Neff Hall - HVAC Upgrades Phase 2

ADDENDUM #01

TO CONTRACT DOCUMENTS FOR:	Project #CP – 231442
ADVERTISEMENT DATE:	March 7, 2024
PREPARED FOR:	The Curators of the University of Missouri
CONSULTANT:	Klingner and Associates, P.C. 3622 Endeavor Avenue, Suite 117 Columbia, MO 65201 (573) 355-5988

The contract documents for the above noted project and the work covered thereby and herein modified.

GENERAL INFORMATION:

1) ADVERTISE FOR BID: **CLARIFICATION** The Bid Opening listed on the Letter of Advertisement is incorrect. The correct date is March 19, 2024 @ 1:30 p.m.

PROJECT MANUAL:

1) Specification Section 1.A., Bid for Lump Sum Contract: A **REVISED** "Bid for Lump Sum Contract" is attached. Revisions have been made to paragraph 5.: Subcontractor List. **BIDS MUST BE SUBMITTED ON THE ATTACHED REVISED FORM**.
2) **ADD** Specification Section 020810 Universal Wastes/Other Environmental Concerns Removal and Disposal.
3) **ADD** Specification Section 028233 Friable and Non-Friable Asbestos Removal.
4) **ADD** Specification Section 028234 Lead-Based Paint Materials Removal and Disposal.
5) Specification Section 233113 Metal Ducts: **ADD** 2.3 Double-Wall Rectangular Ducts and Fittings.
6) Specification Section 238219 Fan Coil Units: **DELETE** 1.2 Submittals A. in its entirety, **ADD** 1.4 Delivery, Storage, and Handling A., **DELETE** Part 2 – Products in its entirety.

7) Specification Section Appendix B: **DELETE** DOAS-1 and AH4 submittal data in its entirety and **REPLACE** with updated DOAS-1 and AH4 submittal data.

DRAWINGS:

1) Drawing Sheet G001 Cover Sheet, **DELETE** Note 12 of General Notes and **REPLACE** with Note 12.) A NEW DEDICATED OUTDOOR AIR UNIT WILL BE PROVIDED BY OWNER AND SHALL BE INSTALLED BY CONTRACTOR. CONTRACTOR IS RESPONSIBLE FOR COORDINATING DELIVERY OF DEDICATED OUTDOOR AIR UNIT WITH THE SUPPLIER TO THE JOB SITE.
2) Drawing Sheet G001 Cover Sheet, **DELETE** Note 13 of General Notes and **REPLACE** with Note 13.) TWO NEW AIR HANDLING UNITS WILL BE PROVIDED BY OWNER AND SHALL BE INSTALLED BY CONTRACTOR. CONTRACTOR IS RESPONSIBLE FOR COORDINATING DELIVERY OF AIR HANDLING UNITS WITH THE SUPPLIER TO THE JOB SITE.
3) Drawing Sheet G001 Cover Sheet, **ADD** Note 14 of General Notes: 14) A NEW FAN COIL UNIT WILL BE PROVIDED BY OWNER AND SHALL BE INSTALLED BY CONTRACTOR. CONTRACTOR IS RESPONSIBLE FOR COORDINATING DELIVERY OF FAN COIL UNIT WITH THE SUPPLIER TO THE JOB SITE.
4) Drawing Sheet G001 Cover Sheet, **ADD** Note 15 to General Notes: 15) OWNER SHALL MOVE FURNITURE, AS REQUIRED, TO FACILITATE WORK. CONTRACTOR TO PROVIDE OWNER WITH 48 HOUR NOTICE PRIOR TO NEEDED ANY FURNITURE RELOCATED.
5) **ADD** Drawing Sheet S100 First Floor Plan & Details.
6) **ADD** Drawing Sheet S200 Attic Floor Framing Plan & Details.
7) Drawing Sheet MD101 Basement Demolition Plan, **ADD** Keynote D43 DISCONNECT AND CAP LOW PRESSURE STEAM AND STEAM CONDENSATE PIPING FROM AIR HANDLING UNIT. DEMOLISH EXISITNG STEAM CONTROL VALVE.
8) Drawing Sheet MD101 Basement Demolition Plan, **ADD** Keynote D44 DEMOLISH EXISTING MOTOR STARTER AND DISCONNECT SWITCH. DEMOLISH FEEDERS AND CONDUIT BACK TO SOURCE.

9) Drawing Sheet MD101 Basement Demolition Plan, **ADD** Keynote D45 DEMOLISH EXISITNG SUPPLY FAN MOTOR. DEMOLISH EXISTING ELECTRICAL FEEDERS BACK TO DISCONNECT.
10) Drawing Sheet MD104 Attic Demolition Plan, **ADD** Keynote D37 DEMOLISH EXISTING AIR HANDLING UNIT DISCONNECT SWITCH AND UNIT CONTROLLER. EXISTING FEEDERS AND CONDUIT TO BE EXTENDED AS REQUIRED TO CONNECT TO NEW ELECTRICAL DISCONNECT. REFER TO E104 FOR NEW LOCATION ON ROOF SUPPORT COLUMN.
11) Drawing Sheet MD104 Attic Demolition Plan, **ADD** Keynote D44 DEMOLISH EXISTING MOTOR STARTER AND DISCONNECT SWITCH. DEMOLISH FEEDERS AND CONDUIT BACK TO SOURCE.
12) Drawing Sheet MD104 Attic Demolition Plan, **ADD** Keynote D45 DEMOLISH EXISITNG SUPPLY FAN MOTOR. DEMOLISH EXISTING ELECTRICAL FEEDERS BACK TO DISCONNECT.
13) Drawing Sheet M401 Outdoor Air Flow Diagrams, OUTDOOR AIR FLOW DIAGRAM – LECTURE 204 OCCUPIED: **REVISE** detail by removing manual return air dampers.
14) Drawing Sheet M401 Outdoor Air Flow Diagrams, OUTDOOR AIR FLOW DIAGRAM – LECTURE 204 UNOCCUPIED: **REVISE** detail by removing manual return air dampers.
15) Drawing Sheet M402 Air Flow Diagrams, AH7 & AH8 AIR FLOW DIAGRAM – LECTURE 204 OCCUPIED: **REVISE** detail by removing manual return air dampers.
16) Drawing Sheet M402 Air Flow Diagrams, AH7 & AH8 AIR FLOW DIAGRAM – LECTURE 204 UNOCCUPIED: **REVISE** detail by removing manual return air dampers.
17) Drawing Sheet M402 Air Flow Diagrams, AH9 AIR FLOW DIAGRAM: **REVISE** detail by removing manual return air damper.
18) Drawing Sheet M402 Air Flow Diagrams, AH6 AIR FLOW DIAGRAM: **REVISE** detail by removing manual return air damper.
19) Drawing Sheet M402 Air Flow Diagrams, AH4 AIR FLOW DIAGRAM: **REVISE** detail by removing manual return air damper.

20) Drawing Sheet M403 Air Flow Diagrams, AH11 AIR FLOW DIAGRAM: **REVISE** detail by removing manual return air damper.
21) Drawing Sheet M403 Air Flow Diagrams, AH15 AIR FLOW DIAGRAM: **REVISE** detail by removing manual return air damper.
22) Drawing Sheet M403 Air Flow Diagrams, AH5 AIR FLOW DIAGRAM: **REVISE** detail by removing manual return air damper.
23) Drawing Sheet M502 Mechanical Details: **DELETE** reference to DOAS in Detail 6.
24) Drawing Sheet M601 Mechanical Schedules, CONTROL VALVE SCHEDULE: **REVISE** schedule by adding control valve type in notes. 1. Belimo Pressure Independent Control with Integral Flow Meter. 2. Belimo Pressure Independent Control Valve.
25) Drawing Sheet M601 Mechanical Schedules, AIR HANDLING UNIT SCHEDULE: **REVISE** AH4 Electrical Phase from 1 to 3 and MCA from 9.7 to 5.8.
26) Drawing Sheet M601 Mechanical Schedules, AIR HANDLING UNIT SCHEDULE: **ADD** Note 4. REPLACE EXISTING SUPPLY FAN MOTOR. REFER TO FAN MOTOR SCHEDULE FOR MORE INFORMATION. **ADD** note to AH5.
27) Drawing Sheet M601 Mechanical Schedules, **ADD** FAN MOTOR SCHEDULE.
28) Drawing Sheet M701 Controls Schematics, Detail FC BUS SCHEMATIC DIAGRAM: **REVISE** detail in its entirety to make text more visible.
29) Drawing Sheet M702 Controls Schematics, Detail MA VFD START CIRCUIT: **REVISE** detail in its entirety to make text more visible.
30) Drawing Sheet M702 Controls Schematics, Detail TYPICAL DPT ARRANGEMENT: **REVISE** detail in its entirety to make text more visible.
31) Drawing Sheet M702 Controls Schematics, Detail VAV AHU CONTROLS: **DELETE** detail in its entirety and **REPLACE** with AH 4, 11, 15 CONTROLS.
32) Drawing Sheet M702 Controls Schematics, Detail HOT WATER SYSTEM CONTROL SCHEMATIC: **REVISE** detail in its entirety to make text more visible.
33) Drawing Sheet M703 Controls Schematics, Detail DOAS WITH VFD START CIRCUIT: **REVISE** detail in its entirety to make text more visible.
34) Drawing Sheet M703 Controls Schematics, Detail DOAS-1 CONTROLS: **REVISE** detail in its entirety to make text more visible.

35) Drawing Sheet M703 Controls Schematics, **ADD** Detail AH-5 CONTROLS.
36) Drawing Sheet M704 Controls Schematics, Detail VAV BOX CONTROL DIAGRAM WITH REHEAT: **REVISE** detail in its entirety to make text more visible.
37) Drawing Sheet M704 Controls Schematics, Detail VAV BOX POWER SUPPLY DIAGRAM: **REVISE** detail in its entirety to make text more visible.
38) Drawing Sheet M704 Controls Schematics, **ADD** Detail BAS PANEL MOUNTING DETAIL.
39) Drawing Sheet M705 Controls Schematics, **DELETE** Detail SINGLE ZONE AHU CONTROLS (AHU-7 AND AHU-8) in its entirety and **REPLACE** with AH-7 & AH-8 CONTROLS.
40) Drawing Sheet M705 Controls Schematics, **ADD** Detail AH-6 & AH-9 CONTROLS.
41) Drawing Sheet E101 Basement Electrical Plan: **REVISE** Breaker Slot location in NH BL2 for FCU-003 from slots 29,31 to 24,26.
42) Drawing Sheet E101 Basement Electrical Plan: **REVISE** Breaker Slot location in NH BL3 for AH5 from slots 9,11 to 1,3,5.
43) Drawing Sheet E101 Basement Electrical Plan: **ADD** Keynote E18 REPLACE EXISTING SUPPLY FAN MOTOR WITH 1/2 HP, GENERAL PURPOSE, THREE PHASE, OPEN DRIP PROOF MOTOR.
44) Drawing Sheet E101 Basement Electrical Plan: **ADD** Keynote E19 FURNISH AND INSTALL NEW SUPPLY FAN MOTOR. WIRE MOTOR TO NEW VARIABLE FREQUENCY DRIVE.
45) Drawing Sheet E101 Basement Electrical Plan: **ADD** Keynote E20 FURNISH AND INSTALL NEW SUPPLY FAN MOTOR VARIABLE FREQUENCY DRIVE. WIRE TO NEW DISCONNECT SWITCH.
46) Drawing Sheet E101 Basement Electrical Plan: **ADD** Keynote E21 RECONNECT EXISTING FEEDERS TO NEW 20 AMP DISCONNECT SWITCH.
47) Drawing Sheet E102 First Floor Electrical Plan: **ADD** Keynote E20 FURNISH AND INSTALL NEW SUPPLY FAN MOTOR VARIABLE FREQUENCY DRIVE. WIRE TO NEW DISCONNECT SWITCH.

48) Drawing Sheet E104 Attic Electrical Plan: **ADD** Keynote E19 FURNISH AND INSTALL NEW SUPPLY FAN MOTOR. WIRE MOTOR TO NEW VARIABLE FREQUENCY DRIVE.
49) Drawing Sheet E104 Attic Electrical Plan: **ADD** Keynote E20 FURNISH AND INSTALL NEW SUPPLY FAN MOTOR VARIABLE FREQUENCY DRIVE. WIRE TO NEW DISCONNECT SWITCH.
50) Drawing Sheet E104 Attic Electrical Plan: **ADD** Keynote E21 RECONNECT EXISTING FEEDERS TO NEW 20 AMP DISCONNECT SWITCH.
51) Drawing Sheet E105 Basement Low Voltage Plan: **ADD** Variable Frequency Drive for AH5 and AH15.
52) Drawing Sheet E106 First Floor Low Voltage Plan: **ADD** Variable Frequency Drive for AH4 and AH11.
53) Drawing Sheet E108 Attic Low Voltage Plan: **ADD** Variable Frequency Drive for AH6, AH9, and DOAS-1.

END OF ADDENDUM #01

SECTION 1.A

BID FOR LUMP SUM CONTRACT

Date:_____

BID OF _____
(hereinafter called "Bidder") a corporation* organized and existing under laws of the State of _____
_____,
a partnership* consisting of _____,
an individual* trading as _____,
a joint venture* consisting of _____
_____.
*Insert Corporation(s), partnership or individual, as applicable.

TO: Curators of the University of Missouri
c/o Associate Vice Chancellor – Facilities
Room L100 General Services Building
Columbia, MO 65211

1. Bidder, in compliance with invitation for bids for construction work in accordance with Drawings and Specifications prepared by KLINGNER & ASSOCIATES, P.C., entitled "NEFF HALL – HVAC UPGRADES PHASE 2", project number CP231442, dated FEBRUARY 9, 2024 having examined Contract Documents and site of proposed work, and being familiar with all conditions pertaining to construction of proposed project, including availability of materials and labor, hereby proposes to furnish all labor, materials and supplies to construct project in accordance with Contract Documents, within time set forth herein at prices stated below. Prices shall cover all expenses, including taxes not covered by the University of Missouri's tax exemption status, incurred in performing work required under Contract documents, of which this Bid is a part.

Bidder acknowledges receipt of following addenda:

Addendum No. _____Dated _____
Addendum No. _____Dated _____
Addendum No. _____Dated _____
Addendum No. _____Dated _____

2. In following Bid(s), amount(s) shall be written in both words and figures. In case of discrepancy between words and figures, words shall govern.

3. BID PRICING
   a. Base Bid:
   The Bidder agrees to furnish all labor, materials, tools, and equipment required to upgrade the existing HVAC system and to renovate the Office 10 Suite in Neff Hall; all as indicated on the Drawings and described in these Specifications for sum of:
   _____
   _____DOLLARS ($_____).

4. PROJECT COMPLETION

   a. Contract Period - Contract period begins on the day the Contractor receives unsigned Contract, Performance Bond, Payment Bond, and "Instructions for Execution of Contract, Bonds, and Insurance Certificates." Bidder agrees to complete project within One Hundred (100) calendar days from receipt of aforementioned documents. Fifteen (15) calendar days have been allocated in construction schedule for receiving aforementioned documents from Bidder.

b. Commencement - Contractor agrees to commence work on this project after the "Notice to Proceed" is issued by the Owner. "Notice to Proceed" will be issued within seven (7) calendar days after Owner receives properly prepared and executed Contract documents listed in paragraph 4.a. above.

c. Liquidated Damages (not used)

d. Special scheduling requirements: As defined in Section 1.E Special Conditions

5. SUBCONTRACTOR LIST:

Bidder hereby certifies that the following subcontractors will be used in performance of Work:

NOTE: Failure to list subcontractors for each category of work identified on this form or listing more than one subcontractor for any category of work without designating the portion of work performed by each shall be grounds for rejection of bid. List name, city, and state of designated subcontractor, for each category of work listed in Bid For Lump Sum Contract. If work within a category will be performed by more than one subcontractor, Bidder shall provide name, city, and state of each subcontractor and specify exact portion of work to be performed by each. If acceptance/non-acceptance of Alternates will affect designation of a subcontractor, Bidder shall provide information, for each affected category, with this bid form. If Bidder intends to perform any designated subcontract work by using Bidder's own employees, then Bidder shall list their own name, city, and state. The bidder may petition the Owner to change a listed subcontractor only within 48 hours of the bid opening. See Information For Bidders Section 16 List of Subcontractors for requirements.

Work to be performed	Subcontractor Name, City, State
HVAC	
Electrical	
Controls	

6. SUPPLIER DIVERSITY PARTICIPATION GOALS

a. The Contractor shall have as a goal, subcontracting with Minority Business Enterprise (MBE) of ten (10%), with Service Disabled Veteran Owned Business (SDVE) of three percent (3%); and with Women Business Enterprise (WBE), Disadvantage Business Enterprise (DBE), and/or Veteran Owned Business of ten (10%) of awarded contract price for work to be performed.

b. Requests for waiver of this goal shall be submitted on the attached Application For Waiver form. A determination by the Director of Facilities Planning & Development, UM, that a good faith effort has not been made by Contractor to achieve above stated goal may result in rejection of bid.

c. The Undersigned proposes to perform work with following Supplier Diversity participation level:

MBE PERCENTAGE PARTICIPATION: _____ percent (_____%)
SDVE PERCENTAGE PARTICIPATION: _____ percent (_____%)

WBE, DBE, and/or VETERAN PERCENTAGE PARTICIPATION:_____ percent (_____%)

d. A Supplier Diversity Compliance Evaluation form shall be submitted with this bid for each diverse subcontractor to be used on this project.

7. BIDDER'S ACKNOWLEDGMENTS

a. Bidder declares that he has had an opportunity to examine the site of the work and he has examined Contract Documents therefore; that he has carefully prepared his bid upon the basis thereof; that he has carefully examined and checked bid, materials, equipment and labor required thereunder, cost thereof, and his figures therefore. Bidder hereby states that amount, or amounts, set forth in bid is, or are, correct and that no mistake or error has occurred in bid or in Bidder's computations upon which this bid is based. Bidder agrees that he will make no claim for reformation, modifications, revisions or correction of bid after scheduled closing time for receipt of bids.

b. Bidder agrees that bid shall not be withdrawn for a period of Ninety (90) days after scheduled closing time for receipt of bids.

c. Bidder understands that Owner reserves right to reject any or all bids and to waive any informalities in bidding.

d. Accompanying the bid is a bid bond, or a certified check or a cashier's check payable without condition to "The Curators of the University of Missouri" which is an amount at least equal to five percent (5%) of amount of largest possible total bid herein submitted, including consideration of Alternates.

e. Accompanying the bid is a Bidder's Statement of Qualifications. Failure of Bidder to submit the Bidder's Statement of Qualifications with the bid may cause the bid to be rejected. Owner does not maintain Bidder's Statements of Qualifications on file.

f. It is understood and agreed that bid security of two (2) lowest and responsive Bidders will be retained until Contract has been executed and an acceptable Performance Bond and Payment Bond has been furnished. It is understood and agreed that if the bid is accepted and the undersigned fails to execute the Contract and furnish acceptable Performance/Payment Bond as required by Contract Documents, accompanying bid security will be realized upon or retained by Owner. Otherwise, the bid security will be returned to the undersigned.

8. BIDDER'S CERTIFICATE

Bidder hereby certifies:

a. His bid is genuine and is not made in interest of or on behalf of any undisclosed person, firm or corporation, and is not submitted in conformity with any agreement or rules of any group, association or corporation.

b. He has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid.

c. He has not solicited or induced any person, firm or corporation to refrain from bidding.

d. He has not sought by collusion or otherwise to obtain for himself any advantage over any other Bidder or over Owner.

e. He will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin in connection with performance of work.

f. By virtue of policy of the Board of Curators, and by virtue of statutory authority, a preference will be given to materials, products, supplies, provisions and all other articles produced, manufactured, mined or grown within the State of Missouri. By virtue of policy of the Board of Curators, preference will also be given to all Missouri firms, corporations, or individuals, all as more fully set forth in "Information For Bidders."

9. BIDDER'S SIGNATURE

Note: All signatures shall be original; not copies, photocopies, stamped, etc.

Authorized Signature	Date
Printed Name	Title
Company Name	
Mailing Address	
City, State, Zip	
Phone No.	Federal Employer ID No.
Fax No.	E-Mail Address
Circle one: Individual Partnership Corporation Joint Venture	
If a corporation, incorporated under the laws of the State of_____	
Licensed to do business in the State of Missouri? ____yes _____no	

(Each Bidder shall complete bid form by manually signing on the proper signature line above and supplying required information called for in connection with the signature. Information is necessary for proper preparation of the Contract, Performance Bond and Payment Bond. Each Bidder shall supply information called for in accompanying "Bidder's Statement of Qualifications.")

END OF SECTION

SECTION 020810

UNIVERSAL WASTES/OTHER ENVIRONMENTAL CONCERNS REMOVAL AND DISPOSAL

PART 1 - GENERAL

Provisions of the General Conditions and Special Conditions are part of this Division.

1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1 The Contractor shall inform him/herself of the conditions for the project, and is responsible for verifying the quantities and location of all work to be performed as outlined in this section. Failure to do so shall not relieve the Contractor of his obligation to furnish all materials and labor necessary to carry out the provisions of the Contract. The work of the Contract can be summarized as follows:

The work consists of the proper removal and incineration/disposal of the following approximate quantities of Universal Waste materials and other Environmental Concerns for the Neff Hall HVAC Building Upgrades – Phase 2 Project – Project #CP231442:

195 each of fluorescent light bulbs

59 each of light ballasts containing PCBs

1 each of smoke detectors

3 each thermostat

1 each of fire alarms

5 each of emergency lights

3 each of exit signs

1.2 CODES AND REGULATIONS:

1.1.2.1 All applicable codes, regulations, standards, statutes, laws, and rules have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith. Where conflicts arise, the most stringent specification shall apply.

1.1.2.2 Federal and State requirements which govern universal and hazardous removal work or hauling and disposal of such waste materials include but are not limited to the following:

1.1.2.2.1 U.S. Department of Labor, Occupational Health and Safety Administration (OSHA), 29 CFR 1910 and 29 CFR 1926.

1.1.2.2.1.1 Construction Industry - 29 CFR 1926.1101

1.1.2.2.1.2 Respiratory Protection – 29 CFR 1910.134

1.1.2.2.1.3 Hazard Communication – 29 CFR 1910.1200

1.1.2.2.1.4 Accident Prevention Signs – 29 CFR 1910.145

1.1.2.2.2 U.S. Environmental Protection Agency (EPA)

1.1.3 **CONTRACTOR'S DUTIES**

1.1.3.1 Except as specifically noted, provide and pay for:

- Labor, materials, and equipment.
- Tools, construction equipment, and machinery.
- Other facilities and services necessary for proper execution and completion of work.

1.1.3.2 Pay legally required sales, consumer, use, payroll, privilege and other taxes. Retail sales tax shall not be included in the bid amount.

1.1.3.3 Secure and pay for, as necessary for proper execution and completion of work, and as applicable at the time of bids:

- Permits
- Government Fees
- Licenses
- Except where specifically noted, provide and pay for waste disposal permits and costs

1.1.3.4 Give required notices.

1.1.3.5 Contractor shall assume full responsibility and liability for compliance with all codes, ordinances, rules, regulations, orders and other legal requirements of Local, State, and Federal public authorities including Environmental Protection Agency (EPA) regulations, Missouri Department of Natural Resources (MDNR) and Occupational Safety and Health Administration (OSHA) which bear on performance work. Where conflicts occur between these specifications and/or the above-mentioned regulations, the more stringent shall govern. The Contractor shall hold the owner and owner’s air monitoring firm harmless for failure to comply with any applicable work, hauling, safety, health, or other regulations on the part of the contractor, contractor’s employees, or contractor’s subcontractors.

1.1.3.6 If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify MU in writing, and any necessary changes shall be accomplished by appropriate modification. It is not the Contractor's responsibility to make certain that the Contract Documents are in accordance with applicable laws, statutes, building codes and regulations. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to MU, he shall assume full responsibility therefore and shall bear all cost attributable thereto.

1.1.3.7 Enforce strict discipline and good order among employees. Do not employ unfit persons or persons not skilled in assigned task.

1.1.3.8 Comply with all applicable federal, state, and local laws regarding job discrimination and payment of prevailing wage rates for the base bid.

1.1.3.9 The use of the best available technology, procedures, and methods for preparation, execution, cleanup, disposal, and safety are absolutely required. This compliance is the sole responsibility of the abatement contractor.

1.1.3.10 Assume responsibility for the proper and safe execution of the work.

1.1.4 **COORDINATION**: The remediation contractor shall be responsible for the coordination of the universal waste materials removal for this project. The remediation contractor shall coordinate with all other on-site contractors and all subcontractors working under separate contracts so as to facilitate the general progress of the work. Each trade shall afford all trades every reasonable opportunity for the installation of their work.

1.2 STOP WORK

1.2.1 If the Owner, or his designated representative, presents a written or verbal stop work order, immediately stop all work or that portion of the work designated. A verbal stop work order shall be confirmed by a written stop work order within 24 hours. Do not commence referenced work until authorized in writing by the Owner or his representative.

1.3 CONTRACTOR USE OF PREMISES

1.3.1 **GENERAL**: During the construction period, the remediation contractor will have access to all parts of the building.

1.3.2 **USE OF THE SITE**: Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction.

1.3.2.1 Keep existing driveways and entrances serving the premises clear and available to the Owner and his employees at all times. Contractor will be provided locations for parking and/or storage of materials. These locations will be placed to each building as close as possible, without disrupting normal daily MU operations.

1.3.2.2 Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage to areas acceptable to Owner. If additional storage is necessary, obtain and pay for such storage off-site.

1.3.2.3 Do not load structure with weight that will endanger structure.

1.3.2.4 Assume full responsibility for protection and safekeeping of products stored on premises.

1.3.2.5 Move any stored products which interfere with operations of Owner or other contractors.

1.3.2.6 Contractor personnel shall utilize only those entrances/exits and parking lots designated by the Owner.

1.3.2.7 Contractor shall utilize only those areas designated by the Owner for the storage of equipment and the placement of dumpsters/transport containers.

1.3.2.8 Take all cautions necessary to ensure there is no universal or hazardous material contamination to those areas not included in work schedule. Should areas outside the work area become contaminated with hazardous materials, the Contractor shall immediately clean them utilizing the wet cleaning and HEPA vacuum methods specified herein. The remediation contractor is responsible for the proper cleanup of all items in the work areas to maintain a clean and safe environment.

1.3.3 **CONTRACTOR'S USE OF THE EXISTING BUILDING**: Maintain the existing building in a safe and weather tight condition throughout the construction period. Take all precautions necessary to protect the building and its occupants during the construction period.

1.3.3.1 Keep areas such as walkways and stairs free from accumulation of waste material, rubbish or construction debris.

1.3.3.2 Smoking or open fires are prohibited within the building or on the premises.

1.4 OWNER OCCUPANCY

1.4.1 PARTIAL OWNER OCCUPANCY: The Owner reserves the right to occupy areas of the building in which universal waste removal has been completed, provided that such occupancy does not substantially interfere with completion of the work. The Owner also reserves the right to occupy portions of the building not involved in this Scope of Work. Such partial occupancy shall not constitute acceptance of the work or any part of the work. The Owner shall also maintain the right to access areas where no universal and hazardous waste work is being performed.

2.1 SUBMITTAL REQUIREMENTS

2.1.1 The following will be submitted by the contractor prior to commencement of work for approval by Owner's Certified Industrial Hygienist or Air Sampling Firm (one copy for the Owner's Representative). The Owner's C.I.H. or Air Sampling Firm will return reviewed copies to contractor and Owner's Representative.

2.1.1.1 One copy of any Safety Data Sheets (SDS) for products to be used by the contractor in the performance of his work. Contractor will also maintain copies of SDS on site per OSHA.

2.1.2 Submit the following for all Supervisor(s) and Workers who will be on the project site prior to commencement of work:

2.1.2.1 A list of project personnel and contact phone numbers

2.1.2.2 Current training certificates, if applicable

2.1.2.3 Physician's Statement that each person is physically fit to wear a respirator, if respirator use is required

2.1.2.4 Respirator Fit Test, if respirator use is required

2.1.3 Submit a detailed plan of the procedures proposed for use in complying with requirements of this specification. Include in the plan the layout and location of work areas, route of ingress and egress for the work areas, methods used to assure safety of building occupants and visitors, method of removal of material, and disposal container requirements.

2.1.4 Proposed disposal/incineration site for universal waste materials, including a disposal plan to detail type of disposal container, method of transportation to disposal site, and waste hauler.

2.1.5 Any other submittals as required by MU.

2.1.6 Upon completion of the universal waste material removal, submit to the Owner's Representative, copies of hazardous materials shipping records, disposal receipts, incineration documentation, etc. for all universal waste materials removed from the project site.

2.1.7 Upon completion of the universal waste material removal, the following information shall be submitted by the contractor to the Owner's C.I.H. or Air Sampling Firm:

2.1.7.1 Construction and demolition waste landfill receipts, disposal receipts, truck tickets, incineration/recycling receipts and documentation.

2.1.7.2 Written visual certification from the Owner's Certified Industrial Hygienist or Air Sampling Firm that universal waste materials have been removed from the facility.

2.2 **TERMINOLOGY** (Definitions)

2.2.1 APPROVED CONSTRUCTION AND DEMOLITION WASTE DISPOSAL SITE: A permitted solid waste landfill that is authorized by the Missouri Department of Natural Resources to receive construction and demolition wastes.

2.2.2 AUTHORIZED VISITOR: The Building Owner, the Building Owner's representative, MU personnel, or a representative of any regulatory or other agency having jurisdiction over the project.

2.2.3 BARRIER: Any surface that seals off the work area to non-authorized personnel from entering the work area.

2.2.4 BUILDING OWNER: A representative of the University of Missouri.

2.2.5 DISPOSAL CONTAINER: A properly labeled container for universal waste materials. The proposed disposal containers for universal wastes will be provided to the Owner's Representative as part of the remediation contractor's pre-work submittals.

2.2.6 HEPA VACUUM EQUIPMENT: High efficiency particulate air filtered vacuuming equipment with a filter system capable of collecting and retaining hazardous particulates. Filters should be of 99.97% efficiency for retaining particulates greater than 0.3 microns.

2.2.7 ON-SITE REPRESENTATIVE: MU's full-time representative responsible for monitoring and enforcement of the specifications.

2.2.8 OWNER'S CERTIFIED INDUSTRIAL HYGIENIST (C.I.H.): An Industrial Hygienist, certified in comprehensive practice by the American Board of Industrial Hygiene (ABIH).

2.2.9 HAZARDOUS MATERIAL SHIPMENT RECORD/DISPOSAL RECEIPT: The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of universal/hazardous materials.

2.2.10 WET CLEANING/WIPING: The process of eliminating contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as necessary.

2.2.11 WORK AREA: A specific isolated area in which universal/hazardous waste materials are required to be handled. The area is designated as a work area from the time that the area is secured, and access restrictions are in place. The area remains designated as a work area until the time that it has been cleaned in accordance with any requirements applicable to the operations conducted.

2.3 EXISTING CONDITIONS

2.3.1 Building Owner and Contractor shall agree on building conditions prior to commencement of work. It shall be the Contractor's responsibility to replace or repair to the Owner's satisfaction, prior to close-out of the project, all damaged items caused by the Contractor and not proven otherwise. All items damaged prior to remediation shall be noted during preconstruction walk-through.

3.1 PERSONNEL PROTECTION REQUIREMENTS

3.1.1 Prior to commencement of work, the workers shall be instructed and shall be knowledgeable on the hazards of the universal waste materials involved and other environmental exposures, use and fitting of respirators, protective clothing, decontamination procedures, and all aspects of remediation work procedures; workers shall have medical examinations.

3.1.2 The Contractor acknowledges that he alone is responsible for enforcing personnel protection requirements and that these specifications provide only a minimum acceptable standard for each phase of operation.

3.1.3 If required or requested of the workers, provide workers with personally issued and marked respiratory equipment approved by NIOSH and accepted by OSHA.

3.1.4 No visitors shall be allowed in work areas, except as authorized.

3.1.5 Where required or if requested by the workers, provide workers with sufficient sets of disposable protective full-body clothing. Such clothing shall consist of full-body coveralls, footwear, and head gear, one-piece coveralls or equal. Provide eye protection and hard hats as required by applicable safety regulations. Disposable clothing shall not be allowed to accumulate and shall be disposed of as contaminated waste.

3.1.6 Provide authorized visitors with suitable protective clothing, headgear, footwear, and gloves as described above whenever they are required to enter the work area.

3.2 MATERIALS

3.2.1 Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.

3.2.1.1 Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.

3.2.1.2 Damaged or deteriorating materials shall not be used and shall be removed from the premises.

3.2.2 PLASTIC SHEETING: A minimum 6-mil (or as specified).

3.2.3 TAPE: Capable of sealing joints of adjacent sheets of polyethylene and for attachment of polyethylene sheets to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water, duct tape, poly prep tapes or approved equal.

3.2.4 ADHESIVES: Capable of sealing joints of adjacent sheets of polyethylene and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water.

3.2.5 IMPERMEABLE CONTAINERS: Suitable to receive and retain any universal waste/hazardous materials until disposal by the owners rep. The containers shall be labeled as required by owner. Containers must be resistant to damage and rupture.

3.2.6 WARNING LABELS AND SIGNS: As required by Federal, State, and Local regulations and the owner.

3.2.7 OTHER MATERIALS: Provide all other materials, such as, but not limited to lumber, plywood, nails, and hardware, which may be required to properly prepare and complete this project.

3.3 TOOLS AND EQUIPMENT

3.3.1 Provide suitable tools for universal/hazardous waste removal and disposal.

3.3.1.1 Water Sprayer: Airless or a low pressure sprayer for amended water application as applicable.

3.3.1.2 Air-Purifying Equipment: High Efficiency Particulate Air Filtration Systems (HEPA) shall comply with ANSI Z9.2-91. No air movement system or air equipment should discharge particulates outside the work area. Thus, the negative air unit shall be equipped with a three filter bank with the last being the HEPA filter capable of removing 99.97% of fibers/particulates >0.3 microns.

3.3.1.3 Scaffolding: As required to accomplish the specified work and meet all applicable safety regulations.

3.3.1.4 Vacuums: Use HEPA type from a known manufacturer.

3.3.1.5 Other tools and equipment as necessary.

3.4 SUPERVISION OF UNIVERSAL WASTES MATERIAL REMOVAL

3.4.1 The contractor shall designate a competent supervisor subject to the approval of the Owner's C.I.H. and/or the Owner's Representative. The supervisor shall be the Contractor's representative on the project, shall meet the requirements of all applicable regulations, and perform or meet the following minimum requirements:

3.4.1.1 Be knowledgeable in all aspects of removal, cleanup and proper disposal of universal waste/hazardous materials as listed in the Scope of Work.

3.4.1.2 Be onsite and supervise all removal, cleanup and disposal activities.

3.4.1.3 Maintain a daily log on the project documenting events, violations, problems, equipment failures, accidents, and inspections.

3.4.1.4 Be responsible for implementation of first aid, safety training, respiratory protection, and ensuring all workers are trained in emergency procedures.

3.4.1.5 Be responsible for conducting a visual inspection of the work area prior to a visual inspection by the Owner's Certified Industrial Hygienist. Inspection shall be documented.

3.5 WORKER PROTECTION / TRAINING

3.5.1 The contractor shall be responsible for providing his employees with proper respiratory protection, respiratory training, a written respirator program, medical examinations, maintaining medical records, protective clothing and equipment to comply with OSHA requirements, if necessary

3.5.2 All workers shall be trained in the dangers inherent in handling universal waste, and hazardous materials, in proper work procedures, and personal protective measures.

3.6 OWNER'S CERTIFIED INDUSTRIAL HYGIENIST/AIR SAMPLING FIRM

3.6.1 It will be the Owner's responsibility to hire a Certified Industrial Hygienist or Air Sampling Firm or use an In-House Certified Industrial Hygienist. The Certified Industrial Hygienist/Air Sampling Firm will also be required to perform the following duties as a minimum:

3.6.1.1 Approval of the Contractor's work plan and methods of remediation to meet regulatory requirements and ensure the health and safety of University faculty, staff, and students.

3.6.1.2 Verify that the Contractor is satisfactorily performing the work in accordance with OSHA regulations.

3.6.1.3 Visual inspection of the work areas.

3.6.1.4 Certify in writing that the Contractor's procedures, methods, and practices were, to the best of his/her knowledge and belief, in compliance with current EPA, OSHA, State, and Local applicable regulations, that the work areas meet the requirements for a final visual inspection prior to re-occupancy, and an accounting of any known deviations.

3.7 SEPARATION OF WORK AREAS FROM NONWORK AREAS

3.7.1 Visual separation shall be accomplished at all "see-through" locations using opaque polyethylene. This separation shall not be incorporated within the other seals involved on this project.

3.8 EMERGENCY PROTECTION PLAN / FIRE EXITS

3.8.1 The contractor shall be responsible for developing a written Emergency Protection Plan and shall maintain this plan onsite. The plan shall include considerations of fire, explosion, toxic atmospheres, electrical hazards, slips, falls, and heat related injury. All employees shall be instructed and trained in the procedures.

3.8.2 The Emergency Protection Plan shall also include written notification of police, fire, and medical personnel of the planned remediation activities, work schedule, and layout of the work area, particularly barriers that may affect response capabilities.

3.8.3 Designate and maintain emergency and fire exits from the work area in accordance with local codes and regulations. All exits shall be clearly marked with fluorescent tape or red paint and shall be clearly visible from any part of the work area.

3.9 LOCAL AREA PROTECTION / SITE SECURITY

3.9.1 The contractor shall secure the work areas to make sure of no inadvertent entry. Any breach to the exterior of the building shall be secured by the remediation contractor. The Contractor shall be responsible for maintaining security of the remediation areas throughout the contract period.

3.9.2 The contractor shall be responsible for all areas of the building used by contractor and/or subcontractors in the performance of the work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of the existing building, except such controls as may be specifically reserved to the owner.

3.9.3 Contractor has the right to exclude from the work area all persons who have no purpose related to the work or its inspection, and shall require all persons in the work area to observe the same regulations required of Contractor's employees.

3.9.4 The contractor shall have control of site security during remediation operations in order to protect the work environment and equipment. Contractor shall have the owner's assistance in notifying building occupants of impending activity and enforcement of restricted access by owner's employees.

3.9.5 The contractor shall keep a minimum of two (2) 10 lb type ABC fire extinguishers onsite. One shall be maintained outside the work area and one inside each work area. Contractor employees shall be trained in the operation of fire extinguishers.

3.9.6 The contractor shall maintain the work area free from rubbish, debris, and dirt, and keep a clean, safe working area.

3.10 UNIVERSAL WASTE/HAZARDOUS MATERIALS REMOVAL OPERATIONS

3.10.1 Any light fixtures, housings, etc. (Non-Universal Wastes), concealing items considered to be universal waste/hazardous material, shall be removed and left on-site for disposal during the building demolition.

3.10.2 For the items listed below, the Abatement Contractor is responsible for the packaging, labeling and consolidation of the items in an area approved upon by MU Environmental Health and Safety and the Abatement Contractor. The packaging material and labels will be provided by MU Environmental Health and Safety. Once the items are properly packaged, labeled, and consolidated, MU Environmental Health and Safety will arrange and pay for disposal.

3.10.3 **FLUORESCENT LIGHT TUBES** may contain small amounts of Mercury. This can potentially be harmful to human health and the environment. The bulbs should be placed in fiberboard boxes provided by MU Environmental Health and Safety. MU Environmental Health and Safety will provide collection supplies, labels, and will coordinate and pay for the disposal of these items.

3.10.4 **POLYCHLORINATED BIPHENYL (PCBS)** are a known carcinogenic material. Its use was discontinued January 1, 1979. Due to the age of the building, it should be assumed that any ballast can contain PCBs unless it is labeled as PCB free by the manufacturer. Due to this, any light ballasts presumed to contain PCBs should be properly disposed. MU Environmental Health Safety will provide collection supplies, labels, and will coordinate and pay for the disposal of these items. Non-PCB ballasts will also be managed by MU Environmental Health Safety.

3.10.5 **EXIT SIGNS AND EMERGENCY LIGHTS** typically have backup batteries that may contain small amounts of lead. These items should be properly collected, packaged, and labeled for disposal via MU Environmental Health and Safety. Non powered exit signs should be assumed to contain radioactive material and should be collected for disposal via MU Environmental Health and Safety. MU Environmental Health and Safety will provide collection supplies, labels, and will coordinate and pay for the disposal of these items.

3.10.6 **THERMOSTATS**: Some thermostats may contain small amounts of mercury. These items must be properly labeled, packaged, and turned over to MU Environmental Health and Safety for proper disposal. MU Environmental Health and Safety will provide collection supplies, labels, and will coordinate and pay for the disposal of these items.

3.10.7 **SMOKE DETECTORS**: Some smoke detectors may contain small amounts of radioactive material. MU Environmental Health and Safety will provide collection supplies, labels, and will coordinate and pay for the disposal of these items.

3.10.8 **FIRE ALARMS**: Some fire alarms may contain small amounts of radioactive material. These should be collected, packaged and properly labeled for disposal via MU Environmental Safety and Health. Coordinate with MU Environmental Health and Safety for collection containers and proper labeling.

3.11 REESTABLISHMENT OF THE WORK AREA

3.11.1 Reestablishment of the work area shall only occur after the Contractor has received a final visual inspection from the Owner's C.I.H. or Air Sampling Firm documenting that the universal/hazardous waste materials have been removed from the project site.

END OF SECTION

SECTION 028233

FRIABLE AND NON-FRIABLE ASBESTOS REMOVAL

PART 1 - GENERAL

Provisions of the General Conditions and Special Conditions are part of this Division.

1.1 SCOPE OF WORK

1. General: The work specified herein shall be the abatement of asbestos-containing materials by certified and registered persons who are knowledgeable, qualified and trained in the abatement, handling, and disposal of asbestos containing material, and subsequent cleaning of the affected environment.

