers, heat recovery units and similar equipment.
6. Fans, blowers, primary balancing dampers mixing boxes and air terminal units.
7. Packaged HVAC units.
8. Duct heaters and terminal heating and cooling units.
9. Tanks and pressure vessels.
10. Strainers, filters, humidifiers, water treatment systems and similar equipment.

B. Where lettering larger than 1” height is needed for proper identification because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved sign at contractor’s option.

C. Lettering shall be minimum 1/4” high where viewing distance is less than 2’-0”; 1/2” high for distances up to 6’-0” and proportionately larger for greater distances. Secondary lettering shall be 2/3 to 3/4 of size of the principal lettering.

1.3 PIPING IDENTIFICATION

A. Install pipe markers on each piping system and include arrows to show normal direction of flow.

B. Install pipe markers where piping is exposed to view, concealed by only a removable ceiling system, installed in machine rooms, installed in accessible maintenance spaces and exterior non-concealed locations.

1. Within 5 feet of each valve and control device.

2. Within 5 feet of each branch, excluding take-offs less than 25 feet in length for fixtures or terminal heating and cooling units; mark flow direction of each pipe at branch connection.
3. Within 5 feet where pipes pass through walls, floors or ceilings or enter non-accessible enclosures. Provide identification on each side of wall, floor or ceiling.
4. At access doors, manholes and similar access points which permit view of concealed piping.
5. Within 5 feet of major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing or 50' along each piping run. Spacing shall be reduced to 25' in congested areas of piping and equipment where there are more than two piping systems or pieces of equipment.

PART 2 – PRODUCTS

2.1 ENGRAVED LAMINATE SIGN

A. Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thickness indicated, engraved with the engravers standard letter style of the sizes and wording indicated. Signs shall be black with white core except as otherwise noted and shall be punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness shall be 1/16" for units up to 20 square inches or 8" in length and 1/8" for larger units.

C. Signs shall be fastened with self-tapping stainless steel screws, except contact type permanent adhesive where screws cannot or should not penetrate the substrate.

2.2 PLASTIC VALVE TAGS

A. Provide manufacturer's standard solid plastic valve tags with printed enamel lettering with system abbreviation in approximately 3/16" high letters and sequenced valve numbers approximately 3/8" high and with 5/32" hole for fastener

B. Tags shall be 1-1/8" square white tags with black lettering.

2.3 PAINTED IDENTIFICATION

A. Painting where allowed shall be performed using standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications. Minimum letter height shall be 1.25" high for ductwork and equipment and 0.75" high for access door signs and similar operational instructions.

B. Paint shall be exterior type, oil based, black paint.

2.4 PLASTIC TAPE PIPE MARKERS

A. Provide manufacturer's standard color-coded pressure sensitive vinyl tame not less than 3 mils thick.

B. Tape width shall be 1.5" for pipes less than 6" in diameter and 2.5" wide for larger pipes.

C. Colors shall comply with ANSI A13.1 except where noted otherwise.

D. Lettering shall be manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by A/E in cases of variance with names shown or specified. Abbreviate system names only as necessary for each application length.

E. Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering or as a separate unit of plastic.

END OF SECTION 230553

SECTION 230593 – TESTING AND BALANCING

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 QUALITY ASSURANCE

A. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. The independent testing, adjusting, and balancing agency shall be certified by National Environmental Balancing Bureau (NEBB) or the Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project. The project shall be staffed at all times by qualified personnel.

C. Balance water systems to +/- 5 percent of specified airflow.

1.2 PROJECT CONDITIONS

A. Testing and Balancing is limited to:

1. Alternate 1: The water flow in the boiler.
2. Alternate 2: The overall airflow of the multizone units.

B. Systems shall be fully operational prior to beginning procedures.

1.3 SEQUENCE AND SCHEDULING

A. Test, adjust and balance the air systems before hydronic, and refrigerant systems.

1.4 PRELIMINARY PROCEDURES

A. In the event that the test and balance contractor is independently contracted with the owner, the division 23 contractor shall assist the test and balance contractor in performing all of these procedures. No extras shall be paid for additional labor or materials required to perform these procedures. Test and balance contractor shall in all cases ensure that these procedures are met to a satisfactory level to perform his work.

B. Before operating the air system, perform these steps:

1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
2. Obtain copies of approved shop drawings of air handling equipment, supply, return and exhaust outlets, and temperature control diagrams.
3. Compare design to installed equipment and field installations.
4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
5. Check filters for cleanliness.
6. Check volume and fire dampers for correct and locked position and temperature control system for complete installation before starting fans.
7. Verify volume dampers are installed at locations needed for balancing the air systems.

8. Prepare test report sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
9. Determine best locations in main and branch ductwork for most accurate duct traverses.
10. Place outlet dampers in the full open position.
11. Lubricate all motors and bearings.
12. Check fan belt tension
13. Check fan rotation.

C. Before operating the hydronic system, perform these steps:

1. Open valves to full open position. Close coil bypass valves.
2. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices and balancing valves and fittings are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
3. Remove and clean all strainers
4. Examine hydronic systems and determine if water has been treated and cleaned.
5. Check pump rotation
6. Clean and set automatic fill valves for required system pressure.
7. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.
8. Check air vents at high points of systems and determine if all are installed and operating freely or to bleed air completely.
9. Set temperature controls so all coils are calling for full flow.
10. Check operation of automatic bypass valves.
11. Check and set operating temperatures of chillers to design requirements.
12. Lubricate all motors and bearings.

1.5 PERFORMING TESTING AND BALANCING

A. Perform testing and balancing procedures on each system identified in accordance with the detailed procedures outlined in the referenced standard.

B. Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary to allow adequate adjustment performance of procedures.

C. Patch insulation, ductwork and housings using materials identical to those being removed.

D. Seal ducts and piping and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers and similar controls and devices to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Energize motors, verify proper operation of motor, drive system and wheel/impeller. Adjust to indicated RPM. Replace motor pulley or impeller as required to achieve design conditions.

H. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

1.6 REPORTS

A. Reports shall be submitted on standard AABC or NEBB forms.

B. Reports shall include Initial, Design and Final readings of the following parameters:

1. Fan Airflow
2. Outside Airflow
3. External Static Pressure (Supply, Return and Exhaust)
4. Total Static Pressure
5. Motor Amps (Each Phase)
6. Motor Volts (Each Phase)
7. Fan Speed Setting
8. Motor Sheave Diameter/Bore
9. Sheave Centerline Distance
10. Belt Quantity, Make and Size
11. Fan Sheave Make
12. Fan Sheave Diameter/Bore
13. Fan RPM
14. Motor HP
15. Motor RPM
16. Discharge Air Temperature from each Multizone Air Handler.
17. Discharge Air Relative Humidity from each Multizone Air Handler.
18. Outside Air Temperature at Time of Test
19. Outside Air Humidity at Time of Test
20. Pump RPM
21. Pump Flow Rates
22. Equipment Water Flow Rates
23. Pump Inlet and outlet Pressures
24. Total Pump Head
25. Water temperatures in all piping systems.

END OF SECTION 230593

SECTION 230701 – HVAC PIPING INSULATION

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 GENERAL

A. Provide necessary materials and accessories for installation of insulation for plumbing and mechanical systems as specified and/or detailed on drawings. Insulation type, jacket, and thickness for specific piping systems or equipment shall be as listed in this specification section.

B. Products or their shipping cartons shall bear label indicating their flame and smoke ratings. Treatments of jackets or facings for impart flame and smoke safety shall be permanent. Use of water soluble treatments such as corn paste or wheat paste is prohibited. This does not exclude approved lagging adhesives.

C. Install insulation over clean dry surfaces with joints firmly butted together. Insulation at equipment, flanges, fittings, etc. shall have straight edges with box type joints with corner beads as required. Where plumbing and heating insulation terminates at equipment or unions, taper insulation at 30 degree angle to pipe with one coat finishing cement and finish same as fittings. Total insulation system shall have neat smooth appearance with no wrinkles, or folds in jackets, joint strips, or fitting covers. Seal butt joints at maximum intervals of 45 feet to prevent vapor barrier failures from being transmitted to adjoining insulations sections.

D. Undamaged insulation systems on cold surface piping and equipment shall perform their intended functions as vapor barriers and thermal insulation without premature deterioration or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.

E. Products shall not contain asbestos, lead, mercury or mercury compounds.

1.2 QUALITY ASSURANCE

A. Flame/Smoke Ratings: Provide composite Plumbing insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1. Exception: Outdoor Piping insulation may have flame spread index of 75 and smoke developed index of 150.

B. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

C. Insulation installer shall advise contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

1.3 INSULATION INSTALLATION REQUIREMENTS

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps.

C. All pipe clamps and other support fittings shall be insulated.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on cold pipe insulation, and protect insulation with shields to prevent puncture or other damage. Provide high density insulation of material as specified herein and of length equivalent to pipe shield. Provide pipe hangers sized for the pipe outside diameter plus insulation thickness. Seal butt joint between insulation and high density insulation with wet coat of vapor barrier lap cement.

1. Exception for vertical piping: Provide clamps sized for the outside diameter of the vertical pipe and extend clamp through insulation. Seal penetrations of insulation and vapor barrier with wet coat of vapor barrier lap cement.

F. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers,

valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

G. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

H. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

I. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

J. Exterior Piping Protection:

1. Piping less than 1.5” nominal outside diameter: Provide an aluminum jacket over all exterior piping insulation. UV paint is not required.

2. Piping 1.5” nominal outside diameter and greater: Provide an aluminum jacket over all exterior piping insulation. UV paint is not required.

1.4 EQUIPMENT INSULATION REQUIREMENTS

A. Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

D. Do not apply insulation to equipment, breechings, or stacks while hot.

E. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

F. Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

G. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.

H. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

I. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

J. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by the manufacturer.

1.5 INSULATION APPLICATION SCHEDULE:

A.	Refrigerant Piping Suction and Return (Up to 1”)	Elastomeric	0.75” Thickness
B.	Refrigerant Piping Suction and Return (Above 1”)	Elastomeric	0.1” Thickness
C.	Condensate Drain Piping	Elastomeric	0.5” Thickness
D.	Cold Surface Equipment	Elastomeric	1” Thickness
E.	Hot Surface Equipment	Elastomeric	1” Thickness

PART 2 - PRODUCTS

2.1 ELASTOMERIC INSULATION:

A. Flexible Elastomeric insulation shall be closed-cell, sponge or expanded-rubber materials and comply with ASTM C 534, type I for tubular materials and type II for sheet products. Insulation values shall comply with energy code minimum requirements. See common work results for current code edition.

2.2 ADHESIVES AND TAPES:

A. Insulating cements and adhesives shall be compatible with the insulation materials, jackets and substrates for bonding insulation to itself and to surfaces to be insulated.