2. The Contractor shall furnish all labor, material, equipment, testing, services, permits, insurance, notifications, necessary or required to perform the work in accordance with applicable local, state, and federal regulations for the abatement of asbestos-containing materials and for other work as specified in this section or as indicated in associated drawings, sketches, or reports of the work.

All fees required for notification requirements, renotifications, and/or inspections by the regulatory agencies shall be paid by the Contractor. Bulk sample analysis information required by the Department of Natural Resources, U.S. Environmental Protection Agency or local authority having jurisdiction in conjunction with the notification shall also be provided by the Contractor unless provided within this section.

3. The work shall include the removal and legal disposal of friable asbestos-containing materials.

A. Friable asbestos:
The contractor shall remove and legally dispose of the following friable asbestos-containing materials for the Neff Hall HVAC Building Upgrades – Phase 2 project – Project NO. CP231442:

- Attic Area - Approximately 100 linear feet of pipe and pipe fitting insulation.

1.2 DEFINITIONS

1. Abatement - Procedures to decrease or eliminate the source of fiber release from asbestos containing building materials. Includes encapsulation, enclosure, and removal.

2. Adequately Wet - To sufficiently mix or penetrate with liquid to prevent the release of particulate.

3. Aggressive Air Sampling - Sweeping of floors, ceilings and walls and other surfaces with the exhaust of a minimum of one (1) horsepower leaf blower or equivalent immediately prior to air monitoring.

4. Approved Waste Disposal Site - A solid waste disposal area that is authorized by the Department of Natural Resources to receive asbestos containing solid wastes.

5. Asbestos - The asbestiform varieties of serpentine (chrysotile, antigorite), riebeckite (crocidolite), cummintonite-grumerite (amosite), anthophyllite, and actinolite-tremolite.

6. Asbestos Abatement Supervisor - An individual who directs, controls, or supervises others in asbestos abatement projects.

7. Asbestos-Containing Building Material (ACBM) - Surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a building.

8. Asbestos-Containing Material (ACM) - Any material containing more than 1 percent asbestos by weight.

9. Barrier - Any surface that seals off the work area to inhibit the movement of fibers.

10. Category I Nonfriable ACM - Asbestos-containing packings, gaskets, resilient floor covering and asphalt roofing products containing more than one percent (1%) asbestos as determined using the method specified in 40 CFR part 763, subpart F, Appendix A, section 1, Polarized Light Microscopy.

11. Category II Nonfriable ACM - Any material, excluding category I nonfriable ACM, containing more than one percent (1%) asbestos as determined using the methods specified in 40 CFR part 763, subpart F, Appendix A, section 1, Polarized Light Microscopy that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.

12. Containment - Area where asbestos abatement project is conducted. Area must be enclosed either by a glove bag or plastic sheeting barrier.

13. Contractor's Competent Person (Qualified Person) - One who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32 (f); in addition, for Class I, II, III, and IV work, who is specially trained in training courses which meet the criteria of EPA's Model Accreditation Plan (40 CFR Part 763) for project designer or supervisor, or its equivalent.

14. Decontamination Area - Enclosed area adjacent and connected to the regulated area which is used for decontamination of workers, materials, and equipment that are contaminated with asbestos.

15. Demolition - the wrecking or taking out of any load bearing structural member of a facility together with any related handling operations.

16. Disposal Bag - A properly labeled 6 mil. thick, leak-tight plastic bag used for transporting asbestos waste from work area to disposal site.

17. Encapsulant (Sealant) - A liquid material which can be applied to asbestos- containing material and which prevents the release of asbestos fibers from the material either by creating a membrane over the surface or by penetrating into the material and binding its components together.

18. Encapsulation - Treatment of asbestos containing materials with an encapsulant.

19. Enclosure - The construction of an airtight, impermeable, permanent barrier around asbestos containing material to control the release of asbestos fibers into the air.

20. Friable Asbestos Material - Any material containing more than one percent asbestos as determined using the method specified in appendix A, subpart F, 40 CFR part 763 section 1, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

21. Glove Bag - A manufactured or fabricated device, typically constructed of six (6) mil transparent polyethylene or polyvinyl chloride plastic. This device consist of two (2) inward projecting long sleeves, an internal tool pouch and an attached, labeled receptacle for asbestos waste.

22. Homogeneous Work Site - Continuous areas with the same type of ACM and in which one type of abatement process is performed.

23. Negative Initial Exposure Assessment - An assessment by a "Competent Person" in which it is concluded that employee exposures during the job are likely to be consistently below the Permissible Exposure Levels.

24. Outside Air - Air outside of the containment.

25. Owner's Air Monitoring Firm - Air Monitoring conducted by a person who is not under the direct control of the person carrying out the asbestos abatement project and who has been selected by the Owner.

26. Owner's Air Sampling Professional - An individual who holds a valid certification from the State of Missouri. The individual shall conduct, oversee, or be responsible for air monitoring of asbestos abatement projects before, during, and after the project has been completed. The air sampling professional must be a State of Missouri certified Asbestos Air Sampling Professional or equivalent training, and supervised by the Owner's Certified Industrial Hygienist (C.I.H.).

27. Owner's Air Sampling Technician - An individual who has been trained by and is under the supervision of an air sampling professional to do air monitoring before, during, and after the asbestos abatement project. The air sampling technician must have a State of Missouri asbestos certificate or equivalent training, and be supervised by the Owner's Certified Industrial Hygienist (C.I.H.).

28. Owner's Certified Industrial Hygienist (C.I.H.) - an Industrial Hygienist, Certified in Comprehensive Practice by the American Board of Industrial Hygiene. The Owner's C.I.H. must also be certified by the Missouri Department of Natural Resources as an air sampling professional and hold a 40 hour AHERA Asbestos Contractor/Supervisor Certificate. The Owner will identify C.I.H. before application for permit.

29. Personal Monitoring - Sampling of the asbestos fiber concentrations within the breathing zone.

30. Regulated Asbestos-Containing Material (RACM) - Friable asbestos material; Category I nonfriable ACM that has become friable; Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations.

31. Remove - To take out RACM or facility components that contain or are covered with RACM from any facility.

32. Renovation - Altering a facility or one or more facility components in any way, including the stripping or removal of RACM from a facility component.

33. Repair - The restoration of asbestos material that has been damaged. Repair consists of the application of rewettable glass cloth, canvas, cement or other suitable material. It may also involve filling damaged areas with non-asbestos substitutes and re- encapsulating or painting previously encapsulated materials.

34. Strip - To take off RACM from any part of a facility or facility components.

35. Waste Shipment Record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos containing waste material.

36. Work Area - A specific isolated area, other than the space enclosed within a glove bag, in which friable asbestos-containing materials is required to be handled. The area is designated as a work area from the time that the area is secured and access restrictions are in place. The area remains designated as a work area until the time that it has been cleaned in accordance with any requirements applicable to the operations conducted.

1.3 CODES AND REGULATIONS

1. General Applicability Of Codes, Regulations and Standards - All applicable codes, regulations, standards, statutes, laws, and rules have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith. Where conflicts arise, the most stringent specification shall apply.

2. Contractor Responsibility - The Contractor shall assume full responsibility and liability for the compliance with all applicable federal, state, and local regulations pertaining to work practices, hauling, disposal and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable federal, state, and local regulations. The Contractor shall hold the owner harmless for failure to comply with any applicable work, hauling, disposal, safety, health, or other regulations on the part of the contractor, contractor's employees, or contractor's subcontractors.

3. Federal and State requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

1. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) including but not limited to:

    1. Title 29, Part 1910, Section 1001 and Part 1926, Section 1101 of the Code of Federal Regulations.

    2. Respiratory Protection, Title 29, Part 1910, Section 134 of the Code of Federal Regulations.

    3. Construction Industry, Title 29. Part 1926, of the Code of Federal Regulations.

    4. Access to Employee Exposure and Medical Records, Title 29, Part 1910, Section 2 of the Code of Federal Regulations.

    5. Hazard Communication, Title 29, Part 1910, Section 1200 of the Code of Federal Regulations.

    6. Specifications for Accident Prevention Signs and Tags, Title 29, Part 1910, Section 145 of the Code of Federal Regulations.

2. U.S. Environmental Protection Agency (EPA) including but not limited to:

    1. National Emission Standards for Hazardous Air Pollutants (NESHAPS) Title 40, Part 61, Subpart M, Code of Federal Regulations.

3. U.S. Department of Transportation (DOT) including but not limited to:

    1. Title 49, Part 172, Section 101 of the Code of Federal Regulations.

4. State of Missouri including but not limited to:

    1. H.B. 77, 85th General Assembly.

    2. Missouri Air Conservation Law Chapter 643.

    3. Missouri Department of Natural Resources, Division 10, Chapter 6 of the Code of State Regulations as follows:

        (1) 10 CSR 10-6.020, Definitions

        (2) 10 CSR 10-6.080, Emission Standards for Hazardous Air Pollutants

        (3) 10 CSR 10-6.230, Administrative Penalties

        (4) Volume 18, Missouri Register, Page 44

(5) 10 CSR 10-6.250, Asbestos Abatement Projects - Certification, Accreditation, and Business Exemption Requirements

1.4 NOTIFICATIONS

1. Notifications meeting the requirements of Volume 18, Missouri Register, page 44, shall be completed and sent by the Contractor not less than ten (10) days before the intended starting date of the project. Send notification to the following:

1. Department of Natural Resources
Air Pollution Control Program (Asbestos)
P.O. Box 176
Jefferson City, Missouri 65102

2. U.S. Environmental Protection Agency
Region VII
Air & Toxic Division, Air Branch
ATTN: Air Compliance
726 Minnesota Avenue
Kansas City, Kansas 66101

3. Provide a copy to the Owner's Representative. Five (5) day notification to the Owner's Representative is required on jobs less than the reportable quantity.

4. If the project is under the jurisdiction of the Kansas City Air Quality Section, St. Louis County Air Pollution Control Branch, or the Springfield-Green County Air Pollution Control Authority, send notification directly to the appropriate agency.

1.5 SUBMITTALS

1. The following will be submitted by contractor prior to commencement of work for approval by the Owner's Certified Industrial Hygienist (one copy for the Owner's Representative). Owner's C.I.H. will return reviewed copies to contractor and Owner's Representative.

1. One copy of safety data sheets (SDS) for products to be used by the Contractor in the performance of his work. Contractor will also maintain copies of SDS on site per OSHA.

2. One copy of the notifications to, or any correspondence with, the regulatory agencies. Submit a listing of all prior regulatory violations.

2. Friable Abatement:

1. Current Certificates of training and statement of qualifications for the project asbestos abatement supervisor and the Missouri Asbestos Occupational Certificates for all project personnel. List a summary of project personnel and contact phone numbers.

2. Name, address, and contact person's name of testing laboratory or laboratories to be utilized analyzing samples for bulk analysis or air samples.

3. Submit a detailed plan of the procedures proposed for use in complying with requirements of this specification and Volume 18, Missouri Register, page 44, and 29 CFR 1926.1101. Include in the plan the layout and location of barriers, decontamination units, route of ingress and egress for work area, methods used to assure safety of building occupants and visitors, methods used to isolate or closing out of HVAC system, personal air monitoring strategy, method of removal of material, and engineering controls utilized to prevent emissions from the work area.

4. Provide a disposal plan to detail type of disposal container, method of transportation to disposal site, waste hauler, and disposal site.

5. Copy of notifications required as part of the emergency notification plan.

3. Non-Friable Abatement:

1. Submit a detailed plan of the procedures proposed to minimize emissions and to prevent the material from becoming friable during removal.

2. Copy of emergency protection plan to be used if the nonfriable material should become friable during removal.

3. Current Certificates of training and statement of qualifications for the "Competent Person".

4. One copy of the Negative Initial Exposure Assessment.

5. Upon completion of the abatement work, the following information shall be submitted to the Owner's Representative.

1. Waste disposal receipts and waste shipment record on all asbestos waste removed from the project.

6. Upon completion of the abatement work, the following information shall be submitted by the Owner's C.I.H. to the Contractor.

1. Air sampling test results for personal (non-OSHA) and final clearance air samples taken under the supervision of Owner's Certified Industrial Hygienist. Results must be in writing in final report form.

2. Written certification from the Owner's Certified Industrial Hygienist.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SUPERVISION OF ABATEMENT

1. The Contractor shall designate a competent supervisor subject to the approval of the Owner's C.I.H. and the Owner's Representative. The supervisor shall be the Contractor's representative on the project and shall meet the requirements of all applicable regulations and perform the following minimum requirements.

    1. Be Certified by the State of Missouri as an Asbestos Abatement Supervisor, a minimum of one year prior full time experience in asbestos abatement work and a minimum of two years' experience as a supervisor, and be qualified as a Competent Person in accordance with OSHA regulation 1926.1101.

    2. Be on site and supervise all abatement work in accordance with OSHA and Volume 18, Missouri Register, page 44.

    3. Conduct all OSHA required air monitoring.

    4. Maintain a daily log on the project documenting events, visitations, problems, equipment failures, accidents, and inspections.

    5. Be responsible for implementation of first aid, safety training, respiratory protection, and ensuring all workers are trained in emergency procedures.

    6. Be responsible for conducting a visual inspection of the work area prior to a visual inspection by the Owner's Certified Industrial Hygienist. Inspection shall be documented.

3.2 NEGATIVE INITIAL EXPOSURE ASSESSMENT

1. The Contractor must conduct a Negative Initial Exposure Assessment (non-friable asbestos) prior to removal of the asbestos material. The Negative Initial Exposure Assessment shall be performed by a "Competent Person" to determine whether the material may be removed and maintained in a nonfriable condition. If the material cannot be removed without becoming friable then the contractor shall comply to the requirements in this specification at no additional cost to the Owner.

2. The method of removal is the Contractor's option. However, in the event of any of the following:

    1. Visible emissions are observed

    2. Sanding, grinding, cutting, or abrading of the material

    3. Air samples exceed 0.1 f/cc

The contractor shall immediately stop work, implement corrective work practices, make any necessary notifications to all regulatory agencies of the changes in work practices and material conditions, and comply with the requirements as set forth in this specification.

3.3 WORKER PROTECTION & TRAINING

1. The Contractor shall be responsible for providing his employees with proper respiratory protection, respiratory training, written respirator program, medical examinations, maintaining medical records, and protective clothing and equipment to comply with OSHA requirements.

2. The Contractor shall be responsible for all testing and costs incurred for complying with requirements of OSHA regulations for Personal Air Sampling.

3. All workers shall be trained in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and protective measures.

4. All workers shall hold valid diplomas as accredited Asbestos Abatement Workers as required by 10 CSR 10-6.250.

3.4 INDEPENDENT TESTING LABORATORY

1. Testing Laboratories utilized by the Contractor for sample analysis during the project shall meet the following minimum requirements and be approved by the Owner's C.I.H. This information shall be submitted to the Owner's Representative for review.

    1. All air monitoring samples shall be analyzed by a testing laboratory accredited by the American Industrial Hygiene Association (AIHA) or by an individual who is currently on the Asbestos Analyst Registry.

    2. All bulk samples shall be analyzed by a testing laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

3.5 OWNER'S AIR SAMPLING PROFESSIONAL & CERTIFIED INDUSTRIAL HYGIENIST

1. It will be the Owner's responsibility to hire an Air Sampling Professional and/or Certified Industrial Hygienist. The Air Sampling Professional & Industrial Hygienist will also be required to perform/oversee the following duties as a minimum:

    1. Approval of the Contractor's work plan and methods of abatement to meet regulatory requirements and ensure the health and safety of University faculty, staff, and students.

    2. Verify that the contractor is satisfactorily performing personal air monitoring as directed by OSHA regulations.

    3. Visual inspection of the work area and final clearance air monitoring.

    4. Certify in writing that the Contractor's procedures, methods and practices were, to the best of my knowledge and belief, in compliance with current EPA, OSHA, State and/or applicable local regulations and that the work areas meet the requirements for final clearance testing and account of any known deviations.

5. Issue final air clearance certifications/notifications.

3.6 EMERGENCY PROTECTION PLAN

1. The contractor shall be responsible for developing a written Emergency Protection Plan and shall maintain this plan on site. The plan shall include considerations of asbestos leakage from the site, fire, explosion, toxic atmospheres, electrical hazards, slips, falls, and heat related injury. All employees shall be instructed and trained in the procedures.

2. Emergency protection plan shall also include written notification of police, fire and medical personnel of the planned abatement activities, work schedule, and layout of work area, particularly barriers that may affect response capabilities.

3.7 LOCAL AREA PROTECTION & SITE SECURITY

1. The contractor shall be responsible for all areas of the building used by him and/or subcontractors in the performance of the work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of the existing building, except such controls as may be specifically reserved to the owner.

2. Contractor has the right to exclude from the work area all persons who have no purpose related to the work or its inspection, and shall require all persons in the work area to observe the same regulations required of Contractor's employees.

3. The contractor shall have control of site security during abatement operations in order to protect work environment and equipment. Contractor shall have the owner’s assistance in notifying building occupants of impending activity and enforcement of restricted access by owner’s employees.

4. The contractor shall keep a minimum of two 10 lbs. type ABC fire extinguishers on site. One shall be maintained outside the work area and one inside the work area. The employees shall be trained in the operation of extinguishers.

5. Where areas cannot be isolated by existing walls and doors from employees, students, or the public, barriers to each floor must be constructed of 1/2" plywood and 2"x4" framing 16" o.c. to isolate the area. The barriers must be installed in such a manner to prevent damage to existing walls, floors, or ceilings. Barrier may have a lockable door.

6. The contractor shall maintain the work area free from rubbish, debris, and dirt and keep a clean, safe working area.

7. The Contractor shall provide warning signage around the regulated area as required by OSHA.

8. The Contractor shall isolate any and all air supply and returns to the abatement space as required by OSHA. Contractor shall coordinate with the Owner's Representative.

9. The Contractor shall keep all areas where adhesive stripper is in use (such as mastic removal) under negative pressure and exhausted to the outside ambient air.

3.8 FINAL CLEARANCE REQUIREMENTS (FRIABLE ASBESTOS)

1. Upon completion of the abatement work, the supervisor shall perform a visual inspection of the work area. If satisfactory, the supervisor shall then request the Owner's C.I.H. or the C.I.H.'s air sampling technician to perform a visual inspection. When the Owner's C.I.H. feels the area is ready based on the results of their visual inspection, the Contractor may apply a lockdown encapsulant. Following application of lockdown encapsulant, the Owner's C.I.H. shall perform the final clearance sampling for airborne fiber concentrations.

2. The Owner's Air Sampling Firm or designee will perform final clearance testing per the following requirements:

    1. Aggressive sampling may be required for all areas where removal has taken place with the exception of glove bag projects where nonaggressive sampling is permitted.

    2. P.C.M. samples analyzed on site shall be counted by an accredited registered microscopist.

    3. For areas specifically specified for clearance by Transmission Electron Microscopy, the method shall be NIOSH 7402.

3. Any work areas failing to meet the clearance requirements of this section shall be recleaned and retested at the contractor's expense until satisfactory levels are obtained.

4. The Owner's Air Sampling Firm will provide a written report of the air monitoring activities to the contractor within 7 days after the final clearance testing.

3.9 FINAL CLEARANCE REQUIREMENTS (NONFRIABLE ASBESTOS)

1. Upon completion of the abatement work, the supervisor shall perform a visual inspection of the work area. If satisfactory, the supervisor shall then request the Owner's Air Sampling Firm to perform a visual inspection. When the Owner's Air Sampling Firm feels the area is ready based on the results of their visual inspection, the Owner's Air Sampling Firm will perform the final clearance sampling for airborne fiber concentrations.

2. The Owner's Air Sampling Firm or designee will perform final clearance testing per the following requirements:

    1. Aggressive sampling shall be required for all areas where removal has taken place with the exception of glove bag projects where nonaggressive sampling is permitted.

    2. P.C.M. samples analyzed on site shall be analyzed by an accredited registered microscopist.

3. Any work areas failing to meet the clearance requirements of this section shall be recleaned and retested at the contractor's expense until satisfactory levels are obtained.

4. The Owner's Air Sampling Firm shall provide a written report of the air monitoring activities to the contractor within 7 days after the final clearance testing.

3.10 REESTABLISHMENT OF THE WORK AREA AND SYSTEMS

1. Reestablishment of the work area shall only occur after the contractor has received final clearance in writing from the Owner's Air Sampling Firm.

2. All damage to finishes, equipment, and/or the area affected by the abatement shall be repaired by the contractor to equal or better condition as it was prior to the work, at no cost to the owner.

3.11 WASTE DISPOSAL

1. All asbestos-containing waste and/or asbestos contaminated debris shall, as a minimum, be double bagged in approved 6 mil. disposal bags or double-wrapped in 6 mil. polyethylene. Each bag/bundle shall be tagged to meet requirements of NESHAPS with an asbestos caution label and a source identification label.

2. Transportation shall meet the requirements of all regulatory agencies for asbestos-containing materials and shall be transported in an enclosed truck.

3. The waste disposal site shall be approved by the Missouri Department of Natural Resources for asbestos disposal. A chain of custody letter/waste shipment record and disposal receipts shall be provided to the owner for all materials disposed of.

3.12 DRAWINGS

Drawings, when provided, are not intended to be used for anything but a "reference" to the work area. Information is not specific to quantities or to exact location of ACM unless explicitly noted. Contractor will be required to field verify the conditions and quantities.

3.13 REPORTS

Reports, when provided, are intended to be used as a basis for the type and composition of the asbestos present for both bidding purposes and for the information required for the notifications to the governing agencies.

PART 1 - GENERAL

Provisions of the General Conditions and Special Conditions are part of this Division.

1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1 The Contractor shall inform him/herself of the conditions for the project and is responsible for verifying the quantities and location of all work to be performed as outlined in this section. Failure to do so shall not relieve the Contractor of his obligation to furnish all materials and labor necessary to carry out the provisions of the Contract. The work of the Contract can be summarized as follows:

The work may consist of the proper removal and disposal of the following approximate quantities of components painted with Lead-Based Paint (LBP) for the Neff Hall HVAC Building Upgrades – Phase 2 Project - MU Project Number CP231442:

- Wood Flooring in Room 10 – Varnish
- Concrete Walls in Room 10 – White
- Concrete Walls in Room 10A – Tan
- Brick Wall in Room 10A – Tan
- Concrete Walls in Room 10B – Tan
- Concrete Wall in Room 10C – White
- Plaster Wall in Corridor C101 – White
- Plaster Walls in Corridor C102 – Cream
- Plaster Walls in Room 120 – White
- Plaster Walls in Room 122 – White
- Plaster Walls in Room 110 – Cream
- Plaster Walls in Room 200 – Blue
- Plaster Ceiling in Room 200 – White
- Plaster Walls in Room 201 – White
- Plaster Walls in Room 203 – White
- Plaster Ceiling in Room 203 – White
- Plaster Walls in Room 205 – White
- Plaster Ceiling in Room 205 – White
- Plaster Walls in Room 208 – White

1.2 CODES AND REGULATIONS:

1.1.2.1 All applicable codes, regulations, standards, statutes, laws, and rules have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith. Where conflicts arise, the most stringent specification shall apply.

1.1.2.2 Federal and State requirements which govern lead-based paint removal work or hauling and disposal of such waste materials include but are not limited to the following:

1.1.2.2.1 U.S. Department of Labor, Occupational Health and Safety Administration (OSHA), 29 CFR 1910 and 29 CFR 1926.

1.1.2.2.1.1 Construction Industry - 29 CFR 1926.1101

1.1.2.2.1.2 Respiratory Protection – 29 CFR 1910.134

1.1.2.2.1.3 Hazard Communication – 29 CFR 1910.1200

1.1.2.2.1.4 Accident Prevention Signs – 29 CFR 1910.145

1.1.2.2.2 U.S. Environmental Protection Agency (EPA)

1.1.3 **CONTRACTOR'S DUTIES**

1.1.3.1 Except as specifically noted, provide and pay for:

- Labor, materials, and equipment.
- Tools, construction equipment, and machinery.
- Other facilities and services necessary for proper execution and completion of work.

1.1.3.2 Pay legally required sales, consumer, use, payroll, privilege and other taxes. Retail sales tax shall not be included in the bid amount.

1.1.3.3 Secure and pay for, as necessary for proper execution and completion of work, and as applicable at the time of bids:

- Permits
- Government Fees
- Licenses
- Except where specifically noted, provide, and pay for waste disposal permits and costs

1.1.3.4 Give required notices.

1.1.3.5 Contractor shall assume full responsibility and liability for compliance with all codes, ordinances, rules, regulations, orders and other legal requirements of Local, State, and Federal public authorities including Environmental Protection Agency (EPA) regulations, Missouri Department of Natural Resources (MDNR) and Occupational Safety and Health Administration (OSHA) which bear on performance work. Where conflicts occur between these specifications and/or the above-mentioned regulations, the more stringent shall govern. The Contractor shall hold the owner and owner’s air monitoring firm harmless for failure to comply with any applicable work, hauling, safety, health, or other regulations on the part of the contractor, contractor’s employees, or contractor’s subcontractors.

1.1.3.6 If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify MU in writing, and any necessary changes shall be accomplished by appropriate modification. It is not the Contractor's responsibility to make certain

that the Contract Documents are in accordance with applicable laws, statutes, building codes and regulations. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to MU, he shall assume full responsibility therefore and shall bear all cost attributable thereto.

1.1.3.7 Enforce strict discipline and good order among employees. Do not employ unfit persons or persons not skilled in assigned task.

1.1.3.8 Comply with all applicable federal, state, and local laws regarding job discrimination and payment of prevailing wage rates for the base bid.

1.1.3.9 The use of the best available technology, procedures, and methods for preparation, execution, cleanup, disposal, and safety are absolutely required. This compliance is the sole responsibility of the abatement contractor.

1.1.3.10 Assume responsibility for the proper and safe execution of the work.

1.1.8 **COORDINATION**: The General Contractor shall be responsible for the coordination of the LBP removal and window replacement for this project. The lead remediation contractor shall coordinate with all other on-site contractors and all subcontractors working under separate contracts so as to facilitate the general progress of the work. Each trade shall afford all trades every reasonable opportunity for the installation of their work.

1.2 STOP WORK

1.2.1 If the Owner, or his designated representative, presents a written or verbal stop work order, immediately stop all work or that portion of the work designated. A verbal stop work order shall be confirmed by a written stop work order within 24 hours. Do not commence referenced work until authorized in writing by the Owner or his representative.

1.3 CONTRACTOR USE OF PREMISES

1.3.1 **GENERAL**: During the construction period, the lead remediation contractor will have access to planned renovations area in Hill Hall for construction operations. Other areas of the building will be strictly off limits to the lead remediation contractor.

1.3.2 **USE OF THE SITE**: Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction.

1.3.2.1 Keep existing driveways and entrances serving the premises clear and available to the Owner and his employees at all times.

1.3.2.2 Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage to areas acceptable to Owner. If additional storage is necessary, obtain and pay for such storage off-site.

1.3.2.3 Do not load structure with weight that will endanger structure.

1.3.2.4 Assume full responsibility for protection and safekeeping of products stored on premises.

1.3.2.5 Move any stored products which interfere with operations of Owner or other contractors.

1.3.2.6 Contractor personnel shall utilize only those entrances/exits and parking lots designated by the Owner.

1.3.2.7 Contractor shall utilize only those areas designated by the Owner for the storage of equipment and the placement of dumpsters/transport containers.

1.3.2.8 Take all cautions necessary to ensure there is no lead contamination to those areas not included in work schedule. Should areas outside the work area become contaminated with hazardous materials, the Contractor shall immediately clean them utilizing the wet cleaning and HEPA vacuum methods specified herein. The hazard remediation contractor is responsible for the proper cleanup of all items in the work areas to maintain a clean and safe environment.

1.3.3 **CONTRACTOR'S USE OF THE EXISTING BUILDING**: Maintain the existing building in a safe and weather tight condition throughout the construction period. Take all precautions necessary to protect the building and its occupants during the construction period.

1.3.3.1 Keep areas such as walkways and stairs free from accumulation of waste material, rubbish or construction debris.

1.3.3.2 Smoking or open fires are prohibited within the building or on the premises.

1.4 OWNER OCCUPANCY

1.4.1 PARTIAL OWNER OCCUPANCY: The Owner reserves the right to occupy areas of the building in which lead removal has been completed, provided that such occupancy does not substantially interfere with completion of the work. The Owner also reserves the right to occupy portions of the building not involved in this Scope of Work. Such partial occupancy shall not constitute acceptance of the work or any part of the work. The Owner shall also maintain the right to access areas where no work is being performed.

2.1 SUBMITTAL REQUIREMENTS

2.1.1 The following will be submitted by the contractor prior to commencement of work for approval by Owner's Certified Industrial Hygienist (one copy for the Owner's Representative). The Owner's C.I.H. will return reviewed copies to contractor and Owner's Representative.

2.1.1.1 One copy of any Safety Data Sheets (SDS) for products to be used by the contractor in the performance of his work. Contractor will also maintain copies of SDS on site per OSHA.

2.1.2 Submit the following for all Supervisor(s) and Workers who will be on the project site prior to commencement of work:

2.1.2.1 A list of project personnel and contact phone numbers

2.1.2.2 Current training certificates, either EPA RRP training or State of Missouri lead licenses

2.1.2.3 Physician's Statement that each person is physically fit to wear a respirator

2.1.2.4 Respirator Fit Test

2.1.3 Submit a detailed plan of the procedures proposed for use in complying with requirements of this specification. Include in the plan the layout and location of work areas, route of ingress and egress for the work areas, methods used to assure safety of building occupants and visitors, method of removal of material, and disposal container requirements for lead-based paint material to be disposed.

2.1.4 Proposed disposal site for lead-based paint materials, including a disposal plan to detail type of disposal container, method of transportation to disposal site, and waste hauler.

2.1.5 Any other submittals as required by MU.

2.1.6 Upon completion of the LBP removal, submit to the Owner's Representative, copies of hazardous materials shipping records, disposal receipts, etc. for all LBP removed from the project site.

2.1.7 Upon completion of the LBP removal, the following information shall be submitted by the Owner's C.I.H./Air Sampling Firm to the contractor:

2.1.7.1 Construction and demolition waste landfill receipts, disposal receipts, truck tickets, incineration/recycling receipts and documentation.

2.1.7.2 Written visual certification from the Owner's Certified Industrial Hygienist/Air Sampling Firm that LBP material have been removed from the facility.

2.2 **TERMINOLOGY** (Definitions)

2.2.1 APPROVED CONSTRUCTION AND DEMOLITION WASTE DISPOSAL SITE: A permitted solid waste landfill that is authorized by the Missouri Department of Natural Resources to receive LBP wastes.

2.2.2 AUTHORIZED VISITOR: The Building Owner, the Building Owner's representative, MU personnel, or a representative of any regulatory or other agency having jurisdiction over the project.

2.2.3 BARRIER: Any surface that seals off the work area to non-authorized personnel from entering the work area.

2.2.4 BUILDING OWNER: A representative of the University of Missouri.

2.2.5 DISPOSAL CONTAINER: A properly labeled container for universal/hazardous materials. The proposed disposal container for lead-based paint will be provided to the Owner's Representative as part of the hazard remediation contractor's pre-work

2.2.6 HEPA VACUUM EQUIPMENT: High efficiency particulate air filtered vacuuming equipment with a filter system capable of collecting and retaining hazardous particulates. Filters should be of 99.97% efficiency for retaining particulates greater than 0.3 microns.

2.2.7 ON-SITE REPRESENTATIVE: MU's full-time representative responsible for air monitoring and enforcement of the specifications.

2.2.8 OWNER'S CERTIFIED INDUSTRIAL HYGIENIST (C.I.H.): An Industrial Hygienist, certified in comprehensive practice by the American Board of Industrial Hygiene (ABIH).

2.2.9 HAZARDOUS MATERIAL SHIPMENT RECORD/DISPOSAL RECEIPT: The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of universal/hazardous materials.

2.2.10 WET CLEANING/WIPING: The process of eliminating contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as necessary.

2.2.11 WORK AREA: A specific isolated area in which lead painted materials are required to be handled. The area is designated as a work area from the time that the area is secured, and access restrictions are in place. The area remains designated as a work area until the time that it has been cleaned in accordance with any requirements applicable to the operations conducted.

2.3 **EXISTING CONDITIONS**

2.3.1 Building Owner and Contractor shall agree on building conditions prior to commencement of work. It shall be the Contractor's responsibility to replace or repair to the Owner's satisfaction, prior to close-out of the project, all damaged

items caused by the Contractor and not proven otherwise. All items damaged prior to remediation shall be noted during preconstruction walk-through.

3.1 PERSONNEL PROTECTION REQUIREMENTS

3.1.1 Prior to commencement of work, the workers shall be instructed and shall be knowledgeable on the hazards of LBP materials involved and other environmental exposures, use and fitting of respirators, protective clothing, decontamination procedures, and all aspects of remediation work procedures; workers shall have medical examinations.

3.1.2 The Contractor acknowledges that he alone is responsible for enforcing personnel protection requirements and that these specifications provide only a minimum acceptable standard for each phase of operation.

3.1.3 If required or requested of the workers, provide workers with personally issued and marked respiratory equipment approved by NIOSH and accepted by OSHA.

3.1.4 No visitors shall be allowed in work areas, except as authorized.

3.1.5 Where required or if requested by the workers, provide workers with sufficient sets of disposable protective full-body clothing. Such clothing shall consist of full-body coveralls, footwear, and head gear, one-piece coveralls or equal. Provide eye protection and hard hats as required by applicable safety regulations. Disposable clothing shall not be allowed to accumulate and shall be disposed of as contaminated waste.

3.1.6 Provide authorized visitors with suitable protective clothing, headgear, footwear, and gloves as described above whenever they are required to enter the work area.

3.2 MATERIALS

3.2.1 Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.

3.2.1.1 Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.

3.2.1.2 Damaged or deteriorating materials shall not be used and shall be removed from the premises.

3.2.2 PLASTIC SHEETING: A minimum 6-mil (or as specified).

3.2.3 TAPE: Capable of sealing joints of adjacent sheets of polyethylene and for attachment of polyethylene sheets to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water, duct tape, poly prep tapes or approved equal.

3.2.4 ADHESIVES: Capable of sealing joints of adjacent sheets of polyethylene and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including

use of amended water.

3.2.5 IMPERMEABLE CONTAINERS: Suitable to receive and retain any hazardous materials until disposal by the owners rep. The containers shall be labeled as required by owner. Containers must be resistant to damage and rupture.

3.2.6 WARNING LABELS AND SIGNS: As required by Regulations and/or the Owner.

3.2.7 OTHER MATERIALS: Provide all other materials, such as, but not limited to lumber, plywood, nails, and hardware, which may be required to properly prepare and complete this project.

3.3 TOOLS AND EQUIPMENT

3.3.1 Provide suitable tools for universal/hazardous waste removal and disposal.

3.3.1.1 Water Sprayer: Airless or a low pressure sprayer for amended water application as applicable.

3.3.1.2 Air-Purifying Equipment: High Efficiency Particulate Air Filtration Systems (HEPA) shall comply with ANSI Z9.2-91. No air movement system or air equipment should discharge particulates outside the work area. Thus, the negative air unit shall be equipped with a three-filter bank with the last being the HEPA filter capable of removing 99.97% of fibers/particulates >0.3 microns.

3.3.1.3 Scaffolding: As required to accomplish the specified work and meet all applicable safety regulations.

2.3.1.4 Vacuums: Use HEPA type from a known manufacturer.

2.3.1.5 Other tools and equipment as necessary.

3.4 SUPERVISION OF LEAD-BASED PAINT REMOVAL

3.4.1 The contractor shall designate a competent supervisor subject to the approval of the Owner's C.I.H. and/or the Owner's Representative. The supervisor shall be the Contractor's representative on the project, shall meet the requirements of all applicable regulations, and perform or meet the following minimum requirements:

3.4.1.1 Be knowledgeable in all aspects of removal, cleanup and proper disposal of LBP as listed in the Scope of Work.

3.4.1.2 Be onsite and supervise all removal, cleanup and disposal activities.

3.4.1.3 Maintain a daily log on the project documenting events, violations, problems, equipment failures, accidents, and inspections.

3.4.1.4 Be responsible for implementation of first aid, safety training, respiratory protection, and ensuring all workers are trained in emergency procedures.

3.4.1.5 Be responsible for conducting a visual inspection of the work area prior to a visual inspection by the Owner's Certified Industrial Hygienist. Inspection shall be documented.

3.5 WORKER PROTECTION / TRAINING

3.5.1 The contractor shall be responsible for providing his employees with proper respiratory protection, respiratory training, a written respirator program, medical examinations, maintaining medical records, protective clothing and equipment to comply with OSHA requirements, if necessary

3.5.2 All workers shall be trained in the dangers inherent in handling LBP, and hazardous materials, in proper work procedures, and personal protective measures.

3.6 OWNER'S CERTIFIED INDUSTRIAL HYGIENIST

3.6.1 It will be the Owner's responsibility to contract with a Certified Industrial Hygienist or Environmental Consulting firm. The Certified Industrial Hygienist/Environmental Consulting firm will also be required to perform the following duties as a minimum:

3.6.1.1 Approval of the Contractor's work plan and methods of remediation to meet regulatory requirements and ensure the health and safety of University faculty, staff, and students.

3.6.1.2 Verify that the Contractor is satisfactorily performing the work in accordance with OSHA regulations.

3.6.1.3 Visual inspection of the work areas.

3.6.1.4 Certify in writing that the Contractor's procedures, methods, and practices were, to the best of his/her knowledge and belief, in compliance with current EPA, OSHA, State, and Local applicable regulations, that the work areas meet the requirements for a final visual inspection prior to re-occupancy, and an accounting of any known deviations.

3.7 SEPARATION OF WORK AREAS FROM NONWORK AREAS

3.7.1 Visual separation shall be accomplished at all "see-through" locations using opaque polyethylene. This separation shall not be incorporated within the other seals involved on this project.

3.8 EMERGENCY PROTECTION PLAN / FIRE EXITS

3.8.1 The contractor shall be responsible for developing a written Emergency Protection Plan and shall maintain this plan onsite. The plan shall include considerations of fire, explosion, toxic atmospheres, electrical hazards, slips, falls, and heat related injury. All employees shall be instructed and trained in the procedures.

3.8.2 The Emergency Protection Plan shall also include written notification of police, fire, and medical personnel of the planned remediation activities, work

schedule, and layout of the work area, particularly barriers that may affect response capabilities.

3.8.3 Designate and maintain emergency and fire exits from the work area in accordance with local codes and regulations. All exits shall be clearly marked with fluorescent tape or red paint and shall be clearly visible from any part of the work area.

3.9 LOCAL AREA PROTECTION / SITE SECURITY

3.9.1 The contractor shall secure the work areas to make sure of no inadvertent entry. Any breach to the exterior of the building shall be secured by the hazard remediation contractor. The Contractor shall be responsible for maintaining security of the remediation areas throughout the contract period.

3.9.2 The contractor shall be responsible for all areas of the building used by contractor and/or subcontractors in the performance of the work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of the existing building, except such controls as may be specifically reserved to the owner.

3.9.3 Contractor has the right to exclude from the work area all persons who have no purpose related to the work or its inspection, and shall require all persons in the work area to observe the same regulations required of Contractor's employees.

3.9.4 The contractor shall have control of site security during remediation operations in order to protect the work environment and equipment. Contractor shall have the owner's assistance in notifying building occupants of impending activity and enforcement of restricted access by owner's employees.

3.9.5 The contractor shall keep a minimum of two (2) 10lb type ABC fire extinguishers onsite. One shall be maintained outside the work area and one inside each work area. Contractor employees shall be trained in the operation of fire extinguishers.

3.9.6 The Contractor shall provide warning signage around the regulated area as required by OSHA.

3.9.7 The Contractor shall isolate any and all air supply and returns to the abatement space as required by OSHA. Contractor shall coordinate with the Owner's Representative.

3.9.8 The contractor shall maintain the work area free from rubbish, debris, and dirt, and keep a clean, safe working area.

3.10 LEAD-BASED PAINT REMOVAL OPERATIONS

3.10.1 **MATERIALS PAINTED WITH LEAD-BASED –** The lead-based paint on the walls and ceilings as listed in this specification section, shall be scraped of loose and flaking paint, the area cleaned with a tri-sodium rinse or equivalent and the surface encapsulated with an encapsulant specifically designed for lead-based paint. The Owner, at its discretion can request that **ALL** lead-based paint listed

in this Scope of work be removed in its entirety. The waste shall be properly removed, containerized, and hauled away and disposed of in a landfill approved by the State of Missouri to accept lead waste material. These areas should be sealed off with polyethylene sheeting over the doors, vents, windows, or any other openings into/out of the area.

3.11 REESTABLISHMENT OF THE WORK AREA

3.11.1 Reestablishment of the work area shall only occur after the Contractor has received a final visual inspection from the Owner's C.I.H./Environmental Consulting firm documenting that the lead waste materials have been removed from the project site.

END OF SECTION

SECTION 233113
METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

1.2 PERFORMANCE REQUIREMENTS

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

1. Static-Pressure Classes:

a. Supply Ducts (except in Mechanical Rooms): 3-inch wg.
b. Return Ducts (Negative Pressure): 1-inch wg.
c. Exhaust Ducts (Negative Pressure): 1-inch wg.

2. Leakage Class:

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

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1.3 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 – " Systems and Equipment" and Section 7 – "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 – "HVAC System Construction and Insulation."

C. SMACNA's HVAC Duct Construction Standards – Metal and Flexible.

D. Maximum leakage for all duct systems is 3%. All ducts shall be tested per SMACNA.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Outer Duct: Minimum 0.028-inch galvanized sheet steel

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Inner Duct: Minimum 0.028-inch galvanized sheet steel.

F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
~~D.~~4. Cover insulation with polyester film complying with UL 181, Class 1.

~~2.3~~2.4 SHEET METAL MATERIALS

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

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

2.42.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

2.52.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 SEAM AND JOINT SEALING

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

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum

Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

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

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.5 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel.

B. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

   a. Velocity 1000 fpm or Lower:

      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.

   b. Velocity 1000 to 1500 fpm:

      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

   c. Velocity 1500 fpm or Higher:

      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1,

"Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

C. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: High efficiency takeoff with gasket.

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals."

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 238219
FAN COIL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fan-coil units and accessories.

1.2 SUBMITTALS

~~A. Product Data: Include rated capacities, operating characteristics, furnished specialties, accessories, and unit dimensions, weights, required clearances, and wiring diagrams.~~

~~B.~~A. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Transport units and components to the project site. Loading, unloading, and transport of units and components are the responsibility of the contractor.

PART 2 - PRODUCTS – NOT USED

~~2.1 MANUFACTURERS~~

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

~~1. Trane Company (The).~~
~~2. Daikin Applied.~~
~~3. Carrier.~~

~~2.2 DUCTED FAN-COIL UNITS~~

~~A. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.~~

~~B. Coil Section Insulation: 1/2-inch thick foil-faced glass fiber complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.~~

~~C. Drain Pans: Plastic or stainless steel formed to slope from all directions to the drain connection as required by ASHRAE 62.~~

~~D. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panels.~~

~~E. Cabinets: Steel with baked-enamel finish in manufacturer's standard paint color.~~

~~1. Supply-Air Plenum: Sheet metal plenum finished and insulated to match the chassis.~~
~~2. Return-Air Plenum: Sheet metal plenum finished to match the chassis.~~
~~3. Dampers: Galvanized steel with extruded-vinyl blade seals, flexible-metal jamb seals, and interlocking linkage.~~

~~F. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.~~

~~1. Pleated Cotton-Polyester Media: 90 percent arrestance and 7 MERV.~~

~~G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.~~

~~H. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.~~

~~I. Belt-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the cabinet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.~~

~~J. Basic Unit Controls:~~

~~1. Control voltage transformer.~~

~~K. Electrical Connection: Factory wire motors and controls for a single electrical connection.~~

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fan-coil units to comply with NFPA 90A.

B. Suspend fan-coil units from structure with elastomeric hangers.

C. Install new filters in each fan-coil unit within two weeks after Substantial Completion.

D. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.
2. Connect condensate drain to indirect waste.

a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

E. Connect supply and return ducts to fan-coil units with flexible duct connectors. Comply with safety requirements in UL 1995 for duct connections.

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

B. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 238219

PROJECT

UMC Neff Hall DOAS

EQ	68696
Equipment tag(s)	DOAS-1
Location	
Sales office	St. Louis
Sales person	Joe Zweifel

Original submittal date	
Revision	0
Current version date	2/26/2024
Prepared by	Justin Rongey

Submittal approval dates are the basis for determining manufacturing lead times. Manufacturing will not begin and shipping dates will not be issued until approved, stamped submittal drawings are received. Performance, openings and dimensions may vary from contract documents. Return of approved drawings constitutes acceptance of these variances.

Trane 9900 Aire Circle, Fort Smith, AR 72916 Phone: (479) 648-7402 Fax: (479) 648-7499

Unit Revision Log

Date	Description
2/26/2024	Original

Clarifications and Exceptions

Units are palletized including all components, base sections, and panels for field installation by others. Please verify the maximum job site constraints are met.

NOT INCLUDED

All items listed below are not included unless specifically listed as included in proposal.
ETL listing including: direct fired gas heater, FlexFit (knockdown), electrical class 1 division 1/2 (explosion proof), custom piping, or if specifically excluded in the proposal clarifications and exceptions.
IBC seismic certification. Equipment construction not in compliance with IBC seismic.
OSHPD seismic certification. Equipment construction not in compliance with OSHPD seismic certification.
IBC wind load certification. Equipment construction not in compliance with IBC wind load certification.
NOA Hurricane certification. Equipment construction not in compliance with NOA Hurricane certification.
Condensate drain "P" traps. All drains will be stubbed through unit for exterior field provided traps.
Expenses associated with customer witness of factory testing is the responsibility of the local Trane sales office.
Onsite services including: rigging, hoisting, assembly, assembly assistance, assembly supervision, testing, air balancing, start-up electrical connections at section splits.
Unit controls including, damper operators, sensors, transformers, and control wiring.
Factory programming of a factory mounted unit controller, including factory and field/customer-provided unit controllers.
Piping, valves, control valves or accessories. All necessary pipe insulation must be furnished, and field installed by others.
VFDs, Starters, disconnects, or motor wiring.
Marine lights, wiring, switch, and receptacle.
VFD harmonic filter (line reactors, etc.) and installation labor to meet harmonic distortion performance criteria.
Roof curbs. All outdoor units are equipped with base suitable for roof curb mounting.
Storage or protection of equipment while in storage.
Sales tax, special permits, or duties.

Notes

Specifications and other job materials reviewed by Trane Custom Support does not transfer liability of missed or excluded items from the responsible local sales office. Interpretations and exceptions taken from the aforementioned documents are the final responsibility of the Trane sales office and customer. Trane Custom Support does not agree to any liquidated damages, right to refusal clauses, or FOB jobsite restrictions unless first reviewed and agreed upon by the Trane legal department. Due to variability of local codes, it is the responsibility of the sales office to verify compliance and identify specific requirements. Any correction necessary after shipment to satisfy local authorities shall be at the expense of others.
Manufacturing ship cycle lead time is contingent upon Trane's acceptance of approved submittals and approved credit, followed by a release for fabrication. Ship cycles are established after fabrication release. Cycles may extend due to unit complexity. For projects with critical schedules or multiple units, contact the factory in advance to develop a detailed shipment timeline.
Field supplied factory installed items must be delivered to the factory by the committed delivery date. Items not delivered by the committed delivery date must be field installed by others at the jobsite.
All sales of equipment are strictly in accordance with Trane's standard Terms and Conditions and are offered with Trane's standard warranty. Please contact Trane's Contract or Warranty Administration group for special consideration beyond the standard terms.
Price quoted below is valid if equipment order is released for production on or prior to the "Release For Production Deadline" for "Ship Quarter Requested". Price quoted includes escalation based on ship quarter requested and announced price increases not yet implemented in systems. Price subject to change if equipment scope is altered.
"Release For Production Deadline" is based on current estimated production cycles and lengths and does not guarantee shipment in requested shipment quarter. Reference the Trane Commercial Systems Product Ship Cycle Information "Green Sheets".
Production cycles are subject to change without notice. Production cycles are estimated based on current availability of common components and production capacity. An official estimated ship date (ESD) will be provided after equipment is released to production. Cycle length is an average time between approved release for production and ESD.
On Flex-Fit units, Trane Factory doesn't provide any conduit or wiring to the field. This must be provided by others.

Primary Construction: (DOAS-1)

Indoor casing
Painted AHU - No
Designed for roof curb - No
Casing performance - Deflection L/250 @ 6 inches of static pressure
Seismic - No
Wind Certified - No
Hurricane / NOA rated - No

Base construction

steel beam C6 x 8.2
Top floor - galvanized steel solid 16 ga
Bottom liner - null
Insulation - Injected foam, R-Value = R20
Floor seams - Caulked and tac welded
Waterdam - No
Opening grating material - N/A

Casing Panel construction

Perimeter Panel

Exterior – galvanized steel solid 18 ga
Interior – galvanized steel solid 20 ga
Panel thickness – 2 inch
Insulation - Injected foam, R-Value = R13.3

Roof Panels

Exterior – galvanized steel solid 18 ga
Interior – galvanized steel solid 20 ga
Panel thickness – 2 inch
Insulation - Injected foam, R-Value = R13.3

C-panels

Material - galvanized steel solid 16 ga
Panel thickness - 2 inch

Coil(s) without drain pan rack - Yes

Mechanical Construction Notes

Project specific custom features	-	Flex Fit Construction INDIVIDUAL UNIT SECTIONS MUST FIT THROUGH A 23" x 43" OPENING OR BE SHIPPED DISASSEMBLED TO FIT THROUGH THE 23" x 43" OPENING AND REASSEMBLED IN THE ATTIC.
Drain Pans	-	16 ga. stainless steel, double-sloped insulated drain pans with 1-1/2in stainless steel MPT drain. All traps furnished and installed in field by others
Safing (component blankoffs)	-	Cooling coil and Heating coil safing is 304 stainless steel All components not mentioned will be safed with G90 galvanized.
Doors	-	Door thickness and materials of construction to match AHU casing.
	-	Allegis K2
	-	Continuous stainless steel piano Hinge
Unit Support Requirements	-	Unit is shipped palletized for field installation. Unit requires full perimeter support at each base split. Installation co-ordination and AHU mounting details need to be made available to AHU manufacturer for review to ensure no interference issues occur at the jobsite. Installation contractor is responsible for providing these details to the AHU manufacturer. Contractor to work with local Trane office and AHU manufacturer.
Ship Loose	-	All components including wall panels and base sections are palletized and shipped loose for field installation by others. Section split sheet metal trim, caps, screws, and sealant. Equipment IOMs

- AHU

Flex Fit (Knockdown unit)

- AHU parts are loaded in multiple factory built pallets
  Pallets are loaded into an enclosed container and shipped to the designated location as detailed out in the order
  On site contractor is responsible to unload the container and store pallets in an enclosed building until needed or provide the necessary protection of parts if left outdoors. Refer to IOM for details on outdoor storage requirements.
  Pallets are not shrink wrapped for shipment.
- Jobsite constraint: 23"W x 43"'H opening
  MAX base section: 39.125"H x 72"W / 200lbs
  MAX panel size: 36"W x 72"H / 150lbs
  Max cooling coil size: SEE COIL DRAWINGS / 531lbs
  Max heating coil size: SEE COIL DRAWINGS / 72lbs
  Max Fan size: 20.13"H x 29.31"W x 30.06"L / 318lbs
  All electrical parts provided are ship loose
  Conduit, wiring etc.. are by others and field supplied and installed

Fan Vibration

- Fans are balanced at the fan manufacturer's facility. Vibration level to meet BV-3 balance levels.

Electrical Construction Notes

ETL

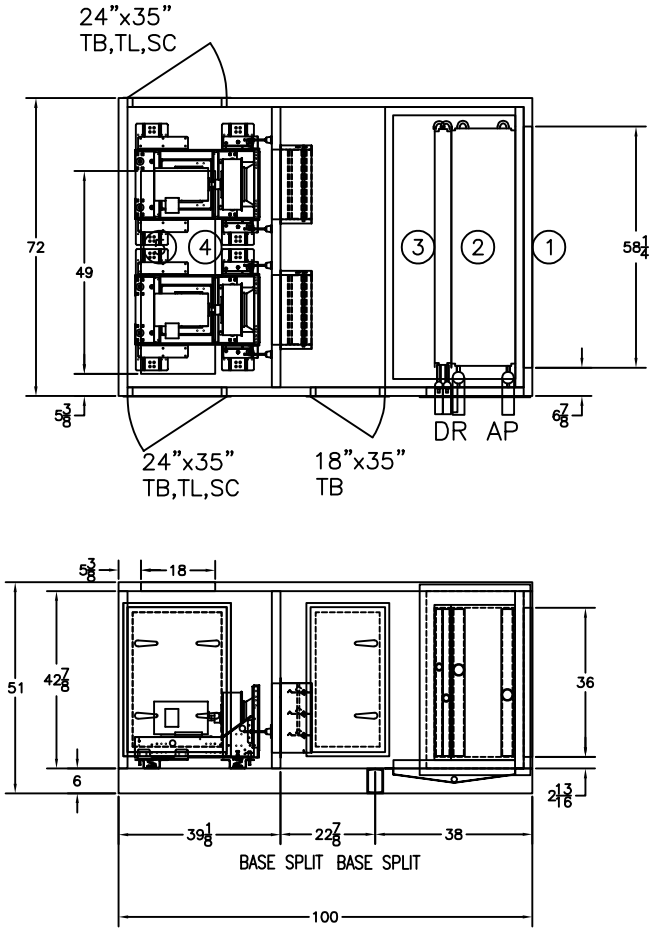
- ETL label is not provided.
  Refer to electrical drawings for more details

Electrical Notes

- Unit is Flex-Fit. No Conduit/Wiring is provided or installed.
  No Lights/Receptacles are provided or installed.
  No VFD, starter, etc are provided or installed.

#	REVISIONS	DATE:	BY:

KNOCKDOWN (FLEX-FIT) UNIT CONSTRUCTION



EQUIPMENT LIST

(1) Return Opening-End 36"x58.25"
(2) Cooling Coil 36"x57"x8row
(3) Heating Coil 36"x57"x1row
(4) Supply Fan TDDP 12.25"/CL2 2HP ea w/ Backdraft Dampers
(5) Supply Discharge Opening-top 18"x49"

TB - Thermal Break
TL - Tool Locking
SC - Secure Catch
DR - Drain Pan
AP - Access Panel

Jobsite constraint: 23"Wx43"'H opening
MAX base section: 39.125"Lx72"W/250lbs
MAX panel size: 36"Lx72"W/150lbs
Max cooling coil size: SEE COIL DRAWINGS/531lbs
Max heating coil size: SEE COIL DRAWINGS/72lbs
Max Fan size: 20.13"Hx29.31"Wx30.06"L/318lbs

DRAWN BY:	Name
DATE:	2/26/2024
SCALE:	To Scale
APPROVED BY:	

U:\DATA\68696\SUBMITTAL\R0 PENDING\DRAWING\INITIAL DRAWINGS\68696-DOAS-1 UPDAT

OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES

TYPE: Indoor	UNIT CASING: 2 Inch / 18 ga
MOUNTING: Pad	INSUL/LINER: 4 Inch / 20 ga
BASE: 6 Inch	DOORS: (See Drawing)
FLOOR: 16 ga	LIGHTING: No
INSUL/LINER: Single Panel Floor	ISOLATION: Spring

PROJECT: UMC - Neff Hall
DESCRIPTION: 4300 CFM
SALES OFFICE: Trane - Fenton, MO

SALES ORDER#: SO#
UNIT TAG: DOAS-1
DWG#:
SHIP WT.: 3500 lbs

TRANE™ TECHNOLOGIES

Trane Custom Air Handler

Unit Overview - DOAS-1

Application	Calculated Unit Size	External Dimensions			Weight	
		Height	Width	Length	Installed	Rigging
Indoor	17	51.0 in	72.0 in	100.0 in	3658 lb	3500 lb

Quantity of Shipping Sections	Largest Base Section			Heaviest Base Sec.	Elevation
	Height	Width	Length		
Palletized	6 in	72.0 in	39.125 in	200 lb	0.00 ft

Supply Fan			
Airflow	4300 cfm	**Total Static Pressure**	2.962 in H2O

Construction Features

Panel	2" double wall foam R-13 with thermal break
Panel Material	Galvanized 18 gage Exterior - Galvanized 20 gage Interior
Integral Base Frame	6" Structural steel base
Floor Material	16 ga Galvanized Single panel floor
Paint	No paint
Design criteria for casing integrity	Max of L/250 deflection with 1% max leakage at 6"WC.
Agency Approval	ETL listed unit

Factory Provided Options

Option Notes
36"x57" HTCL & CLCL Installed in CLCL module #1
Flexfit - 3 Base Sections (2 splits)
Add drain holes to heating coil casing

Unit Controls

Controller Type	None

Cooling section - Position: 1

Coil Construction	
Model	Chilled water - W
Rows	8
Tube Diameter	5/8" tube (15.875 mm)
Tube Matl/Wall Thickness	.024" (0.610mm) copper
Fin Spacing	120 Per Foot
Fin Material	Aluminum
Fin Type	Prima flo H .01"
Face Area	14.25 sq ft
Coil (top/single) H x L	36" (914 mm) x 57" (1448 mm)
Casing	Stainless
Turbulators	Present
Coil Connection Material Type	Black steel
Rigging Weight	530.2 lb
Installed Weight	666.3 lb
Coil Section Options	
Drain Connection / Material	RH Stainless
Floor drain	No

Coil Performance	
Capacity	
Total	408.81 MBh
Sensible	215.47 MBh
Air	
Flow	4300 cfm
Entering Dry Bulb	95.00 F
Entering Wet Bulb	78.00 F
Leaving Dry Bulb	50.00 F
Leaving Wet Bulb	49.90 F
Pressure Drop	0.474 in H2O
Face Velocity	302 ft/min
Fluid	
Flow	54.34 gpm
Entering	45.00 F
Leaving	60.00 F
Pressure Drop	9.10 ft fluid
Tube Velocity	2.57 ft/s
Reynolds Number	9609.48
Type	Water
Fouling Factor	0.00000 hr-sq ft-deg F/Btu
Volume	16.28 gal
AHRI 410 Classification	
AHRI 410 Classification	NOT Certified by AHRI
Data Generation Date	2/22/2024
Trane Select Assist update number	2290

Note: Coil is NOT certified by AHRI. Coil is within the scope of AHRI Standard 410.

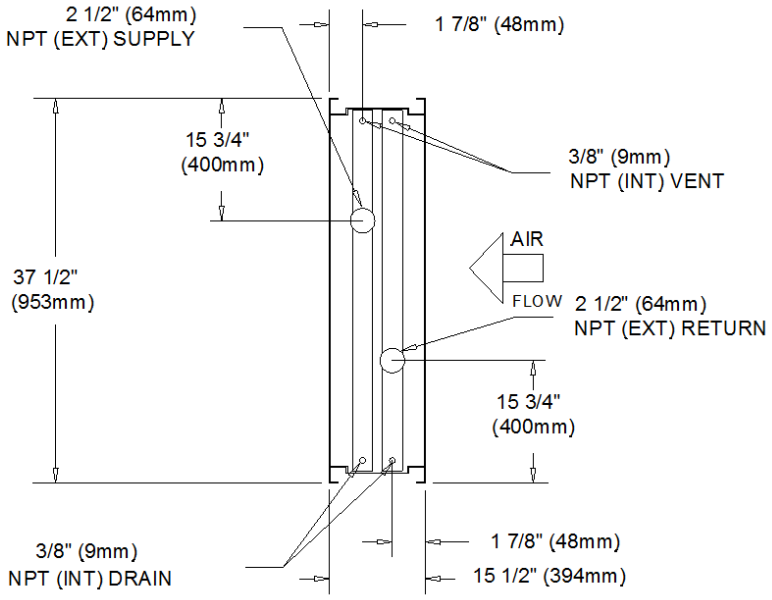
Access - Position: 2

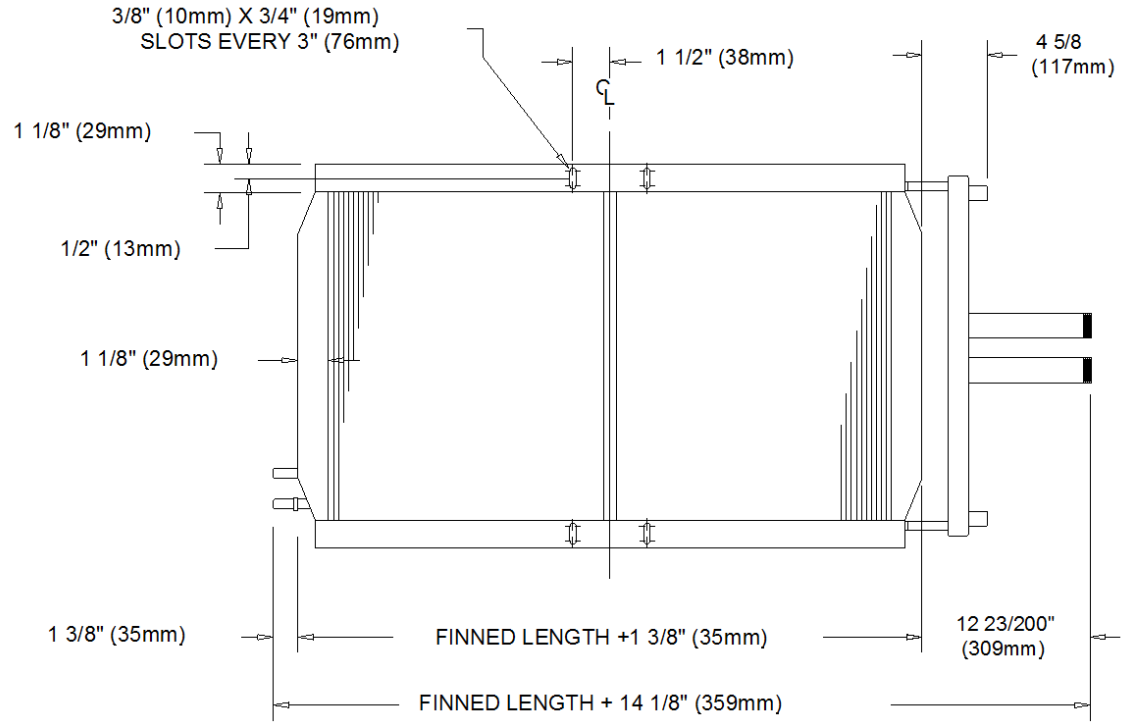
Options	
Drain Connection/Material	None
Floor drain	No

Doors

	Position	Size	Swing	Construction	Secured Access	Hinge Location	Clear pane Window	Test Port
Door 1	Right	18" door opening x 35.000 in	Outward	Thermal break door	None	Left	N/A	N/A

36" W 8 ROW
RIGHT HAND





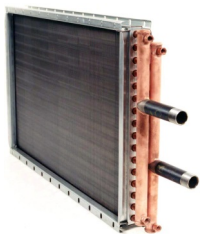
Heating Coil

Equipment Details

Coil utilization	Shipping coil

Coil Construction

Model Number	D5WB36057G0AA082BACA00A**********
System type	Hot Water 5/8” Shipping Coil, General (5W)
Rows	1
Tube matl/wall thickness	.024 (0.610 mm) copper
Nominal fin spacing	82 fins per foot
Fin material	Aluminum
Fin type	Prima-Flo E Standard
Actual coil face area	14.25
Nominal coil height	36" (914 mm)
Finned length	57" (1448 mm)
Casing option	Galvanized
Turbulators	No
Rigging weight	71.2 lb
Installed weight	92.2 lb
Tube matl/wall thickness	.024 (0.610 mm) copper



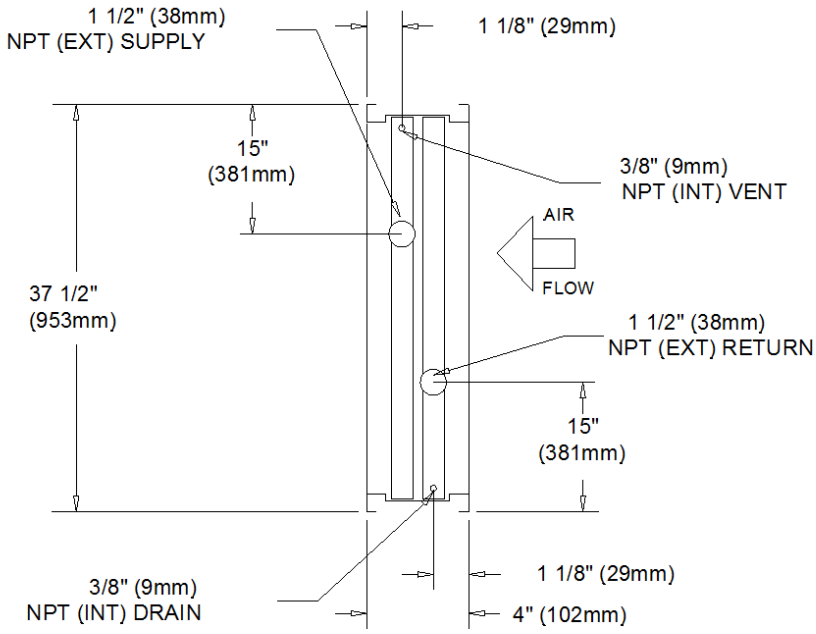
Coil Performance

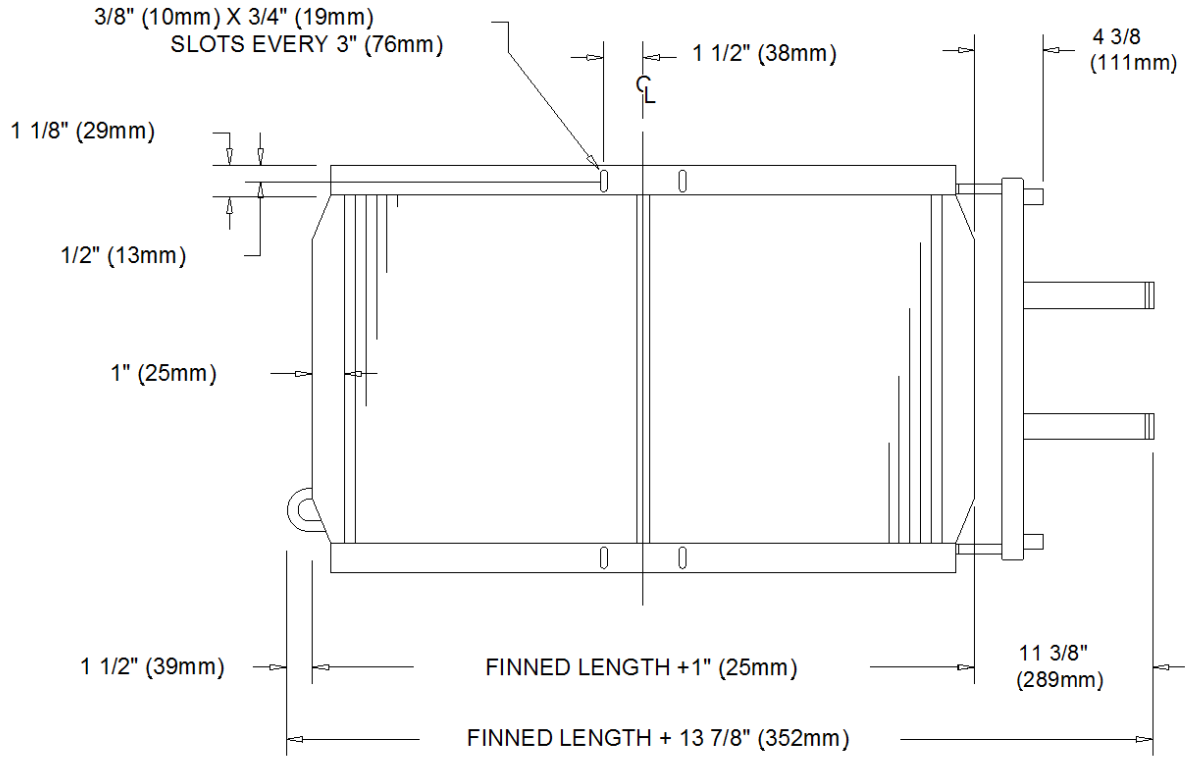
Capacity	
Total capacity	131.97 MBh
Air	
Coil type	5/8” Shipping Coil, General (5W)
Actual airflow	4300 cfm
Entering dry bulb	50.00 F
Leaving dry bulb	78.30 F
APD	0.028 in H2O
Face velocity	302 ft/min

Fluid	
Standard fluid flow rate	6.60 gpm
Entering fluid temp	180.00 F
Leaving fluid temp	140.00 F
Fluid PD	0.13 ft fluid
Fluid velocity	0.62 ft/sec
Fluid type	Water
Volume	2.53 gal
Fouling factor	0.00025 hr-sq ft-deg F/Btu
Reynolds number	7488.81 Each
AHRI 410 Classification	
AHRI 410 classification	AHRI ACHC certified
Data generation date	12/6/2023
Trane Select Assist update number	2770.00

Note: Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

36" 5W 1 ROW


1 1/2" (38mm)
NPT (EXT) SUPPLY
1 1/8" (29mm)
15"
(381mm)
3/8" (9mm)
NPT (INT) VENT
AIR
FLOW
37 1/2"
(953mm)
1 1/2" (38mm)
NPT (EXT) RETURN
15"
(381mm)
3/8" (9mm)
NPT (INT) DRAIN
1 1/8" (29mm)
4" (102mm)


3/8" (10mm) X 3/4" (19mm)
SLOTS EVERY 3" (76mm)
1 1/2" (38mm)
4 3/8
(111mm)
1 1/8" (29mm)
1/2" (13mm)
1" (25mm)
1 1/2" (39mm)
FINNED LENGTH +1" (25mm)
11 3/8"
(289mm)
FINNED LENGTH + 13 7/8" (352mm)

Supply fan section - Position: 3

Fan Data	
Wheel Diameter/Type/Class	12.25 DDP CL2 Plenum SWSI Class 2
Fan Set	Trane DDP 2X1 100%
Number of Fans	2
Drive Location	Drive right hand
Blades	Higher eff.-some bands lower, more spike
Fan Performance	
Airflow	4300 cfm
Total Static Pressure	2.962 in H2O
Total Brake Power	3.207 hp
Operating Speed	3221 rpm
Unit Static Efficiency	62.62 %
Fan Design Temp	70.00 F
Motor Interface Options	
Selection Type	None
Voltage	200-208/3
VFD Frequency	54.00 Hz

Motor Data	
Power / Fan	2 HP
Voltage	200-208/3
Speed	3600
Class	Premium Efficient ODP
Efficiency	85.50 %
Part Load Efficiency	78.66 %
Shaft Grounding Ring	Yes
Fan Section Options	
Backdraft Damper	Backdraft damper
Insulation	No
Plenum Fan Protective Enclosure	No
Inlet Screen	No
Inlet Screen	No
Coplanar Separation	No
Floor drain	No

Fan Discharge Options

Face	Type	Airflow	Face Velocity	Opening Dimensions	Pressure Drop	Exhaust Hood	Damper Torque Requirement
Top	First plenum fan discharge	4300 cfm	702 ft/min	18.000 in x 49.000 in	0.000 in H2O	N/A	43 lbf.in

Doors

	Position	Size	Swing	Construction	Secured Access	Hinge Location	Clear pane Window	Test Port
Door 1	Right	24" door opening x 35.000 in	Outward	Thermal break door	Tool locking	Right	N/A	N/A
Door 2	Left	24" door opening x 35.000 in	Outward	Thermal break door	Tool locking	Right	N/A	N/A

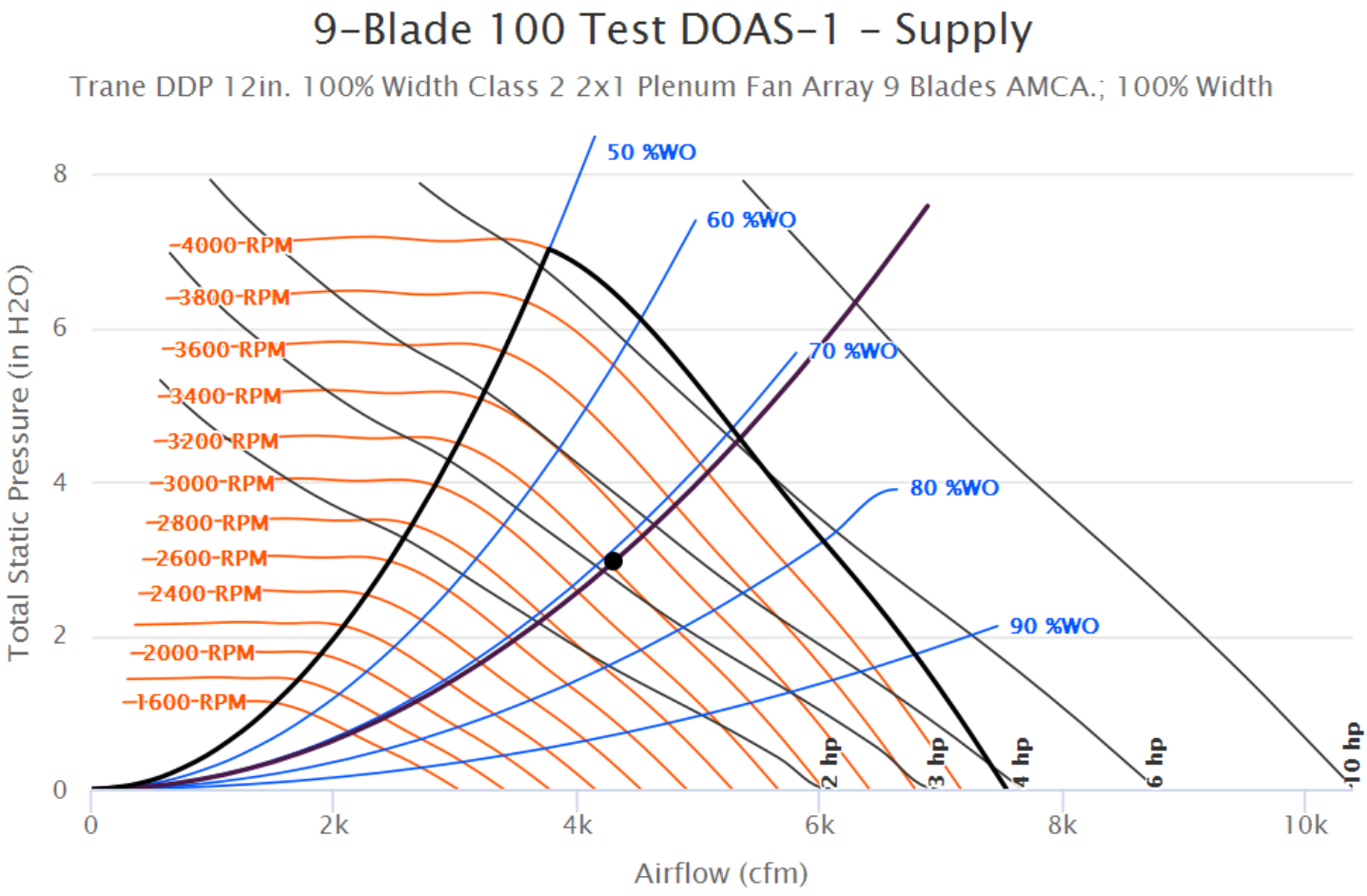
Pressure Drop in (in w.g.)

Supply fan	
Coil	0.50
Fan	0.36
Internal Static Pressure	**0.60**
External Static Pressure	**2.10**
Total Static Pressure	**2.96**

Fan Details

Unit Size	12TF	**Operating Brake Power**	3.207 hp
Motor Frequency	54.00 Hz	**Altitude**	0.00 ft
Operating Airflow	4,300 cfm	**Design Temp.**	70.00 F
Operating Static Pressure	2.962 in H2O	**Efficiency**	62.62 %
Operating RPM	3,221 rpm		

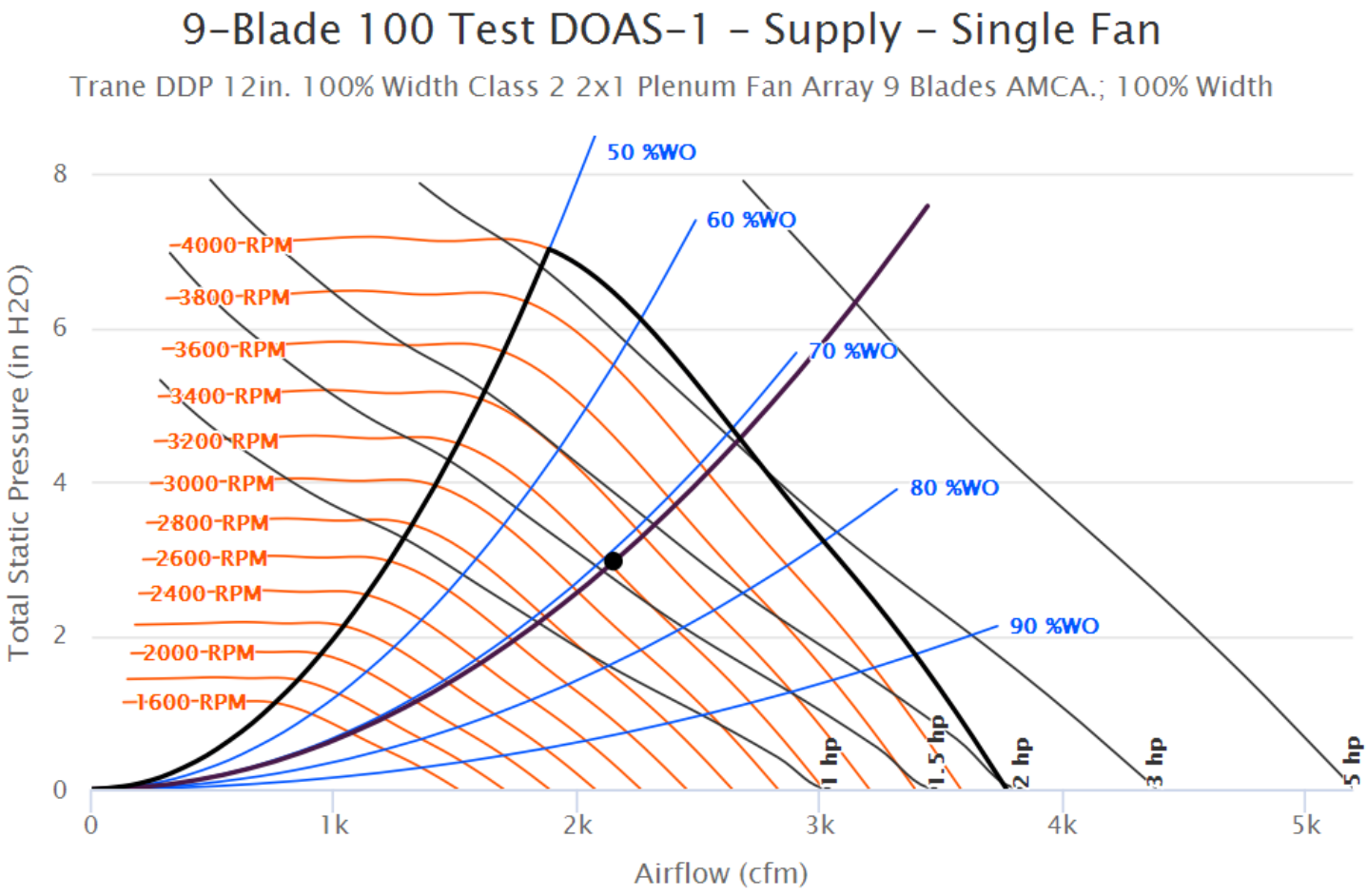
Design VFD frequency is less than line frequency. Ensure the air delivery system can handle being pressurized to the Maximum static pressure detailed in the product data and shown on the fan curve.



Fan Details

Unit Size	12TF	**Operating Brake Power**	1.603 hp
Motor Frequency	54.00 Hz	**Altitude**	0.00 ft
Operating Airflow	2,150 cfm	**Design Temp.**	70.00 F
Operating Static Pressure	2.962 in H2O	**Efficiency**	62.62 %
Operating RPM	3,221 rpm		

Design VFD frequency is less than line frequency. Ensure the air delivery system can handle being pressurized to the Maximum static pressure detailed in the product data and shown on the fan curve.



BALDOR • RELIANCE

Customer information packet

EM3155T-G

2HP, 3450RPM, 3PH, 60HZ, 143T, 3524M, OPSB, F1
Class - None
Division - Not Applicable

2/23/2024 2:00:44 PM

Specifications

Enclosure	OPSB
Frame	143T
Frame Material	Steel
Frequency	60.00 Hz
Motor Letter Type	Three Phase
Output @ Frequency	2.000 HP @ 60 HZ
Phase	3
Synchronous Speed @ Frequency	3600 RPM @ 60 HZ
Voltage @ Frequency	460.0 V @ 60 HZ
	230.0 V @ 60 HZ
XP Class and Group	None
XP Division	Not Applicable
Agency Approvals	CSA
	CSA EEV
	UR
Ambient Temperature	40 °C
Auxillary Box	No Auxillary Box
Auxillary Box Lead Termination	None
Base Indicator	Rigid
Bearing Grease Type	Polyrex EM (-20F +300F)
Blower	None
Current @ Voltage	5.000 A @ 230.0 V
	5.600 A @ 208.0 V
	2.500 A @ 460.0 V
Design Code	B
Drip Cover	No Drip Cover
Duty Rating	CONT
Efficiency @ 100% Load	85.5 %
Electrically Isolated Bearing	Not Electrically Isolated
Feedback Device	NO FEEDBACK
Front Face Code	Standard
Front Shaft Indicator	None

Part detail

Revision	T
Type	AC
Mech. spec.	35Z948
Base	
Status	PRD/A
Elec. spec.	35WGQ054
Layout	35LYZ948
Eff. date	01-03-2023
CD Diagram	CD0005
Poles	02
Leads	9#18
Proprietary	False
Created date	11-17-2011

Heater Indicator	No Heater
High Voltage Full Load Amps	2.5 a
Insulation Class	H
Inverter Code	Inverter Ready
KVA Code	K
Lifting Lugs	No Lifting Lugs
Locked Bearing Indicator	Locked Bearing
Motor Lead Exit	Ko Box
Motor Lead Quantity/Wire Size	9 @ 18 AWG
Motor Lead Termination	Flying Leads
Motor Standards	NEMA
Motor Type	3524M
Mounting Arrangement	F1
Number of Poles	2
Overall Length	11.62 IN
Power Factor	87
Product Family	General Purpose
Pulley End Bearing Type	Ball
Pulley Face Code	Standard
Pulley Shaft Indicator	Standard
Rodent Screen	None
RoHS Status	ROHS COMPLIANT
Service Factor	1.15
Shaft Diameter	0.875 IN
Shaft Extension Location	Pulley End
Shaft Ground Indicator	Shaft Grounding
Shaft Rotation	Reversible
Shaft Slinger Indicator	No Slinger
Speed	3450 rpm
Speed Code	Single Speed
Starting Method	Direct on line
Thermal Device - Bearing	None
Thermal Device - Winding	None
Vibration Sensor Indicator	No Vibration Sensor

Winding Thermal 1	None
Winding Thermal 2	None

Nameplate

NP3553LUA									
CAT.NO.	EM3155T-G								
SPEC.	35Z948Q054G1								
HP	2								
VOLTS	230/460								
AMPS	5/2.5								
RPM	3450								
FRAME	143T	**HZ**	60	**PH**	3				
SF	1.15	**CODE**	K	**DES**	B	**CLASS**	H		
NEMA NOM. EFF	85.5	**PF**	87						
RATING	40C AMB-CONT								
CC	010A	**USABLE AT 208V**	N/A						
DE	6205	**ODE**	6203						
ENCL	OPSB	**SN**							
VPWM INVERTER READY									
CT30-60(2:1) VT3-60(20:1)									
USABLE AT	50HZ 2HP 190/380V 6/3A								SF1.0

AC Induction Motor Performance Data
Record # 53133
Typical performance - not guaranteed values

Winding: 35WGQ054-R009	**Type:** 3524M	**Enclosure:** OPSB

Nameplate Data				**460 V, 60 Hz: High Voltage Connection**	
Rated Output (HP)			2	**Full Load Torque**	3 LB-FT
Volts			230/460	**Start Configuration**	direct on line
Full Load Amps			5/2.5	**Breakdown Torque**	11 LB-FT
R.P.M.			3450	**Pull-up Torque**	8 LB-FT
Hz	60	**Phase**	3	**Locked-rotor Torque**	9.6 LB-FT
NEMA Design Code	B	**KVA Code**	K	**Starting Current**	21.5 A
Service Factor (S.F.)			1.15	**No-load Current**	1 A
NEMA Nom. Eff.	85.5	**Power Factor**	87	**Line-line Res. @ 25ºC**	7.37 Ω
Rating - Duty			40C AMB-CONT	**Temp. Rise @ Rated Load**	31°C
S.F. Amps				**Temp. Rise @ S.F. Load**	37°C
				Locked-rotor Power Factor	53.6
				Rotor inertia	0.0657 LB-FT2

Load Characteristics 460 V, 60 Hz, 2 HP

% of Rated Load	**25**	**50**	**75**	**100**	**125**	**150**	**S.F.**
Power Factor	51	70	81	86	87	88	87
Efficiency	78.3	85.2	86.9	86.5	85.6	84.2	86
Speed	3570	3541	3510	3476	3441	3403	3455
Line amperes	1.2	1.6	2	2.5	3.1	3.7	2.86

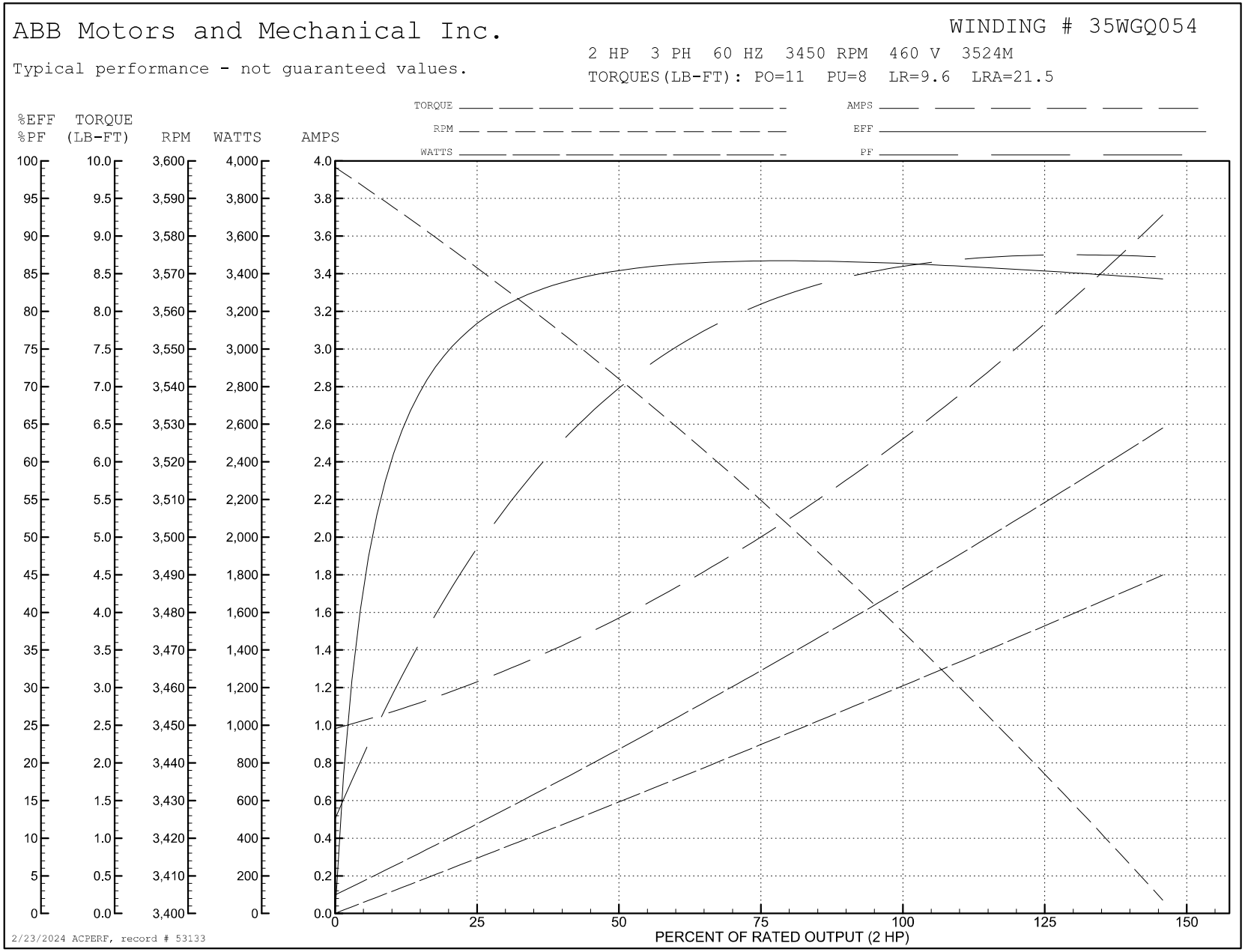
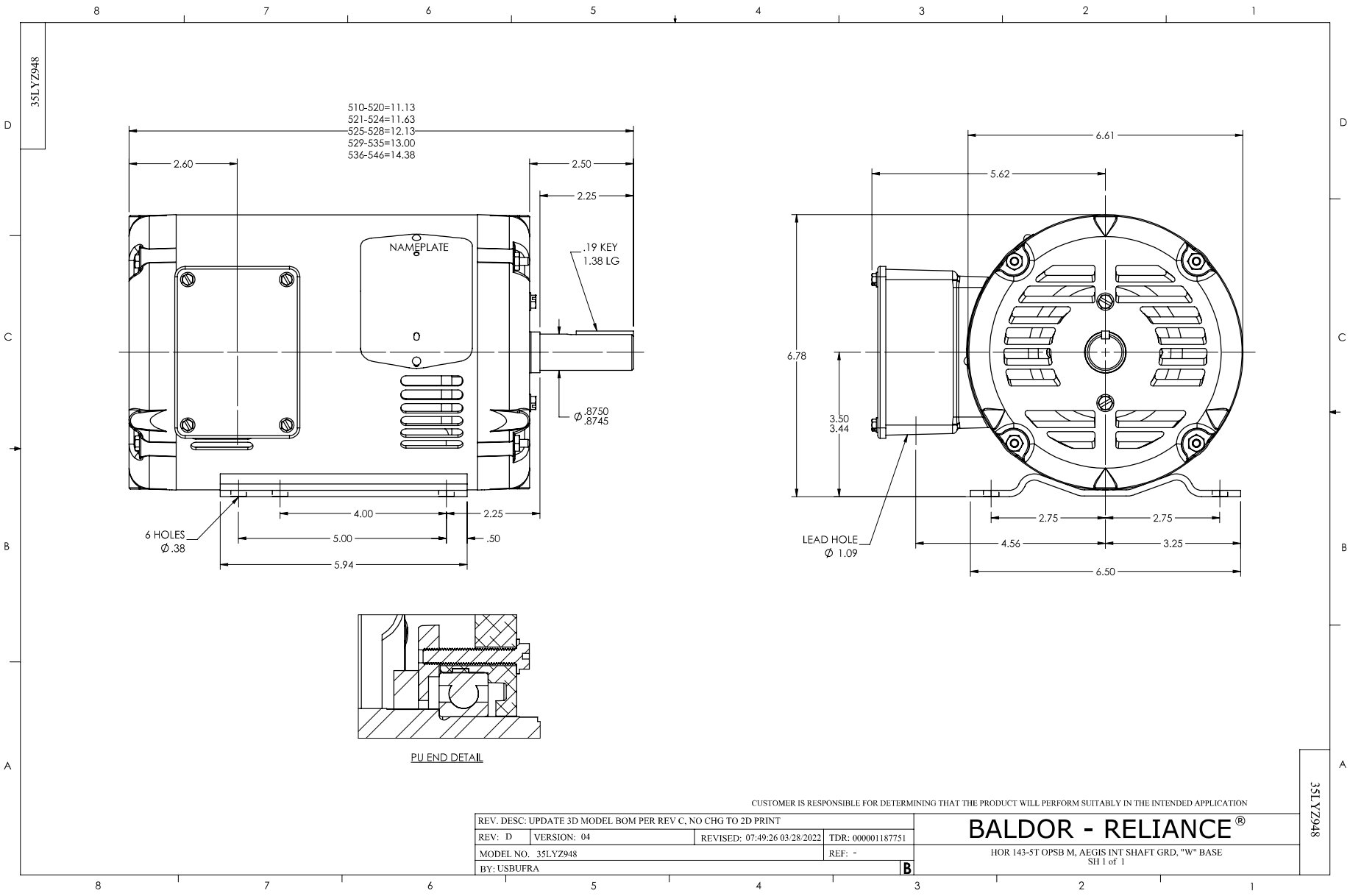
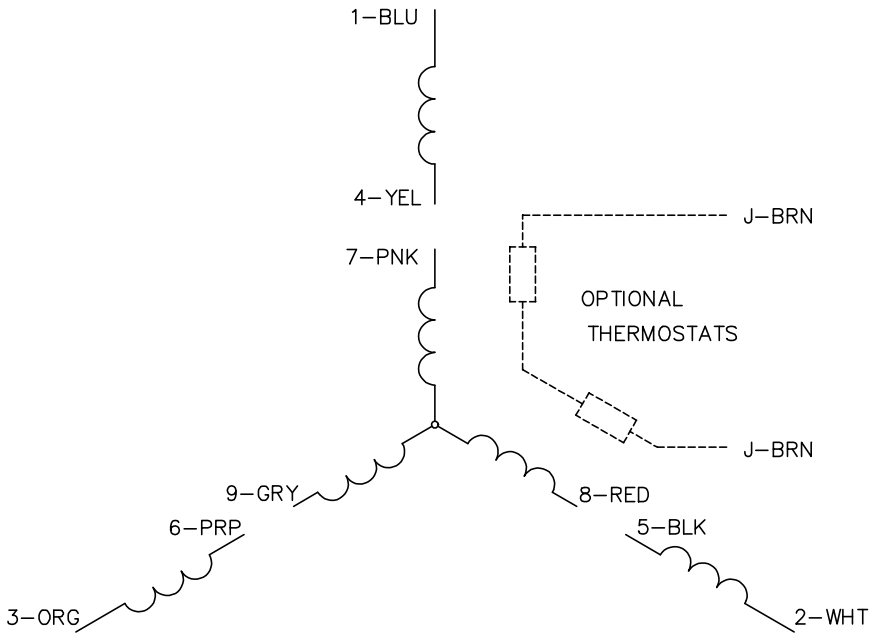
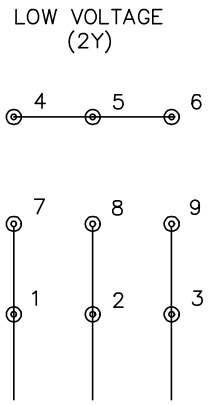


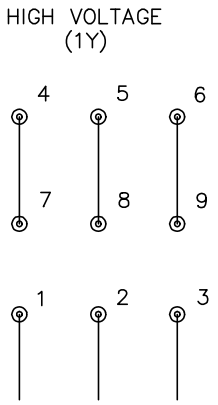
ABB Motors and Mechanical Inc.
WINDING # 35WGQ054
Typical performance - not guaranteed values.
2 HP 3 PH 60 HZ 3450 RPM 460 V 3524M
TORQUES(LB-FT): PO=11 PU=8 LR=9.6 LRA=21.5
TORQUE
RPM
WATTS
AMPS
EFF
PF
%EFF %PF
TORQUE (LB-FT)
RPM
WATTS
AMPS
PERCENT OF RATED OUTPUT (2 HP)
2/23/2024 ACPERF, record # 53133


35LYZ948
510-520=11.13
521-524=11.63
525-528=12.13
529-535=13.00
536-546=14.38
2.60
2.50
2.25
NAMEPLATE
.19 KEY
1.38 LG
Ø .8750
.8745
4.00
2.25
6 HOLES
Ø .38
5.00
.50
5.94
6.61
5.62
6.78
3.50
3.44
2.75
2.75
LEAD HOLE
Ø 1.09
4.56
3.25
6.50
PU END DETAIL
CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT THE PRODUCT WILL PERFORM SUITABLY IN THE INTENDED APPLICATION
REV. DESC: UPDATE 3D MODEL BOM PER REV C, NO CHG TO 2D PRINT
REV: D
VERSION: 04
REVISED: 07:49:26 03/28/2022
TDR: 000001187751
MODEL NO. 35LYZ948
REF: -
BY: USBUFRA
B
BALDOR - RELIANCE®
HOR 143-5T OPSB M, AEGIS INT SHAFT GRD, "W" BASE
SH 1 of 1
35LYZ948

CD0005







NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			BALDOR ELECTRIC Co.
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	3PH, DV, 9 LEADS

	REVISION	VERSION
DRAWING	D	0

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES. TOLERANCE:
.X ±0.0
.XX ±0.03
.XXX ±0.000
FINISH
ANGLES ± 3.0 ° HOLE DIA + .005 - .005
CONFORMS TO ASME Y14.5M-1994.

TRANE

DRAWN BY: K. LIN ©TRANE DATE: 12-OCT-2016

DO NOT SCALE PRINT

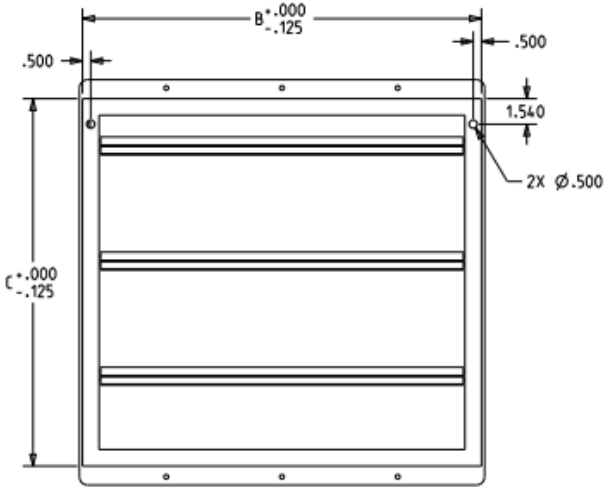
THIRD ANGLE PROJECTION

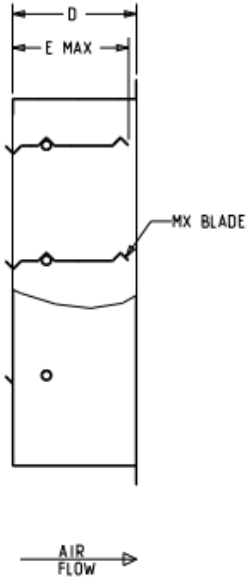
49513756 SHEET 1 OF 2 REV D

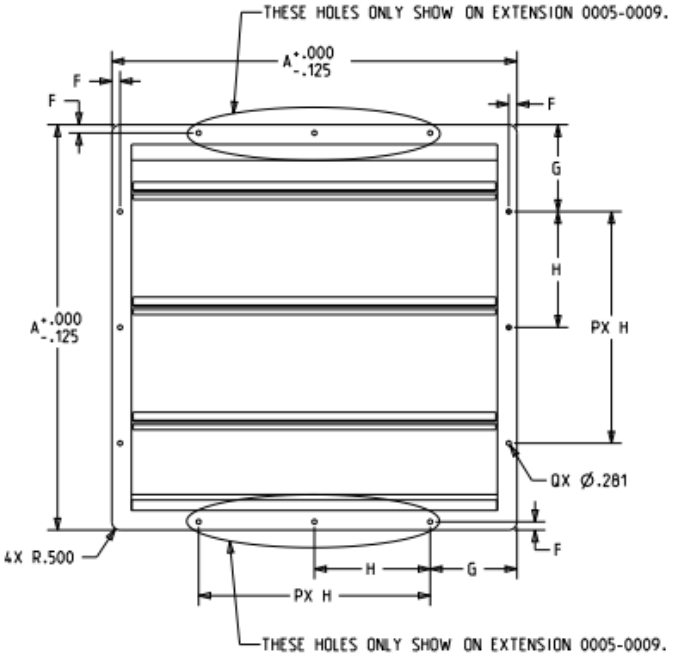
DAMPER BACKDRAFT

NOTES:
1. CHANGES TO THIS PRINT MAY AFFECT PURCHASING AND VENDOR. NOTIFY THEM OF CHANGES.
2. CONFORMS TO TRANE S65380222.
3. DAMPERS ARE FOR HORIZONAL BLADE INSTALLATION.

EXT	NAME	A	B	C	D	E	F	G	H	P	Q	M	WEIGHT
495137560001	DAMPER; BACKDRAFT 105 DDP FAN	16.125	15.750	13.830	7.500	7.250	.313	3.063	5.000	2	6	2	11.3
495137560002	DAMPER; BACKDRAFT 122 DDP FAN	19.188	18.813	16.893	7.500	7.250	.500	4.594	5.000	2	6	3	13.7
495137560003	DAMPER; BACKDRAFT 135 DDP FAN	20.000	19.625	17.705	7.500	7.250	.500	5.000	5.000	2	6	3	14.3
495137560004	DAMPER; BACKDRAFT 150 DDP FAN	22.500	22.125	20.205	7.500	7.250	.500	4.250	7.000	2	6	3	17.4
495137560005	DAMPER; BACKDRAFT 165 DDP FAN	24.500	24.125	22.205	7.500	7.250	.500	5.250	7.000	2	12	3	19.3
495137560006	DAMPER; BACKDRAFT 182 DDP FAN	27.125	26.750	24.830	7.500	7.250	.500	6.563	7.000	2	12	4	21.5
495137560007	DAMPER; BACKDRAFT 200 DDP FAN	29.625	29.250	27.330	7.500	7.250	.500	2.313	5.000	5	24	4	25.3
495137560008	DAMPER; BACKDRAFT 222 DDP FAN	31.875	31.500	29.580	7.500	7.250	.500	3.438	5.000	5	24	4	27.7
495137560009	DAMPER; BACKDRAFT 245 DDP FAN	34.375	34.000	32.080	7.500	7.250	.500	6.688	7.000	3	16	5	31.5
495137560012	DAMPER; BACKDRAFT FAN 400 MI	16.438	16.063	14.143	9.750	6.500	.688	2.750	5.469	2	6	2	13.3
495137560013	DAMPER; BACKDRAFT FAN 450 MI	20.500	20.125	18.205	9.750	6.500	.688	2.750	5.000	3	8	3	17.0
495137560014	DAMPER; BACKDRAFT FAN 500 MI	21.500	21.125	19.205	9.750	6.500	.688	2.750	5.333	3	8	3	18.0
495137560015	DAMPER; BACKDRAFT FAN 560, 630 MI	25.500	25.125	23.205	9.750	6.500	.688	2.750	5.000	4	10	4	22.8







4 3 2 1

Klima-flex™

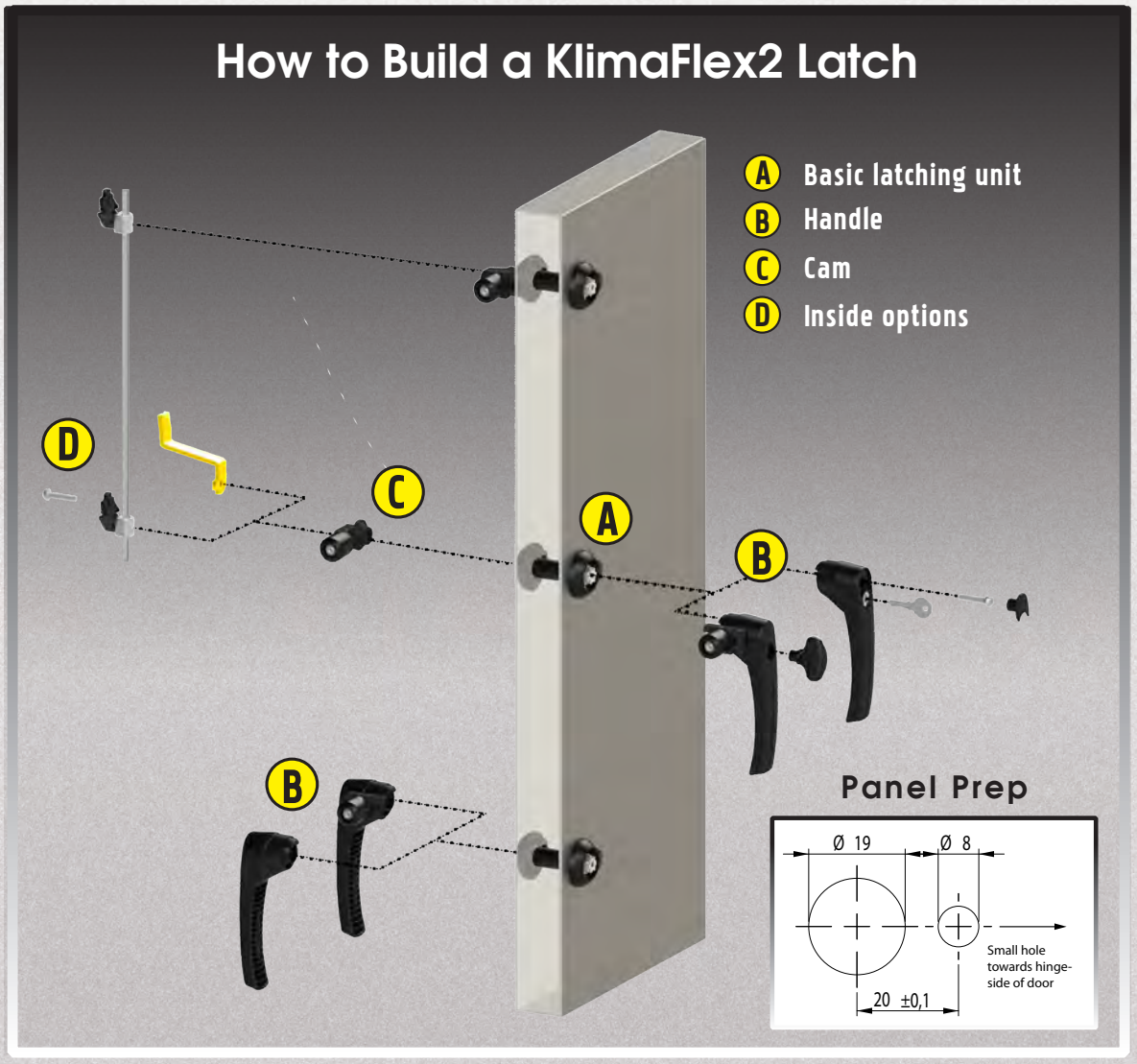
VENTILATION SYSTEMS

HVAC

ALLEGIS

A CUSTOMER DRIVEN COMPANY

Klima·flex 2



Out-Swing Door

- **A** Choose a latching unit corresponding to the thickness of the door
- **B** Choose an out-swing handle
- **C** Add a roller cam
- **D** If needed, choose inside options: rod link, safety catch, safety handle, inside handle

In-Swing Door

- **A** Choose a latching unit corresponding to the thickness of the door
- **B** + **C** Choose an in-swing handle with roller cam
- **D** If you need an inside security handle, mount a 2651-205400 handle on the inside of the door

Klima·flex 2

Handles

There are a variety of handle combinations depending upon your application. Choose between key locking, tool operated, or non-locking. Designed for ease of installation in the factory or the field, the handles are mounted with a single screw.

The handles have a built in, adjustable roller cam that reduces friction during the latching operation. The cam is normally placed on the right side of the handle, but can be moved to the left side. Contact Allegis for KlimaFlex-2 handles with the roller cam pre-mounted on the left side.

Tool-Operated

Key-Locking

Non-Locking

Pad-Lockable

KLIMAFLEX™ 2 SYSTEM - INSIDE AND OUTSIDE HANDLES

P/N	Description	Latching type	P/N	Description	Latching type
2651-205000	In-swing	Non-locking	2651-205400	Out-swing	Non-locking
2651-205105	In-swing	Square 8	2651-205505	Out-swing	Square 8
2651-205114	In-swing	Triangle 7	2651-205514	Out-swing	Triangle 7
2651-205134	In-swing	Recessed hexagon 8 (5/16")	2651-205534	Out-swing	Recessed hexagon 8 (5/16")
2651-205281	In-swing	Keyed: IL1333	2651-205681	Out-swing	Keyed: IL1333
			2651-205700	Out-swing	Padlockable

MATERIAL:
Handle: Glass reinforced nylon (PA6 GF30)
Roller cam: Steel, Glass reinforced nylon (PA6 GF30)

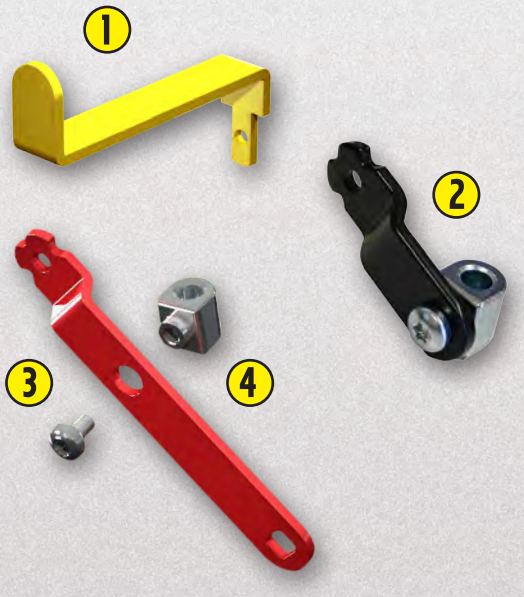
* Contact ALLEGIS for more information about adding your logo to the handle plug and/or custom colored handles.

Klima·flex 2

Cams, Linkages & Accessories

In the KlimaFlex-2 System you can combine different parts to achieve the latching system required. Choose from the list below.

KLIMAFLEX™ 2 - INSIDE LATCHING OPTIONS		
P/N	**Description**	**Image**
2651-901025	Safety catch for a 1" door	**1**
2651-901050	Safety catch for a 2" door	**1**
2651-901075	Safety catch for a 3" door	**1**
2651-901100	Safety catch for a 4" door	**1**
2651-902001	Rod link allows interlinking latch points w/o the use of inside safety handle	**2**
2651-904000	Inside security handle w/o rod link	**3**
2651-903001	Security handle w/ rod link	**3 + 4**
2651-903002	Rod link only; for inside handle	**4**



MATERIAL:
Safety catch, Rod link, Inside security handle, and Inside security handle with rod link: Steel, zinc plated

Roller Cam

The KlimaFlex-2 roller cam is designed to fit into either side of the K2 latching units. It is easy to adjust with a torx-bit. The roller cam reduces the friction during the latching operation. Set it so that the door closes smoothly and is kept securely closed.

MATERIAL:
Roller cam: Glass reinforced nylon (PA6 GF30)
Housing: Zinc die-cast
Bracket: Plated steel

KLIMAFLEX™ 2 - ROLLER CAM	
P/N	**Ø of Roller**
8-325-243	25 mm

Klima-flex™

Advantages, Features and Benefits

of the KlimaFlex Series of HVAC Hardware

All KlimaFlex Latches

- Full thermal break between inside and outside of door
- Non-locking, tool-locking, padlocking, and key locking handles available
- Latches are "non-handed" and oriented so that handle can rest in the horizontal or vertical position
- Fitted with adjustable, plastic tapered roller cams for smooth compression of door without marking or gasket damage
- Simple, two hole panel preparation
- Latches can be configured for multipoint latching, inside release, and with a safety catch
- Latch can be secured without handle installed, so that HVAC unit can be transported and installed without the fear of handles breaking or the unit exceeding width restrictions
- Custom logos available

Specific to K2 Latch

- Replaceable without destroying the door
- The Klimaflex-2 latch does not depend upon compression of the door for mounting. So "oil canning" of the door, which leads to leaks, does not occur
- Pour in place gasket eliminates loose gaskets and ensures positive sealing every time
- Installation is accomplished with just one tool (Torx T-30)

Additional Products to meet your HVAC needs

- Hinges; Adjustable, lift-off, elevated axis point to eliminate gasket pinching
- View Ports; UV resistant, sealed, easy to install
- Door Seals; extruded, clip-on, or adhesive style
- Custom products available through the Allegis Engineering Group

HVAC

ALLEGIS
A CUSTOMER DRIVEN COMPANY

Allegis Corporation
8001 Central Avenue N.E.
Minneapolis, MN 55432

Toll Free 1-866-378-7550

www.allegiscorp.com

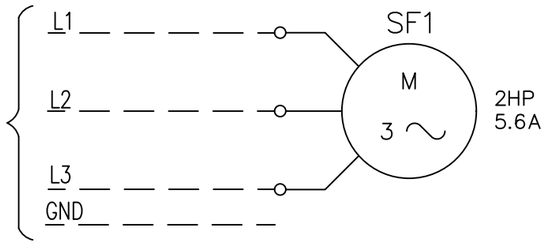
Job: C
EQ NUMBER: 68696

[ELECTRICAL DRAWING AND DATA SUBMITTAL]

Trane 9900 Aire Circle, Fort Smith, AR 72916 Phone: (479) 648-7438 Fax: (479) 648-7499

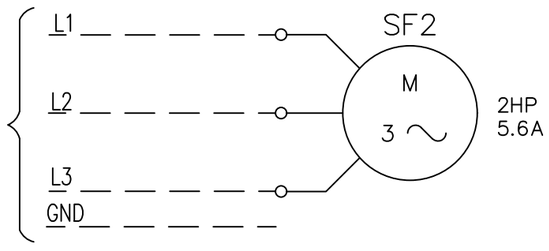
(CIRCUIT 1)
FLA: 5.6A
MCA: 7A
MOCP: 15A
SCCR: N/A

CUSTOMER
PROVIDED
208 VAC
3 PH
60 HZ



(CIRCUIT 2)
FLA: 5.6A
MCA: 7A
MOCP: 15A
SCCR: N/A

CUSTOMER
PROVIDED
208 VAC
3 PH
60 HZ



REPLACES	AUTOCAD	68696-ELEC-DOAS-1-1 REV A
REVISION DATE	TRANE CUSTOM	UMC-NEFF HALL
DRAWN BY JTH	THIS DRAWING IS PROPRIETARY AND SHALL NOT BE COPIED OR ITS CONTENTS DISCLOSED TO OUTSIDE PARTIES WITHOUT THE WRITTEN CONSENT OF TRANE CUSTOM	TAG: DOAS-1 ELECTRICAL DIAGRAM
DATE 2/22/24	SIMILAR TO	SHEET 1 of 1

LEGEND

DEVICE DESIGNATION	DESCRIPTION	MODEL NUMBER / MFGR. / VENDOR
SF1-2	FAN MOTOR, BALDOR, 208V, 3PH, 60Hz, 2 HP	SEE MOTOR SCHEDULE

NOTES:
1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25°C(77°F) AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
2. SOLID LINES INDICATE FACTORY WIRING. DASHED LINES INDICATE FIELD WIRING. PHANTOM LINES INDICATE OPTIONAL FEATURES.
3. UNIT IS FLEX-FIT. NO CONDUIT/WIRING IS PROVIDED OR INSTALLED BY TRANE FACTORY.

⚠ WARNING

HAZARDOUS VOLTAGE!

DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS AND FOLLOW LOCK OUT AND TAG PROCEDURES BEFORE SERVICING. INSURE THAT ALL MOTOR CAPACITORS HAVE DISCHARGED STORED VOLTAGE. UNITS WITH VARIABLE SPEED DRIVE, REFER TO DRIVE INSTRUCTIONS FOR CAPACITOR DISCHARGE.

FAILURE TO DO THE ABOVE BEFORE SERVICING COULD RESULT IN DEATH OR SERIOUS INJURY.

⚠ AVERTISSEMENT

TENSION DANGEREUSE!

COUPER TOUTES LES TENSIONS ET OUVRIR LES SECTIONNEURS À DISTANCE, PUIS SUIVRE LES PROCÉDURES DE VERROUILLAGE ET DES ÉTIQUETTES AVANT TOUTE INTERVENTION. VÉRIFIER QUE TOUS LES CONDENSATEURS DES MOTEURS SONT DÉCHARGÉS. DANS LE CAS D'UNITÉS COMPORTANT DES ENTRAÎNEMENTS À VITESSE VARIABLE, SE REPORTER AUX INSTRUCTIONS DE L'ENTRAÎNEMENT POUR DÉCHARGER LES CONDENSATEURS.

NE PAS RESPECTER CES MESURES DE PRÉCAUTION PEUT ENTRAÎNER DES BLESSURES GRAVES POUVANT ÊTRE MORTELLES.

⚠ ADVERTENCIA

¡VOLTAJE PELIGROSO!

DESCONECTE TODA LA ENERGÍA ELÉCTRICA, INCLUSO LAS DESCONEXIONES REMOTAS Y SIGA LOS PROCEDIMIENTOS DE CIERRE Y ETIQUETADO ANTES DE PROCEDER AL SERVICIO. ASEGÚRESE DE QUE TODOS LOS CAPACITORES DEL MOTOR HAYAN DESCARGADO EL VOLTAJE ALMACENADO. PARA LAS UNIDADES CON EJE DE DIRECCIÓN DE VELOCIDAD VARIABLE, CONSULTE LAS INSTRUCCIONES PARA LA DESCARGA DEL CONDENSADOR.

EL NO REALIZAR LO ANTERIORMENTE INDICADO, PODRÍA OCASIONAR LA MUERTE O SERIAS LESIONES PERSONALES.

CAUTION

USE COPPER CONDUCTORS ONLY!

UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS.

FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.

ATTENTION

N'UTILISER QUE DES CONDUCTEURS EN CUIVRE!

LES BORNES DE L'UNITÉ NE SONT PAS CONÇUES POUR RECEVOIR D'AUTRES TYPES DE CONDUCTEURS.

L'UTILISATION DE TOUT AUTRE CONDUCTEUR PEUT ENDOMMAGER L'ÉQUIPEMENT.

PRECAUCIÓN

¡UTILICE ÚNICAMENTE CONDUCTORES DE COBRE!

LAS TERMINALES DE LA UNIDAD NO ESTÁN DISEÑADAS PARA ACEPTAR OTROS TIPOS DE CONDUCTORES.

SI NO LO HACE, PUEDE OCASIONAR DAÑO AL EQUIPO.

AH4 Revised Submittal

Prepared For:
University Of Missouri
Attn: Heather Brown

Sold To:
University Of Missouri
Attn: Heather Brown

Date: March 04, 2024

Job Name:
MU - CP231442 Neff Hall HVAC Phase 2

Trane U.S. Inc. is pleased to provide the following submittal for your review and approval.

Product Summary

Qty	Product
1	Blower coil

Joe Zweifel, Senior Account Manager
Trane U.S. Inc.
101 Matrix Commons Drive
Fenton, MO 63026
E-mail: jzweifel@trane.com
Office Phone: (314) 853-8406
Cell: (314) 853-8406

The attached information describes the equipment we propose to furnish for this project and is submitted for your approval.

Submittal acceptance and return is a critical step, so please ensure submittals are returned with approval to release to production within 14 days of submittal date.

Product performance and submittal data is valid for a period of 6 months from the date of submittal generation. If six months or more has elapsed between submittal generation and equipment release, the product performance and submittal data will need to be verified. It is the customer's responsibility to obtain such verification.

Table of Contents

Tag Data - Blower coil (Qty: 1)

Item	Tag(s)	Qty	Description	Model Number
A1	AH4 3 ph	1	BCXE Blower Coil (BCXE)	BCVE060EBA0C6C040000000C0BK

Product Data - Blower coil

Item: A1 Qty: 1 Tag(s): AH4 3 ph

VERTICAL CONFIGURATION
Unit Size 60; 5 Ton
208/60/3
Double wall panels
Bottom Return
SST Drain pan front connection
6 Row Hydronic Coil
1 Horsepower
2" Pleated MERV 13
Customer Supplied Terminal Interface
Year 2 parts warranty whole unit
1st year labor warranty whole unit

Product Report - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph

Unit Overview

Model Number	Design Airflow	Elevation	External Dimensions			Weight	
			Length	Width	Height	Shipping	Operating
BCVE060	1875 cfm	0.00 ft	27.450 in	34.800 in	58.600 in	312.2 lb	329.2 lb

Unit Features

Insulation type	Double wall panels
Filter type	2" Pleated MERV 13

Motor/Electrical Information

Unit voltage	208/60/3
Motor full load amps	4.60 A
Fan electrical power	860.0 W
Min circuit ampacity	5.75 A
Maximum overcurrent protection	15.00 A
Brake horsepower	0.869 hp
ECM horsepower	1.000 hp
ESP	0.500 in H2O
TSP	1.517 in H2O
Design fan speed	1125 rpm
Medium fan speed	956 rpm
Low fan speed	742 rpm
Certification	Certified in accordance with AHRI 430-2020

Coil Information

Coil #1	6R Hydronic	**Cooling face velocity**	450 ft/min
		Cooling fluid type	Water
		Motor heat calculation	Include

Coil Performance - Cooling			
Total cooling capacity	57.50 MBh	**Cooling ent fluid temp**	45.00 F
Sensible capacity	41.21 MBh	**Cooling leaving fluid temp**	60.00 F
Cooling EDB	77.00 F	**Cooling delta T**	15.00 F
Cooling EWB	66.00 F	**Cooling flow rate**	8.00 gpm
Cooling LDB	57.05 F	**Cooling fluid PD**	3.30 ft H2O
Cooling LWB	56.13 F	**Valve Kit PD**	0.00 ft H2O
		Fluid velocity	2.00 ft/s
		APD	0.761 in H2O

Controls, Sensors and Valves

Control type	CSTI
Unit Coil #1 control valve type	Field Supplied, Analog (2-10VDC)

Acoustics

Notes 1: Sound levels will be 3-5 db higher depending on conditions due to double wall.

Mechanical Specifications - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph

BCVE General
The product line consists of a vertical air handling unit. Air handling airflow data is certified in accordance with AHRI standard 430. The unit is UL listed to US and Canadian safety standards and complies with NFPA 90A. Air handlers consist of a hydronic and or DX coil, drain pan and centrifugal fan with motor in a common cabinet. Unit and accessories are insulated with 1" 1.5 lb/cu. ft density fiberglass insulation. Double wall is also available. Large motor access panels are provided on the front side of the unit.

Casing
Casings are constructed of galvanized steel, insulated with 1" 1.0 lb/cu. ft density fiberglass fire resistant and odorless glass fiber material to provide thermal and acoustical insulation. Fan housing sides are directly attached to the air handler front and back panels strengthening the entire unit assembly. Coil access panels are located on the front side of the air handler and allow removal of the internal coils and drain pan. Main access panels provide generous access to the fan and motor from the front side of the air handler.

Double Wall Panels
Double wall panel casings are constructed of a galvanized steel inner panel and a galvanized steel outer panel. Enclosed between the panels is 1" 1.0 lb/cu. ft density fiberglass with an R-Value of 4.2. The insulation is UL listed and meets NFPA-90A and UL191 standards.

Coil #1 Hydronic Cooling Coils
Cooling coils are four, six, or eight row chilled water. All water coils are 12 fins per inch and have 3/8" tubes with 0.012" wall thickness. All water coils use highly efficient Trane Delta Flo, Type H aluminum fins, mechanically bonded to seamless copper tubes. All coils are specifically designed and circuited for water use. All coils are factory tested with 450.00 psi air under water. Maximum standard operating conditions are 300.00 psi at 200.0 F. Sweat type connections are standard. Coil performance data is in accordance with the current edition of AHRI Standard 410.

Unit Fan
The fans are DWDI (double width double inlet) forward curved centrifugal blower type. The fans are direct drive mounted directly to the motor shaft. All fans are dynamically balanced. All air handlers have a single fan.

Electronically Commutated Motors (ECM) - Three Phase
All motors are brushless DC (BLDC) electronically commutated motors (ECM) factory programmed and run tested in assembled units. The motor controller is mounted in a control box with a built in integrated user interface and LED tachometer. If adjustments are needed, motor parameters can be adjusted through momentary contact switches accessible without factory service personnel on the motor control board. Motors will soft ramp between speeds to lessen the acoustics due to sudden speed changes. Motors can be operated at three speeds or at variable speed with factory supplied or field supplied controllers. The motor will choose the highest speed if there are simultaneous or conflicting speed requests. All motors have integral overload protection with a maximum ambient operating temperature of 130.0 F and use permanently sealed ball bearings. Motors can operate at plus or minus 10 percent of rated voltage on all speed settings.

2" Pleated Throw-Away Merv 13 Filter
2-inch pleated media filters made with 100% synthetic fibers that are continuously laminated to a supported steel-wire grid with water repellent adhesive shall be provided. Filters shall be capable of operating up to 625 fpm face velocity without loss of filter efficiency and holding capacity. The filters shall have a MERV 13 rating when tested in accordance with the ANSI/ASHRAE Standard 52.2.