B. Mastics shall be compatible with insulation materials, jackets, and substrates and shall comply with MIL-A-24179A Type II. Vapor-barrier mastic shall be water based suitable for indoor and outdoor use on below ambient services.

C. Tapes shall be white, vapor-retarder tape matching factory-applied jacket with acrylic adhesive and shall comply with ASTM C 1136.

D. All insulation finishes shall be compatible with the insulation product being finished and shall be in a color as selected by architect.

END OF SECTION 230701

SECTION 230902 – BUILDING MANAGEMENT SYSTEM

PART 1 GENERAL

1.1 MECHANICAL GENERAL PROVISIONS

A. Existing control system is Schneider Electric by C&C Group. All new controls work shall be by C&C group. Contact Brian Schepers (BSchepers@c-cgroup.com; Mobile - 573.291.5425)

B. Control system shall be compatible with all related systems installed in the project including HVAC equipment, electrical wiring, fire alarm devices, campus LAN, Variable Frequency Drives, etc.

C. Contractor shall coordinate with other trades to install complete operational system. Costs to correct any deficiencies in other work divisions shall be included in bid, unless A/E are notified in writing prior to bid. Examples of deficiencies shall include line voltage power, HVAC equipment controllers, etc.

D. Contractor shall be qualified to install system and shall carry all factory certifications as recommended by manufacturer.

E. Control system start-up shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in controls system configuration and operation. This service shall be equipment and system count dependent and shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

1.2 CONTROL SYSTEM DESCRIPTION

A. The Building Automation System shall be an extension of the existing BACnet campus wide control system.

B. System architecture shall provide secure Web access using any of the current versions of Microsoft Edge, Mozilla Firefox, or Google Chrome browsers from any computer on the owner's LAN.

C. The Building Automation System shall be as indicated on the drawings and described in these specifications. System must be fully integrated and coordinated with mechanical equipment DDC controllers furnished and installed in the equipment manufacturer’s factory as specified in those sections. The intent of the BAS is to integrate all mechanical equipment into one system for global monitoring, control, and alarming associated with the building. It is the BAS manufacturer’s responsibility to provide all the design, engineering, and field coordination required to ensure all equipment sequence of operations are met as specified and the designated BAS operators have the capability of managing the building mechanical system to ensure occupant comfort while maintaining energy efficiency.

D. The BAS shall meet BACnet communication standards to ensure the system maintains “interoperability” to avoid proprietary arrangements that will make it difficult for the Owner to consider other BAS manufacturers in future projects. These open protocol communication standards are discussed in more detail later in this specification.

E. BMS controllers shall be listed by BACnet Testing Laboratories (BTL) with appropriate classification.

1. System controller shall be BTL listed BACnet Building Controller (B-BC)

2. Equipment Controllers shall be BTL listed BACnet Application Specific Controller (B-ASC) or BACnet Advanced Application Controller (B-AAC), as appropriate for the purpose of the controller.

F. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems and terminal devices on this project.

G. The BMS shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by the security permissions of the operator role. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the control system and have access to all appropriate data.

H. Communication between DDC controllers and all workstation(s) shall be over a high-speed network. All nodes on this network shall be peers. The operator shall not have to know the controller identifier or location to view or control a point (object). Application Specific Controllers shall be constantly scanned by the Building Controllers to update point information and alarm information globally.

1.3 CODES AND STANDARDS

A. All products of the BMS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided on request, with the submittal package. Systems or products not currently offering the following approvals are not acceptable.
   1. Federal Communications Commission (FCC), Rules and Regulations, Part 15 Class A Radio Frequency Devices.
   2. FCC, Part 15, Subpart J.
   3. UL 504 - Industrial Control Equipment.
   4. UL 916 - Energy Management Systems All.
   5. ASHRAE/ANSI 135-2012 (BACnet) - (System Level Devices) - Building Controllers shall conform to the listed version of the BACnet specification in order to improve interoperability with various building system manufacturers' control systems and devices.

1.4 QUALITY ASSURANCE

A. The manufacturer of the BMS digital controllers shall, if requested, provide documentation supporting compliance with the current applicable ISO 9000 series standard.

B. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in the production and installation of HVAC control systems.

Products shall be manufacturer's latest standard design and have been tested and proven in actual use.

1.5 SOFTWARE OWNERSHP

A. The owner shall have full ownership and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BMS. No subscription fees shall be required for access to logged data or remote adjustment of setpoints and schedules.

B. Project specific software and documentation shall become the owner’s property upon project completion. This includes the following:

1. Operator Graphic files
2. As-built hardware design drawings
3. Operating & Maintenance Manuals
4. BAS System software database
5. Controller application programming databases
6. Application Specific Controller configuration files
7. Required Licensed software

1.6 SUBMITTALS

A. BMS manufacturer shall provide shop drawings and manufacturers’ standard specification data sheets on all hardware and software being provided for this project. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications.

B. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review shall not relieve the BAS manufacturer of furnishing quantities required based upon contract documents.

C. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with the specifications or which is deemed valuable in documenting and understanding the system to be installed.

D. Provide all manufacturers’ technical cut sheets for major system components. When technical cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means.

E. Provide proposed Building Automation System architectural diagram depicting various controller types, workstations, device locations, addresses, and communication cable requirements

F. Provide points list showing all system objects and the proposed English language object names.

G. Provide a sequence of operation for each controlled mechanical system and terminal end devices.

H. Provide a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet system level device (i.e. Building Controller & Operator Workstations) type. This defines the points list for proper coordination of interoperability with other building systems if applicable for this project.

I. Submit documentation of contractor qualifications, including those indicated in "Quality Assurance" if requested by the A-E.

J. Any deviations from these specifications or the work indicated on the drawings shall be clearly identified in the Submittals.

K. Project Record Drawings - These shall be as-built versions of the submittal shop drawings.

L. Testing and Commissioning Reports and Checklists signed off by trained factory (equipment manufacturers) and field (BAS) commissioning personnel.

1.7 DELIVERY, STORAGE AND HANDLING

A. Maintain integrity of shipping cartons for each piece of equipment and control device through shipping, storage and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.8 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers and structural and architectural features.

B. Protect installed products until completion of project. Touch-up, repair or replace damaged products before Substantial Completion.

1.9 SYSTEM MAINTENANCE

A. Perform Building Automation System preventative maintenance and support for a period of 1 year (beginning the date of substantial completion).

1. Make a minimum of 2 complete Building Automation System inspections, in addition to normal warranty requirements. Inspections to include:

a. System Review – Review the BAS to correct programming errors, failed points, points in alarm, and points that have been overridden manually.

b. Seasonal Control Loop Tuning – Control loops are reviewed to reflect changing seasonal conditions and / or facility heating and cooling loads.

c. Sequence of operation verification – Systems all verified to be operating as designed and in automatic operation. Scheduling and setpoints are reviewed and modified.

d. Database back-up

e. Operator coaching

2. Technician shall review critical alarm log and advise owner of additional services that may be required.

B. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of owner.

1.10 WARRANTY PERIOD SERVICES

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the BMS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the Control System Contractor at no expense to the Owner.

C. Maintenance of Computer Software Programs: The Control System Contractor shall maintain all software during the standard first year warranty period. In addition, all factory or sub-vendor upgrades to software during the first year warranty period shall be added to the systems, when they become available, at no additional cost. In addition to first year standard warranty, software provided by Control System Contractor shall come with a 3 Year Software Maintenance license. All SNC and BAS Servers are included in this coverage. Labor to implement upgrades in years two through five are not included in standard warranty.

D. Maintenance of Control Hardware: The Control System Contractor shall inspect, repair, replace, adjust, and calibrate, as required, the controllers, control devices and associated peripheral units during the warranty period. The Control System Contractor shall then furnish a report describing the status of the equipment, problem areas (if any) noticed during service work, and description of the corrective actions taken. The report shall clearly certify that all hardware is functioning correctly.

E. Service Period: Calls for service by the Owner shall be honored within 24 hours and are not to be considered as part of routine maintenance.

F. Service Documentation: A copy of the service report associated with each owner-initiated service call shall be provided to the owner.

1.11 WARRANTY ACCESS

A. The Owner shall grant to the Control System Contractor reasonable access to the BMS during the warranty period. Remote access to the BMS (for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period) will be allowed.

1.12 ONLINE HELP AND TRAINING

A. Provide an online help system to assist the operator in operation and configuration of the system. Online help shall be available for all system functions and shall provide the relevant data for each particular screen.

1.13 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:
   1. Actuator: Control device that opens or closes valve or damper in response to control signal.
   2. AI: Analog Input.
   3. AO: Analog Output.
   4. Analog: Continuously variable state over stated range of values.

5. BMS: Building Management System.
6. DDC: Direct Digital Control.
7. Discrete: Binary or digital state.
8. DI: Discrete Input.
9. DO: Discrete Output.
10. FC: Fail Closed position of control device or actuator. Device moves to closed position on loss of control signal or energy source.
11. FO: Fail open (position of control device or actuator). Device moves to open position on loss of control signal or energy source.
12. GUI: Graphical User Interface.
13. HVAC: Heating, Ventilating and Air Conditioning.
14. IDC: Interoperable Digital Controller.
15. ILC: Interoperable Lon Controller.
16. LAN: Local Area Network.
17. Modulating: Movement of a control device through an entire range of values, proportional to an infinitely variable input value.
18. Motorized: Control device with actuator.
19. NAC: Network Area Controller.
20. NC: Normally closed position of switch after control signal is removed or normally closed position of manually operated valves or dampers.
21. NO: Normally open position of switch after control signal is removed; or the open position of a controlled valve or damper after the control signal is removed; or the usual position of a manually operated valve.
22. OSS: Operating System Server, host for system graphics, alarms, trends, etc.
23. Operator: Same as actuator.
24. PC: Personal Computer.
25. Peer-to-Peer: Mode of communication between controllers in which each device connected to network has equal status and each shares its database values with all other devices connected to network.
26. P: Proportional control; control mode with continuous linear relationship between observed input signal and final controlled output element.
27. PI: Proportional-Integral control, control mode with continuous proportional output plus additional change in output based on both amount and duration of change in controller variable (reset control).
28. PICS: BACnet Product Interoperability Compliance Statement.
29. PID: Proportional-Integral-Derivative control, control mode with continuous correction of final controller output element versus input signal based on proportional error, its time history (reset) and rate at which it's changing (derivative).
30. Point: Analog or discrete instrument with addressable database value.
31. WAN: Wide Area Network.

PART 2 PRODUCTS

2.1 GENERAL SYSTEM PERFORMANCE

A. This project shall be comprised of a high-speed Ethernet network utilizing BACnet/IP communications between System Controllers and Workstations. Communications between System Controllers and sub-networks of Equipment Controllers shall be as defined herein.

B. The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, a network area controller, graphics and programming, and other

control devices for a complete system as specified herein.

C. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network.

D. Performance Standards. The BAS system shall conform to the following:

1. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 5 seconds. Analog objects shall start to adjust within 5 seconds.
2. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current within the prior 10 seconds.
3. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 10 seconds.
4. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
5. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
6. Multiple Alarm Annunciations. All workstations on the network shall receive alarms within 5 seconds of each other.
7. Reporting Accuracy. Table 1 lists minimum acceptable reporting accuracies for all values reported by the specified system.
    a. Table 1: Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C [±1°F]
Ducted Air	±1.0°C [±2°F]
Outside Air	±1.0°C [±2°F]
Water Temperature	±0.5°C [±1°F]
Delta –T	±0.15°C[±0.25°F]
Relative Humidity	±5% RH
Water Flow	±5% of full scale
Air Flow (terminal)	±10% of reading *Note 1
Air Flow (measuring stations)	±5% of reading
Air Pressure (ducts)	±25 Pa [±0.1 "W.G.]
Air Pressure (space)	±3 Pa [±0.01 "W.G.]
Water Pressure	±2% of full scale *Note 2
Electrical Power	5% of reading *Note 3
Carbon Monoxide (CO)	± 50 PPM
Carbon Dioxide (CO2)	± 50 PPM

Note 1: (10%-100% of scale) (cannot read accurately below 10%)

Note 2: for both absolute and differential pressure

Note 3: * not including utility supplied meters

2.2 SYSTEM SECURITY

A. User Profiles shall restrict the user to only the objects, applications, and system functions as assigned by the system administrator.

B. The system shall include pre-defined “roles” that allow a system administrator to quickly assign permissions to a user.

C. User logon/logoff attempts shall be recorded.

D. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.

E. The system shall support Active Directory for user set-up and management

F. The system shall track and record all user log-in activity and all changes done at the enterprise level including who made the change, when, what was changed, pervious value and new value.

2.3 SYSTEM NETWORK CONTROLLER (SNC)

A. Each System Controller shall perform communications to a network of Equipment Controllers using BACnet IP/MSTP (RS485) as defined by the BACnet standard.

B. These controllers are designed to manage communications between the programmable equipment controllers (PEC), advanced unitary controllers (AUC), and central controllers (CC) which are connected to its communications trunks, manage communications between itself and other system network controllers (SNC) and with any operator workstations (OWS) that are part of the BAS, and perform control and operating strategies for the system based on information from any controller connected to the BAS.

C. The controllers must be fully programmable to meet the unique requirements of the facility it must control.

D. The controllers must be capable of peer-to-peer communications with other SNC's and with any OWS connected to the BAS, whether the OWS is directly connected, connected via modem or connected via the Internet.

E. The communication protocols utilized for peer-to-peer communications between SNC's will be BACnet IP/MSTP. Use of a proprietary communication protocol for peer-to-peer communications between SNC's is not allowed.

F. The SNC shall be capable of executing application control programs to provide:

1. Calendar functions
2. Scheduling
3. Trending
4. Alarm monitoring and routing
5. Time synchronization
6. Network management functions for all SNC and PEC based devices

G. The SNC must provide the following hardware features as a minimum:

1. One Ethernet Port-10/100 Mdps
2. One RS-232/485 port
3. Battery Backup
4. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain at least 1 gigabyte storage capacity)
5. Network connection to all HVAC equipment so that all input and output points used by HVAC equipment and specified on plans are communicated to/from SNC.
6. Power Supply - 120V with NEMA 5-20P or NEMA 5-15P cord and plug, or 24 VAC/DC.
7. USB drive

H. The SNC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.

I. The SNC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.

J. The SNC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via wide-area network.

2.4 PROGRAMMABLE EQUIPMENT CONTROLLER (PEC)

A. All PECs shall be application programmable and shall at all times maintain their certification.

All control sequences within or programmed into the PEC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.

B. The PEC shall provide LED indication of communication and controller performance to the technician, without cover removal.

C. For ease of troubleshooting, the controller shall support BACnet data trend logging.

D. To meet the sequence of operation for each application, the Controller shall use library programs provided by the controller manufacturer that are either factory loaded or downloaded with service tool to the Controller.

E. Each PEC shall have expansion ability to support additional I/O requirements through the use of remote input/output modules.

F. PEC Controllers shall support at minimum the following control techniques:
1. General-purpose control loops that can incorporate Demand Limit Control strategies, Set point reset, adaptive intelligent recovery, and time of day bypass.
2. General-purpose, non-linear control loops.
3. Start/stop Loops.
4. If/Then/Else logic loops.
5. Math Function loops (MIN, MAX, AVG, SUM, SUB, SQRT, MUL, DIV, ENTHALPY).

G. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.

1. Operating conditions:

a. Temperature: -40°F to 158°F (-40°C to 70°C)

b. Relative Humidity: 5% to 100% RH (non-condensing)

2. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.

3. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° F to 158° F [-40° C to 70° C].

H. Input/Output: The Controller shall have on board or through expansion module all I/O capable of performing all functionality needed for the application. Controls provided by the equipment manufacture must supply the required I/O for the equipment. In addition other controls must meet the following requirements:

1. Shall support flexibility in valve type, the controllers shall be capable of supporting the following valve control types: 0-10VDC, 0-5VDC, 4-20mA, 24VAC - 2 position.

2. Shall support flexibility in sensor type, the Controller shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, 50ms or longer pulses, 200 to 20Kohm and RTD input.

3. Shall support flexibility in sensor type, all Analog Outputs shall have the additional capability of being programmed to operate as Universal Inputs or Pulse Width Modulation Outputs.

4. Shall support flexibility in sensor type, the Controller and/or expansion modules shall support dry and wetted (24VAC) binary inputs.

5. The controller shall support pulse accumulator for connecting devices like energy meters.

6. In order to support a wide range of devices, the Controller's binary output shall be able to drive at least 10VA each.

7. For future needs, any unused I/O that is not needed for the functionality of the equipment shall be available to be used by custom programs on the Controller and by any other controller on the network.

8. The Controller shall provide 24VAC and 24VDC power terminals sensors and other devices required.

9. The Controller shall provide a dedicated static pressure input.

I. Serviceability: The Controller shall provide the following in order to improve serviceability of the Controller.

1. Diagnostic LEDs for power/normal operation/status, BACnet communications, sensor bus communications, and binary outputs. All wiring connections shall be clearly labeled and made to be field removable.

2. Binary and analog inputs and outputs shall use removable connectors or be connected to terminal strip external to the control box.

3. Software service tool connection through all of the following methods: direct cable connection to the Controller, connection through another controller on BACnet link and through the Controller's zone sensor.

4. For safety purposes, the controller shall be capable of being powered by a portable computer's USB port for the purposes of configuration, programming and testing programs so that this work can be accomplished with the power off to the associated equipment.

5. The Controller software tool service port shall utilize standard off-the-shelf USB printer cable.

6. Capabilities to temporarily override the BACnet point values with built-in time expiration in the Controller.

7. To aid in service replacement, the Controller shall easily attached to standard DIN rail mounting.

8. For future expansion, the Controller shall be capable of adding sequence of operation programming utilizing service tools software with a graphical programming interface (editing or programming in line code is not permissible).

9. To aid in service replacement, the Controller shall allow for setting its BACnet address via controller mounted rotary switches that correspond to the numerical value of the address. (DIP switch methodologies are not allowed). Setting of the address shall be accomplished without the need of a service tool or power applied to the controller.

10. Controller data shall be maintained through a power failure.

J. Software Retention: All Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.

2.5 OTHER CONTROL SYSTEM HARDWARE

A. Control damper actuators shall be furnished by the Control System Contractor. Two-position or proportional electric actuators shall be direct-mount type sized to provide a minimum of 5 in-lb torque per square foot of damper area. Damper actuators shall be spring return type. Operators shall be heavy-duty electronic type for positioning automatic dampers in response to a control signal. Motor shall be of sufficient size to operate damper positively and smoothly to obtain correct sequence as indicated. All applications requiring proportional operation shall utilize truly proportional electric actuators. Damper actuators shall be Belimo

B. Wall Mount Room Temperature sensors: Each room temperature sensor shall provide temperature indication to the digital controller, provide the capability for a software-limited occupant set point adjustment (warmer-cooler slider bar or switch) and limited operation override capability. Room Temperature Sensors shall be 20,000-ohm thermistor type with a temperature range of -40 to 140 degrees F (-38 to 60 degrees C). The sensor shall be complete with a decorative cover and suitable for mounting over a standard electrical utility box. These devices shall have an accuracy of 0.5 degrees F (.024 degrees C) over the entire range.

C. Duct-mounted and Outside Air Temperature Sensors: 20,000-ohm thermistor temperature sensors with an accuracy of +/- 0.2 degrees C. Outside air sensors shall include an integral sun shield. Duct-mounted sensors shall have an insertion measuring probe of a length appropriate for the duct size, with a temperature range of -40 to 160 degrees F(-38 to 71 degrees C) The sensor shall include a utility box and a gasket to prevent air leakage and vibration noise. For all mixed air and preheat air applications, install bendable averaging duct sensors with a minimum 8 feet (2438 mm) long sensor element. These devices shall have accuracy of 0.5 degrees F (.024 degrees C) over the entire range.

D. Humidity sensors shall be thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%) at 0 to 90% RH, 12 - 30 VDC input voltage, analog output (0 - 10 VDC or 4 - 20mA output). Operating range shall be 0 to 100% RH and 32 to 140 degrees F (0 to 60 degrees C). Sensors shall be selected for wall, duct or outdoor type installation as appropriate. Honeywell is basis of design.

E. Carbon Dioxide Sensors (CO2): Sensors shall utilize Non-dispersive infrared technology (N.D.I.R.), repeatable to plus or minus 20 PPM. Sensor range shall be 0 - 2000 PPM. Accuracy shall be plus or minus five percent (5%) or 75 PPM, whichever is greater. Response shall be less than one minute. Input voltage shall be 20 to 30 VAC or DC. Output shall be 0 - 10 VDC. Sensor shall be wall or duct mounted type, as appropriate for the application, housed in a high impact plastic enclosure.

F. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.

G. Differential Analog (duct) Static Pressure Transmitters Provide a pressure transmitter with integral capacitance type sensing and solid-state circuitry. Accuracy shall be plus or minus 1% of full range; range shall be selected for the specific application. Provide zero and span adjustment capability. Device shall have integral static pickup tube.

H. Differential Air Pressure Switches: Provide SPDT type, UL-approved, and selected for the appropriate operating range where applied. Switches shall have adjustable set points and barbed

pressure tips.

I. Water Flow Switches: Provide a SPST type contact switch with bronze paddle blade, sized for the actual pipe size at the location. If installed outdoors, provide a NEMA-4 enclosure. Flow switch shall be UL listed.

J. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. All electrical devices within a control panel shall be factory wired. Control panel shall be assembled by the BMS in a UL-Certified 508A panel shop. A complete set of ' as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

K. Pipe and Duct Temperature sensing elements: 20,000-ohm thermistor temperature sensors with and accuracy of +/- 1% accuracy. Their range shall be -5 to 250 degrees F (-20 to 121 degrees C). Limited range sensors shall be acceptable provided they are capable of sensing the range expected for the point at the specified accuracy. Thermal wells with heat conductive gel shall be included.

L. Relays: Start/stop relay model shall provide either momentary or maintained switching action as appropriate for the motor being started. All relays shall be plugged in, interchangeable, mounted on a sub base and wired to numbered terminals strips. Relays installed in panels shall all be DPDT with indicating lamp. Relays installed outside of controlled devices shall be enclosed in a NEMA enclosure suitable for the location. Relays shall be labeled with UR symbol. RIB-style relays are acceptable for remote enable/disable.

M. Emergency Stop Switches: Provide toggle-type switch with normally-closed contact. Switch shall be labeled "AIR HANDLER EMERGENCY SHUTOFF, NORMAL - OFF.".

N. Transducers: Differential pressure transducers shall be electronic with a 4-20 mA output signal compatible to the Direct Digital Controller. Wetted parts shall be stainless steel. Unit shall be designed to operate in the pressure ranges involved.

O. Control Power Transformers: Provide step-down transformers for all DDC controllers and devices as required. Transformers shall be sized for the load, but shall be sized for 50 watts, minimum. Transformers shall be UL listed Class 2 type, for 120 VAC/24 VAC operation.

P. Line voltage protection: All DDC system control panels that are powered by 120 VAC circuits shall be provided with surge protection. This protection is in addition to any internal protection provided by the manufacturer. The protection shall meet UL, ULC 1449, IEEE C62.41B. A grounding conductor, (minimum 12 AWG), shall be brought to each control panel.

PART 3 EXECUTION

3.1 GENERAL

A. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

B. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Control System Contractor in accordance with these specifications.

C. Equipment furnished by the Mechanical Contractor that is normally wired before installation

shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Control System Contractor.

D. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.2 INSTALLATION REQUIREMENTS

A. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

B. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Control System Contractor in accordance with these specifications.

C. Equipment furnished by the Mechanical Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Control System Contractor.

D. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.3 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

3.4 WIRING

A. All electrical control wiring to the control panels shall be the responsibility of the Control System Contractor.

B. All wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local codes. All control wiring shall be installed in raceways.

C. Excess wire shall not be looped or coiled in the controller cabinet.

D. Incorporate electrical noise suppression techniques in relay control circuits.

E. There shall be no drilling on the controller cabinet after the controls are mounted inside.

F. Careful stripping of wire while inside the cabinet is required to ensure that no wire strand fragments land on circuit boards.

G. Use manufacturer-specified wire for all network connections.

H. Use approved optical isolation and lightning protection when penetrating building envelope.

I. Read installation instructions carefully. Any unavoidable deviations shall be approved by owner's rep prior to installation.

3.5 ACCEPTANCE TESTING

A. Upon completion of the installation, the Control System Contractor shall load all system software and start-up the system. The Control System Contractor shall perform all necessary

calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.

B. The Control System Contractor shall perform tests to verify proper performance of components, routines and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

C. System Acceptance: Satisfactory completion is when the Control System Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.6 OPERATOR TRAINING

A. During system commissioning and at such time acceptable performance of the Control System hardware and software has been established, the Control System Contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.

B. The Control System Contractor shall provide comprehensive training for system orientation, product maintenance and troubleshooting, programming and engineering.

C. The Control System Contractor shall provide instruction to the owner's designated personnel on the operation of the BMS and describe its intended use with respect to the programmed functions specified. Operator orientation of the BMS shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.

3.7 OPERATION & MAINTENANCE MANUALS

A. See Division 1 for requirements. O&M manuals shall include the following elements, as a minimum:
   1. As-built control drawings for all equipment.
   2. As-built Network Communications Diagram.
   3. General description and specifications for all components.
   4. Completed Performance Verification sheets.
   5. Completed Controller Checkout/Calibration Sheets.
   6. Preventative Maintenance and Calibration procedures, hardware troubleshooting, and hardware repair/replacement procedures.
   7. Recommended preventative maintenance procedures including a schedule of tasks and task descriptions.
   8. Licenses, Guarantee, and Warranty documents for all equipment and systems.

END OF SECTION 230913

SECTION 232113 – HVAC PIPING AND SPECIALTIES

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 PIPING INSTALLATIONS

A. Provide piping material for use as listed in piping materials schedule shown on plans.

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 services

F. Install piping free from sags and bends

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install groups of pipes parallel to each other spaced to permit application of insulation and servicing of valves.

K. Install drains, consisting of a tee fitting, NPS 0.75” ball valve and short NPS 0.75” threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

L. Install piping at uniform grade of 0.2 percent upward in direction of flow.

M. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

N. Install branch connections to mains using mechanically formed tee fittings in main pipe with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

O. Install unions in piping 2” and smaller, adjacent to valves, at final connections of equipment and at other locations noted on plans.

P. Install flanges in piping 2.5” and larger at final connections of equipment and elsewhere as indicated

Q. Install strainers on inlet side of each control valve, pressure reducing valve, solenoid valve, in-line pump and at other locations noted on plans. Install 0.75” nipple and ball valve in blowdown connection of strainers 2” and larger. Match size of strainer blowoff connection for strainers smaller than 2”.

R. Identify piping as specified in Division 23 Section “Identification for HVAC Piping and Equipment”.

1.2 HANGERS AND SUPPORTS

A. Copper and Steel Pipe hangers shall be installed with the following maximum spacing and minimum rod sizes.

1. 0.75” Pipe - Max Span 5’ - Minimum Rod Size 3/8”
2. 1” Pipe - Max Span 6’ - Minimum Rod Size 3/8”
3. 1.25” Pipe - Max Span 7’ - Minimum Rod Size 3/8”
4. 1.5” Pipe - Max Span 8’ - Minimum Rod Size 3/8”
5. 2” Pipe - Max Span 8’ - Minimum Rod Size 3/8”
6. 2.5” Pipe - Max Span 9’ - Minimum Rod Size 1/2”
7. 3” Pipe - Max Span 10’ - Minimum Rod Size 1/2”
8. 4” Pipe - Max Span 14’ - Minimum Rod Size 5/8”

B. Plastic piping hangers shall be spaced according to pipe manufacturer’s written instructions for service conditions. Avoid point loading and space and install hangers with the fewest practical rigid anchor points.

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

1.3 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt and debris from inside and outside of pipe and fittings before assembly.

C. Soldered joints: Apply ASTM B813 water-flushable flux to tube end unless otherwise indicated. Construct joints according to ASTM B 828 or CDA’s “Copper Tube Handbook.” Using lead free solder allow complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS’s “Brazing Handbook”, “Pipe and Tube” Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full interior diameter. Join pipe fittings as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Do not used pipe of pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to ASW D10.12/D10.12M, using qualified processes and welding operators according to specified quality assurance requirements.

G. Flanged Joints: Select appropriate gasket material, size, type and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following.

1. Comply with ASTM F402 for safe handling practice of cleaners, primers and solvent cements.
2. CPVC piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule 40, 80 and 120 according to ASTM D 2672. Join other-than-schedule number 40, 80 and 120 PVC pipe and socket fittings according to ASTM D 2855.

4. 4. PVC Non-pressure Piping: Join according to ASTM D 2855.

I. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions

1.4 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gauges and thermometers at coil inlet as outlet connections.

1.5 PIPE EXPANSION

A. Provide expansion joints, expansion loops, anchors and guides as required for proper control of expansion and contraction of piping. Piping from mains to equipment branches and risers shall be provided with swing, swivel joints or offsets to relieve stresses due to expansion or contraction of piping.

B. Provide pipe loops as shown on drawings or specified. Where pipe loop dimensions are not shown on plans they shall be as recommended by pipe manufacturer based on thermal expansion.

C. Expansion Joints Specified below shall comply with the following:

1. Install expansion joints of sizes matching sizes of piping in which they are installed

2. Install packed type expansion joints with packing suitable for fluid service

3. Install metal bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturer's Association, Inc."

4. Install rubber packless joints according to FSA-NMEJ-702.

5. Install grooved joint expansion joints to grooved-end steel piping.

D. Expansion loops shall comply with the following:

1. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

E. Alignment guide anchors specified below shall comply with the following:

1. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

2. Install two guides on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

3. Install anchors at locations required to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of location and stresses to connected equipment.

1.6 REFRIGERANT SPECIFIC SYSTEM INSTALLATION REQUIREMENTS

A. Charge the system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.

2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.

3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 PSI.
4. Charge system with a new filter dryer core in charging line.

B. Refrigerant system Adjustment:

1. Adjust the thermostatic expansion valve to obtain proper evaporator superheat.
2. Adjust high and low pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
3. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions.
    a. Open shutoff valves in condenser water circuit.
    b. Verify that compressor oil level is correct.
    c. Open compressor suction and discharge valves.
    d. Open refrigerant valves except bypass valves that are used for other purposes.
    e. Check open compressor-motor alignment and verify lubrication for motors and bearings.
4. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

1.7 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

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

B. Perform the following tests on all piping:

1. Hydrostatic Test:
    a. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
    b. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
    c. Isolate expansion tanks and determine that hydronic system is full of water.
    d. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due

to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."

e. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

2. Procedures required by authority having jurisdiction that exceed requirements of tests listed above shall be performed by contractor to obtain system acceptance.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and bleed air completely.
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.
8. For all systems requiring glycol for freeze protection, contractor shall draw a sample from the system after fully purging system, shall submit the sample to a testing agency for verification of glycol contamination and other fluid characteristics and shall submit written report to engineer for review.

D. After testing:

1. Adjust set point temperature of all HVAC equipment to system design temperatures. Temperatures shall be as listed on drawings or as directed by owner.

E. Follow up testing:

1. Contractor shall return to project site after 30 days of relevant system operation and shall retest water system to ensure glycol concentration has been maintained after system operation. This shall include a return during the project warranty period if seasonal variation is required to obtain the required 30 days of system operation.

PART 2 PRODUCTS

2.1 PIPING

A. Copper Tube:

1. Provide hard temper copper water tubing conforming to ASTM B 88. Tubing shall be type K, L or M as listed in schedule.
2. Tubing joints shall be soldered or brazed as indicated in schedule.

B. DWV Copper Tube:

1. Type M DWV copper tubing shall conform to ASTM B 306, type DWV.

C. ACR Copper Tubing:

1. Provide hard temper nitrogenized seamless copper refrigerant tubing conforming to ASTM B 88. Tube shall be L or K as listed in schedule.
2. Tubing shall be brazed or grooved joints manufactured to copper tube dimensions. Flaring tubing ends to accommodate alternate sized couplings is not allowed.
3. Type ACR soft copper tubing conforming to ASTM B 280 shall be allowed for connection between VRF air handlers nominal size 0 to 5 tons, and branch selector/controller boxes, as allowed by air handler manufacturer.