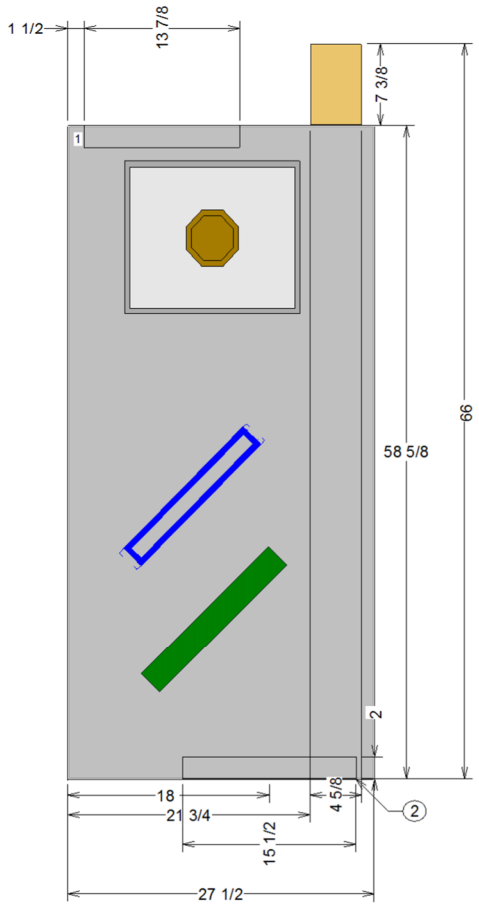
Stainless Steel Drain Pan
The drain pan is noncorrosive and double-sloped to allow condensate drainage. The drainpan construction is stainless steel. Coils mount above the drain pan, not in the drain pan - thus allowing the drain pan to be fully inspected and cleaned. The drain pan can also be removed for cleaning. The drain pan connections are 3/4" NPT schedule 40 stainless steel pipe. The main drain connection is at the lowest point of the drain pan. An auxiliary drain connection is provided on the same side as the main connection.

Internal Trap
All drain pan connections are internally trapped to eliminate need for external trap and aid with installation. The internal trap is removeable for cleanability.

Customer Supplied Terminal Interface (CSTI)

The customer supplied terminal interface (CSTI) is a pre-wired control offering of selected control components. This option intended to be used with a field-supplied, low-voltage thermostat or controller and field supplied temperature sensors. The control box contains a relay board which includes a line voltage to 24-volt transformer and disconnect switch (for non-electric heat units). Selected components are wired to a low-voltage terminal block and are run-tested, so only a power connection and thermostat/controller connection are needed to commission the unit.

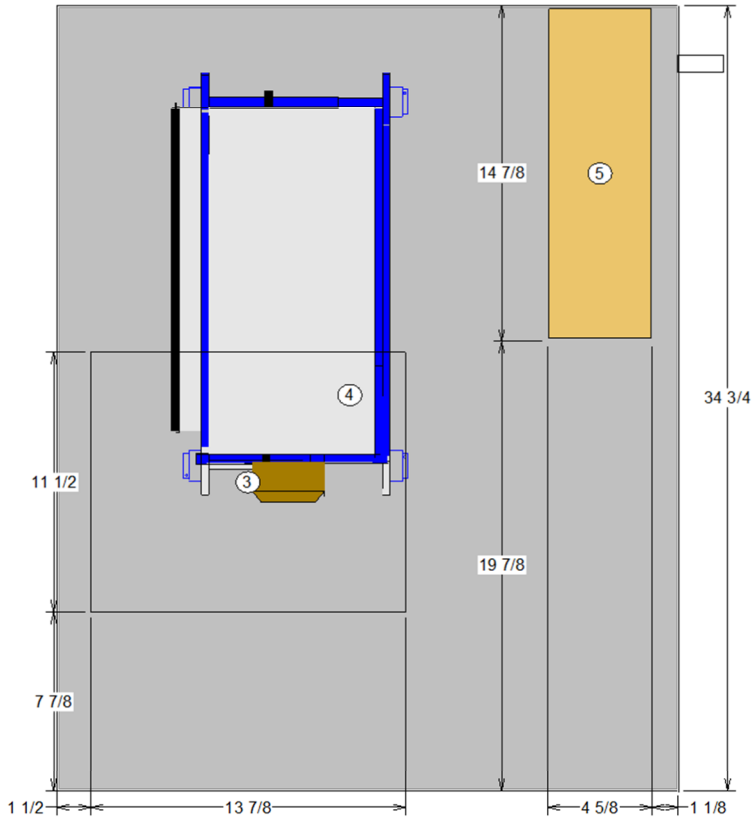
Dimensional Drawings - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph



OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

Unit size (Nominal CFM): 60 (2000 CFM)	Job Name: MU - CP231442 Neff Hall HVAC Phase 2	Unit Insulation: Double wall panels	TRANE
Seismic certification:	Design airflow: 1875 cfm	Proposal Number	
	Sales Office	Tags: AH4 3 ph	
		Rigging/Installed Weight: 312.2 lb / 329.2 lb	

Dimensional Drawings - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph



1 Opening bottom 27 x 15.5
2 Opening bottom 27 x 15.5
3 Opening top 11.5 x 13.9
4 Housed fan
5 External control box top

OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

Unit size (Nominal CFM): 60 (2000 CFM)	Job Name: MU - CP231442 Neff Hall HVAC Phase 2	Unit Insulation: Double wall panels
Seismic certification:	Design airflow: 1875 cfm	Proposal Number
	Sales Office	Tags: AH4 3 ph
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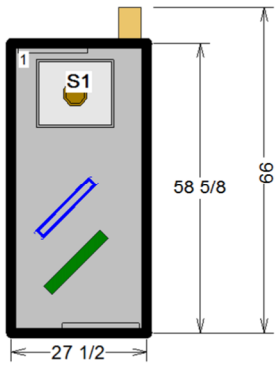
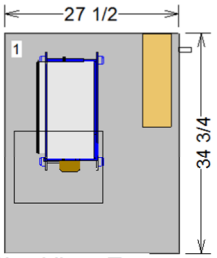
Dimensional Drawings - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph



Shipping splits are indicated by thick black lines

Pos #	Module	Length	Weight
1	Fan and coil section	27 1/2	329.20
	Installed Unit Weight		329.20 lbs

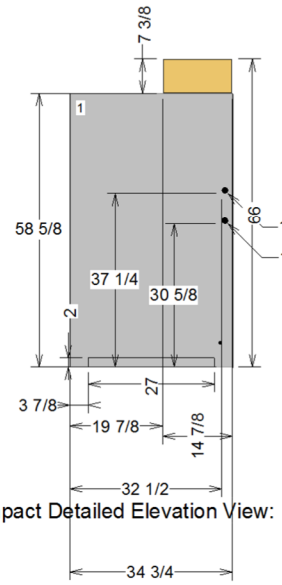


Basic Overall Plan View: Top - Measurements in inches

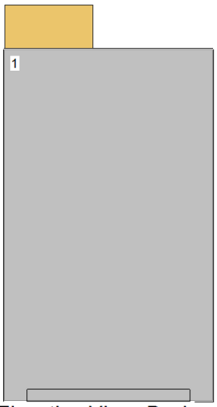
OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

Unit size (Nominal CFM): 60 (2000 CFM)	Job Name: MU - CP231442 Neff Hall HVAC Phase 2	Unit Insulation: Double wall panels	TRANE
Seismic certification:	Design airflow: 1875 cfm	Proposal Number	
	Sales Office	Tags: AH4 3 ph	
		Rigging/Installed Weight: 312.2 lb / 329.2 lb	

Dimensional Drawings - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph



Compact Detailed Elevation View: Front - Measurements in inches

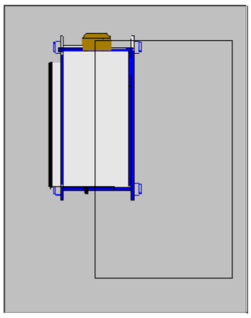


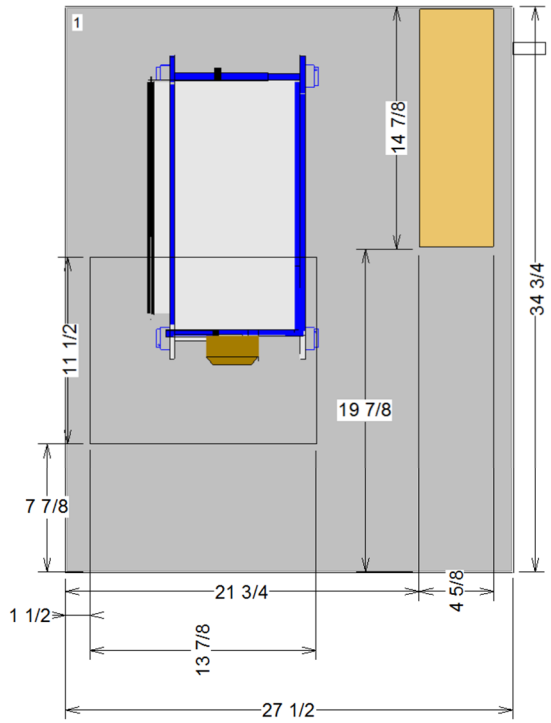
Compact Detailed Elevation View: Back - Measurements in inches

OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

Unit size (Nominal CFM): 60 (2000 CFM)	Job Name: MU - CP231442 Neff Hall HVAC Phase 2	Unit Insulation: Double wall panels
Seismic certification:	Design airflow: 1875 cfm	Proposal Number
	Sales Office	Tags: AH4 3 ph
		Rigging/Installed Weight: 312.2 lb / 329.2 lb

Dimensional Drawings - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph



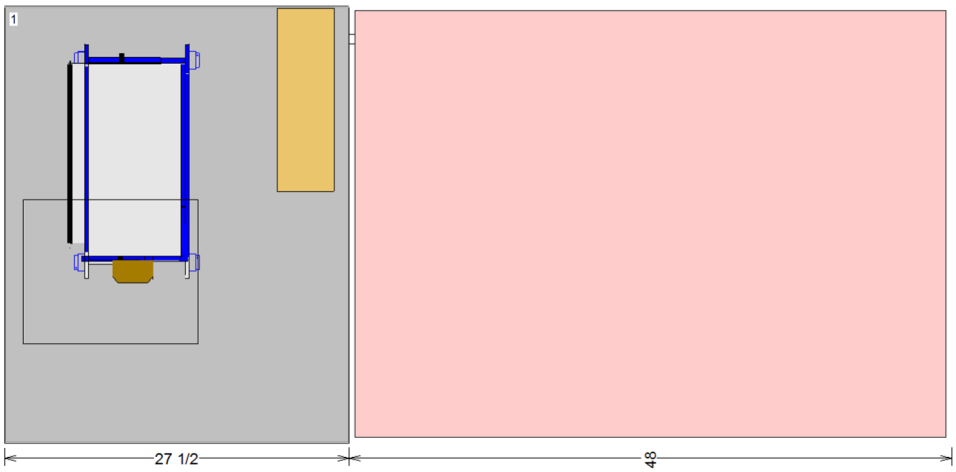


Right Side of Unit Detailed Plan View: Top - Measurements in inches

OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

Unit size (Nominal CFM): 60 (2000 CFM)	Job Name: MU - CP231442 Neff Hall HVAC Phase 2	Unit Insulation: Double wall panels	TRANE
Seismic certification:	Design airflow: 1875 cfm	Proposal Number	
	Sales Office	Tags: AH4 3 ph	
		Rigging/Installed Weight: 312.2 lb / 329.2 lb	

Dimensional Drawings - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph



Basic Service Clearance - Plan - Measurements in inches

The coil(s) are intended to be removed from the coil connection side of the unit
In the event of a coil removal, the clearance located opposite of the coil connection side is required to remove hardware that secures the coil
****If the clearance opposite of the coil conection side of the unit is not available, the unit will need to be repositioned at the time of the coil removal****

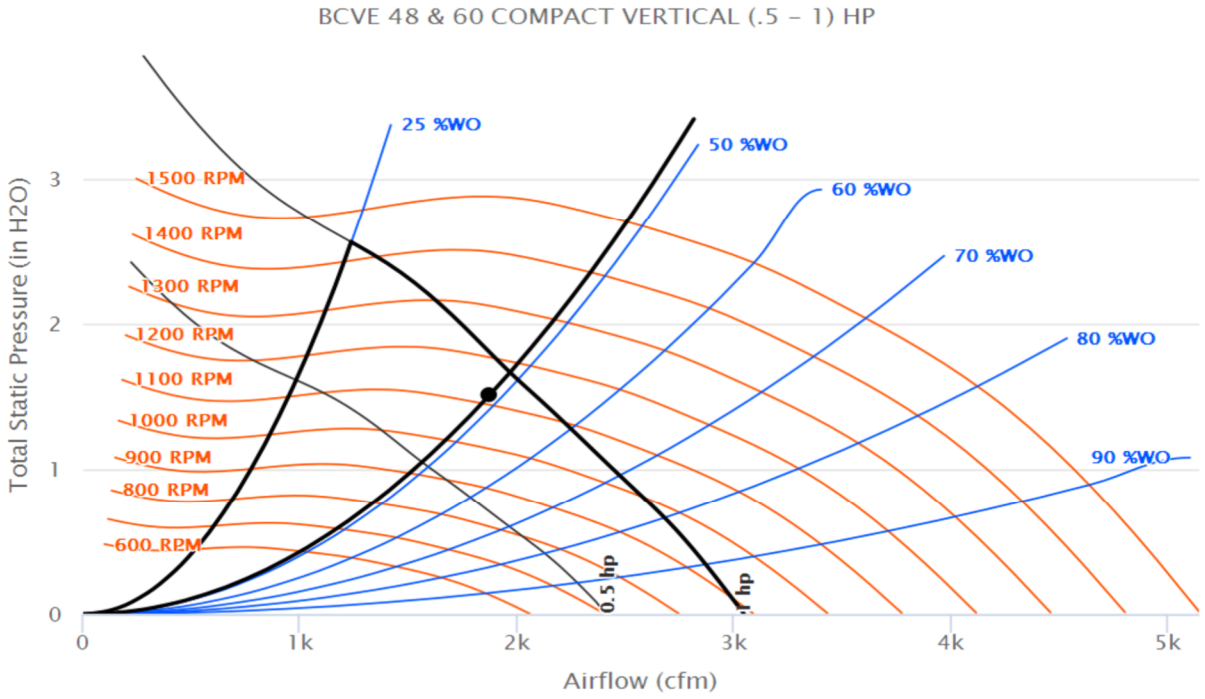
OPENING AND DIMENSIONS MAY VARY FROM CONTRACT DOCUMENTS / RETURN OF APPROVED DRAWINGS CONSTITUTES ACCEPTANCE OF THESE VARIANCES / NOT TO SCALE

Unit size (Nominal CFM): 60 (2000 CFM)	Job Name: MU - CP231442 Neff Hall HVAC Phase 2	Unit Insulation: Double wall panels	TRANE
Seismic certification:	Design airflow: 1875 cfm	Proposal Number	
	Sales Office	Tags: AH4 3 ph	
		Rigging/Installed Weight: 312.2 lb / 329.2 lb	

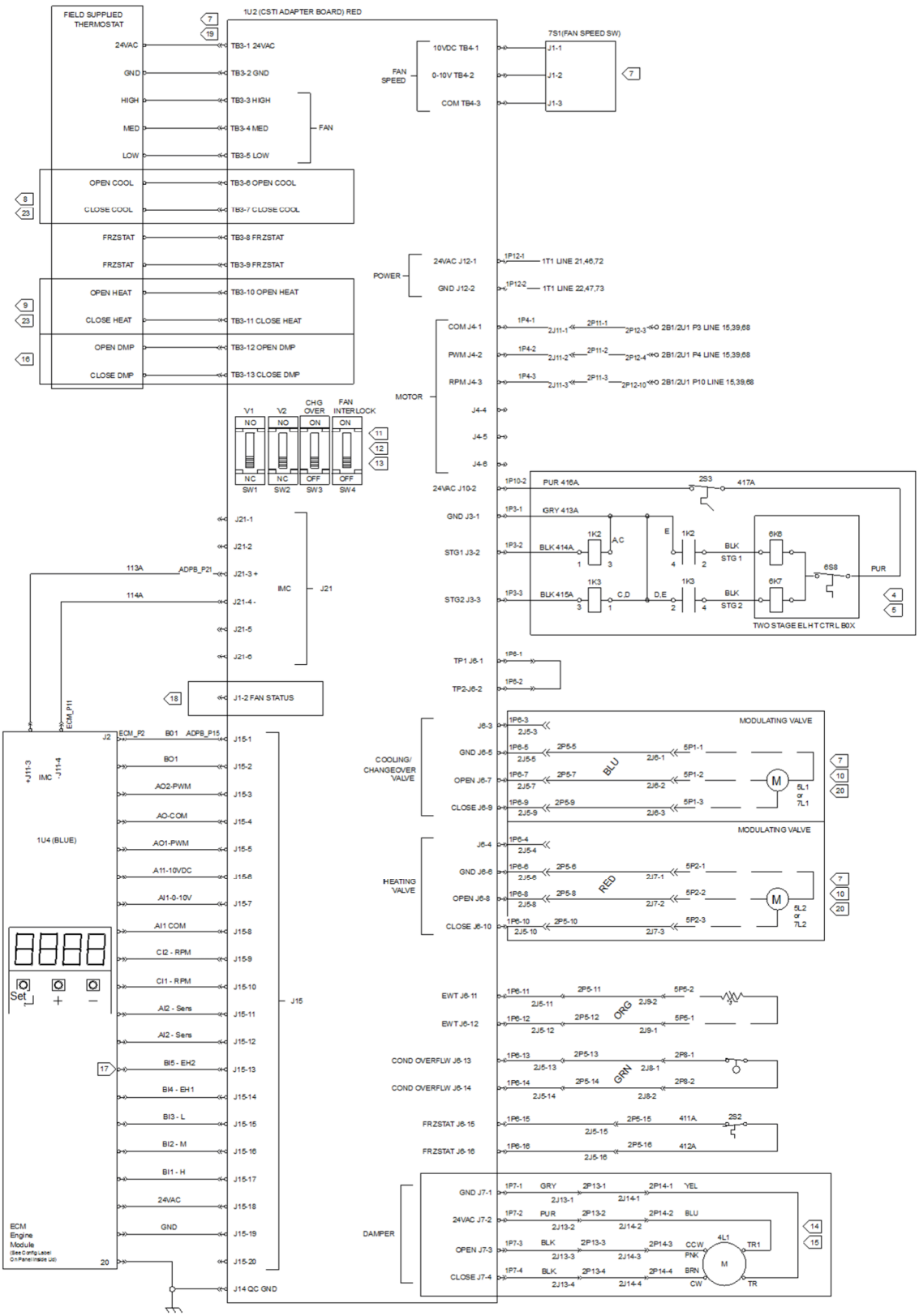
Fan Curve - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph

Fan Details

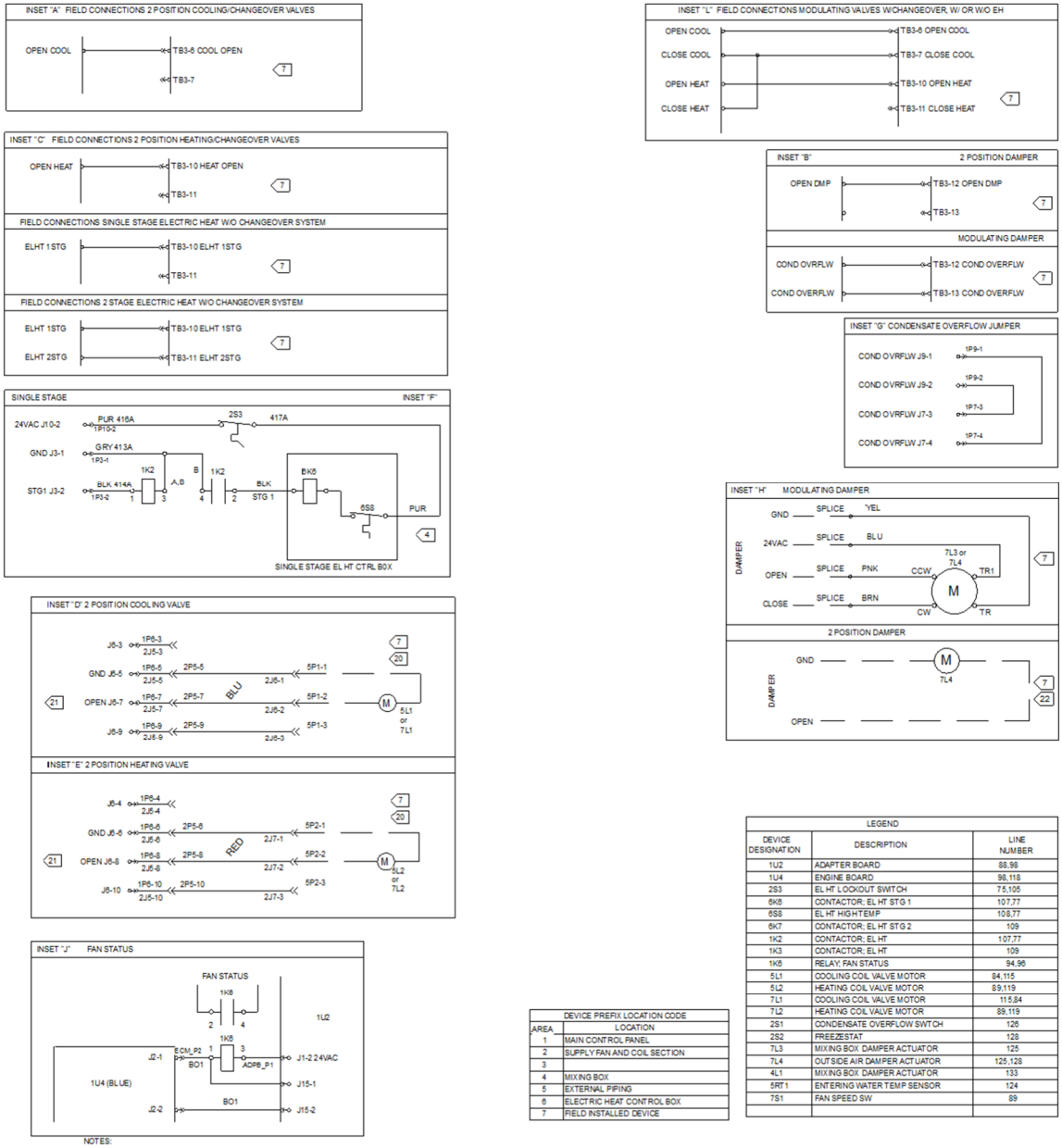
Unit Size	60 (2000 CFM)	**Operating Brake Power**	0.869 hp
Operating Airflow	1,875 cfm	**Altitude**	0.00 ft
Operating Static Pressure	1.517 in H2O	**Design Temp.**	77.00 F
Operating RPM	1,125 rpm		



Accessory - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph



Accessory - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph



DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX
5	EXTERNAL PIPING
6	ELECTRIC HEAT CONTROL BOX
7	FIELD INSTALLED DEVICE

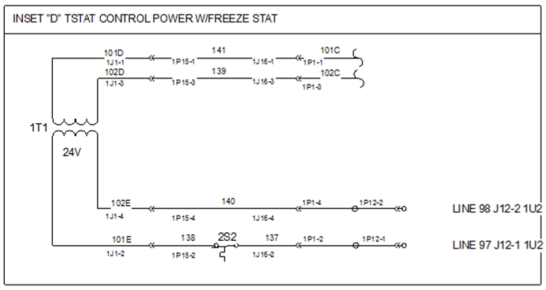
LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1U2	ADAPTER BOARD	88,96
1U4	ENGINE BOARD	96,118
2S3	EL HT LOCKOUT SWITCH	75,105
6K5	CONTACTOR; EL HT STG 1	107,77
6S8	EL HT HIGH TEMP	108,77
6K7	CONTACTOR; EL HT STG 2	109
1K2	CONTACTOR; EL HT	107,77
1K3	CONTACTOR; EL HT	109
1K8	RELAY; FAN STATUS	94,96
5L1	COOLING COIL VALVE MOTOR	84,115
5L2	HEATING COIL VALVE MOTOR	89,119
7L1	COOLING COIL VALVE MOTOR	115,84
7L2	HEATING COIL VALVE MOTOR	89,119
2S1	CONDENSATE OVERFLOW SWTCH	126
2S2	FREEZESTAT	128
7L3	MIXING BOX DAMPER ACTUATOR	125
7L4	OUTSIDE AIR DAMPER ACTUATOR	125,128
4L1	MIXING BOX DAMPER ACTUATOR	133
5RT1	ENTERING WATER TEMP SENSOR	124
7S1	FAN SPEED SW	89

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50 % RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
2. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINED ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. PHANTOM LINE ENCLOSURES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTIONS. SOLID LINES INDICATE WIRING BY TRANE.
3. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), STATE AND LOCAL REQUIREMENTS. ALL FIELD WIRING MUST HAVE INSULATION VOLTAGE RATING THAT EQUALS OR EXCEEDS UNIT RATED VOLTAGE.

4. ELECTRIC HEAT SCHEMATIC IS LOCATED IN THE ELECTRIC HEAT CONTROL BOX PANEL.
5. WIRING SHOWN IS FOR TWO STAGE ELECTRIC HEAT. FOR SINGLE STAGE EH SEE INSET "F"
7. USE CLASS 2 WIRING.
8. FIELD CONNECTIONS SHOWN ON TB3-6 AND TB3-7 ARE FOR COOLING MODULATING VALVES. FOR FIELD CONNECTIONS TO COOLING TWO POSITION VALVES OR CHANGEOVER VALVES, SEE INSET "A".
9. FIELD CONNECTIONS SHOWN ON TB3-10 AND TB3-11 ARE FOR HEATING MODULATING VALVES. FOR FIELD CONNECTIONS TO HEATING TWO POSITION VALVES OR CHANGEOVER VALVES, AND SINGLE STAGE ELECTRIC HEAT, TWO STAGE ELECTRIC HEAT, W/O CHANGEOVER SYSTEM, SEE INSET "C".
10. WIRING SHOWN IS FOR MODULATING VALVES. FOR COOLING 2 POSITION VALVE, SEE INSET "D". FOR HEATING 2 POSITION VALVE, SEE INSET "E".
11. SW1 AND SW2 ARE SHOWN IN THE OFF POSITION. SW1 AND OR SW2 ARE TURNED OFF WHEN VALVES ARE NORMALLY CLOSED OR MODULATING (CVT1 OR CVT2 = A,C,E,F,G,J). SW1 AND/OR SW2 ARE TURNED ON WHEN VALVES ARE NORMALLY OPEN. (CVT1 OR CVT2 = B,D,H).
12. SW3 IS SHOWN IN THE OFF POSITION. SW3 IS TURNED ON WHEN CHANGEOVER COILS ARE SELECTED (COIL1 OR COIL2 = J,K).
13. SW4 IS SHOWN IN THE OFF POSITION. SW4 IS TURNED ON WHEN UNIT HAS ELECTRIC HEAT (STGE = 1,2,3).
14. WIRING SHOWN IS FOR FACTORY INSTALLED MODULATING DAMPER. FOR CONDENSATE OVERFLOW JUMPER, SEE INSET "G". FOR 2 POSITION DAMPER AND MODULATING FIELD SUPPLIED/ SHIP LOOSE DAMPER WIRING, SEE INSET "H".
15. REMOVE TEST JUMPER PRIOR TO CONNECTING MIXING BOX TO MAIN UNIT.
16. FIELD CONNECTIONS SHOWN ON TB3-12 AND TB3-13 ARE FOR MODULATING DAMPER. FOR 2 POSITION DAMPER AND CONDENSATE OVERFLOW FIELD WIRING, SEE INSET "B".
17. WIRE IS OMMITTED WHEN 2-10V HEATING VALVE IS USED
18. SEE INSET "J" FOR FAN STATUS WIRING. (CTRL = N).
19. 24V OUTPUT IS RATED 15VA
20. FIELD SUPPLIED ACTUATOR WIRING UTILIZES THE SAME CONNECTION POINTS AS FACTORY ACTUATOR WIRING.
21. VALVES SHOWN IN NORMALLY CLOSED POSITION, FOR NORMALLY OPEN POSITION, THE VALVE SIGNAL BECOMES CLOSE.
22. DAMPER SHOWN IN NORMALLY CLOSED POSITION, FOR NORMALLY OPEN POSITION, THE DAMPER SIGNAL BECOMES CLOSE.
23. FIELD CONNECTIONS SHOWN ON TB3-6, TB3-7, TB3-10, TB3-11 ARE FOR MODULATING VALVES W/O CHANGEOVER AND ELECTRIC HEAT SYSTEM. FOR FIELD CONNECTIONS OF MODULATING VALVES W/CHANGEOVER, W/ OR W/O ELECTRIC HEAT SYSTEM, SEE INSET "L".

Accessory - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph



USE COPPER CONDUCTORS ONLY

NOTICE

UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS.

FAILURE TO DO THE ABOVE COULD RESULT IN EQUIPMENT DAMAGE.

N'UTILISER QUE DES CONDUCTEURS EN CUIVRE!

AVIS

LES BORNES DE L'UNITÉ NE SONT PAS CONÇUES POUR RECEVOIR D'AUTRES TYPES DE CONDUCTEURS.

FAIRE DEFAUT À LA PROCÉDURE CI-DESSUS PEUT ENTRAÎNER DES DOMMAGES À L'ÉQUIPEMENT.

¡UTILICE ÚNICAMENTE CONDUCTORES DE COBRE!

AVISO

LAS TERMINALES DE LA UNIDAD NO ESTÁN DISEÑADAS PARA ACEPTAR OTROS TIPOS DE CONDUCTORES.

NO SEGUIR LAS INSTRUCCIONES ANTERIORES PUEDE PROVOCAR DAÑOS EN EL EQUIPO.

⚠ WARNING

HAZARDOUS VOLTAGE!

DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS AND FOLLOW LOCK OUT AND TAG PROCEDURES BEFORE SERVICING. INSURE THAT ALL MOTOR CAPACITORS HAVE DISCHARGED STORED VOLTAGE. UNITS WITH VARIABLE SPEED DRIVE, REFER TO DRIVE INSTRUCTIONS FOR CAPACITOR DISCHARGE.

FAILURE TO DO THE ABOVE BEFORE SERVICING COULD RESULT IN DEATH OR SERIOUS INJURY.

⚠ AVERTISSEMENT

TENSION DANGEREUSE!

COUPER TOUTES LES TENSIONS ET OUVRIR LES SECTIONNEURS À DISTANCE, PUIS SUIVRE LES PROCÉDURES DE VERROUILLAGE ET DES ÉTIQUETTES AVANT TOUTE INTERVENTION. VÉRIFIER QUE TOUS LES CONDENSATEURS DES MOTEURS SONT DÉCHARGÉS. DANS LE CAS D'UNITÉS COMPORTANT DES ENTRAÎNEMENTS À VITESSE VARIABLE, SE REPORTER AUX INSTRUCTIONS DE L'ENTRAÎNEMENT POUR DÉCHARGER LES CONDENSATEURS.

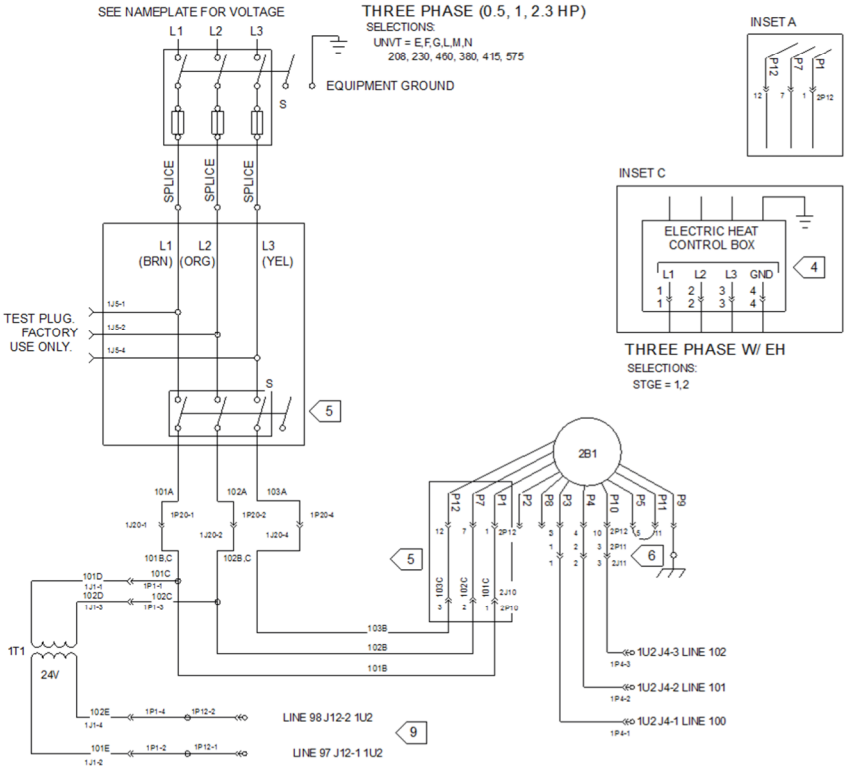
NE PAS RESPECTER CES MESURES DE PRÉCAUTION PEUT ENTRAÎNER DES BLESSURES GRAVES POUVANT ÊTRE MORTELLES.

⚠ ADVERTENCIA

¡VOLTAJE PELIGROSO!

DESCONECTE TODA LA ENERGÍA ELÉCTRICA, INCLUSO LAS DESCONEXIONES REMOTAS Y SIGA LOS PROCEDIMIENTOS DE CIERRE Y ETIQUETADO ANTES DE PROCEDER AL SERVICIO. ASEGÚRESE DE QUE TODOS LOS CAPACITORES DEL MOTOR HAYAN DESCARGADO EL VOLTAJE ALMACENADO. PARA LAS UNIDADES CON EJE DE DIRECCIÓN DE VELOCIDAD VARIABLE, CONSULTE LAS INSTRUCCIONES PARA LA DESCARGA DEL CONDENSADOR.

EL NO REALIZAR LO ANTERIORMENTE INDICADO, PODRÍA OCASIONAR LA MUERTE O SERIAS LESIONES PERSONALES.



DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX
5	EXTERNAL PIPING
6	ELECTRIC HEAT CONTROL BOX
7	FIELD INSTALLED DEVICE

LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
SINGLE PHASE		
7S2	FUSED DISCONNECT SWITCH	3
1S1	MANUAL DISCONNECT SWITCH	12
1T1	TRANSFORMER	20
2B1	FAN MOTOR	14
THREE PHASE (0.5, 1, 2.3 HP)		
7S2	FUSED DISCONNECT SWITCH	27
1S1	MANUAL DISCONNECT SWITCH	37
1T1	TRANSFORMER	44
2B1	FAN MOTOR	48
THREE PHASE (1.5, 3.0, 3.5, 5.0 HP)		
7S2	FUSED DISCONNECT SWITCH	54
1S1	MANUAL DISCONNECT SWITCH	63
1T1	TRANSFORMER	70
2B1	FAN MOTOR	58
2U1	MOTOR DRIVER	67
2S2	FREEZE STAT	29

50262929

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50 % RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
2. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. PHANTOM LINED ENCLOSURES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTIONS. SOLID LINES INDICATE WIRING BY TRANE CO.
3. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), STATE AND LOCAL REQUIREMENTS.

4 ELECTRIC HEAT SCHEMATIC IS LOCATED IN THE ELECTRIC HEAT CONTROL BOX PANEL.

5 WIRING SHOWN IS FOR NO ELECTRIC HEAT. FOR ELECTRIC HEAT SINGLE PHASE SEE INSET A&B. FOR ELECTRIC HEAT THREE PHASE SEE INSET A&C.

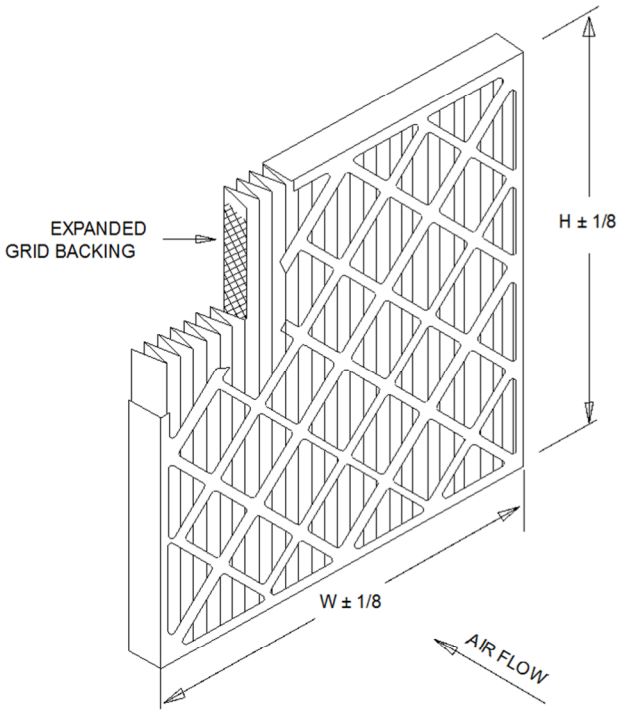
6 CW JUMPER IS PRESENT FROM PIN P5 TO P11 ON UNITS WITH CW MOTOR ROTATION AS VIEWED FROM SHAFT END.

7 MOTOR VOLTAGE CONFIGURATION P2-P8 JUMPERED FOR 115V OPERATION ONLY.

8 USE COPPER CONDUCTORS ONLY.

9 WIRING SHOWS FOR TSTAT CONTROL POWER W/O FREEZE STAT AND CSTI CONTROL POWER W/ OR W/O FREEZE STAT, FOR TSTAT CONTROL POWER W/ FREEZE STAT SEE INSET "D"

Accessory - Blower coil
Item: A1 Qty: 1 Tag(s): AH4 3 ph



NOMINAL SIZE IN. W X H	ACTUAL SIZE IN. W X H
12 X 12	11-1/2 X 11-1/2
12 X 20	11-1/2 X 19-1/2
12 X 24	11-1/2 X 23-1/2
16 X 16	15-1/2 X 15-1/2
16 X 25	15-1/2 X 24-1/2
18 X 20	17-1/2 X 19-1/2
18 X 24	17-1/2 X 23-1/2
18 X 25	17-1/2 X 24-1/2
20 X 20	19-1/2 X 19-1/2
20 X 24	19-1/2 X 23-1/2
20 X 25	19-1/2 X 24-1/2
24 X 24	23-1/2 X 23-1/2

Unit Size	12	18	24	36	48	54	60	72	90	120
Unit Flat Filter (BCHE)										
(Qty) Size	(1) 12 X 20	(1) 12 X 24	(1) 12 X 24	(1) 12 X 12 (1) 12 X 24	-	(1) 16 X 16 (1) 16 X 25	-	(2) 16 X 25	(1) 20 X 24 (1) 24 X 24	(3) 18 X 24
Unit Flat Filter (BCVE)										
(Qty) Size	-	-	(1) 12 X 24	(1) 18 X 24	(1) 18 X 20 (1) 12 X 20	-	(1) 18 X 24 (1) 12 X 24	(2) 16 X 25	(1) 20 X 24 (1) 24 X 24	(3) 18 X 24
Bottom (or Top) Access Filter										
(Qty) Size	(1) 12 X 20	(1) 12 X 24	(1) 12 X 24	(1) 12 X 12 (1) 12 X 24	-	(1) 16 X 16 (1) 16 X 25	-	(2) 16 X 25	(1) 20 X 24 (1) 24 X 24	(3) 18 X 24
Angle Filter										
(Qty) Size	(2) 12 X 20	(2) 12 X 24	(2) 12 X 24	(2) 12 X 12 (2) 12 X 24	-	(2) 12 X 20 (2) 12 X 24	-	(2) 12 X 12 (4) 12 X 20	(2) 20 X 20 (2) 20 X 25	(6) 18 X 20

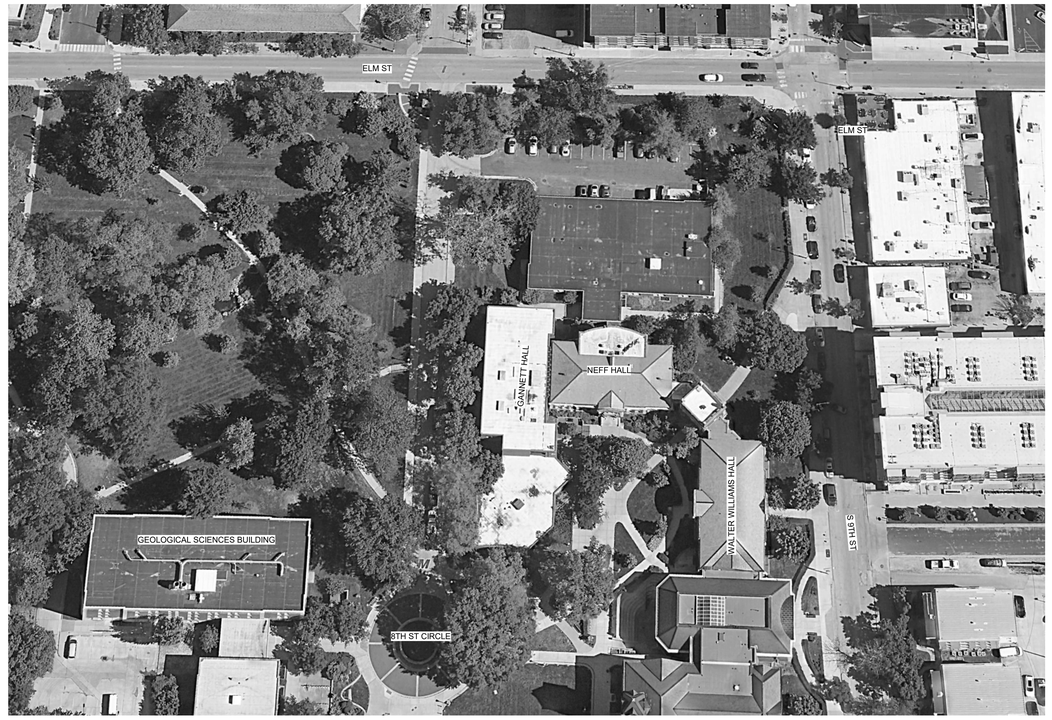
NEFF HALL - HVAC UPGRADES PHASE 2

309 S 9TH STREET COLUMBIA, MO 65201

FOR:
UNIVERSITY OF MISSOURI

BY A/E FIRM:

KLINGNER & ASSOCIATES, P.C.
3622 ENDEAVOR AVENUE, SUITE 117
COLUMBIA, MO 65201
PHONE: (573) 355-5988



A1

SHEET INDEX

GENERAL NOTES:

1) THE CONTRACTOR(S) SHALL CONFIRM CONDITIONS DESCRIBED HEREIN AND TELL THE ENGINEER OF ANY DISCREPANCIES AND INTERFERENCES ENCOUNTERED PRIOR TO STARTING WORK AFFECTED THEREBY.