2.2 FITTINGS

A. Wrought Copper Fittings:

1. Provide wrought solder joint copper tube fitting conforming to ANSI B 16.22

B. Cast Iron Threaded Fittings:

1. Conform to ASME B 16.4 with classes as indicated on piping material schedule.

C. Nickel Copper Alloy Steel Welding Fittings:

1. Provide nickel copper alloy steel welding fittings conforming to ANSI B16.9 and ASTM A234.

2.3 JOINING MATERIALS

A. Pipe flange gasket materials shall be suitable for chemical and thermal conditions of piing system contents. Provide 1/8” maximum thickness, nonmetallic, flat, asbestos free material conforming to ASME B 16.21.

B. Flange bolts and nuts shall conform to ASME B18.2.1 and shall be carbon steel unless otherwise noted.

C. Plastic pipe flange gasket bolts and nuts shall be type and material recommended by piping system manufacturer.

D. Solder filler metals shall conform to ASTM B 32 and shall be lead free alloys that include water flushable flux according to ASTM B 813.

E. Brazing filler metals shall conform to AWS A 5.8 BCuP series and shall be copper phosphorus alloys for joining copper with copper or Bag-1 silver alloy for joining copper with bronze or steel.

F. Welding filler materials shall comply with ASW D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Pipe:

1. CPVC piping cements shall conform to ASTM F 493.
2. PVC piping solvent cements shall conform to ASTM D 2564. Include primer complying with ASTM F 656.

H. Gasket material thickness, material and type shall be suitable for fluid to be handled and working temperatures and pressures.

2.4 TRANSITION FITTINGS

A. Plastic to Metal Transition Fittings:

1. Provide one piece fitting with one threaded brass or copper insert and one Schedule 80 solvent-cement-joint end.

B. Plastic to Metal Transition Unions:

1. Provide MSS SP-107 union. Include brass or copper end, schedule 80 solvent cement joint end, rubber gasket and threaded union.

2.5 DIELECTRIC FITTINGS

A. Fittings shall be combination fitting of copper alloy and ferrous materials with threaded solder joint plain or weld neck end connections that match piping system materials.

B. Insulating material shall be suitable for system fluid, pressure and temperature

C. Dielectric unions:

1. Provide factory fabricated union assembly with pressure and temperature rating suitable for system operating range.

D. Dielectric Flanges:

1. Provide factory fabricated companion flange assembly with pressure and temperature rating suitable for system operating range.

E. Dielectric Coupling:

1. Provide galvanized steel coupling with inert and non-corrosive thermoplastic lining and threaded ends. Coupling shall have pressure and temperature rating suitable for system operating range.

F. Dielectric Nipples:

1. Provide electroplated steel nipple with inert and noncorrosive, thermoplastic lining, plain, threaded or grooved ends. Nipples shall have pressure and temperature rating suitable for system operating range.

2.6 EXPANSION LOOPS

A. Provide pipe expansion loop constructed of main pipe material. Acceptable methods include use of elbows in a U or Z shape as defined by ASHRAE or ASME; or a detailed stress analysis may be utilized to define areas of expansion.

2.7 ALIGNMENT GUIDES AND ANCHORS

A. Provide steel, factory fabricated alignment guide with bolted two-section outer cylinder and base for attaching to structure; with two section guiding spider for bolting to pipe.

B. Anchors shall be mechanically fastened with tension and shear capacities appropriate for application.

END OF SECTION 232113

SECTION 233400 – FAN WALL

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 General Requirements

A. See schedule on plans for unit requirements.

1.2 Manufacturers:

A. See schedule of manufacturers

PART 2 – PRODUCT

2.1 Unit construction

A. System shall be modularly constructed.
B. System shall be equipped with integral electrical and control raceways.
C. Cabinet shall be constructed with aluminum and lined with perforated interior aluminum panels.
D. Provide integral lifting lugs with each module.
E. Equip each fan wall with low pressure drop, aluminum backdraft damper.
F. Provide adjustable side rail for fan mounting.

2.2 FAN WHEEL

A. Provide AMCA 210 air performance data.
B. Provide AMCA 300 sound performance data.
C. Motor drive shall be UL listed in accordance with standard E481280
D. Equip with permanently lubricated ball bearings.
E. Equip with isolated shaft for bearing arc mitigation.

END OF SECTION 233400

SECTION 233420 – UV LIGHT FILTER

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 INDEPENDENT TESTING – All UV-C components shall be tested and labeled as UL Listed.

1.2 DRAWING SCHEDULE – See schedule on drawings for all specification requirements.

PART 2 - PRODUCTS

2.1 FIXTURING - shall consist of a Lamp Driver, Driver Housing, Lamp Connector, Lamp Holder, and UV-C Lamp.

2.2 POWER SUPPLY HOUSING – shall be NEMA 2/IP11 compliant, constructed of 20ga galvanized, powder coated steel and designed to facilitate NEC style Driver installations outside of plenums. The Housing shall accommodate the required number of Drivers while protecting against electrical shock and moisture incursion.

2.3 IRRADIATION – Fixtureless lamps shall be installed in sufficient quantity to provide a minimum of 6 UV- C lamp Watts per square foot of coil surface area, consistent with ASHRAE 2011 Handbook, Chapter 60.8. They shall provide an “equal” distribution of 360° irradiation using the lowest possible shadowed losses in the plenum to provide the highest UV-C energy absorption by airborne microbial products. The energy striking “all” surfaces shall be sufficient to maintain coil capacity by degrading all surface mold, bacteria and other organic material found in HVAC systems.

2.4 POWER SUPPLY – The power supply shall be UL Listed, 120-277VAC - 50/60Hz, HO type. They shall be High Power Factor, Low THD, Class P, Sound Rated “A”, Type 1 Outdoor designs with inherent Thermal Protection, no PCB’s and labeled for field wiring. They shall be capable of operating at temperatures of from 33°F to 170°F, while producing the specified output and organism destruction at no more than 10 Watts of power consumption for each square foot of treated, cross sectional plane. The power supply shall be capable of ensuring a minimum of 9000 hours of lamp life, and with 85% of its initial output at end of the lamp useful life. The power supply shall be protected against “end of lamp life” conditions.

2.5 PLENUM CABLE EXTENSION - sufficient length to facilitate lamp connection to a remotely located Power supply. The Cable Extension shall be capable of carrying the striking and operational voltage and meet UL 758 and UL 1581. The Cable Extension shall be UL recognized material and constructed.

2.6 LAMP CONNECTOR - Shall be UL listed, 4-pin Single End (SE) type. The Holder shall be constructed of UV resistant materials and designed to connect the Lamp to the Connector and Holder to protect against electrical shock, moisture and separation.

2.7 LAMPS - They shall be high output (HO), T5 diameter, hot cathode, single-ended 4-pin types that produce UV-C energy primarily at the 254nm wavelength. Each lamp shall contain no more than 12 mg of mercury and be capable of operating in air temperatures of 33°F to 170°F, at any velocity.

Useful lamp life shall be 9000 hours (minimum) with no more than a 15% output loss at the end of the lamps life. They shall not produce measurable ozone.

2.8 LAMP AND LAMP POWER MONITORING - shall supply continuous monitoring device that provides a direct on/off LED display lamp, and a 3V-5V on/off signal, as an indicator to a building management system that lamp(s)/power supply(s) is/are operational. Optional remote monitor(s) shall be installed outside the plenum

END OF SECTION 233420

SECTION 235216 – CONDENSING BOILERS

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.

B. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in of piping and electrical connections.

C. Examine mechanical spaces for suitable conditions where boilers will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

1.2 INSTALLATION

A. Install equipment on 4” concrete housekeeping pad.

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

1.3 CONNECTIONS

A. Install boilers level on concrete bases. Concrete base is specified in Division 23 Section "Common Work Results for HVAC," and concrete materials and installation requirements are specified in Division 03.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

D. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of equipment connection. Provide a reducer if required.

E. Connect hot-water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.

F. Install piping from safety relief valves to nearest floor drain.

G. Install flue venting kit and combustion air intake and connect full size vents to boiler connections.

1.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:
   1. Perform installation and startup checks according to manufacturer's written instructions. Complete startup form included with Boiler and return to Manufacturer as described in the instructions.

   2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.

   3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

      a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.

      b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

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

E. Performance Tests:

   1. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.

   2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.

   3. Perform field performance tests to determine capacity and efficiency of boilers.

   4. Repeat tests until results comply with requirements indicated.

   5. Provide analysis equipment required to determine performance.

   6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.

   7. Notify Architect in advance of test dates.

   8. Perform a combustion analysis after installation and adjust gas valve per the Installation and Operations manual and note in startup report.

9. Document test results in a report and submit to Architect.

1.5 DEMONSTRATION

A. Engage a factory representative of a factory authorized service representative for boiler startup and to train owners maintenance personnel to adjust operate and maintain boilers.

1.6 WARRANTY REQUIREMENTS

A. Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Fire-Tube Condensing Boilers:

a. Heat Exchanger, Pressure Vessel and Condensation Collection Basin shall carry a 10 year limited warranty against defects in materials or workmanship and failure due to thermal shock.

b. All other components shall carry a one year warranty from date of boiler start up

PART 2 PRODUCTS

2.1 CONSTRUCTION

A. Boiler shall be natural gas fired, fully condensing, and fire tube design. The boiler shall be factory-fabricated, factory-assembled, and factory-tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. equipped with wound spring reverse carryover mechanism to keep time during power failures.

B. The heater exchanger shall bear the ASME “H” stamp for 160 psi working pressure and shall be National Board listed. The heat exchanger shall be constructed of a fully welded 316L stainless steel and of fire tube design. Fire tube shall be of the Wave Fire Tube design and capable of transferring 30,000 to 40,000 Btu’s per tube. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. There shall be no banding material, bolts, gaskets or “O” rings in the heat exchanger design. Cast iron, aluminum, or condensing copper tube boilers will not be accepted.

C. Condensate Collection Basin: Fully welded 316L stainless steel.

D. Intake Filter and Dirty Filter Switch: Boiler shall include an intake air filter with a factory installed air pressure switch. The pressure switch will alert the end user on the screen of the boiler that the intake filter is dirty and needs to be changed.

E. The pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The pressure vessel shall be designed for a single-pass water flow to limit the water side pressure drop. Pressure drop shall be no greater than 2.4 psi at 180 gpm.