2) THE CONTRACTOR(S) SHALL FIELD VERIFY EXISTING DIMENSIONS AND CONDITIONS AND TELL THE ENGINEER OF ANY DISCREPANCIES AND INTERFERENCES ENCOUNTERED PRIOR TO STARTING WORK AFFECTED THEREBY.

3) THE CONTRACTOR(S) SHALL COMPLY WITH THE LATEST EDITION OF APPLICABLE CODES AND STANDARDS INCLUDING BUT NOT LIMITED TO:
   - THE AMERICANS WITH DISABILITIES ACT (ADAAG)
   - INTERNATIONAL BUILDING CODE (IBC 2021)
   - NFPA 70 NATIONAL ELECTRIC CODE (NEC 2020)
   - NFPA 90A 2020 INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS
   - INTERNATIONAL FIRE CODE (IFC 2021)
   - INTERNATIONAL FUEL GAS CODE (IFGC 2021)
   - INTERNATIONAL MECHANICAL CODE (IMC 2021)
   - INTERNATIONAL PLUMBING CODE (IPC 2021)
   - LIFE SAFETY CODE (NFPA 101 2020)
   - ASHRAE STANDARD 90.1 - 2019
   - ASHRAW STANDARD 62.1 - 2019
   - AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
   - AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
   - AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
   - AMERICAN CONCRETE INSTITUTE (ACI)
   - UNDERWRITER'S LABORATORIES, INC. (UL) FEDERAL SPECIFICATIONS
   - NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
   - WILLIAMS STEIGER OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 (OSHA)
   - SHEET METAL AND AIR CONDITIONING CONTRACTOR'S NATIONAL ASSOCIATION (SMACNA)
   - BOILER AND PRESSURE VESSEL ACT OF THE STATE OF MISSOURI

4) THE CONTRACTOR(S) SHALL BE RESPONSIBLE FOR OSHA COMPLIANCE AND JOB SITE SAFETY.

5) CONTRACTOR(S) SHALL VERIFY LOCATIONS OF ALL UTILITIES (TELEPHONE, DATA, GAS, ELECTRIC, SANITARY AND STORM SEWERS, ETC.) AT THE SITE BEFORE STARTING EXCAVATION OR CONSTRUCTION. THESE ITEMS SHALL BE MARKED AND PROTECTED. CONTRACTOR IS RESPONSIBLE FOR DAMAGE TO EXISTING UTILITIES.

6) CONTRACTOR(S) SHALL TAKE PRECAUTIONS NECESSARY TO PROTECT ADJACENT PROPERTY FROM DAMAGE RESULTING FROM CONSTRUCTION OPERATIONS.

7) CONTRACTOR SHALL PROTECT EXISTING FINISHES AND OTHER BUILDING COMPONENTS FROM DAMAGE. ANY SURFACES AND/OR COMPONENTS DAMAGED DURING THE CONSTRUCTION PROJECTS SHALL BE RETURNED TO PRE-PROJECT CONDITIONS AND/OR MADE TO MATCH ADJACENT MATERIALS.

8) EQUIPMENT, DEVICES, APPARATUS, SYSTEMS, AND INSTALLATIONS SHALL BE ENTIRELY SUITABLE AND SAFE FOR EACH INTENDED APPLICATION AND BE IN FULL COMPLIANCE WITH APPLICABLE STANDARDS, REQUIREMENTS, RULES, REGULATIONS, CODES, STATUTES, AND ORDINANCES. NOTHING CONTAINED IN THESE PLANS AND SPECIFICATIONS SHALL BE CONSTRUED TO CONFLICT WITH THESE LAWS, CODES, AND ORDINANCES.

9) HAZARDOUS MATERIAL TESTING AND REMEDIATION TO BE PERFORMED BY OWNER.

10) DEMOLITION KEYNOTES D01 AND D04 WERE INCLUEDED IN PHASE 1 OF THIS PROJECT AND ARE NOT INCLUDED IN THIS SET OF DRAWINGS.

11) MECHANICAL KEYNOTES M01 THROUGH M13 WERE INCLUDED IN PHASE 1 OF THIS PROJECT AND ARE NOT INCLUDED IN THIS SET OF DRAWINGS.

A1

12) A NEW DEDICATED OUTDOOR AIR UNIT WILL BE PROVIDED BY OWNER AND SHALL BE INSTALLED BY CONTRACTOR. CONTRACTOR IS RESPONSIBLE FOR COORDINATING DELIVERY OF DEDICATED OUTDOOR AIR UNIT WITH THE SUPPLIER TO THE JOB SITE.

13) TWO NEW AIR HANDLING UNITS WILL BE PROVIDED BY OWNER AND SHALL BE INSTALLED BY CONTRACTOR. CONTRACTOR IS RESPONSIBLE FOR COORDINATING DELIVERY OF AIR HANDLING UNITS WITH THE SUPPLIER TO THE JOB SITE.

14) A NEW FAN COIL UNIT WILL BE PROVIDED BY OWNER AND SHALL BE INSTALLED BY CONTRACTOR. CONTRACTOR IS RESPONSIBLE FOR COORDINATING DELIVERY OF FAN COIL UNIT WITH THE SUPPLIER TO THE JOB SITE.

15) OWNER SHALL MOVE FURNITURE, AS REQUIRED, TO FACILITATE WORK. CONTRACTOR TO PROVIDE OWNER WITH 48 HOUR NOTICE PRIOR TO NEEDED ANY FURNITURE RELOCATED.

GENERAL DEMOLITION NOTES:

1. ALL MECHANICAL AND ELECTRICAL DEMOLITION WORK IS SHOWN ON COMMON DEMOLITION SHEETS.
2. CONTRACTOR SHALL PROVIDE THE OWNER, IN WRITTING, WITH AT LEAST SEVEN DAYS ADVANCED NOTICE PRIOR TO BEGINNING DEMOLITION WORK IN ANY AREA. CONTRACTOR MUST RECIEVE WRITTEN APPROVAL FROM THE OWNER PRIOR TO STARTING DEMOLITION WORK IN EACH MAJOR AREA OF WORK. DEMOLISHED CONTROLS COMPONENTS AND MECHANICAL EQUIPMENT SHALL BE OFFERED TO OWNER.

GENERAL HVAC NOTES:

1. UPON COMPLETION OF CONSTRUCTION, REPLACE ALL FILTERS ON NEWLY INSTALLED EQUIPMENT.
2. ALL RUNOUTS TO DIFFUSERS SHALL HAVE A VOLUME CONTROL DAMPER AT THE CONNECTION TO THE BRANCH OR MAIN DUCT.
3. FLEXIBLE DUCT SHALL BE A MAXIMUM OF FIVE (5) FEET IN LENGTH AND SHALL BE ROUTED TO MINIMIZE LENGTH WITH NO KINKS OR SHARP BENDS.
4. CONTRACTOR SHALL CONNECT RUNOUT TO CONTRACTOR FABRICATED BOOT AS NECESSARY TO ACCOMMODATE DIFFUSER.
5. A FLEXIBLE CONNECTION BETWEEN MECHANICAL UNITS AND BOTH THE SUPPLY AND RETURN AIR DUCTWORK IS REQUIRED FOR VIBRATION ISOLATION AND NOISE REDUCTION.
6. AIR AND HYDRONIC SYSTEM TESTING, ADJUSTING, AND BALANCING SHALL BE PROVIDED BY OWNER.
7. SERVICE OPENINGS SHALL BE LOCATED IN THE DUCTWORK BEFORE AND AFTER EACH TURNING VANE. SEE NFPA 90A FOR LOCATIONS OF ADDITIONAL ACCESS DOORS AND PANEL REQUIRED THROUGHOUT THE AIR DISTRIBUTION SYSTEM.

HVAC SYMBOLS

- 16"x8" — SQUARE DUCT SIZE TAG (WIDTH x HEIGHT)
- (E) — EXISTING DUCT TAG
- DUCT BEING DEMOLISHED
- SA — SUPPLY AIR
- OA — OUTSIDE AIR
- RA — RETURN AIR
- EA — EXHAUST AIR
- AIR INLET/OUTLET — CONNECT TO EXISTING
- A / 500 — TYPE (SEE SCHEDULE FOR NEW, ES/ERI/ET FOR EXISTING) GRILLES, REGISTERS, AND DIFFUSERS TAG; CFM
- AHU-8 — MECHANICAL EQUIPMENT
- SR — EXISTING STEAM RADIATOR
- CARBON DIOXIDE SENSOR — CO2 — TH — TEMPERATURE & HUMIDITY SENSOR
- CARBON MONOXIDE SENSOR — CO — TS — TEMPERATURE SENSOR
- NITROGEN DIOXIDE SENSOR — NO2 — T — THERMOSTAT
- HUMIDITY SENSOR — HS — DP — HYDRONIC DIFFERENTIAL PRESSURE SENSOR
- HUMIDISTAT — H — S — DUCT STATIC PRESSURE SENSOR
- MANUAL BALANCING DAMPER
- F — FIRE DAMPER
- M — MOTORIZED DAMPER

GENERAL ELECTRICAL NOTES:

1. DRAWINGS ARE SCHEMATIC AND SHOW APPROXIMATE LOCATIONS OF ELECTRICAL EQUIPMENT. EXACT LOCATIONS SHALL BE COORDINATED BY THE CONTRACTOR AND VERIFIED IN THE FIELD PRIOR TO ROUGH-IN.
2. INSTALLATIONS WHICH INCLUDE ELECTRICAL FIXTURES, DEVICES, CONDUIT, SWITCHES, PANELS, HANGERS, WIRE, CABLE, STANDARDS, ETC., MUST BE ENTIRELY SUITABLE FOR TEMPERATURES, HUMIDITY, DAMP AREAS, VOLTAGE, FREQUENCY, AND ALL INSTALLATION CONDITIONS ENCOUNTERED.
3. INSTALLATION MUST BE ENTIRELY SAFE IN EVERY RESPECT, AND MUST NOT CREATE ANY CONDITIONS OF ANY KIND WHICH WILL BE HARMFUL TO ANY OCCUPANT OF THE BUILDING. IF CONTRACTOR BELIEVES THAT INSTALLATION WILL NOT BE SAFE FOR ALL PEOPLE, HE/SHE SHALL SO REPORT IN WRITING TO ENGINEER BEFORE ANY EQUIPMENT IS PURCHASED OR WORK IS INSTALLED, GIVING EXACT RECOMMENDATIONS, AND REASONS FOR THEM.
4. GROUNDING: ALL GROUNDING SHALL BE IN STRICT ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE (NEC).
5. INSTALLATION OF ELECTRICAL DEVICES SHALL BE COORDINATED WITH OTHER TRADES AS NECESSARY TO PREVENT ANY CONFLICTS DURING CONSTRUCTION.
6. WHERE THERMOSTAT LOCATIONS ARE SHOWN, A SURFACE MOUNTED BOX AND CONDUIT TO ABOVE THE SUSPENDED CEILING SHALL BE PROVIDED.
7. EQUIPMENT GROUNDING CONDUCTORS SHALL BE PULLED WITH ALL BRANCH CIRCUITS. CONDUIT SHALL NOT BE USED AS A GROUND U.N.O.
8. OBTAIN ALL NECESSARY PERMITS AND ARRANGE FOR ALL INSPECTIONS REQUIRED BY STATE OR LOCAL AUTHORITIES.
9. MATERIALS MUST BE NEW, IN FIRST CLASS CONDITION.
10. CONDUIT SHALL BE SEPARATELY HUNG AND ANCHORED, FREE TO EXPAND AND CONTRACT QUIETLY, WITHOUT IMPOSING STRAINS ON STRUCTURE, DEVICES, AND EQUIPMENT. CONDUIT SHALL BE RUN PARALLEL OR PERPENDICULAR TO BUILDING LINES.
11. CONTRACTOR SHALL PERFORM EXCAVATION REQUIRED TO INSTALL HIS WORK.
12. ALL ELECTRICAL PENETRATIONS IN FIRE RATED CONSTRUCTION SHALL BE UL LISTED OF EQUAL OR GREATER HOUR RATING.
13. ALL SPACES AROUND ELECTRICAL PENETRATIONS THOUGH A SMOKE PARTITION SHALL BE FILLED WITH AN APPROVED MATERIAL TO LIMIT THE FREE PASSAGE OF SMOKE.

ELECTRICAL SYMBOLS

- SINGLE RECEPTACLE
- STANDARD DUPLEX RECEPTACLE
- EMERGENCY POWER DUPLEX RECEPTACLE
- DUPLEX RECEPTACLE WITH ISOLATED GROUND
- AC — DUPLEX RECEPTACLE INSTALLED ABOVE COUNTER
- 6F — DUPLEX RECEPTACLE INSTALLED AT DISTANCE ABOVE FINISHED FLOOR
- GFCI — DUPLEX RECEPTACLE WITH GROUND FAULT CIRCUIT INTERRUPTER
- FOURPLEX RECEPTACLE
- FOURPLEX EMERGENCY RECEPTACLE
- 208/240 VOLT 2-POLE RECEPTACLE
- FLOOR RECEPTACLE (FOURPLEX SHOWN)
- SINGLE POLE SWITCH
- 3-WAY SWITCH
- 4-WAY SWITCH
- DIMMER SWITCH
- KEYED SWITCH
- TIMER SWITCH
- OCCUPS — OCCUPANCY SENSOR SWITCH
- VACANCY SENSOR SWITCH
- LVS — LOW VOLTAGE SWITCH
- LVSD — LOW VOLTAGE SWITCH WITH DIMMING
- FAN SPEED CONTROL SWITCH
- MOTOR HORSEPOWER RATED SWITCH
- HOA — HAND/OFF/AUTO SWITCH
- 4F — WALL MOUNT OCCUPANCY SENSOR AT DISTANCE ABOVE FINISHED FLOOR (SENSOR TYPE UNSPECIFIED)
- PI — WALL MOUNT OCCUPANCY SENSOR PASSIVE INFRARED
- US — WALL MOUNT OCCUPANCY SENSOR ULTRASONIC
- DT — WALL MOUNT OCCUPANCY DUAL TECHNOLOGY
- CEILING MOUNT OCCUPANCY SENSOR
- CEILING MOUNT VACANCY SENSOR
- DUCT SMOKE DETECTOR
- FIRE ALARM CONTROL PANEL
- FIRE ALARM REMOTE ANNUNCIATOR PANEL
- 3F — JUNCTION BOX WALL MOUNTED A DISTANCE ABOVE FINISHED FLOOR
- CMC — JUNCTION BOX CEILING MOUNTED
- JUNCTION BOX RECESSED IN FLOOR
- CP — CONDUIT PULL BOX
- SAFETY DISCONNECT SWITCH (FUSED)
- SAFETY DISCONNECT SWITCH (NON-FUSED)
- CIRCUIT BREAKER PANEL
- MOTOR (SEE SCHEDULE)
- LOW VOLTAGE POWER CIRCUIT
- LINE VOLTAGE POWER CIRCUIT
- 2"ø EMT — CONDUIT SIZE AND TYPE
- SR — SURFACE MOUNTED RACEWAY
- CONDUIT TRANSITION UP
- CONDUIT TRANSITION DOWN
- BRANCH CIRCUIT HOME RUN
- -UE- — UNDERGROUND ELECTRICAL
- -UHVE- — UNDERGROUND HIGH VOLTAGE ELECTRICAL
- -UT- — UNDERGROUND TELEPHONE
- -UCOM- — UNDERGROUND COMMUNICATIONS
- -UTV- — UNDERGROUND CABLE TELEVISION (CATV OR CCTV)
- -UFIBR- — UNDERGROUND FIBER OPTIC
- -OHE- — OVERHEAD ELECTRIC
- -OHT- — OVERHEAD TELEPHONE
- FUSED DISCONNECT SWITCH
- VARIABLE FREQUENCY DRIVE
- CONNECT TO EXISTING

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REVISION HISTORY

	DESCRIPTION	DATE	APPR
A1	PHASE 2 ADD# 01	03/07/24	MHB

ISSUED FOR 02/09/24
CONSTRUCTION PHASE 2

STATE OF MISSOURI
Matthew Hayes Bridges
NUMBER PE-2010018578
PROFESSIONAL ENGINEER
02/09/2024

NEFF HALL - HVAC UPGRADES PHASE 2
UNIVERSITY OF MISSOURI
309 S 9TH STREET COLUMBIA, MO 65201

Non-Reduced Sheet Size 30" x 42"
Full sized plans have been prepared using standard scales. Reduced sized plans may not conform to standard scales.

DESIGNED	DRAWN
MHB	MHB
FIELD	FIELD BOOK
CHECKED	CHECK DATE
JAK	02/09/24

SHEET TITLE
COVER SHEET

PROJECT NO.
CP231442
DRAWING ISSUED DATE:
03/07/24
SHEET
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GENERAL NOTES

ELEVATION DATUM
SEE ARCHITECTURAL DRAWINGS OR SITE PLAN FOR FINISH FLOOR ELEVATIONS

DESIGN SPECIFICATIONS
2021 INTERNATIONAL BUILDING CODE

EARTHWORK
EARTHWORK OPERATIONS SHALL BE PERFORMED UNDER THE DIRECTION OF A PROFESSIONAL TESTING AGENCY TO ASSURE COMPLIANCE WITH THE RECOMMENDATIONS OF THE SOILS REPORT.

CONCRETE

CONCRETE WORK SHALL CONFORM TO ALL REQUIREMENTS OF THE CURRENT ACI 301, SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS, ACI 318 BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE, ACI 305 SPECIFICATIONS FOR HOT WATER CONCRETE, AND ACI 306 SPECIFICATIONS FOR COLD WEATHER CONCRETE, WITH THE FOLLOWING ADDITIONAL REQUIREMENTS:

1. CONCRETE SHALL DEVELOP THE FOLLOWING 28-DAY MINIMUM COMPRESSIVE STRENGTH:
   FOUNDATIONS – 3,000 PSI
   CAST-IN-PLACE WALLS – 3,500 PSI
   FLOOR SLAB – 4,000 PSI
   EXTERIOR SLABS, WALLS AND CURBS – 4,000 PSI
2. ALL FOOTINGS SHALL BEAR ON UNDISTURBED SOIL OR ENGINEERED FILL.
3. CHLORIDE- BASED ADMIXTURES ARE PROHIBITED IN ALL REINFORCED CONCRETE.
4. REINFORCING STEEL SHALL CONFORM TO ASTM A615, A616, OR A617, GRADE 60.
5. ALL CONTINUOUS REINFORCING STEEL THAT MEETS AT A CORNER SHALL BE TIED TOGETHER WITH A CORNER BAR THAT HAS SUFFICIENT LAP DISTANCE IN EACH DIRECTION
6. CONTINUOUS REINFORCING BARS LAP LENGTH SHALL BE A MINIMUM OF 48 BAR DIAMETERS UNLESS NOTED OTHERWISE
7. CONCRETE SLUMP SHALL BE A MAXIMUM OF 4" +/- 1" (ASTM C- 143) AS DELIVERED IN THE FIELD. CONTRACTOR MAY USE CHEMICAL ADMIXTURES TO ATTAIN A MAXIMUM SLUMP OF 8" FOR WORKABILITY. NO WATER MAY BE ADDED TO THE CONCRETE MIX ON SITE UNLESS WATER IS WITHHELD AT THE BATCHING FACILITY. IF WATER IS WITHHELD AT THE BATCHING FACILITY IT SHOULD BE REFLECTED ON THE LOAD TICKET. THE TOTAL AMOUNT OF WATER IN THE MIX SHALL NOT EXCEED WHAT IS NOTED ON THE APPROVED MIXED. THIS SHALL BE NOTED IN THE SPECIAL INSPECTOR'S RECORDS.
8. CONCRETE EXPOSED TO WEATHER, VEHICLES, AND/OR DEICING CHEMICALS SHALL BE AIR-ENTRAINED WITH 6% (+/-) 1.5% ENTRAINED AIR BY VOLUME AT POINT OF DISCHARGE. DO NOT ALLOW AIR CONTENT OF TROWELED FINISHED FLOORS TO EXCEED 3%.
9. SUBMIT CONCRETE MIX PROPORTIONS PRIOR TO START OF WORK. DO NOT BEGIN CONCRETE PRODUCTION UNTIL MIXES HAVE BEEN REVIEWED AND ARE ACCEPTABLE TO THE ENGINEER.
10. READY MIX CONCRETE SHALL COMPLY WITH REQUIREMENTS OF ASTM C94.
11. CONCRETE WORK EXECUTION
    A. CONSTRUCT FORMS TO CORRECT SIZE, SHAPE, ALIGNMENT, ELEVATION AND POSITION; AND TO SUPPORT VERTICAL AND LATERAL LOADS.
    B. POSITION, SUPPORT, AND SECURE REINFORCEMENT AGAINST DISPLACEMENT. MINIMUM CONCRETE COVER FOR REINFORCEMENT SHALL BE, UNLESS NOTED OTHERWISE ON THE DRAWINGS:
       CAST AGAINST AND EXPOSED TO EARTH.....3 INCHES
       EXPOSED TO EARTH OR WEATHER.....2 INCHES
       NOT EXPOSED TO WEATHER OR
       IN CONTACT WITH EARTH.....1 ½ INCHES
    C. PROVIDE CONTROL JOINTS IN SLABS-ON-GRADE AT NOT GREATER THAN 15 FEET ON CENTER IN EACH DIRECTION. SAW CUT CONTROL JOINTS MINIMUM ¼ OF SLAB DEPTH, AS SOON AFTER SLAB FINISHING WITHOUT DISLODGING AGGREGATE.
    D. STEEL TROWEL FINISH ALL INTERIOR CONCRETE SLABS, BROOM FINISH ALL EXTERIOR CONCRETE SLABS.
    E. CURE ALL CONCRETE IN COMPLIANCE WITH ACI 301, USING A LIQUID TYPE MEMBRANE, NON-RESIDUAL, CURING COMPOUND COMPLYING WITH ASTM C309. ASSURE COMPATIBILITY WITH FINISH FLOOR COVERING.

STRUCTURAL STEEL

1. FABRICATION AND ERECTION OF STRUCTURAL STEEL SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE AISC SPECIFICATIONS FOR STRUCTURAL STEEL BUILDINGS, THE AISC CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES AND CURRENT OSHA STANDARDS.
2. WIDE FLANGE SHAPES SHALL CONFORM TO ASTM A992. STRUCTURAL TUBES SHALL CONFORM TO ASTM A500 GRADE B. ALL OTHER STRUCTURAL STEEL SHALL CONFORM TO ASTM A36.
3. BOLTS, UNLESS OTHERWISE SHOWN, SHALL CONFORM TO ASTM A325-N, SIZE AS PER PLAN.
4. ANCHOR BOLTS, UNLESS OTHERWISE SHOWN, SHALL CONFORM TO ASTM F1554 GRADE 36.
5. SPLICING OF STRUCTURAL STEEL IS PROHIBITED EXCEPT AS DETAILED.
6. ALL STRUCTURAL AND MISCELLANEOUS STEEL ITEMS SHALL RECEIVE ONE COAT OF "IRONCLAD RETARDO RUST INHIBITIVE PAINT 163" (BENJAMIN MOORE) OR APPROVED EQUAL UNLESS OTHERWISE INDICATED IN THE SPECIFICATIONS. ALL STEEL SURFACES EMBEDDED IN CONCRETE SHALL NOT BE PAINTED. PREPARATION OF STEEL SURFACES SHALL MEET THE REQUIREMENTS OF THE STEEL STRUCTURES PAINTING COUNCIL (SSPC-SP1) AND THE REMOVAL OF GREASE AND OIL BY SOLVENT CLEANING (SSPC-SP1) AND THE REMOVAL OF MILL SCALE, RUST, WELD FLUX AND SLAG BY HAND TOOL CLEANING (SSPC-SP2). PRIMER SHALL BE APPLIED AT THE MANUFACTURER'S RECOMMENDED RATE BUT NOT LESS THAN ONE GALLON PER 400 SQ.FT. THEREBY DEPOSITING A DRY FILM THICKNESS OF NOT LESS THAN 1.5 MILS. ANY SCARRED AREAS SHALL BE TOUCHED UP WITH THE SAME PAINT AFTER ERECTION.
7. ALL WELDING SHALL BE DONE BY QUALIFIED WELDERS IN ACCORDANCE WITH THE CURRENT EDITION OF THE AWS STRUCTURAL WELDING CODE. WELDING ELECTRODES SHALL BE E70XX.

POST-INSTALLED ANCHORS

1. ALL POST-INSTALLED ANCHORS SHALL MEET THE REQUIREMENTS OF THE CODE-CITED EDITION OF ACI 318, APPENDIX "D", AND SHALL BE ACCEPTABLE FOR BOTH CRACKED AND UNCRACKED CONCRETE.
2. EXPANSION ANCHORS HAVE BEEN DESIGNED AS HILTI KWIK BOLT TZ ANCHORS, UNLESS NOTED OTHERWISE.
3. ADHESIVE ANCHORS HAVE BEEN DESIGNED TO USE HILTI HIT HY 200 ADHESIVE IN CONCRETE OR SOLID MASONRY, UNLESS NOTED OTHERWISE.
4. EQUIVALENT ANCHORS MAY BE SUBMITTED FOR THE ENGINEER'S APPROVAL. SUBMITTALS ARE THE CONTRACTOR'S RESPONSIBILITY AND MUST INCLUDE EVALUATION REPORTS FROM THE INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO).
5. EMBEDMENT DEPTH IS DEFINED AS THE DISTANCE FROM THE SURFACE OF THE LOAD-BEARING BASE MATERIAL TO THE DEEPEST PART OF THE ANCHOR AFTER THE ANCHOR HAS BEEN DRIVEN INTO THE HOLE BUT NOT YET EXPANDED.
6. ADHESIVE ANCHORS SHALL BE ACCEPTABLE FOR LONG-TERM LOADING. WHEN BASE MATERIAL TEMPERATURES ARE BELOW 40 DEG F, ONLY NON-EPOXY-BASED ADHESIVES SHALL BE USED.
7. POST-INSTALLED ANCHORS SHALL ONLY BE USED WHERE SPECIFIED ON THE DRAWINGS. THE CONTRACTOR SHALL OBTAIN APPROVAL FROM THE ENGINEER PRIOR TO USING POST-INSTALLED ANCHORS FOR MISSING OR MISPLACED CAST-IN-PLANE ANCHORS. CARE SHALL BE TAKEN TO AVOID CONFLICTS WITH EXISTING REINFORCING BARS. HOLES SHALL BE DRILLED AND CLEANED PER ANCHOR MANUFACTURER'S SPECIFICATIONS.
8. STAINLESS STEEL ANCHORS ARE REQUIRED AT ALL PERMANENTLY EXPOSED WEATHER CONDITIONS.

SPECIAL INSPECTIONS

THE FOLLOWING ITEMS REQUIRE SPECIAL INSPECTION IN ACCORDANCE WITH CHAPTER 17 OF THE INTERNATIONAL BUILDING CODE.

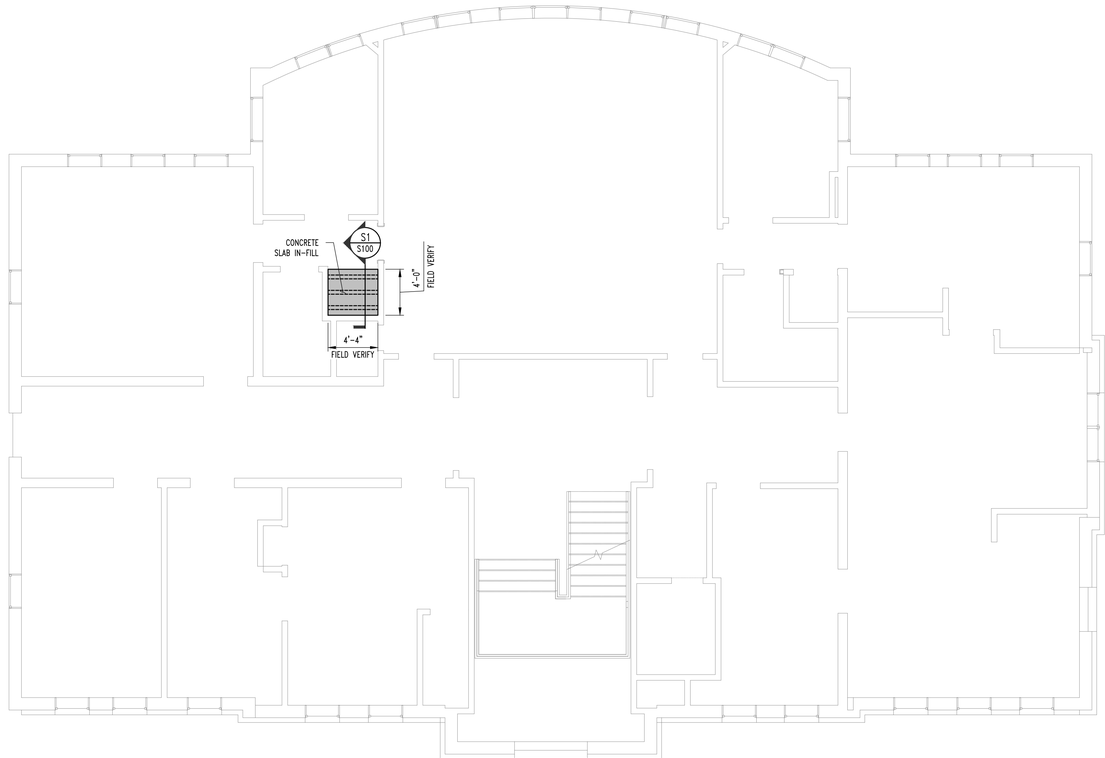
a. CONCRETE GROUT DESIGN MIX (PERIODIC)
b. PLACING OF CONCRETE AND REINFORCING STEEL (CONTINUOUS OF CONCRETE SAMPLING / PERIODIC OF REINFORCING)
c. BOLTS & ANCHORS EMBEDDED IN CONCRETE (PERIODIC)
d. STRUCTURAL STEEL FABRICATIONS (UNLESS AISC APPROVED) (PERIODIC)
e. STRUCTURAL STEEL BOLTING & WELDING (PERIODIC)
f. POST INSTALLED ANCHORS IN CONCRETE (CONTINUOUS)

THE CONTRACTOR SHALL REQUEST SPECIAL INSPECTION OF THE ITEMS LISTED ABOVE PRIOR TO THOSE ITEMS BECOMING INACCESSIBLE AND UNOBSERVABLE DUE TO PROGRESSION OF THE WORK.

DESIGN DATA

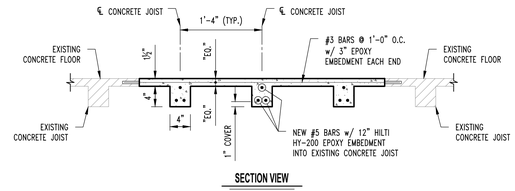
2021 INTERNATIONAL BUILDING CODE / ASCE 7-16

BUILDING OCCUPANCY CATEGORY	II
FLOOR LOAD DATA	
LIVE LOAD	100 PLUS EQUIPMENT
SLAB/FLOOR JOISTS/BEAMS	50
MECHANICAL, CEILING, FLOORING	15.0
TOTAL TO BEAMS	165 lbs/sq.ft
EARTHQUAKE DESIGN DATA	
RISK CATEGORY	II
I_E =	1.25
S_S =	0.161
S_1 =	0.094
SITE CLASS	D (ASSUMED)
S_{DS} =	0.172
S_{D1} =	0.15
SEISMIC DESIGN CATEGORY	C

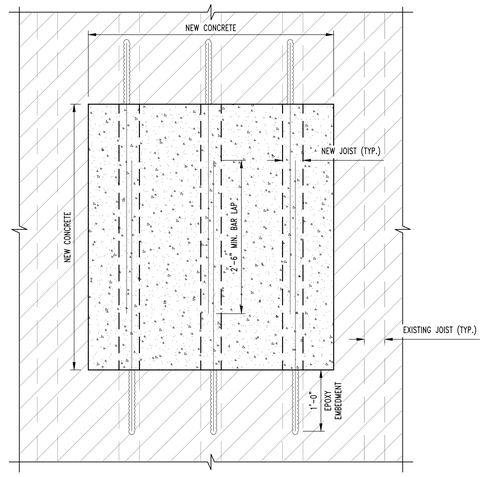


1 S100 **FIRST FLOOR PLAN**
SCALE: 3/16" = 1'-0"

PLAN NORTH



SECTION VIEW



S1 S100 **EXISTING OPENING IN-FILL DETAIL**
SCALE: 1" = 1'-0"

STRUCTURAL ENGINEER:
CROCKETT ENGINEERING CONSULTANTS
1906 W. Nifong Blvd., Bldg 1
Columbia, Missouri 65203
(573) 445-6105
www.crockettengineering.com
Crockett Engineering Consultants, LLC
Missouri Certificate of Authority
#2006013501

REVISION HISTORY

	DESCRIPTION	DATE	APPR

STATE OF MISSOURI
GREGORY L. LINNEMAN
NUMBER PE-2005001013
GREGORY L. LINNEMAN - PE
MO LICENSE - 2005001013
03/01/2024

ISSUED FOR 3/01/24
ADDENDUM #1

NEFF HALL - HVAC UPGRADES PHASE 2

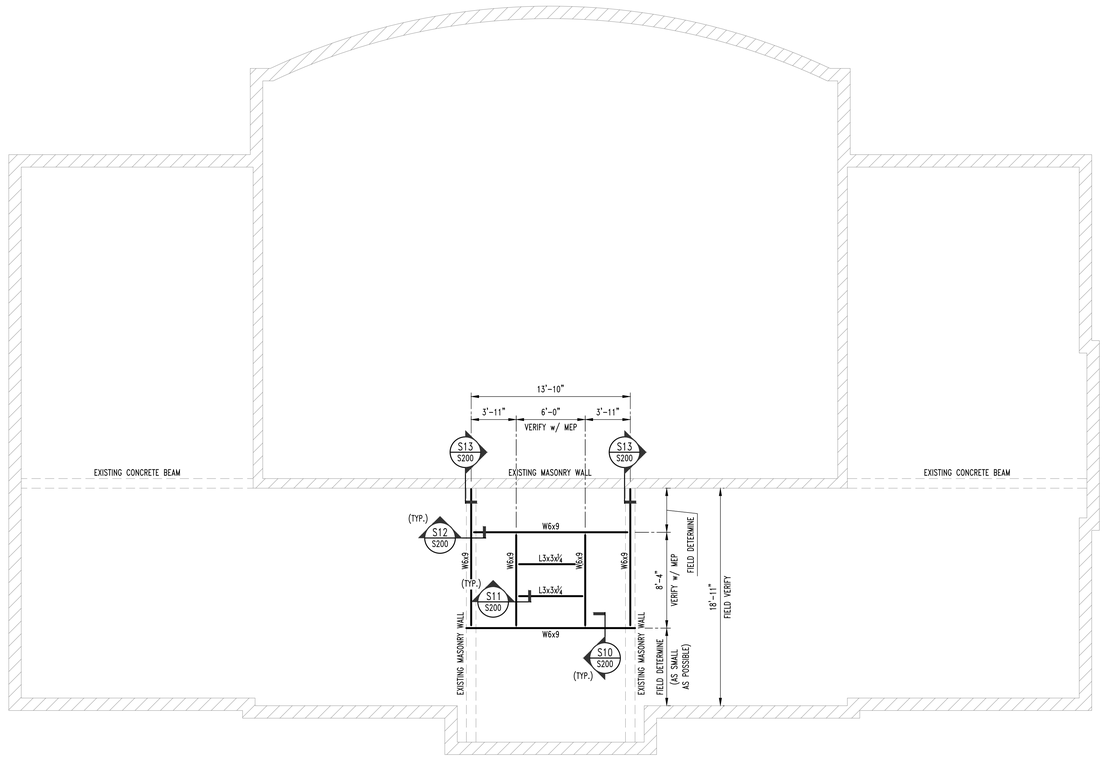
UNIVERSITY OF MISSOURI
309 S 9TH STREET COLUMBIA, MO 65201

Non-Reduced Sheet Size 30" x 42"
Full sized plans have been prepared using standard scales. Reduced sized plans may not conform to standard scales.

DESIGNED	DRAWN
GLL	RCA
FIELD	FIELD BOOK
CHECKED GLL	CHECK DATE

SHEET TITLE
FIRST FLOOR
PLAN & DETAILS

PROJECT NO.
CP231442
DRAWING ISSUED DATE:
03/01/2024
SHEET
S100

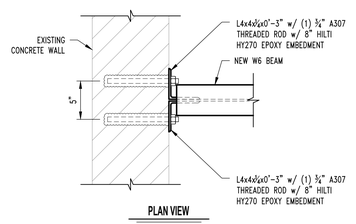


1 S200 **ATTIC FLOOR FRAMING PLAN**

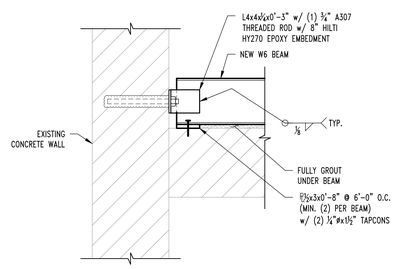
SCALE: 3/16" = 1'-0"

PLAN NORTH

NOTE:
VERIFY FINAL EQUIPMENT LOCATION w/ MEP.

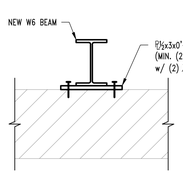


PLAN VIEW



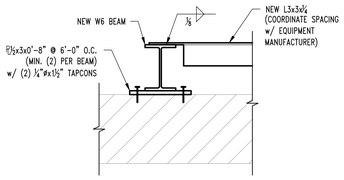
S13 S200 **FRAMING SECTION**

SCALE: 1½" = 1'-0"



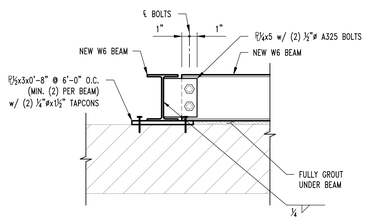
S10 S200 **FRAMING SECTION**

SCALE: 1½" = 1'-0"



S11 S200 **FRAMING SECTION**

SCALE: 1½" = 1'-0"



S12 S200 **FRAMING SECTION**

SCALE: 1½" = 1'-0"

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REVISION HISTORY

	DESCRIPTION	DATE	APPR
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ADDENDUM #1

NEFF HALL - HVAC UPGRADES PHASE 2

UNIVERSITY OF MISSOURI
309 S 9TH STREET COLUMBIA, MO 65201

Non-Reduced Sheet Size 30" x 42"
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DESIGNED	DRAWN
GLL	RCA
FIELD	FIELD BOOK
CHECKED GLL	CHECK DATE

SHEET TITLE
ATTIC FLOOR FRAMING PLAN & DETAILS

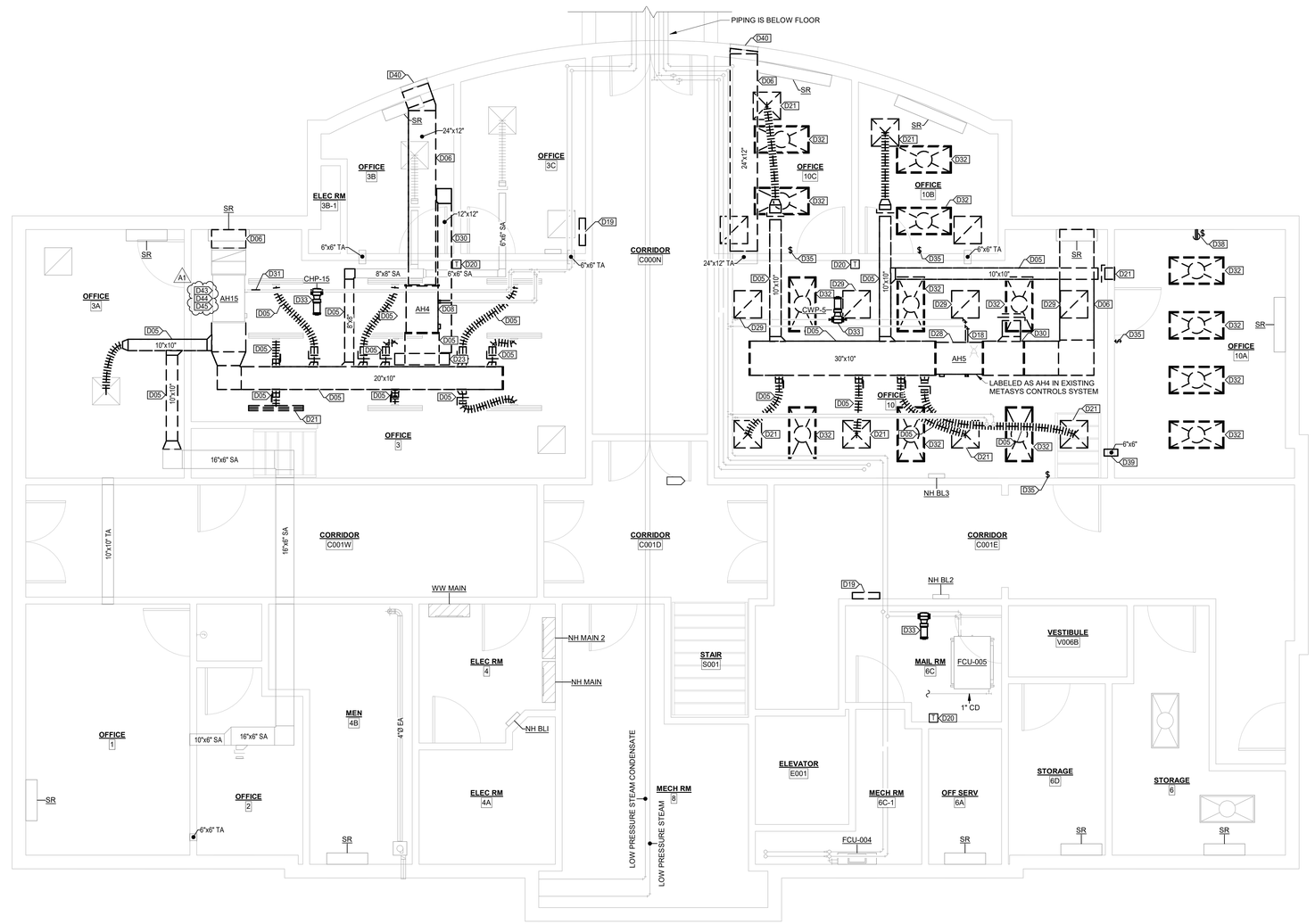
PROJECT NO. **CP231442**
DRAWING ISSUED DATE: **03/01/2024**
SHEET
S200

GENERAL DEMOLITION NOTES:

1. ALL MECHANICAL AND ELECTRICAL DEMOLITION WORK IS SHOWN ON COMMON DEMOLITION SHEETS.
2. CONTRACTOR SHALL PROVIDE THE OWNER, IN WRITTING, WITH AT LEAST SEVEN DAYS ADVANCED NOTICE PRIOR TO BEGINNING DEMOLITION WORK IN ANY AREA. CONTRACTOR MUST RECIEVE WRITTEN APPROVAL FROM THE OWNER PRIOR TO STARTING DEMOLITION WORK IN EACH MAJOR AREA OF WORK. DEMOLISHED CONTROLS COMPONENTS AND MECHANICAL EQUIPMENT SHALL BE OFFERED TO OWNER.