F. Natural gas, forced draft single burner shall be premix design with an upper and lower chamber supplied by individual combustion systems. The burner shall be high temperature stainless steel with a woven Fecralloy outer covering to provide modulating firing rates. The burner shall be capable of the stated gas train turndown without loss of combustion efficiency. The burner shall have an independent laboratory rating for Oxides of Nitrogen (NOx) to meet requirements of South Coast Air Quality Management District (SCAQMD) as compliant with

Rule 1146.2 (FB1500-FB2000), San Diego Air Control Pollution District as compliant with Regulation 69.2.1 (FB1500-FB5000), Bay Area Quality Management District as compliant with Regulation 9 Rule 7 (FB1500-FB5000) and Texas Commission on Environmental Quality (FB1500-FB2000) as being compliant with Section 117.465.

G. Boiler shall be equipped with a pulse width modulating blower system to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The burner firing sequence of operation shall include pre-purge, firing, modulation, and post-purge operation.

H. The boiler shall be supplied with two gas valves designed with negative pressure regulation and shall be capable of 10:1 turndown.

I. Ignition shall be spark ignition type with 100 percent main-valve shutoff with electronic flame supervision.

J. Casing:

1. Jacket: Heavy gauge primed and painted steel jacket with snap-in closures.

2. Control Compartment Enclosures: NEMA 250, Type 1A.

3. Insulation: Minimum ½ inch thick, mineral fiber insulation surrounding the heat exchanger.

4. Combustion-Air Connections: Inlet and vent duct collars.

2.2 TRIM

A. Safety Relief Valve:

1. Size and Capacity: 50 lb.

2. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

B. Pressure Gage: Minimum 3-1/2-inch diameter. Gage shall have normal operating pressure about 50 percent of full range.

C. Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.

D. Condensate Neutralization Kit: Factory supplied condensate trap with condensate trip sensor, high capacity condensate receiver prefilled with appropriate medium.

2.3 CONTROLS

A. Boiler controls shall feature a standard, factory installed 8” LCD screen display with the following features:

1. Variable Speed Boiler Pump Control: Boiler may be programmed to send a 0-10V DC output signal to an ECM or VFD boiler pump to maintain a designed temperature rise across the heat exchanger. The boiler shall be able to operate in this mode with a

minimum temperature rise of 20 degrees F and a maximum temperature rise of 60 degrees F.

2. Outdoor air reset: Boiler shall calculate the set point using a field installed, factory supplied outdoor sensor and an adjustable reset curve.
3. Pump exercise: Boiler shall energize any pump it controls for an adjustable time if the associated pump has been off for a time period of 24 hours.
4. Ramp delay: Boiler may be programmed to limit the firing rate based on six limits steps and six time intervals.
5. Boost function: Boiler may be programmed to automatically increase the set point a fixed number of degrees (adjustable by installer) if the setpoint has been continuously active for a set period of time (time adjustable by installer). This process will continue until the space heating demand ends.
6. Domestic hot water priority: Boiler shall make the domestic hot water call for heat a priority over any space heating call and adjust the boiler setpoint to the domestic hot water boiler setpoint.
7. Domestic hot water modulation limiting: Boiler may be programmed to limit the maximum domestic hot water firing rate to match the input rating of the indirect tank coil.
8. Domestic hot water night setback: Boiler may be programmed to reduce the domestic hot water tank set point during a certain time of the day.
9. PC port connection: Boiler shall have a PC port allowing the connection of PC boiler software.
10. Time clock: Boiler shall have an internal time clock with the ability to time and date stamp lock-out codes and maintain records of runtime.
11. Service reminder: Boiler shall have the ability to display a yellow colored service notification screen based upon months of installation, hours of operation, and number of boiler cycles. All notifications are adjustable by the installer.
12. Three pump control: Boiler shall have the ability to control the boiler pump, system pump and the domestic hot water pump.
13. Anti-cycling control: Boiler shall have the ability to set a time delay after a heating demand is satisfied allowing the boiler to block a new call for heat. The boiler will display an anti-cycling blocking on the screen until the time has elapsed or the water temperature drops below the anti-cycling differential parameter. The anti-cycling control parameter is adjustable by the installer.
14. Night setback: Boiler may be programmed to reduce the space heating temperature set point during a certain time of the day.
15. Freeze protection: Boiler shall turn on the boiler and system pumps when the boiler water temperature falls below 45 degrees. When the boiler water temperature falls below 37 degrees the boiler will automatically turn on. Boiler and pumps will turn off when the boiler water temperature rises above 43 degrees.

16. Isolation valve control: Boiler shall have the ability to control a 2-way motorized control valve. Boiler shall also be able to force a fixed number of valves to always be energized regardless of the number of boilers that are firing.

17. BMS integration with 0-10V DC input: The Control shall allow an option to Enable and control set point temperature or control firing rate by sending the boiler a 0-10V input signal.

18. Data logging: Boiler shall have non-volatile data logging memory including last 10 lockouts, hours running and ignition attempts and should be able to view on boiler screen.

B. The boiler shall have a built in Cascade controller to sequence and rotate lead boiler to ensure equal runtime while maintaining modulation of up to 8 boilers of different btu inputs without utilization of an external controller. The factory installed, internal cascade controller shall include:

1. Efficiency optimization: The Control module shall allow multiple boilers to fire at minimum firing rate in lieu of Lead/Lag.

2. Rotation of lead boiler: The Control module shall change the lead boiler every hour for the first 24 hours after initializing the Cascade. Following that, the leader will be changed once every 24 hours.

C. All setpoints shall be adjustable. Pressure control shall be factory wired and mounted to cycle burner.

D. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

1. High Temperature Limit: Automatic and manual reset stops burner if operating conditions rise above maximum boiler design temperature. Limit switch to be manually reset on the control interface.

2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manually reset on the control interface.

3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.

4. High and Low Gas Pressure Switches: Pressure switches shall prevent burner operation on low or high gas pressure. Pressure switches to be manually reset on the control interface.

5. Blocked Drain Switch: Blocked drain switch shall prevent burner operation when tripped. Switch to be manually reset on the control interface.

6. Low air pressure switch: Pressure switches shall prevent burner operation on low air pressure. Switch to be manually reset on the control interface.

7. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for any lockout conditions.

E. All controls shall be BACnet compatible and shall be compatible with central building management as specified in division 23.

2.4 ELECTRICAL POWER

A. Unit shall be equipped with single point field power connection. Factory installed and factory wired switches motor controllers, transformers and other electrical devices necessary shall provide single point field power connection to boiler.

2.5 EMERGENCY SHUTOFF

A. Contractor shall provide push button emergency shutoff for all boilers located in each mechanical room. Contractor shall provide wiring as required for connection to boiler and shall locate the shutoff as directed by the boiler inspector on site and in compliance with all code requirements. When depressed a single push button shall shutoff all boilers in the associated mechanical room.

2.6 VENTING

A. Exhaust flue for the FB751 – FB 2001 must be Category IV approved vent material from one of the approved manufacturers listed by boiler manufacturer manual. Boilers exhaust vent length shall be able to extend to 100 equivalent feet.

B. Intake piping for all models must be of approved material as listed in the Installation and Operations manual. Boilers intake pipe length must be able to extend to 100 equivalent feet.

C. Boiler venting and intake piping configuration shall be installed per one of the approved venting methods shown in the Installation and Operation manual.

D. Boiler shall come standard with a flue sensor to monitor and display flue gas temperature on factory provided LCD display.

E. Boilers using common venting must contact the factory for sizing.

F. Refer to manufacturer’s Installation and Operations manual for detailed venting instructions and approved manufacturers.

2.7 SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

C. Allow Owner access to source quality-control testing of boilers. Notify Architect 14 days in advance of testing.

END OF SECTION 235216

SECTION 236426 – AIR-COOLED CONDENSER

PART 1 – SUMMARY/SYSTEM DESCRIPTION/ACCEPTABLE MANUFACTURERS

1.1 General Requirements

A. Technical Systems air cooled condensing units are designed for easy handling and reduced installation costs. All condensing units are pressure tested prior to shipment. Units are ETL certified and labeled. Internal power and control wiring are ready for field connection to utilities.

1.2 Manufacturers:

A. See schedule of manufacturers

PART 2 – PRODUCT

2.1 Cabinet

A. All Technical Systems condensing units are constructed of heavy duty mill galvanized steel panels. Units are base rail configured for distributed roof loadings, convenient handling and easier installation. Lifting points and mounting holes are available on each unit.

2.2 Compressors

A. The heremetic sealed scroll compressors are statically and dynamically balanced with full pressure lubrication and charged with oil for smooth and quiet operation. Each compressor is equipped with a crankcase heater, suction and discharge service valves, and inherent overload and overheat protector consisting of winding embedded sensors. Compressor motors are suction gas cooled. Compressors are rated in accordance with ASHRAE 23.1.

2.3 Condenser(s)

A. Condenser coils are constructed of seamless copper tubes with die-formed tempered aluminum plate fins. Tubes are arranged in a staggered row pattern and mechanically expanded into fins for full contact and optimum heat transfer. Fins are formed with full collars and completely cover tube surface.

B. Condenser casings are heavy duty, corrosion resistant, mill galvanized 16-gauge steel. Coils are circuited to match refrigeration circuits. Fans are baffled to prevent crossover air flow. Headers are constructed of heavy wall seamless copper tubing. Coils are leak tested underwater.

2.4 “True” Subcooling Coil

A. A separate “true” subcooling coil, integral with the condenser, is provided on each circuit to eliminate the possibility of liquid flashing and to increase unit efficiency. Subcooling coil comes out at condenser “P” traps, then enters subcooling circuit.

2.5 Condenser Fans

A. Fans are direct drive propeller type with steel hubs and aluminum blades. Fans discharge vertically to minimize noise generation and air recirculation. Fans rotate within a formed (spun) venturi and are protected with an epoxy powder coated fan guard. Condenser plenum is compartmentalized to prevent air crossover.

B. Fan motors are three-phase, 1140 RPM and are specifically designed for vertical shaft and direct drive applications. Motors feature permanently lubricated ball bearings and have inherent overload protection. Fan/motor assembly is mounted using sheet metal mounts.

2.6 Refrigeration Circuit

A. All units utilize 410a refrigerant. Dual compressor models have independent refrigeration circuits with a liquid line shut off and charging connection. All refrigerant containing vessels are constructed in accordance with UL or ASME Section VIII.

2.7 Controls

A. All unit operating and safety controls are UL and ETL certified. Controls include branch and subcircuit fusing, contactors, relays and pressure controls. Manual high pressure safety control and automatic low pressure operating control are standard. Control panels are constructed to NEMA 3R requirements and are UL 508 listed and labeled.