KEYNOTE LEGEND

VALUE	DESCRIPTION
D05	DEMOLISH EXISTING SUPPLY AIR DUCT WHERE SHOWN.
D06	DEMOLISH EXISTING OUTDOOR AIR DUCT WHERE SHOWN.
D08	DEMOLISH EXISTING AIR HANDLING UNIT, AH4. DISCONNECT AIR HANDLING UNIT FROM EXISTING ELECTRICAL FEEDERS. EXISTING FEEDERS AND CONDUIT TO BE EXTENDED AS REQUIRED TO CONNECT TO NEW AIR HANDLING UNIT, AH4 ON FIRST FLOOR. DEMOLISH CONTROL WIRING AND CONDUIT BACK TO CONTROL PANEL. AIR HANDLING UNIT SHALL BE OFFERED TO THE OWNER FOR SALVAGE.
D18	DEMOLISH EXISTING SUPPLY AND RETURN CHILLED WATER PIPING WHERE SHOWN. INSTALL ISOLATION BALL VALVE AND CAP PIPING TO REMAIN.
D19	DEMOLISH EXISTING CONTROL PANEL. EXISTING FEEDERS AND CONDUIT TO BE EXTENDED AS REQUIRED TO CONNECT TO NEW CONTROL PANEL.
D20	DEMOLISH EXISTING THERMOSTAT. EXISTING CONTROL WIRING TO BE DEMOLISHED BACK TO AIR HANDLING UNIT.
D21	DEMOLISH EXISTING SUPPLY AIR DIFFUSER.
D23	DEMOLISH EXISTING SUPPLY AIR DUCT UP TO FIRST FLOOR CEILING AND AS REQUIRED TO FACILITATE INSTALLATION OF NEW AH4.
D28	DEMOLISH EXISTING AIR HANDLING UNIT, AH5. DISCONNECT AIR HANDLING UNIT FROM EXISTING ELECTRICAL FEEDERS. EXISTING FEEDERS AND CONDUIT TO BE DEMOLISH BACK TO SOURCE. DEMOLISH CONTROL WIRING AND CONDUIT BACK TO CONTROL PANEL. AIR HANDLING UNIT SHALL BE OFFERED TO THE OWNER FOR SALVAGE.
D29	DEMOLISH EXISTING RETURN AIR GRILLE.
D30	DEMOLISH EXISTING RETURN AIR DUCTWORK WHERE SHOWN.
D31	DEMOLISH EXISTING HYDRONIC CONTROL VALVE.
D32	DEMOLISH EXISTING LIGHT FIXTURE. EXTEND POWER WIRING AS NECESSARY TO CONNECT TO NEW LIGHT FIXTURE.
D33	DEMOLISH EXISTING CHILLED WATER PUMP. EXISTING FEEDERS AND CONDUIT TO BE DEMOLISH BACK TO SOURCE.
D35	DEMOLISH EXISTING LIGHTING SWITCH. WALL BOX TO REMAIN.
D38	DEMOLISH EXISTING 240 VOLT OUTLET AND DISCONNECT SWITCH. EXISTING FEEDERS AND CONDUIT TO BE DEMOLISH BACK TO SOURCE.
D39	DEMOLISH EXISTING TRANSFER AIR DUCT.
D40	IF EXISTING LOUVER HAS NOT BEEN REMOVED PRIOR TO OUTDOOR AIR DUCT DEMOLITION, CAP LOUVER AND INSULATE DUCT ON INSIDE OF BUILDING.
D43	DISCONNECT AND CAP LOW PRESSURE STEAM AND STEAM CONDENSATE PIPING FROM AIR HANDLING UNIT. DEMOLISH EXISITNG STEAM CONTROL VALVE.
D44	DEMOLISH EXISTING MOTOR STARTER AND DISCONNECT SWITCH. DEMOLISH FEEDERS AND CONDUIT BACK TO SOURCE.
D45	DEMOLISH EXISTING SUPPLY FAN MOTOR. DEMOLISH EXISTING ELECTRICAL FEEDERS BACK TO DISCONNECT.



1 BASEMENT DEMOLITION PLAN
1/4" = 1'-0"

0 2' 4' 8'
SCALE: 1/4" = 1'-0"

KLINGNER & ASSOCIATES, P.C.
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Burlington, IA Davenport, IA Hannibal, MO

REVISION HISTORY

Δ	DESCRIPTION	DATE	APPR
A1	PHASE 2 ADD# 01	03/07/24	MHB

ISSUED FOR **02/09/24**

CONSTRUCTION PHASE 2

STATE OF MISSOURI
Matthew Hayes Bridges
NUMBER PE-2010018578
PROFESSIONAL ENGINEER
02/09/2024

NEFF HALL - HVAC UPGRADES PHASE 2

UNIVERSITY OF MISSOURI
309 S 9TH STREET COLUMBIA, MO 65201

Non-Reduced Sheet Size 30" x 42"
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MHB	MHB
FIELD	FIELD BOOK
CHECKED	CHECK DATE
JAK	02/09/24

SHEET TITLE

BASEMENT DEMOLITION PLAN

PROJECT NO.
CP231442
DRAWING ISSUED DATE:
03/07/24
SHEET
MD101

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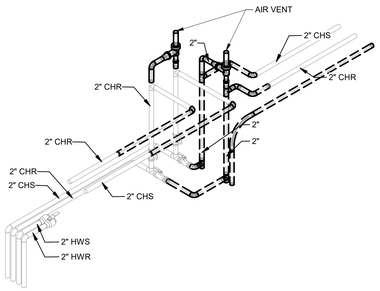

2 ATTIC HYDRONIC RISER DEMOLITION ISOMETRIC VIEW

GENERAL DEMOLITION NOTES:

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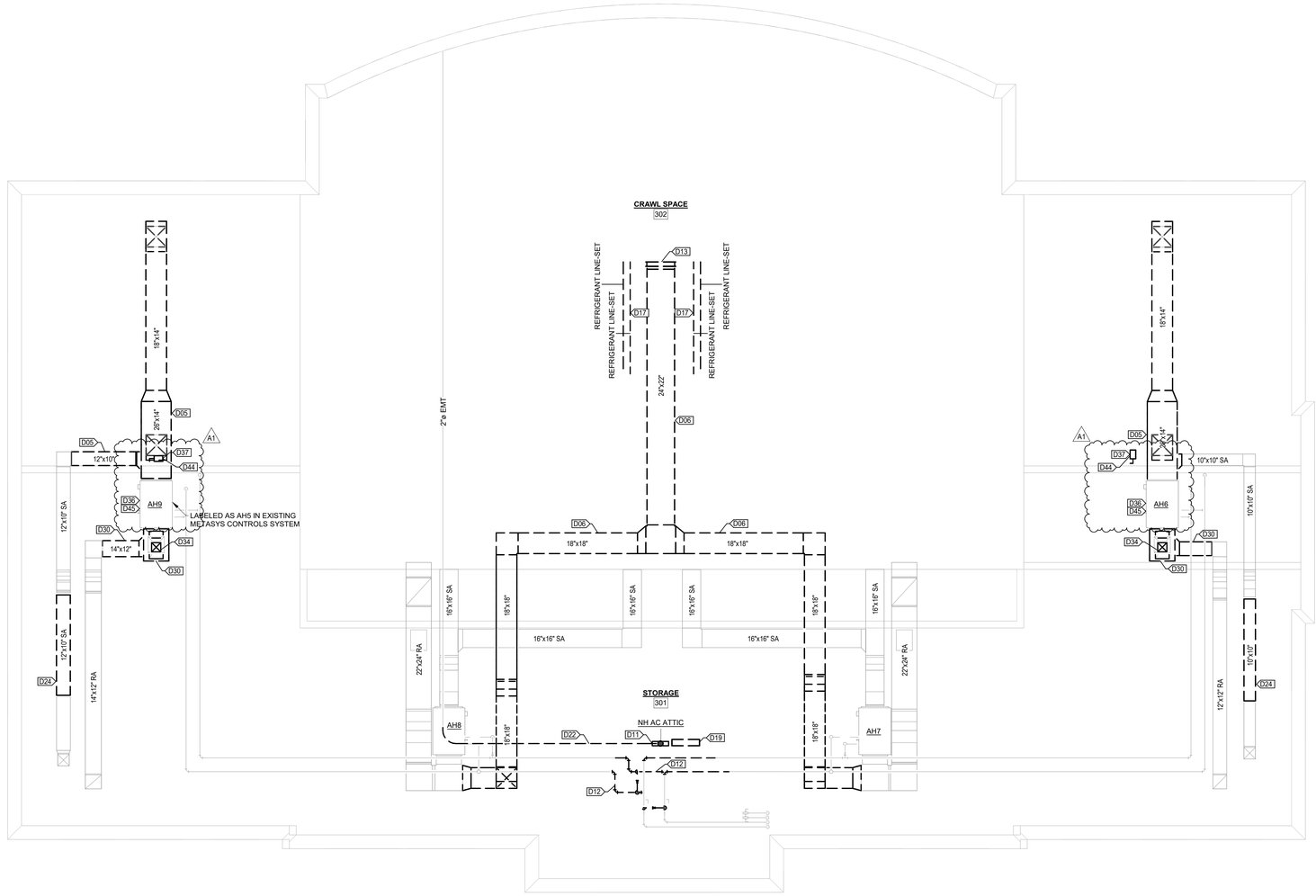
KEYNOTE LEGEND

VALUE	DESCRIPTION
D05	DEMOLISH EXISTING SUPPLY AIR DUCT WHERE SHOWN.
D06	DEMOLISH EXISTING OUTDOOR AIR DUCT WHERE SHOWN.
D11	RELOCATE EXISITNG NH AC ATTIC ELECTRICAL PANEL AND BUS BAR. REFER TO ELECTRICAL PLANS.
D12	MODIFY EXISTING CHILLED WATER SUPPLY AND RETURN PIPING WHERE SHOWN TO FACILITY NEW DEDICATED OUTDOOR AIR UNIT AND ASSOCIATED DUCTWORK.
D13	DEMOLISH EXISTING OUTDOOR AIR INTAKE LOUVER.
D17	DEMOLISH EXISTING ABANDONED IN PLACE REFRIGERANT LINE SETS. PIPING ENDS ROUGHLY WHERE SHOWN. MAKE FORMER PENETRATIONS THROUGH DORMER WEATHER TIGHT.
D19	DEMOLISH EXISTING CONTROL PANEL. EXISTING FEEDERS AND CONDUIT TO BE EXTENDED AS REQUIRED TO CONNECT TO NEW CONTROL PANEL.
D22	DEMOLISH EXISTING ELECTRICAL CONDUIT WHERE SHOWN. EXTEND FEEDER TO NEW JUNCTION BOX LOCATION.
D24	DEMOLISH EXISTING SUPPLY AIR DUCT WHERE SHOWN AND AS REQUIRED TO FACILITATE NEW VAV BOX INSTALLATION.
D30	DEMOLISH EXISTING RETURN AIR DUCTWORK WHERE SHOWN.
D34	DEMOLISH EXISTING OUTDOOR AIR DUCT TO JUST BELOW THE ROOF. CAP AND PREPAR TO CONNECT NEW EXHAUST AIR DUCT.
D36	RELOCATE EXISTING AIR HANDLING UNIT AND UNIT SUPPORT STRUCTURE. REFER TO M104 FOR NEW UNIT LOCATION. EXTEND ELECTRICAL FEEDERS, CONDENSATE PIPING, AND HYDRONIC PIPING AS REQUIRED TO REACH NEW AIR HANDLING UNIT LOCATION.
D37	DEMOLISH EXISTING AIR HANDLING UNIT DISCONNECT SWITCH AND UNIT CONTROLLER. EXISTING FEEDERS AND CONDUIT TO BE EXTENDED AS REQUIRED TO CONNECT TO NEW ELECTRICAL DISCONNECT. REFER TO E104 FOR NEW LOCATION ON ROOF SUPPORT COLUMN.
D44	DEMOLISH EXISTING MOTOR STARTER AND DISCONNECT SWITCH. DEMOLISH FEEDERS AND CONDUIT BACK TO SOURCE.
D45	DEMOLISH EXISITNG SUPPLY FAN MOTOR. DEMOLISH EXISTING ELECTRICAL FEEDERS BACK TO DISCONNECT.



1 ATTIC DEMOLITION PLAN
1/4" = 1'-0"

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A1	PHASE 2 ADD# 01	03/07/24	MHB

ISSUED FOR **02/09/24**

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STATE OF MISSOURI
Matthew Hayes Bridges
NUMBER PE-2010018578
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02/09/2024

NEFF HALL - HVAC UPGRADES PHASE 2

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MHB	MHB
FIELD	FIELD BOOK
CHECKED JAK	CHECK DATE 02/09/24

SHEET TITLE

ATTIC DEMOLITION PLAN

PROJECT NO. **CP231442**
DRAWING ISSUED DATE: **03/07/24**
SHEET

MD104

0 2' 4' 8'
SCALE: 1/4" = 1'-0"

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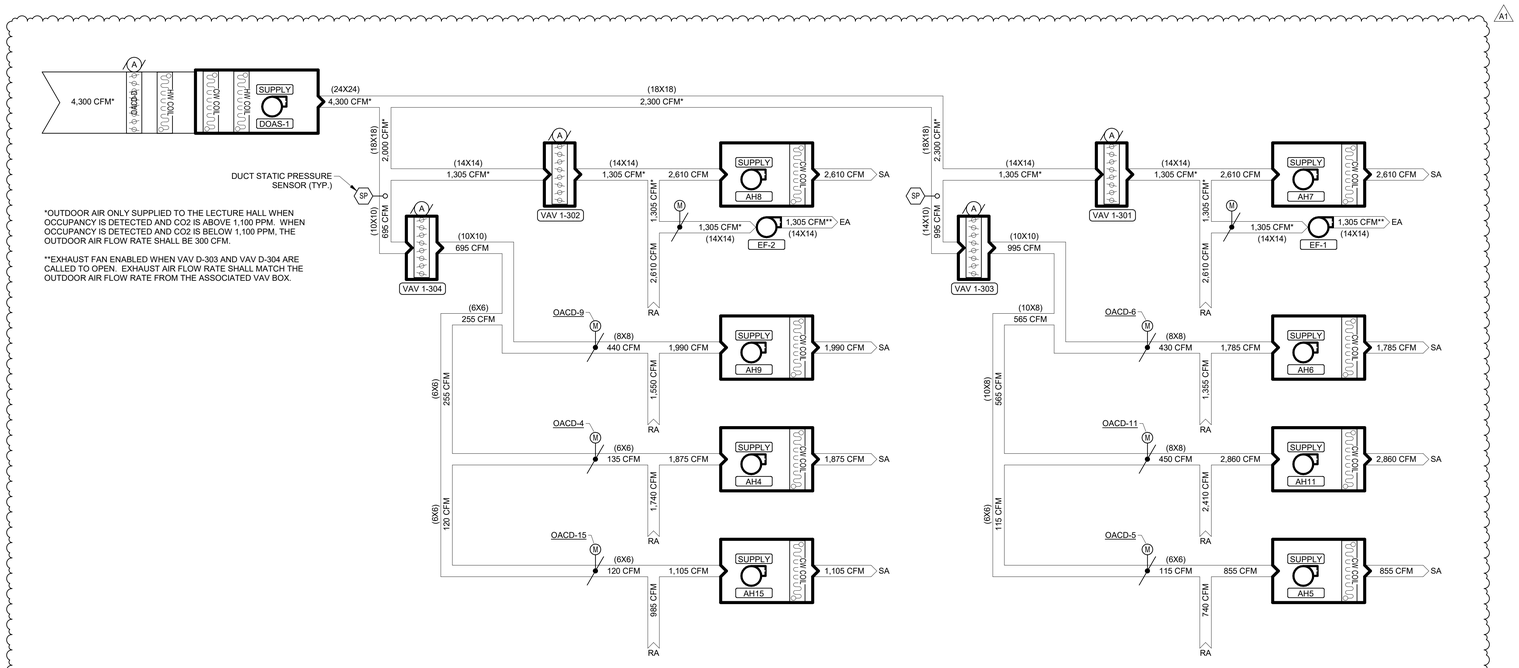
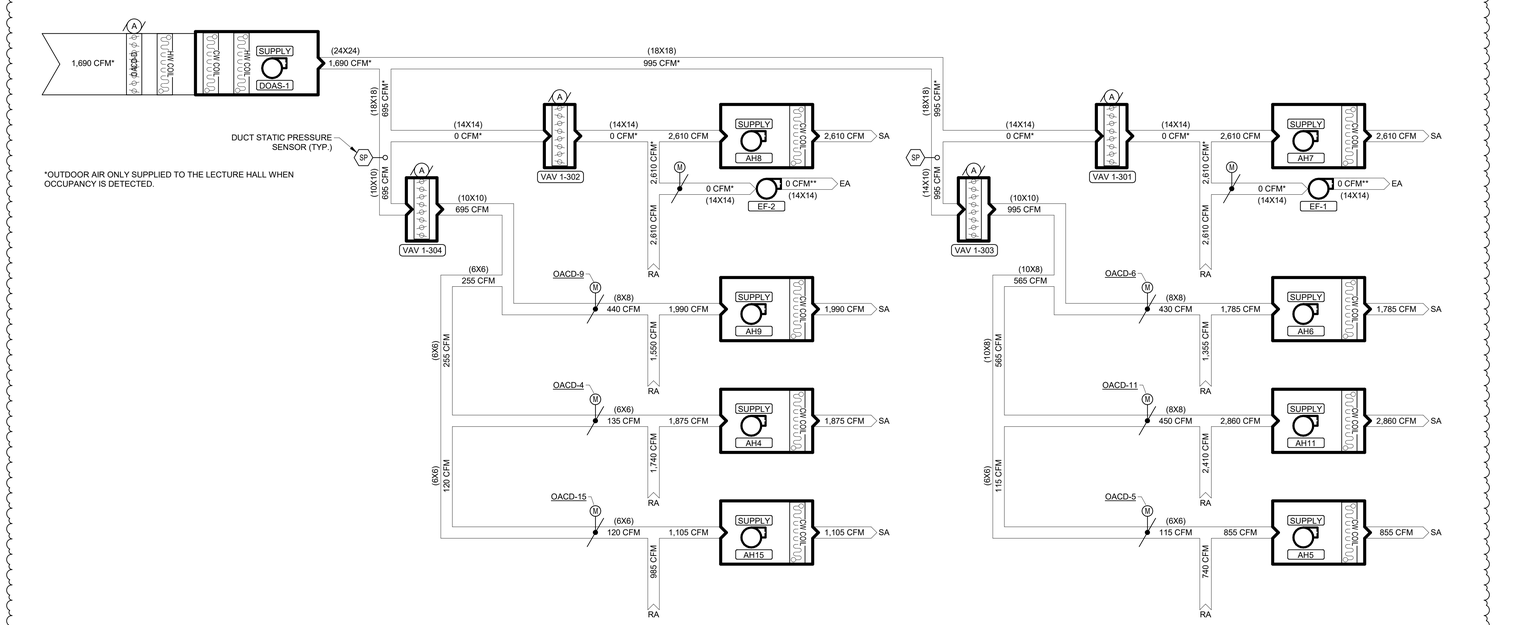


OUTDOOR AIR FLOW DIAGRAM - LECTURE 204 OCCUPIED



OUTDOOR AIR FLOW DIAGRAM - LECTURE 204 UNOCCUPIED

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Burlington, IA Davenport, IA Hannibal, MO

REVISION HISTORY

	DESCRIPTION	DATE	APPR
A1	PHASE 2 ADD# 01	03/07/24	MHB

ISSUED FOR **02/09/24**

CONSTRUCTION PHASE 2

STATE OF MISSOURI
Matthew Hayes Bridges
NUMBER PE-2010018578
PROFESSIONAL ENGINEER
02/09/2024

NEFF HALL - HVAC UPGRADES PHASE 2

UNIVERSITY OF MISSOURI
309 S 9TH STREET COLUMBIA, MO 65201

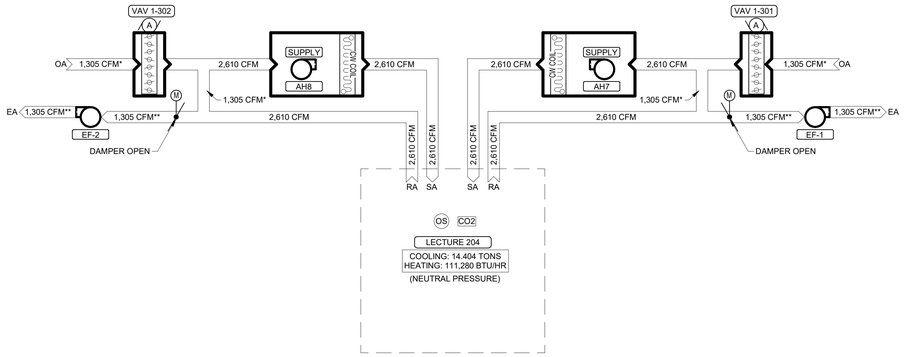
Non-Reduced Sheet Size 30" x 42"
Full sized plans have been prepared using standard scales. Reduced sized plans may not conform to standard scales.

DESIGNED	DRAWN
MHB	MHB
FIELD	FIELD BOOK
CHECKED JAK	CHECK DATE 02/09/24

SHEET TITLE

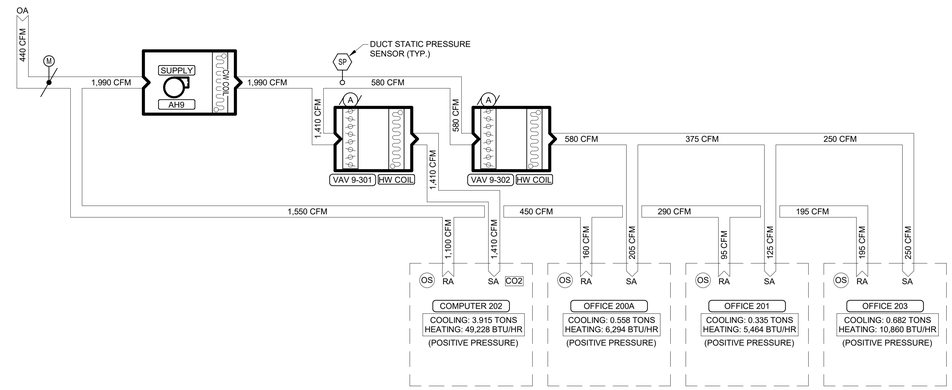
OUTDOOR AIR FLOW DIAGRAMS

PROJECT NO. **CP231442**
DRAWING ISSUED DATE: **03/07/24**
SHEET
M401

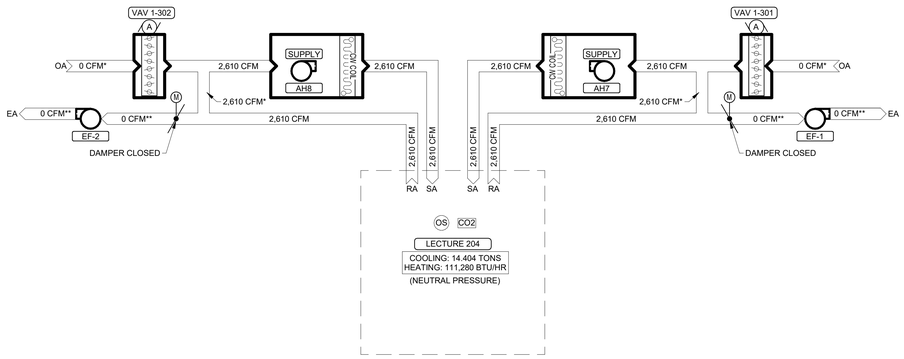


*OUTDOOR AIR ONLY SUPPLIED TO THE LECTURE HALL WHEN OCCUPANCY IS DETECTED. WHEN OCCUPANCY IS DETECTED AND CO2 IS ABOVE 1,100 PPM, SUPPLY THE OUTDOOR AIR RATE SHOWN ABOVE. WHEN OCCUPANCY IS DETECTED AND CO2 IS BELOW 1,100 PPM, THE OUTDOOR AIR FLOW RATE SHALL BE 300 CFM.
**EXHAUST FAN ENABLED WHEN THE OUTDOOR AIR DAMPERS TO AH7 AND AH8 ARE CALLED TO OPEN.

AH7 & AH8 AIR FLOW DIAGRAM - LECTURE 204 OCCUPIED

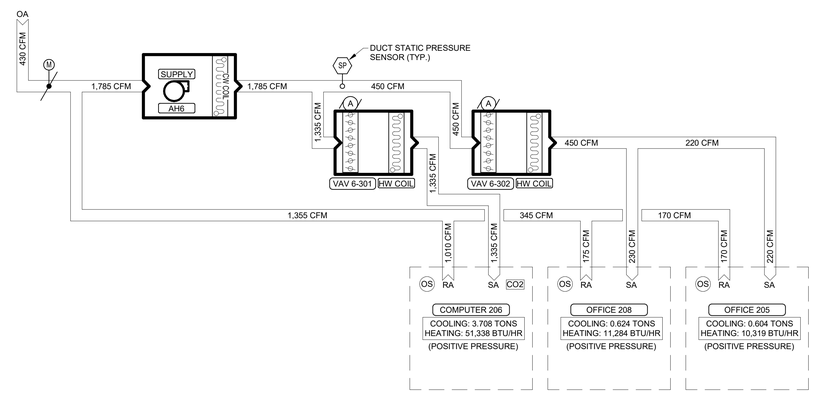


AH9 AIR FLOW DIAGRAM

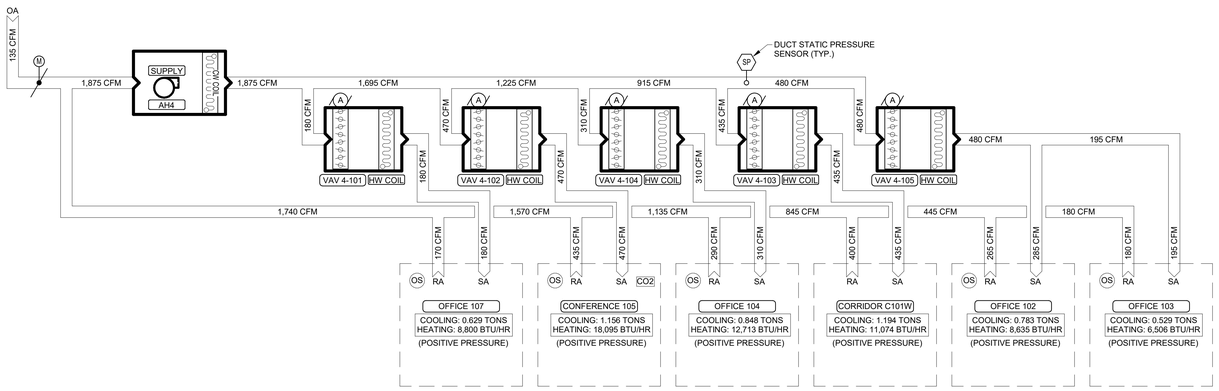


*OUTDOOR AIR ONLY SUPPLIED TO THE LECTURE HALL WHEN OCCUPANCY IS DETECTED.
**EXHAUST FAN ENABLED WHEN THE OUTDOOR AIR DAMPERS TO AH7 AND AH8 ARE CALLED TO OPEN.

AH7 & AH8 AIR FLOW DIAGRAM - LECTURE 204 UNOCCUPIED



AH6 AIR FLOW DIAGRAM



AH4 AIR FLOW DIAGRAM

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REVISION HISTORY

Δ	DESCRIPTION	DATE	APPR
A1	PHASE 2 ADD# 01	03/07/24	MHB

ISSUED FOR **02/09/24**

CONSTRUCTION PHASE 2

STATE OF MISSOURI
Matthew Hayes Bridges
NUMBER PE-2010031578
PROFESSIONAL ENGINEER
02/09/2024

NEFF HALL - HVAC UPGRADES PHASE 2

UNIVERSITY OF MISSOURI
309 S 9TH STREET COLUMBIA, MO 65201

Non-Reduced Sheet Size 30" x 42"
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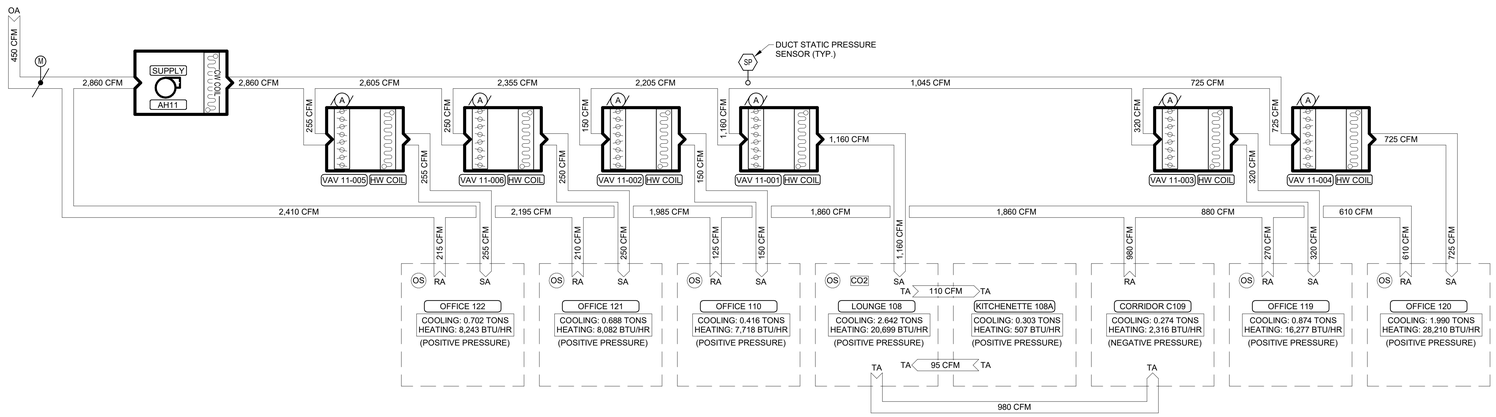
DESIGNED	DRAWN
MHB	MHB
FIELD	FIELD BOOK
CHECKED JAK	CHECK DATE 02/09/24

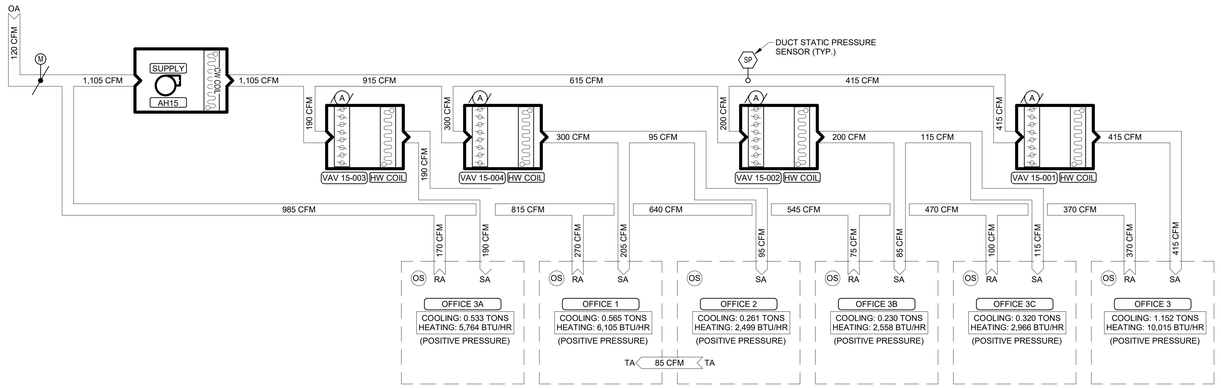
SHEET TITLE

AIR FLOW DIAGRAMS

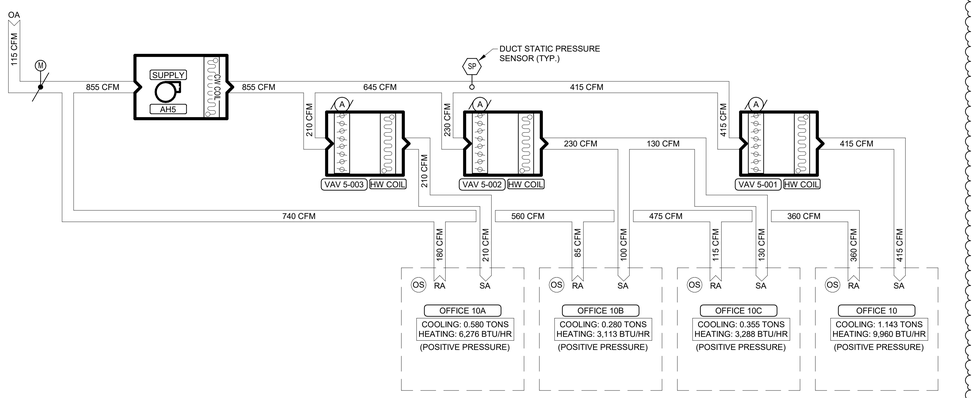
PROJECT NO. **CP231442**
DRAWING ISSUED DATE: **03/07/24**
SHEET
M402



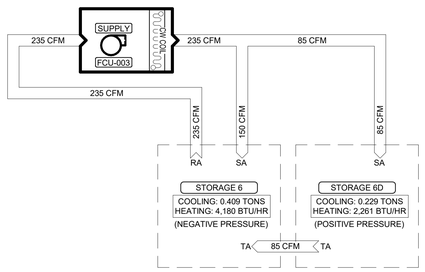
AH11 AIR FLOW DIAGRAM



AH15 AIR FLOW DIAGRAM



AH5 AIR FLOW DIAGRAM



FCU-2 AIR FLOW DIAGRAM

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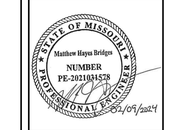
REVISION HISTORY

	DESCRIPTION	DATE	APPR
A1	PHASE 2 ADD# 01	03/07/24	MHB

ISSUED FOR **02/09/24**

CONSTRUCTION PHASE 2



NEFF HALL - HVAC UPGRADES PHASE 2

UNIVERSITY OF MISSOURI
309 S 9TH STREET COLUMBIA, MO 65201

Non-Reduced Sheet Size 30" x 42"
Full sized plans have been prepared using standard scales. Reduced sized plans may not conform to standard scales.

DESIGNED MHB	DRAWN MHB
FIELD	FIELD BOOK
CHECKED JAK	CHECK DATE 02/09/24

SHEET TITLE

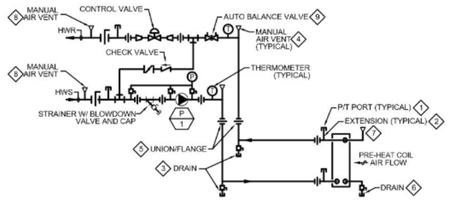
AIR FLOW DIAGRAMS

PROJECT NO. **CP231442**

DRAWING ISSUED DATE: **03/07/24**

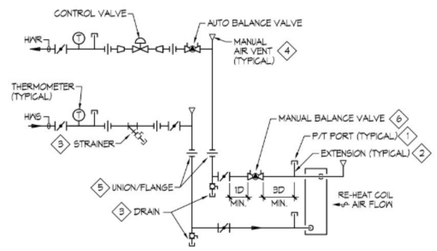
SHEET

M403



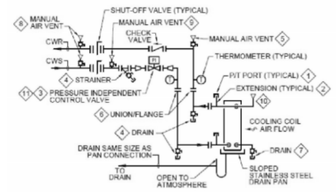
1. FOR P/T PORT, USE PRESSURE TAP PROVIDED BY MANUFACTURER AT COIL IF AVAILABLE.
2. INSTALL EXTENSION AT PRESSURE TAP SO P/T PORT IS AT LEVEL OF INSULATION.
3. 3/4 INCH THREADED HOSE CONNECTION AND CAP.
4. PROVIDE MANUAL AIR VENT AT THE HIGH POINT BETWEEN THE COIL AND SHUT-OFF/ISOLATION VALVE IN THE SUPPLY AND RETURN PIPING. PROVIDE 3/4" THREADED HOSE CONNECTION AND CAP
5. LOCATE SHUT-OFF VALVES, UNIONS AND FLANGES TO ALLOW CLEAR SPACE FOR REMOVAL OF COIL.
6. INSTALL DRAIN, SHUT-OFF VALVE, THREADED PIPE AND CAP. PIPE DRAIN TO OUTSIDE OF CABINET AND SEAL PENETRATION. THE DRAIN IS ONLY REQUIRED IF BOTTOM OF COIL IS LOWER THAN EXTERNAL PIPE CONNECTION TO THE COIL HEADER.
7. INSTALL MANUAL AIR VENT, SHUT-OFF VALVE, THREADED PIPE AND CAP. PIPE VENT TO OUTSIDE OF CABINET AND SEAL PENETRATION. THIS VENT IS ONLY REQUIRED IF THE TOP OF THE COIL IS HIGHER THAN THE EXTERNAL PIPE CONNECTION TO THE COIL HEADER.
8. PROVIDE MANUAL AIR VENTS AT ANY HIGH POINTS IN SUPPLY AND RETURN BETWEEN COIL SHUT OFF VALVE AND MAIN. 3/4 INCH THREADED HOSE CONNECTION AND CAP.
9. PROVIDE WITH FLOW RATING TO MATCH THE COIL SUBMITTAL FLOWRATE, OR THE NEXT AVAILABLE FLOWRATE GREATER THAN THE COIL SUBMITTAL.

1 DUCT MOUNTED HOT WATER PREHEAT COIL PIPING DETAIL
NTS



1. FOR P/T PORT, USE PRESSURE TAP PROVIDED BY MANUFACTURER AT COIL IF AVAILABLE.
2. INSTALL EXTENSION AT PRESSURE TAP SO P/T PORT IS AT LEVEL OF INSULATION.
3. 3/4 INCH THREADED HOSE CONNECTION AND CAP.
4. PROVIDE MANUAL AIR VENTS AT ANY HIGH POINT IN SUPPLY AND RETURN BETWEEN COIL AND MAIN.
5. LOCATE SHUT-OFF VALVES, UNIONS AND FLANGES TO ALLOW CLEAR SPACE FOR REMOVAL OF COIL.
6. PROVIDE BALANCE VALVE IN HWR OF EACH COIL FOR MULTIPLE COIL ARRANGEMENT. (NOT REQUIRED IF ONLY ONE COIL)

2 AHU HOT WATER REHEAT COIL PIPING DETAIL
NTS

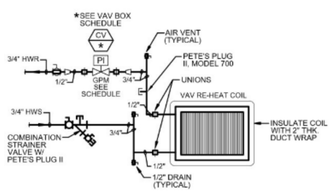


AHU CHILLED WATER COIL PIPING

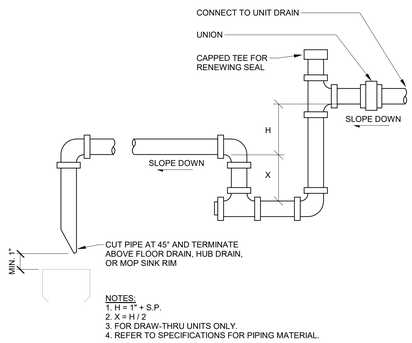
1 MAU01 SCALE: NONE

1. FOR P/T PORT, USE PRESSURE TAP PROVIDED BY MANUFACTURER AT COIL IF AVAILABLE.
2. INSTALL EXTENSION AT PRESSURE TAP SO P/T PORT IS AT LEVEL OF INSULATION.
3. INSTALL P/T PORT UPSTREAM AND DOWNSTREAM OF CONTROL VALVE IF PORTS NOT ON VALVE.
4. 3/4 INCH THREADED HOSE CONNECTION AND CAP. THESE DRAINS ARE NOT REQUIRED IF A COIL DRAIN IS INSTALLED THAT IS LOWER THAN THE EXTERNAL PIPE TO THE COIL.
5. PROVIDE A MANUAL AIR VENT AT THE HIGH POINT BETWEEN THE COIL AND CHECK VALVE ON THE RETURN PIPING. 3/4 INCH THREADED HOSE CONNECTION AND CAP.
6. LOCATE SHUT OFF VALVES, UNIONS AND FLANGES TO ALLOW CLEAR SPACE FOR REMOVAL OF COIL.
7. INSTALL DRAIN, SHUT-OFF VALVE, THREADED PIPE AND CAP. PIPE DRAIN TO OUTSIDE OF CABINET AND SEAL PENETRATION. THIS DRAIN REQUIRED ONLY IF BOTTOM OF COIL IS LOWER THAN EXTERNAL PIPE CONNECTION TO COIL HEADER.
8. PROVIDE MANUAL AIR VENTS AT ANY HIGH POINTS IN SUPPLY AND RETURN BETWEEN COIL SHUT OFF VALVE AND MAIN. 3/4 INCH THREADED HOSE CONNECTION AND CAP.
9. PROVIDE A MANUAL AIR VENT AT THE HIGH POINT BETWEEN THE SHUT OFF VALVE AND STRAINER ON THE SUPPLY PIPING. 3/4 INCH THREADED HOSE CONNECTION AND CAP.
10. INSTALL MANUAL AIR VENT, SHUT-OFF VALVE, THREADED PIPE AND CAP. PIPE TO OUTSIDE OF CABINET AND SEAL PENETRATION. THIS VENT ONLY REQUIRED IF THE TOP OF THE COIL IS HIGHER THAN THE EXTERNAL PIPE CONNECTION TO THE COIL HEADER.
11. PROVIDE WITH FLOW RATING TO MATCH THE COIL SUBMITTAL FLOWRATE, OR THE NEXT AVAILABLE FLOWRATE GREATER THAN THE COIL SUBMITTAL FLOWRATE.