END OF SECTION 236426

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 CODE SECTIONS

A. 2023 National Electrical Code, NFPA 70

B. 2024 International Building Code

C. 2024 International Plumbing Code

D. 2024 International Energy Code

E. ADA – American Disabilities Act

F. ANSI – American National Standards Institute

G. ASTM – American Society of Testing Materials

H. NFPA – National Fire Protection Association

I. NEMA – National Electrical Manufactures Association

J. OSHA – Occupational Safety and Health Act

K. UL – Underwriter's Laboratories

L. All codes listed on architectural Code Reference Sheet or project cover sheet.

1.2 GENERAL

A. Provide all work in accordance with applicable codes, rules, ordinances, and regulations of local, State, and Federal Governments and other Authorities Having Jurisdiction (AHJ).

B. This Division requires the furnishing and installing of complete functioning systems, and each element thereof, as specified or indicated on the drawings and specifications or reasonably inferred; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system functioning as indicated by the design and the equipment specified. Elements of the work include materials, supervision, supplies, equipment, transportation, and utilities.

C. The drawings have been prepared diagrammatically intended to convey the scope of work, indicating the intended general arrangement of the equipment, fixtures, piping, etc. without showing all the exact details as to elevations, offsets, control lines, and other installation requirements. The contractor shall use the drawings as a guide when laying out the work and shall verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers requirements, will ensure a complete, coordinated, satisfactory and properly operating system. Plans shall not be scaled

D. Contractor shall coordinate with all other trades to ensure that all required project components are included in project bid.

E. If in any case the plans or specifications conflict with either manufacturer's requirements or minimum code requirements the information on plans and specifications shall be superseded by manufacturers and code requirements.

F. All change order requests shall be accompanied with itemized tabular breakdown of all materials and labor associated with installation of all associated materials for review of the design team. Lump sum pricing will not be accepted.

G. Contractor shall refer to each drawing and specification section in construction document set. No bids shall be submitted without review of all construction documents.

1.3 LOCAL CONDITIONS

A. Visit site and determine existing local conditions affecting work in contract.

B. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

1.4 ALLOWABLE MANUFACTURERS

A. Allowable manufactures for all products listed in division 26 are listed in “Schedule of Manufacturers” on plans.

1.5 SUBMITTAL REQUIREMENTS

A. See section 013300.

1.6 CIRCUIT LABELS

A. Contractor shall provide typed circuit directories indicating the use of each circuit breaker for new and existing panels that are affected in the project scope. Existing directories shall be replaced with new typed directories reflecting all modifications to circuit arrangements in each panel.

1.7 WARRANTY REQUIREMENTS

A. All work shall be warrantied for a period of not less than one year from the date of substantial completion. The contractor shall provide work at no additional cost to correct any deficiencies in their work that were identified to have been present during the warrantied period.

1.8 DEMOLITION

A. All equipment to be removed and reinstalled shall be disconnected, with services capped, cleaned and stored for reconnection.

B. Information on drawings represents information from old drawings and limited site inspection. Contractor shall field verify existing conditions prior to submitting bid. No extras shall be paid due to unanticipated conditions.

C. Contractor shall be responsible for all coring, patching and repair of all wall and floor systems as required due to new construction. Maintain all fire ratings of existing building elements.

D. For all existing fixtures, receptacles, wiring, equipment, etc. shown to be removed, the owner shall have the first right of refusal.

E. Contractor shall be responsible for removal of all electrical devices and wiring in all demolished walls, whether specifically indicated or not.

F. Where demolished devices are part of a circuit that is thru-wired, or has additional devices on the circuit that are to remain unchanged, the contractor is responsible for maintaining the integrity of the existing circuit. Any additional conduit, conductors, boxes, etc. needed to modify the existing circuit to maintain the integrity are the responsibility of the electrical contractor and shall be included in bid.

G. When a fixture, device or pieces of equipment is noted for removal along with associated wiring or associated wiring and conduit, contractor shall remove wiring and conduit back to nearest junction box so that no conduit or wiring is exposed in occupied area. Wiring shall be

disconnected upstream of removed fixture, device or piece of equipment so that wiring termination cannot be accidentally energized.

H. Where demolition process has caused damage to equipment, fixtures, conduit, wiring and other devices to remain, these items shall be repaired or replaced at contractor's expense to the approval of the Architect.

1.9 INSTALLATION

A. All raceways and wiring shall be installed so that they are concealed from view unless otherwise noted. Exposed conduit shall be allowed at structural level in areas in which there is no ceiling installed. All conduit shall be routed perpendicular or parallel to building lines and structure.

B. No combustible materials shall be allowed in return air plenum regardless of indication on plans.

C. Installation shall comply with NECA 1

D. Measure mounting heights indicated on plans to bottom of unit for suspended items and to center of unit for wall mounted items.

E. If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

F. Install all equipment to facilitate service, maintenance and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

G. Apply firestopping to penetrations of fire rated floor and wall assemblies for electrical installations to restore original fire resistance rating of assembly.

H. Contractor shall relocate all circuit breakers to balance electrical load between each panel phase.

I. All exposed conduit shall be painted to match surface installed adjacent to. Verify all paint colors with architect prior to installation.

1.10 TEMPORARY FACILITIES

A. See section 015000.

PART 2 – PRODUCTS

2.1 HOUSEKEEPING PADS

A. All equipment shall be installed on concrete housekeeping pads. Pad shall extend beyond equipment perimeter 4" and shall elevate equipment off of finish floor 4".

B. Contractor shall have option to provide prefabricated housekeeping pad or pour pad in place.

2.2 SLEEVES

A. Sleeves shall be constructed from the following materials at contractor's option.

1. Galvanized steel round tubing, closed with welded longitudinal joint.

2. Schedule 40 Steel Pipe.

3. DUCTED RETURN ONLY – Schedule 40 PVC pipe.

END OF SECTION 260500

SECTION 260519 – CONDUCTORS AND CABLES

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 INSTALLATION REQUIREMENTS

A. Follow circuiting shown on drawings for lighting, power and equipment connections.

B. Shared neutrals and grounds are not allowed.

C. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

D. Route conductors in raceway continuous between outlets and junction boxes with no splices or taps pulled into conduits.

E. Terminate solid conductors at equipment terminal strips and other similar terminal points with insulated solderless terminal connectors. Terminate all stranded conductor terminal points with insulated solderless terminal connectors.

F. Neatly route tie and support conductors terminating at switchboards, motor control centers, panelboards, and audio-visual equipment with cable ties and clamps.

G. Use manufacturer approved pulling compound or lubricant where necessary. Do not exceed manufacturer's recommended maximum pulling tension and sidewall pressure values.

H. Use pulling means including fish tape, cable, rope and basked weave wire/cable grips that will not damage cable or raceway.

I. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

J. Identify and color code conductors and cables according to Division 26 "Identification for Electrical Systems."

K. Support Cables according to Division 26, "Hangers and Supports for Electrical Systems."

L. Tighten electrical connections and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B

M. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

N. Make fixture taps with self-stripping electrical tap connectors.

O. Install conductor at each outlet with at least 6" of slack.

P. Apply firestopping to electrical penetrations of fire rated floor and wall assemblies to restore original fire-resistance rating of assembly according.

Q. No conductors smaller than #12 AWG are allowed unless specifically noted on plans.

R. All circuits in patient care areas shall be equipped with redundant grounding patch in accordance with requirements of the National Electrical Code.

S. Conductor size shall be provided so that voltage drop in branch circuit does not exceed 3%. Conductor size shall be provided so that voltage drop in panel feeders does not exceed 2%. Combined voltage drop of branch circuit and panel feeders shall not exceed 5%. Conductor sizes shown on drawings represent the minimum conductor size. Increase size as required to comply with voltage drop requirements according to requirements of National Electrical Code.

T. In some cases, tick marks are omitted for clarity or in cases in which insufficient space is available to display on plans. If contractor cannot determine correct number of wires to be included in conduit, contact A/E for assistance.

1.2 CONDUCTOR APPLICATION

A. All conductors shall be installed in rigid raceway unless otherwise noted.

PART 2 – PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Conductors shall be Copper and shall comply with NEMA WC 70.

B. Conductors shall be rated for 600 volts at conductor temperatures not to exceed 105 degrees Celsius.

C. Conductors shall be UL listed.

D. Conductor insulation shall be THHN-THWN installed in raceway.

E. Conductors shall be solid for size #10 AWG and smaller and shall be stranded for #8 AWG and larger.

F. Multi-conductor cable shall comply with NEMA WC 70 for metal clad cable with ground wire.

G. In patient care areas, all metal clad cable shall be hospital grade and shall be equipped with separate ground.

END OF SECTION 260519

SECTION 260533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed Conduit: Rigid Steel Conduit.
2. Concealed Conduit Above Grade: EMT
3. Underground Conduit: RNC, Type EPC – 40 – PVC direct buried.
4. Connection to Vibrating Equipment (Including Transformers, and Hydraulic, Pneumatic, Electric Solenoid or Motor Driven Equipment): LFNC

B. Indoors:

1. Exposed, not subject to physical damage: EMT
2. Exposed, subject to physical damage: Rigid Steel Conduit
    a. Includes raceways in the following locations:
        i. Loading Dock
        ii. Corridors used for traffic of mechanized carts, forklifts and pallet handling units.
        iii. Mechanical Rooms
        iv. Bottom Feed panel board conduit entries.
3. Concealed in ceilings and interior walls and partitions: EMT
4. Connection to vibrating equipment (Including Transformers, and Hydraulic, Pneumatic, Electric Solenoid or Motor Driven Equipment):
    a. Dry locations: FMC
    b. Wet or Damp Locations: LFMC

C. All conduits shall be a minimum size of 0.75”.

D. All underground conduits shall transition from PVC to metallic at sweep prior to penetrating building slab or finished grade so that no PVC conduit is exposed above grade. See Sections above for locations that require EMT or Rigid Steel Conduit.

1.2 BOXES ENCLOSURES AND CABINETS APPLICATION

A. Electrical Service Outlets (including plug receptacles, lamp receptacles, lighting fixtures and switches): 4” code gauge Sheet Metal Outlet Box

B. Light Fixture Boxes: 4” code gauge sheet metal outlet box with 0.375” inch or larger fixture stud in each outlet box to receive lighting fixture. Select covers with proper opening for device installed in outlet box.

C. Surface Mounted Exterior Boxes: Cast Metal Outlet Box

D. Surface Mounted boxes installed above kitchen floor: Cast Metal Outlet Box

1.3 OUTLET BOX AND RACEWAY INSTALLATION REQUIREMENTS

A. Use of utility or handy boxes shall only be allowed when box is flush mounted in masonry wall with dead end conduit entry from end or back.

B. Locate outlet boxes generally from column centers and finished wall lines. Install ceiling outlet boxes at suspended ceiling elevations.

C. Provide bracing straps spanning studs for support of all junction boxes installed in new walls.

D. Accurately locate lighting fixtures and appliance outlet boxes mounted in concrete or in plaster finish on concrete. Install outlet boxes in forms to dimensions taken from bench marks, columns walls or floors. Rough-in light fixtures and appliance outlet boxes to general locations before installation of walls and furring and reset to exact dimensions as walls and furring are constructed. Set outlet boxes true to horizontal and vertical finish lines of building. If outlet is shown to be installed in or on a column, outlet shall be centered on column.

E. Install outlet boxes accessible. Provide outlet boxes above piping or ductwork with extension stems or offsets as required to clear piping and ductwork.

F. When light fixtures are shown above a mirror, center fixture above mirror and install fixture with 2" of clearance between bottom of fixture and top of mirror.

G. Install boxes to maintain all fire ratings. In accordance with requirements of building code, Include fire rated sealing assemblies, putty pads and offset boxes where back to back.

H. Provide coverplates for all unused data devices.

I. All conduit elbows shall be long radius type. E/C shall review with A/E any instance in which a short radius elbow is required for coordination with field installation conditions.

J. All raceways, cables and boxes shall be recessed unless otherwise noted. Where shown in existing walls, contractor shall remove and replace wall finishes as required for installation or shall fish flexible cabling into wall cavity.

K. Unless otherwise noted, conduit connected to exterior building disconnect switches, C/T cabinets, meters, distribution panels, transfer switches and other equipment shall not be routed vertically and exposed on exterior of building. Route all conduit on interior of building concealed in wall. Notify A/E if construction type does not facilitate concealed conduit installation for clarification of routing.

PART 2 – PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. EMT (Electrical Metallic Tubing): Comply with ANSI C80.3

B. Rigid Steel: Comply with ANSI C80.1

C. FMC (Flexible Metal Conduit): Conduit shall be Zinc Coated Steel or Aluminum.

D. Fittings for conduit including all types and flexible and liquid tight, EMT, and cable shall comply with NEMA FB 1 and shall be listed for type and size raceway with which used and for application and environment in which installed.

1. Provide Steel, set screw or compression type conduit fittings.

2. Conduit fittings for hazardous locations shall comply with UL 886.

2.2 NON METALLIC CONDUIT AND TUBING

A. LFNC (Liquidtight Flexible Metal Conduit): Comply with UL 360.

B. RNC (Rigid Non-Metallic Conduit): Comply with NEMA TC2. Conduit shall be type EPC-40-PVC, unless otherwise noted.

C. Fittings for RNC shall comply with NEMA TC 3 and shall match conduit or tubing type and size to which applied.

D. Fittings for LFNC shall comply with UL 514B.

2.3 METAL WIREWAYS AND GUTTERS

A. Wireways shall be constructed of sheet metal sized and shaped as indicated in NEMA 250. Wireways shall be bear NEMA rating for application and location in which they are used. Include couplings offsets, elbows, expansion joints, adapters, hold down straps, end caps and other fittings to match and mate with wireways as required for complete system. Wireway cover shall be hinged type. Finish shall be manufacturer's standard enamel finish.

B. Items may be fabricated locally to same specifications as manufacturer's specified. Provide locally fabricated items free of burrs, sharp edges, un-reamed holes, exposed screw points or bolts and finished with one coat of suitable enamel inside and out, prior to mounting.

C. Provide sectional covers to maximize ease of removal.

2.4 SURFACE RACEWAYS

A. Provide non-metallic type surface raceway with two piece construction, manufactured of rigid PVC with texture and color selected by Architect.

2.5 BOXES, ENCLOSURES AND CABINETS

A. No sectional outlet boxes are allowed.

B. Raised Cover: Provide code gauge galvanized steel raised covers on outlet boxes installed in plaster finish. Set to plaster grounds with outside edge of cover flush with plaster finish.

C. Sheet Metal Outlet Boxes: Steel, sheet metal knockout outlet box, complying with NEMA OS 1. Provide required depth for service or device.

D. Cast Metal Outlet Boxes: comply with NEMA FB 1 provide cast type FS or FD box with device cover and gasket. Provide blank cover and gasket when used as a junction box. Provide required depth for service or device.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2.

END OF SECTION 260533

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL AND EQUIPMENT AND WIRING

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

E. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Non-metallic Color Coded Tape or Marker Tape: Secure tight to surface of conductor or cable with non-metallic tie wraps or adhesive, as specified, at a location with high visibility and accessibility; and, in all enclosures with exposed energized parts.

G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

H. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

1.2 ELECTRICAL EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate sign or plastic equipment marker on or near each major item of electrical equipment and each operational device as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Distribution Panelboards
2. Branch Panelboards
3. Disconnect Switches
4. Enclosed Circuit Breakers
5. Lighting Contactors
6. Motor Starters
7. Variable Frequency Drives

B. Where lettering larger than 1” height is needed for proper identification because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved sign at contractor’s option.

C. Lettering shall be minimum 1/4” high where viewing distance is less than 2’-0”; 1/2” high for distances up to 6’-0” and proportionately larger for greater distances. Secondary lettering shall be 2/3 to 3/4 of size of the principal lettering.

1.3 WIRING IDENTIFICATION

A. Install wiring tape on each conductor in accordance with the following color scheme.

1. 120/240V Systems

a. Phase A: Black

b. Phase B: Red

c. Phase C: Blue (Where Applicable)

d. Neutral: White

e. Ground: Green

PART 2 – PRODUCTS

2.1 ENGRAVED LAMINATE SIGN

A. Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thickness indicated, engraved with the engravers standard letter style of the sizes and wording indicated. Signs shall be black with white core except as otherwise noted and shall be punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness shall be 1/16” for units up to 20 square inches or 8” in length and 1/8” for larger units.

2.2 PAINTED IDENTIFICATION

A. Painting where allowed shall be performed using standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications. Minimum letter height shall be 1.25” high for ductwork and equipment and 0.75” high for access door signs and similar operational instructions.

B. Paint shall be exterior type, oil based, black paint.

2.3 CABLE IDENTIFICATION MATERIALS

A. Color Coded Tape: Self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1” to 2” wide, colored as noted above.

B. Marker tapes: Vinyl or vinyl cloth, self-adhesive, wraparound type with circuit identification legend machine printed by thermal transfer or equivalent process.

END OF SECTION 260553

SECTION 262416 – PANELBOARDS

PART 1 – GENERAL REQUIREMENTS AND EXECUTION REQUIREMENTS

1.1 INSTALLATION REQUIREMENTS

A. Do not interrupt electric service to facilities occupied by owner or others unless coordinated with owner and architect.

B. Install panelboards and accessories according to NEMA PB 1.1

C. Mount top of trim 90” above finished floor unless otherwise noted.

D. Mount panel board cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install all overcurrent protective devices and controllers not already factory installed. Set field adjustable circuit breaker trip ranges.

F. Install filler plates in unused spaces.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

H. Installation shall comply with NECA 1.

I. After substantial completion, but not more than 60 days after final acceptance, measure load balancing and make circuit changes.

1. Measure during period of normal system loading.

2. Coordinate scheduling of load balancing circuit changes with owner and perform changes outside normal occupancy/working schedule of the facility.

3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

J. Provide temporary heat to maintain temperature according to manufacturer’s written instructions.

1.2 BREAKER COORDINATION

A. All circuit breakers including load side branch breaker shall be selectively coordinated and rated for available fault current listed in panel schedule or calculated at feeder connection of panel. Series rating is not allowed.

B. All circuit breakers feeding equipment such as, transfer switches, HVAC equipment, owner installed process equipment, elevators or other building equipment shall be coordinated with requirements of equipment manufacturer to ensure proper coordination and fault protection.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures:

1. Enclosures shall be flush and surface type as shown on plans. Panels shall be rated for environmental conditions at installed locations.

2. Front shall be secured to box with concealed trim clamps. For surface mounted fronts, match box dimensions. For flush mounted fronts, overlap box.
3. Skirt for surface mounted panelboards shall be same gauge and finish as panelboard front with flanges for attachment to panelboard, wall and ceiling or floor.
4. Finishes:
    a. Panels and Trim: Steel, factory finished with manufacturer's standard two coat, rust inhibitor primer and baked on finish.
    b. Back boxes: Galvanized steel
    c. Provide permanent fungicidal treatment for overcurrent protective devices and other components.
5. Inside panelboard provide directory card mounted in transparent card holder with typed circuit directory listing all circuit numbers and loads served.

B. Phase Neutral and Ground Buses:
1. Material Tin plated copper.
2. Equipment ground bus: Adequate for feeder and branch circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch circuit isolated ground conductors; insulated from box.
4. Neutral bus: UL rated for nonlinear loads.
5. Rating: Bus structure shall be rated by heat tests conducted in accordance with UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests.

C. Conductor Connectors:
1. Material: Tin Plated Copper.
2. Main and Neutral Lugs: Suitable for connection to Copper or Aluminum Conductors
3. Feed Through Lugs: Suitable for use with Copper or Aluminum conductors. Locate at opposite end of bus from incoming lugs or main device.
4. Subfeed Lugs: Suitable for use with aluminum or copper conductors. Locate at same end of bus as incoming lugs or main device.

D. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers when shown with one or more main service disconnecting means and overcurrent protective devices.

E. Future Devices: Provide mounting brackets, bus connections, filler plates and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Rating: Panelboard shall be fully rated for available fault current listed on plans or as calculated based on actual field installed conditions.

G. All panelboards and load centers shall be keyed alike.

H. Include tools and miscellaneous items required for overcurrent protective device test, maintenance and operation.

2.2 LIGHTING AND BRANCH CIRCUIT PANELBOARDS

A. Provide dead front panelboards as indicated in schedule with bolt-in or plug-on molded case circuit breakers. Panelboards shall comply with NEMA publication PB-1, UL67 and UL50.

B. Provide one spare 0.75" conduit for every three spares and/or blank spaces with a minimum of three spare conduits per panel. Terminate conduit above accessible ceiling unless indicated otherwise.

2.3 DISCONNECTION AND OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers: Circuit breakers shall be rated for size and amperage indicated on plans. Breakers shall be standard construction. All circuit breakers shall be UL and CSA listed, IEC 157-1 rated, meet NEMA AB1 and federal specification W-C 375B/GEN when applicable. Molded case circuit breakers shall have over center toggle type mechanisms, providing quick make, quick break action. Breakers shall be calibrated for operation in an ambient temperature of 40°C. Each circuit breaker shall have trip indication by handle position and shall be trip free. Two and three pole breakers shall be common trip. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole. Circuit breaker frame sizes greater than 100 amperes shall have variable magnetic trip elements that are set by a single adjustment so that tripping characteristics are uniform in each pole. A push to trip button shall be provided on the cover for mechanically tripping the circuit breaker. The circuit breaker shall have reverse connection capability and be suitable for mounting and operating in any position. Unless otherwise indicated, branch circuit breakers rated for up to 100 amperes shall have 10,000 RMS short circuit amperes symmetrical interrupting capacity. Circuit breakers above 100 amperes shall have 42,000 RMS short circuit amperes capacity.

END OF SECTION 262416