3 AHU CHILLED WATER COIL PIPING DETAIL
NTS

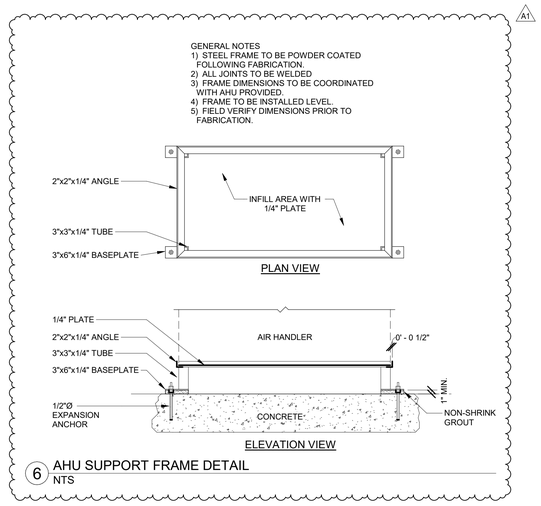


4 VAV REHEAT COIL PIPING DETAIL
NTS

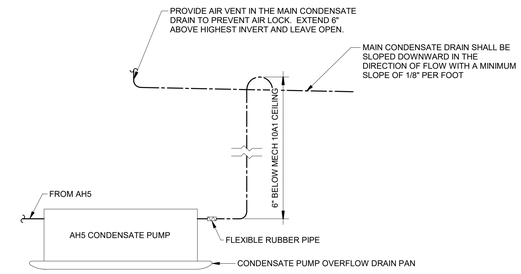


NOTES:
1. H = 1" + S.P.
2. X = H / 2
3. FOR DRAW-THRU UNITS ONLY.
4. REFER TO SPECIFICATIONS FOR PIPING MATERIAL.

5 COOLING COIL CONDENSATION DRAIN DETAIL
NTS



6 AHU SUPPORT FRAME DETAIL
NTS



7 AH5 CONDENSATE PUMP DETAIL
NTS

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REVISION HISTORY

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CONSTRUCTION PHASE 2

STATE OF MISSOURI
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NUMBER PE-2010018578
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MHB	MHB
FIELD	FIELD BOOK
CHECKED JAK	CHECK DATE 02/09/24

SHEET TITLE

MECHANICAL DETAILS

PROJECT NO. **CP231442**
DRAWING ISSUED DATE: **03/07/24**
SHEET
M502

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DEDICATED OUTDOOR AIR UNIT SCHEDULE INFORMATIONAL ONLY

MARK	DESCRIPTION	BASIS OF DESIGN		SUPPLY FAN				COOLING COIL						REHEAT COIL						ELECTRICAL					NOTES
				DESIGN AIR FLOW		MINIMUM AIR FLOW																			
		MANUFACTURER	MODEL	AIR FLOW (CFM)	ESP (IN. WG.)	AIR FLOW (CFM)	ESP (IN. WG.)	CAPACITY (BTU/HR)	EWT (DEG. F)	LWT (DEG. F)	FLOWRATE (GPM)	ENTERING AIR TEMP (DEG. F)	LEAVING AIR TEMP (DEG. F)	CAPACITY (BTU/HR)	EWT (DEG. F)	LWT (DEG. F)	FLOWRATE (GPM)	ENTERING AIR TEMP (DEG. F)	LEAVING AIR TEMP (DEG. F)	VOLTAGE	PHASE	HZ	MCA	MOCP	
DOAS-1	INDOOR, DEDICATED OUTDOOR AIR UNIT	TRANE	FLEXFIT	4,300	2.10	1,690	1.90	408,810	45	60	55.0	95/78	50/49.9	104,060	180	140	6.6	50	78.3	208	3	60	8.2	15	1

NOTES:
1. UNIT TO BE OWNER FURNISHED AND CONTRACTOR INSTALLED. UNIT ASSEMBLED DIMENSIONS: 100" L x 72" W x 51" H.

AIR HANDLING UNIT SCHEDULE

MARK	DESCRIPTION	BASIS OF DESIGN		SUPPLY FAN				COOLING COIL						ELECTRICAL					NOTES
				DESIGN AIR FLOW		MINIMUM AIR FLOW													
		MANUFACTURER	MODEL	AIR FLOW (CFM)	ESP (IN. WG.)	AIR FLOW (CFM)	ESP (IN. WG.)	CAPACITY (BTU/HR)	EWT (DEG. F)	LWT (DEG. F)	FLOWRATE (GPM)	ENTERING AIR TEMP (DEG. F)	LEAVING AIR TEMP (DEG. F)	VOLTAGE	PHASE	HZ	MCA	MOCP	
AH4	INDOOR, VERTICAL AIR HANDLING UNIT	TRANE	BCVE	1,875	0.50	630	0.40	57,110	45	60	8.0	77.6/66.0	57.2/56.2	208	3	60	5.8	15	1
AH5	ENERGY RECOVERY VERTICAL UNIT VENTILATOR	CHANGE AIR	B-CW-SH	855	0.40	420	0.30	28,320	45	60	4.0	77.6/66.0	55.7/54.7	208	1	60	8.1	15	2,4
AH11	INDOOR, VERTICAL AIR HANDLING UNIT	TRANE	BCVE	2,860	0.40	975	0.30	98,240	45	58	14.0	77.5/66.0	57.1/56.2	208	3	60	9.5	15	3

NOTES:
1. UNIT TO BE OWNER FURNISHED AND CONTRACTOR INSTALLED. UNIT DIMENSIONS: 27.5" L x 34.8" W x 58.6" H. UNIT WEIGHT: 315 LBS.
2. UNIT TO BE OWNER FURNISHED AND CONTRACTOR INSTALLED. UNIT DIMENSIONS: 21.5" L x 40.5" W x 91" H. UNIT WEIGHT: 1,200 LBS.
3. UNIT TO BE OWNER FURNISHED AND CONTRACTOR INSTALLED. UNIT DIMENSIONS: 38.7" L x 48" W x 66.7" H. UNIT WEIGHT: 425 LBS.
4. REPLACE EXISTING SUPPLY FAN MOTOR. REFER TO FAN MOTOR SCHEDULE FOR MORE INFORMATION.

FAN MOTOR SCHEDULE

MARK	DESCRIPTION	AIR HANDLING UNIT	MOTOR HP	MOUNT	FAN DRIVE TYPE	MAXIMUM MOTOR SPEED	VOLTAGE	PHASE	HZ	MAXIMUM AMPS	NOTES
M5	GENERAL DUTY FAN MOTOR	AH5	1/2	BASE MOUNT	DIRECT DRIVEN	1800 RPM	208	3	60	16	1
M6	GENERAL DUTY FAN MOTOR	AH6	1	BASE MOUNT	BELT DRIVEN	1800 RPM	208	3	60	16	2
M9	GENERAL DUTY FAN MOTOR	AH9	1	BASE MOUNT	BELT DRIVEN	1800 RPM	208	3	60	16	2

NOTES:
1. PROVIDE WITH NEW MOTOR CONNECTIONS TO FAN WHEEL.
2. PROVIDE WITH NEW ADJUSTABLE MOTOR SHEAVE AND FAN BELT.

FAN COIL UNIT SCHEDULE

MARK	DESCRIPTION	BASIS OF DESIGN		SUPPLY FAN		COOLING COIL						ELECTRICAL					NOTES
		MANUFACTURER	MODEL	AIR FLOW (CFM)	ESP (IN. WG.)	CAPACITY (BTU/HR)	EWT (DEG. F)	LWT (DEG. F)	FLOWRATE (GPM)	ENTERING AIR TEMP (DEG. F)	LEAVING AIR TEMP (DEG. F)	VOLTAGE	PHASE	HZ	MCA	MOCP	
FCU-003	HORIZONTAL, CEILING SUSPENDED FAN COIL UNIT	TRANE	FCDB	235	0.20	6,340	45	57.6	1.0	77.0/64.8	56.5/55.9	208	1	60	1.75	15	1

NOTES:
1. UNIT TO BE OWNER FURNISHED AND CONTRACTOR INSTALLED. UNIT DIMENSIONS: 33" L x 26" W x 10" H. UNIT WEIGHT: 84 LBS.

DUCT MOUNTED DOAS-1 FILTER BOX SCHEDULE

MARK	DESCRIPTION	BASIS OF DESIGN		AIR FLOW			PRE-FILTER					SECONDARY FILTER					DUCT DIMENSIONS		NOTES
		MANUFACTURER	MODEL	DESIGN FLOW (CFM)	MAX. FILTER VELOCITY (FT/MIN)	MAX. PRESSURE DROP (IN. WG.)	FILTER QUANTITY	FILTER HEIGHT (IN.)	FILTER WIDTH (IN.)	RATING	FILTER DEPTH (IN.)	FILTER QUANTITY	FILTER HEIGHT (IN.)	FILTER WIDTH (IN.)	RATING	FILTER DEPTH (IN.)	WIDTH (IN.)	HEIGHT (IN.)	
OAF-1	DUCT MOUNTED FILTER BOX	AAF CAMFIL AIR FILTERS INC.	SUREPLEAT GLIDEPACK AIRE-LOC	4,300	500	0.30	3	24	18	MERV 8	2	3	24	18	MERV 13	4	54	24	1

NOTES:
1. INSULATED, DOUBLE WALL GALVANIZED STEEL DOOR AND HOUSING CONSTRUCTION.

VARIABLE-AIR-VOLUME BOX SCHEDULE

MARK	DESCRIPTION	BASIS OF DESIGN		INLET DUCT DIAMETER	COOLING		DESIGN HEATING AIR FLOW (CFM)	REHEAT COIL						NOTES
		MANUFACTURER	MODEL		MAXIMUM AIR FLOW (CFM)	MINIMUM AIR FLOW (CFM)		CAPACITY (BTU/HR)	EWT (DEG. F)	LWT (DEG. F)	FLOWRATE (GPM)	ENTERING AIR TEMP (DEG. F)	LEAVING AIR TEMP (DEG. F)	
VAV 1-301	VAV BOX	TITUS	DESV	12"	1,305	0	1,305	--	--	--	--	--	--	3,4
VAV 1-302	VAV BOX	TITUS	DESV	12"	1,305	0	1,305	--	--	--	--	--	--	3,4
VAV 1-303	VAV BOX	TITUS	DESV	12"	995	115	995	--	--	--	--	--	--	3
VAV 1-304	VAV BOX	TITUS	DESV	12"	695	120	695	--	--	--	--	--	--	3
VAV 4-101	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	8"	180	60	175	7,643	180	140	0.4	55	95	1,2,3
VAV 4-102	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	12"	470	150	410	18,095	180	140	1.0	55	95	1,2,3,4
VAV 4-103	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	12"	435	140	250	11,074	180	140	0.6	55	95	1,2
VAV 4-104	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	10"	310	100	290	12,713	180	140	0.7	55	95	1,2,3
VAV 4-105	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	12"	480	150	345	15,141	180	140	0.8	55	95	1,2,3
VAV 5-001	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	12"	415	130	230	9,960	180	140	0.5	55	95	1,2,3
VAV 5-002	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	10"	230	70	145	6,400	180	140	0.5	55	95	1,2,3
VAV 5-003	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	8"	210	70	145	6,300	180	140	0.3	55	95	1,2,3
VAV 6-301	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	16"	1,335	365	1,170	51,340	180	140	2.6	55	95	1,2,3,4
VAV 6-302	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	10"	450	140	450	21,600	180	140	1.1	55	95	1,2,3
VAV 9-301	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	16"	1,410	365	1,120	49,230	180	140	2.5	55	95	1,2,3,4
VAV 9-302	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	12"	580	180	515	22,620	180	140	1.2	55	95	1,2,3
VAV 11-101	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	16"	1,160	350	580	25,520	180	140	1.3	55	95	1,2,3,4
VAV 11-102	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	8"	150	50	150	7,720	180	140	0.4	55	95	1,2,3
VAV 11-103	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	10"	320	100	320	16,280	180	140	1.0	55	95	1,2,3
VAV 11-104	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	14"	725	250	640	28,210	180	140	1.5	55	95	1,2,3
VAV 11-105	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	10"	255	80	190	8,250	180	140	0.4	55	95	1,2,3
VAV 11-106	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	10"	250	80	200	8,750	180	140	0.5	55	95	1,2,3
VAV 15-001	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	12"	415	130	230	10,015	180	140	0.5	55	95	1,2,3
VAV 15-002	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	8"	200	60	125	5,525	180	140	0.3	55	95	1,2,3
VAV 15-003	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	8"	190	60	145	6,250	180	140	0.4	55	95	1,2,3
VAV 15-004	VAV BOX WITH HOT WATER REHEAT	TITUS	DESV	10"	300	90	195	8,600	180	140	0.5	55	95	1,2,3

NOTES:
1. COILS SHALL HAVE A MAXIMUM OF 10 FINS PER INCH.
2. MAXIMUM COIL PRESSURE DROP: 10 FT W.C.
3. VAV BOX CONNECTED TO OCCUPANCY SENSOR.
4. VAV BOX CONNECTED TO CARBON DIOXIDE SENSOR.

DUCT MOUNTED DOAS-1 PRE-HEAT COIL SCHEDULE

MARK	CAPACITY (BTU/HR)	EWT (DEG. F)	LWT (DEG. F)	FLOWRATE (GPM)	ENTERING AIR TEMP (DEG. F)	LEAVING AIR TEMP (DEG. F)	AIRFLOW (CFM)	DUCT WIDTH (IN.)	DUCT HEIGHT (IN.)	NOTES
DOAS PREHEAT	284,000	180	140	14.5	0	60	4,300	54	24	1,2,3

NOTES:
1. COIL SHALL HAVE A MAXIMUM OF 10 FINS PER INCH.
2. MAXIMUM COIL HYDRONIC PRESSURE DROP: 15 FT W.C.
3. MAXIMUM COIL AIR SIDE PRESSURE DROP: 0.05 IN. WG.

DOAS-1 PREHEAT COIL PUMP SCHEDULE

MARK	DESCRIPTION	BASIS OF DESIGN		DESIGN FLOW		MOTOR DATA		ELECTRICAL				NOTES
		MANUFACTURER	MODEL	FLOWRATE (GPM)	HEAD (FT)	MOTOR SIZE (HP)	RPM	VOLTAGE	PHASE	HZ	FLA	
P-1	INLINE CIRCULATOR PUMP	ARMSTRONG BELL & GOSSETT GRUNDFOS	4380 ECOCIRC XL MAGNA1	14.5	20	1/6	3450	120	1	60	1.9	1,2

NOTES:
1. COORDINATE PUMP SIZE WITH ACTUAL HWC-1 PROVIDED.
2. DESIGN HEAD LOSS BASED ON A COIL PRESSURE DROP OF 15 FT W.C. COORDINATE PUMP SELECTION WITH ACTUAL DOAS-1 PRE-HEAT COIL PROVIDED.

CONTROL VALVE SCHEDULE

TAG	DESCRIPTION	CONTROL	VALVE FAIL POSITION	EQUIPMENT SERVED	COIL WATER P.D.	COIL FLOW RATE	Cv*	NOTES
HCV-1	2 WAY MODULATING - CHILLED WATER	2-10 VDC	CLOSED	AH15	10 FT	5.0 GPM	1.5	1
HCV-2	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 15-001	0.25 FT	0.5 GPM	1.5	2
HCV-3	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 15-002	0.25 FT	0.3 GPM	0.9	2
HCV-4	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 15-003	0.25 FT	0.4 GPM	1.2	2
HCV-5	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 15-004	0.25 FT	0.5 GPM	1.5	2
HCV-6	2 WAY MODULATING - CHILLED WATER	2-10 VDC	CLOSED	AH5	10 FT	4.0 GPM	1.2	1
HCV-7	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 5-001	0.25 FT	0.5 GPM	1.5	2
HCV-8	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 5-002	0.25 FT	0.5 GPM	1.5	2
HCV-9	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 5-003	0.25 FT	0.3 GPM	0.9	2
HCV-10	2 WAY MODULATING - CHILLED WATER	2-10 VDC	CLOSED	FCU-001	10 FT	2.0 GPM	0.6	1
HCV-11	2 WAY MODULATING - CHILLED WATER	2-10 VDC	CLOSED	FCU-003	10 FT	1.0 GPM	0.3	1
HCV-12	2 WAY MODULATING - CHILLED WATER	2-10 VDC	CLOSED	FCU-004	0.5 FT	2.4 GPM	5.1	1
HCV-13	2 WAY MODULATING - CHILLED WATER	2-10 VDC	CLOSED	AH4	10 FT	8.0 GPM	2.5	1
HCV-14	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 4-101	0.25 FT	0.4 GPM	1.2	2
HCV-15	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 4-102	0.25 FT	1.0 GPM	3.0	2
HCV-16	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 4-103	0.25 FT	0.6 GPM	1.8	2
HCV-17	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 4-104	0.25 FT	0.7 GPM	2.1	2
HCV-18	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 4-105	0.25 FT	0.8 GPM	2.4	2
HCV-19	2 WAY MODULATING - CHILLED WATER	2-10 VDC	CLOSED	AH11	10 FT	14.0 GPM	4.4	1
HCV-20	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 11-101	0.25 FT	1.3 GPM	3.9	2
HCV-21	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 11-102	0.25 FT	0.4 GPM	1.2	2
HCV-22	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 11-103	0.25 FT	1.0 GPM	3.0	2
HCV-23	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 11-104	0.25 FT	1.5 GPM	4.5	2
HCV-24	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 11-105	0.25 FT	0.4 GPM	1.2	2
HCV-25	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 11-106	0.25 FT	0.5 GPM	1.5	2
HCV-26	2 WAY MODULATING - CHILLED WATER	2-10 VDC	CLOSED	AH9	4.7 FT	9.0 GPM	4.1	1
HCV-27	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 9-301	0.25 FT	2.5 GPM	7.6	2
HCV-28	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 9-302	0.25 FT	1.2 GPM	3.6	2
HCV-29	2 WAY MODULATING - CHILLED WATER	2-10 VDC	CLOSED	AH8	10 FT	12.0 GPM	3.7	1
HCV-30	2 WAY MODULATING - CHILLED WATER	2-10 VDC	CLOSED	AH7	10 FT	12.0 GPM	3.7	1
HCV-31	2 WAY MODULATING - CHILLED WATER	2-10 VDC	CLOSED	DOAS-1 CW COIL	15.0 FT	55.0 GPM	21.5	1
HCV-32	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	DOAS-1 HW COIL	15.0 FT	8.0 GPM	2.3	2
HCV-33	2 WAY MODULATING - CHILLED WATER	2-10 VDC	CLOSED	AH6	4.7 FT	9.0 GPM	4.1	1
HCV-34	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 6-301	0.25 FT	2.6 GPM	7.9	2
HCV-35	2 WAY MODULATING - HOT WATER	2-10 VDC	IN PLACE	VAV 6-302	0.25 FT	1.1 GPM	3.3	2
HCV-36	2 WAY MODULATING - HOT WATER	2-10 VDC	OPEN	DOAS PREHEAT	15.0 FT	12.0 GPM	4.7	2

NOTES:
1. BELIMO 2-WAY PRESSURE INDEPENDENT CONTROL VALVE WITH INTEGRAL FLOW METER.
2. BELIMO 2-WAY PRESSURE INDEPENDENT CONTROL VALVE.

*Cv SHALL BE BASED ON ACTUAL EQUIPMENT WATER COIL PRESSURE DROP.

EXHAUST FAN SCHEDULE

MARK	DESCRIPTION	BASIS OF DESIGN		DESIGN AIR FLOW				MOTOR		ELECTRICAL					NOTES
				DESIGN AIR FLOW		MINIMUM AIR FLOW									
		MANUFACTURER	MODEL	AIR FLOW (CFM)	ESP (IN. WG.)	AIR FLOW (CFM)	ESP (IN. WG.)	HP	RPM	VOLTAGE	PHASE	HZ	MCA	MOCP	
EF-1	INLINE CENTRIFUGAL FAN	GREENHECK AEROVENT TWIN CITY FANS	SQ SCDD DSI	1,305	0.30	700	0.20	1/4	1800	115	1	60	2.0	15	
EF-2	INLINE CENTRIFUGAL FAN	GREENHECK AEROVENT TWIN CITY FANS	SQ SCDD DSI	1,305	0.30	700	0.20	1/4	1800	115	1	60	2.0	15	

CONTROL DAMPER SCHEDULE

TAG	DESCRIPTION	AIRFLOW (CFM)	DUCT DIMENSIONS		MAX. DAMPER AIR PRESSURE DROP	DAMPER FAIL POSITION	DAMPER LOCATION		NOTES
			HEIGHT	WIDTH			FLOOR LEVEL	ROOM	
OACD-5	OPPOSED BLADE, 24V ACTUATED CONTROL DAMPER	115	0' - 6"	0' - 6"	0.10 in-wg	IN PLACE	BASEMENT	OFFICE 10	
OACD-15	OPPOSED BLADE, 24V ACTUATED CONTROL DAMPER	120	0' - 6"	0' - 6"	0.10 in-wg	IN PLACE	BASEMENT	OFFICE 3	
OACD-4	OPPOSED BLADE, 24V ACTUATED CONTROL DAMPER	135	0' - 6"	0' - 6"	0.10 in-wg	IN PLACE	FIRST FLOOR	MECH RM 106	
OACD-11	OPPOSED BLADE, 24V ACTUATED CONTROL DAMPER	450	0' - 8"	0' - 10"	0.10 in-wg	IN PLACE	FIRST FLOOR	MECH RM 109B	
OACD-6	OPPOSED BLADE, 24V ACTUATED CONTROL DAMPER	430	0' - 8"	0' - 8"	0.10 in-wg	IN PLACE	ATTIC	STORAGE 301	
OACD-9	OPPOSED BLADE, 24V ACTUATED CONTROL DAMPER	440	0' - 8"	0' - 8"	0.10 in-wg	IN PLACE	ATTIC	STORAGE 301	
OACD-D	OPPOSED BLADE, 24V ACTUATED CONTROL DAMPER	430	2' - 0"	2' - 0"	0.10 in-wg	IN PLACE	ATTIC	CRAWL SPACE 302	

GRILLES, REGISTERS, AND DIFFUSERS SCHEDULE

TAG	TYPE	DISCRIPTION	FACE SIZE		CONNECTION SIZE			TOTAL P.D.	THROW			MAX. NC	MATERIAL	FINISH	FRAME	BASIS OF DESIGN		REMARKS
			LENGTH	WIDTH	RECTANGULAR LENGTH	RECTANGULAR WIDTH	ROUND		150 FPM	100 FPM	50 FPM					MAKE	MODEL	
RA	CEILING RETURN / TRANSFER GRILLE	1/2" x 1/2" x 1" EGGCRATE GRID.	24"	24"	20"	20"		0.01 in-wg					ALUMINUM	WHITE ENAMEL	LAY-IN	TITUS	50F	
S1	CEILING SUPPLY DIFFUSER	24x24 MODULAR FULL-FACE DIFFUSER WITH ROUND NECK	24"	24"			8"	0.07 in-wg	3'	5'	9'	19	ALUMINUM	WHITE ENAMEL	LAY-IN	TITUS	TMSA	
S2	SUPPLY REGISTER	DOUBLE DEFLECTION GRILLE WITH FRONT BLADES PARALLEL TO SHORT DIMENSION. 3/4" SPACING.	8"	8"	6"	6"		0.06 in-wg	3'	5'	7'	10	ALUMINUM	WHITE ENAMEL	WALL MOUNT	TITUS	300RL	
S3	SUPPLY REGISTER	DOUBLE DEFLECTION GRILLE WITH FRONT BLADES PARALLEL TO SHORT DIMENSION. 3/4" SPACING.	10"	8"	8"	8"		0.05 in-wg	4'	6'	10'	10	ALUMINUM	WHITE ENAMEL	WALL MOUNT	TITUS	300RL	
T1	TRANSFER GRILLE	SIGHT PROOF GRILLE WITH INVERTED-V BLADES IN HORIZONTAL POSITION.	8"	8"	6"	6"						0	ALUMINUM	WHITE ENAMEL	WALL MOUNT	TITUS	350RL	

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REVISION HISTORY

⚠	DESCRIPTION	DATE	APPR
A1	PHASE 2 ADD# 01	03/07/24	MHB

ISSUED FOR **02/09/24**

CONSTRUCTION PHASE 2

STATE OF MISSOURI
Matthew Hayes Bridges
NUMBER PE-2010018578
PROFESSIONAL ENGINEER
02/09/2024

NEFF HALL - HVAC UPGRADES PHASE 2

UNIVERSITY OF MISSOURI
309 S 9TH STREET COLUMBIA, MO 65201

Non-Reduced Sheet Size 30" x 42"
Full sized plans have been prepared using standard scales. Reduced sized plans may not conform to standard scales.

DESIGNED	DRAWN
MHB	MHB
FIELD	FIELD BOOK
CHECKED JAK	CHECK DATE 02/09/24

SHEET TITLE

MECHANICAL SCHEDULES

PROJECT NO. **CP231442**

DRAWING ISSUED DATE: **03/07/24**

SHEET

M601

SEQUENCE OF OPERATION

GENERAL OPERATION

A. OCCUPANCY MODE:
1. THE OCCUPANCY MODE (OCCUPIED OR UNOCCUPIED) SHALL BE DETERMINED THROUGH A USER-ADJUSTABLE, GRAPHICAL, SCHEDULING PROGRAM. SCHEDULING PROGRAM SHALL SUPPORT SEVEN-DAY SCHEDULING, CALENDAR SCHEDULING, AND HOLIDAY SCHEDULE OVERRIDE. THE BAS SHALL SUPPORT DIFFERENT OCCUPANCY SCHEDULES FOR EACH ROOM TEMPERATURE SETPOINT.

B. ROOM TEMPERATURE SETPOINTS

1. OCCUPIED PERIOD ROOM SETPOINTS (REGULARLY SCHEDULED WORK DAYS FROM 7:00 AM- 6:00 PM, MONDAY-FRIDAY)
a. USER SHALL BE ABLE TO ADJUST ROOM TEMPERATURE SETPOINTS FROM THE LOCAL CONTROLLER.

2. UN-OCCUPIED PERIOD ZONE SETPOINTS (ALL REMAINING TIME THAT IS NOT DEFINED AS OCCUPIED)
a. ZONE SETPOINTS SHALL BE SET BACK DURING UNOCCUPIED HOURS.

C. ALL SETPOINTS INDICATED SHALL BE ADJUSTABLE WITHIN THE BAS SYSTEM.

DEDICATED OUTDOOR AIR SYSTEM SEQUENCE OF OPERATION

A. CENTRAL BAS SYSTEM CONTROL
1. THE BAS SHALL ENABLE THE DOAS DURING ALL OCCUPIED HOURS.

2. SAFETY SHUTDOWNS/ALARM GENERATION:
a. BUILDING FIRE ALARM ACTIVATION SHALL DISABLE OPERATION OF THE DOAS.

b. A DOAS GENERAL ALARM SHALL BE GENERATED IF THE DOAS IS NOT PROVEN BY THE SUPPLY AIR FLOW SWITCH WITHIN FIVE MINUTES OF GENERATING A DOAS RUN SIGNAL.

3. THE BAS SYSTEM SHALL DETERMINE SETPOINTS ACCORDING TO THE FOLLOWING:
a. IF THE ENTERING AIR TEMPERATURE TO THE DOAS PREHEAT COIL IS ABOVE 55°F (ADJUSTABLE BETWEEN 45°F AND 60°F):
1. THE DOAS SHALL BE IN COOLING MODE.

2. THE CHILLED WATER COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN THE BAS PROVIDED LEAVING CHILLED WATER COIL AIR TEMPERATURE SETPOINT OF 50°F (ADJUSTABLE BETWEEN 45°F AND 60°F).

b. IF THE ENTERING AIR TEMPERATURE TO THE DOAS PREHEAT COIL IS BELOW 55°F (ADJUSTABLE BETWEEN 45° F AND 60°F):

1. THE CHILLED WATER COIL SHALL BE DISABLED.

2. THE DOAS PREHEAT COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN THE BAS PROVIDED LEAVING DOAS PREHEAT COIL AIR TEMPERATURE SETPOINT OF 50°F (ADJUSTABLE BETWEEN 45°F AND 60°F).

3. THE DOAS REHEAT COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN THE BAS PROVIDED LEAVING DOAS REHEAT COIL AIR TEMPERATURE SETPOINT OF 65°F (ADJUSTABLE BETWEEN 45°F AND 80°F)

c. IF THE ENTERING AIR TEMPERATURE TO THE DOAS PREHEAT COIL IS BELOW 50°F (ADJUSTABLE BETWEEN 45°F AND 60°F):

1. THE DOAS SHALL BE IN HEATING MODE.

2. THE DOAS PREHEAT COIL PUMP SHALL BE ENABLED WHEN THE ENTERING AIR TEMPERATURE TO THE DOAS PREHEAT COIL IS BELOW 40°F (ADJUSTABLE BETWEEN 35°F AND 50°F).

3. THE DOAS PREHEAT COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN THE BAS PROVIDED LEAVING DOAS PREHEAT COIL AIR TEMPERATURE SETPOINT OF 50°F (ADJUSTABLE BETWEEN 45°F AND 60°F).

4. THE DOAS REHEAT COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN THE BAS PROVIDED LEAVING DOAS REHEAT COIL AIR TEMPERATURE SETPOINT OF 72°F (ADJUSTABLE BETWEEN 45°F AND 80°F).

5. SUPPLY FAN:
A. UPON ENABLING OF THE DOAS, THE DOAS SUPPLY FAN SHALL MODULATE TO MAINTAIN A DUCT STATIC PRESSURE OF +2.10 IN. WG. (ADJUSTABLE BETWEEN 1.00 IN. WG AND 3.00 IN. WG).

6. THE OUTDOOR AIR DAMPER SHALL BE FULLY OPEN WHENEVER THE DOAS IS ENABLED.

OUTDOOR AIR VAV BOXES SEQUENCE OF OPERATION

A. CENTRAL BAS SYSTEM CONTROL

1. THE BAS SHALL ENABLE THE OUTDOOR AIR VAV BOXES AT ALL TIMES.

2. SAFETY SHUTDOWNS/ALARM GENERATION:
a. BUILDING FIRE ALARM ACTIVATION SHALL DISABLE OPERATION OF ALL OF THE COMPONENTS COMPRISING THE VAV SYSTEM.

3. VAV BOX OPERATION:
a. VAV BOX DAMPER SHALL OPEN WHENEVER OCCUPANCY IS SENSED IN ANY SPACE CONNECTED TO AN ASSOCIATED VAV BOX.
b. VAV BOXES ASSOCIATED WITH THE LECTURE HALL 204 SHALL SUPPLY THE MINIMUM OUTDOOR AIR FLOW RATE AS DEFINED ON M402 WHEN OCCUPANCY IS DETECTED AND SPACE CO2 LEVELS ARE BELOW 1,100 PPM. WHEN OCCUPANCY IS DETECTED AND SPACE CO2 LEVELS ARE ABOVE 1,100 PPM, THE VAV BOX SHALL SUPPLY THE MAXIMUM OUTDOOR AIR FLOW RATE AS DEFINED ON M402.

VAV AIR HANDLING UNIT SEQUENCE OF OPERATION

A. CENTRAL BAS SYSTEM CONTROL

1. THE BAS SHALL ENABLE THE AHU AT ALL TIMES.
a. AHUS SHALL OPERATE CONTINUOUSLY DURING OCCUPIED HOURS.
b. AHUS SHALL OPERATE INTERMITTENTLY TO MAINTAIN UNOCCUPIED ZONE TEMPERATURES DURING UNOCCUPIED HOURS.

2. SAFETY SHUTDOWNS/ALARM GENERATION:
a. BUILDING FIRE ALARM ACTIVATION SHALL DISABLE OPERATION OF THE AHU.

3. UPON ENABLING OF THE AHU, THE AHU SUPPLY FAN SHALL OPERATE TO MAINTAIN A DUCT STATIC PRESSURE SETPOINT OF +0.50 IN. WG. (ADJUSTABLE BETWEEN 0.25 IN. WG AND 1.50 IN. WG).

4. UPON ENABLING OF THE AHU, THE OUTDOOR AIR DAMPER SHALL BE SET TO PROVIDE THE MINIMUM REQUIRED OUTDOOR AIR FLOW RATE FOR OCCUPIED PERIODS.

5. THE AHU DISCHARGE AIR TEMPERATURE SETPOINT SHALL BE RESET BASED ON OUTDOOR AIR TEMPERATURE.

VAV BOXES WITH HOT WATER REHEAT SEQUENCE OF OPERATION

A. CENTRAL BAS SYSTEM CONTROL

1. THE BAS SHALL ENABLE THE VAV BOXES AT ALL TIMES.

2. SAFETY SHUTDOWNS/ALARM GENERATION:
a. A VAV BOX GENERAL ALARM SHALL BE GENERATED IF THE SPACE TEMPERATURE IS TOO HIGH OR TOO LOW FOR AN EXTENDED PERIOD OF TIME.

3. VAV BOX SETPOINTS:
a. VAV BOXES SHALL OPERATE TO MAINTAIN SPACE TEMPERATURE SETPOINT AS PROVIDED WITHIN THE GENERAL BAS SYSTEM DESCRIPTION.
b. VAV BOXES SHALL AUTOMATICALLY ENABLE THE HOT WATER REHEAT COIL BASED ON THE SPACE TEMPERATURE RELATIONSHIP TO SETPOINT.
c. SPACE TEMPERATURE SETPOINTS SHALL BE CONTROLLED THROUGH THE BAS.

FAN COIL UNIT SEQUENCE OF OPERATION

A. NETWORKED HVAC THERMOSTAT CONTROLLER

1. SPACE TEMPERATURE SHALL ENABLE THE FCU AT ALL TIMES.

2. FAN COIL UNIT SETPOINTS:
a. FAN COIL UNIT SHALL OPERATE TO MAINTAIN SPACE TEMPERATURE SETPOINT AS PROVIDED WITHIN THE GENERAL BAS SYSTEM DESCRIPTION.
b. SPACE TEMPERATURE SETPOINTS SHALL BE CONTROLLED THROUGH THE TEC THERMOSTAT.
c. TEC THERMOSTAT SHALL AUTOMATICALLY ENABLE THE CHILLED WATER COIL BASED ON THE SPACE TEMPERATURE RELATIONSHIP TO SETPOINT.

3. FAN COIL UNIT SUPPLY FAN SHALL BE ENABLED DURING ALL OCCUPIED HOURS.

EXHAUST FAN SYSTEM

A. EXHAUST SYSTEM CONTROL

1. THE EXHAUST SYSTEM SHALL BE ENABLED WHENEVER OCCUPANCY IS SENSED IN THE LECTURE HALL 204.

2. THE EXHAUST FAN SYSTEM SHALL PROVIDE THE MINIMUM EXHAUST AIR FLOW RATE AS DEFINED ON M402 WHEN OCCUPANCY IS DETECTED AND SPACE CO2 LEVELS ARE BELOW 1,100 PPM. WHEN OCCUPANCY IS DETECTED AND SPACE CO2 LEVELS ARE ABOVE 1,100 PPM, THE EXHAUST FAN SYSTEM SHALL PROVIDE THE MAXIMUM EXHAUST AIR FLOW RATE AS DEFINED ON M402.

CAV AIR HANDLING UNIT SEQUENCE OF OPERATION

A. CENTRAL BAS SYSTEM CONTROL

1. THE BAS SHALL ENABLE THE AHU AT ALL TIMES.
a. AHUS SHALL OPERATE CONTINUOUSLY DURING OCCUPIED HOURS.
b. AHUS SHALL OPERATE INTERMITTENTLY TO MAINTAIN UNOCCUPIED ZONE TEMPERATURES DURING UNOCCUPIED HOURS.

2. SAFETY SHUTDOWNS/ALARM GENERATION:
a. BUILDING FIRE ALARM ACTIVATION SHALL DISABLE OPERATION OF THE AHU.

3. UPON ENABLING OF THE AHU, THE AHU SUPPLY FAN SHALL RUN.

4. UPON ENABLING OF THE AHU, THE OUTDOOR AIR DAMPER SHALL BE SET TO PROVIDE THE MINIMUM REQUIRED OUTDOOR AIR FLOW RATE FOR OCCUPIED PERIODS.

5. THE AHU DISCHARGE AIR TEMPERATURE SETPOINT SHALL BE RESET BASED ON OUTDOOR AIR TEMPERATURE.

GENERAL NOTES:

1. FC BUS TO BE CONTINUOUS DAISY CHAIN WITHOUT SPLICES. CONNECTIONS CAN ONLY BE MADE AT CONTROLLERS. SEE PLANS FOR QUANTITY AND LOCATIONS OF VAV/FCU CONTROLLERS. LOCATE PANELS IN SAME ROOM AS EQUIPMENT SERVED.

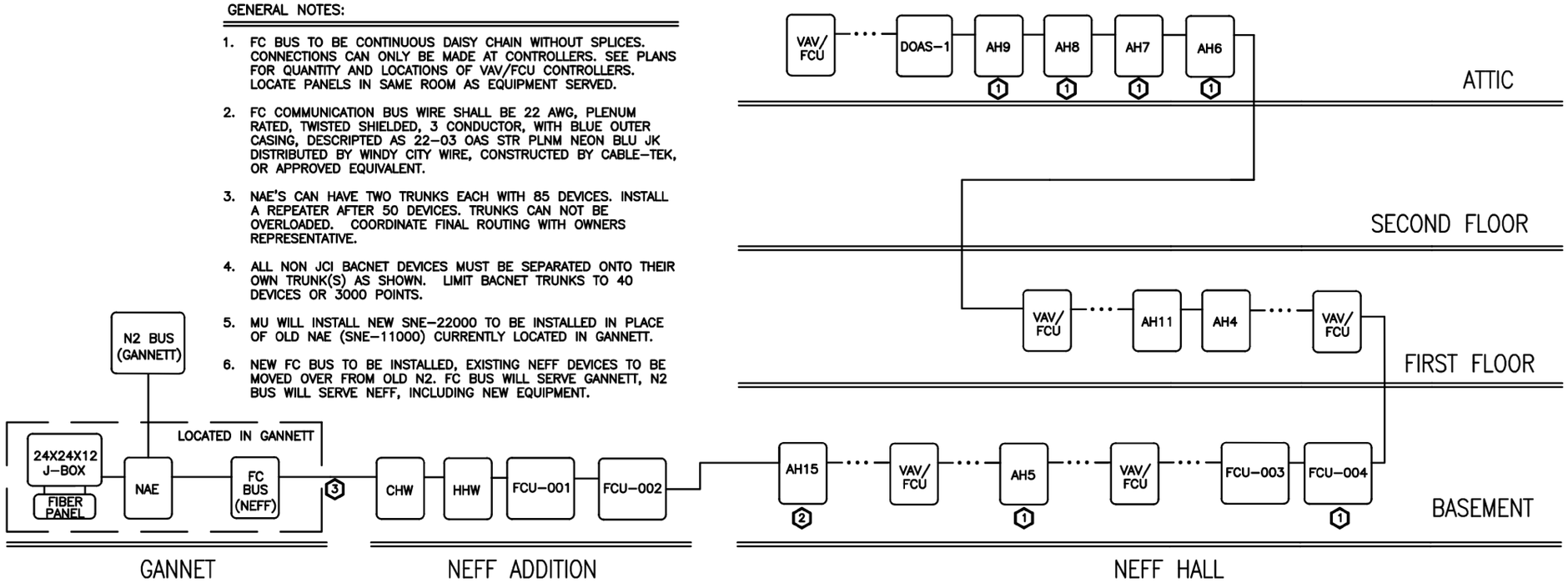
2. FC COMMUNICATION BUS WIRE SHALL BE 22 AWG, PLENUM RATED, TWISTED SHIELDED, 3 CONDUCTOR, WITH BLUE OUTER CASING, DESCRIPTED AS 22-03 OAS STR PLNM NEON BLU JK DISTRIBUTED BY WINDY CITY WIRE, CONSTRUCTED BY CABLE-TEK, OR APPROVED EQUIVALENT.

3. NAE'S CAN HAVE TWO TRUNKS EACH WITH 85 DEVICES. INSTALL A REPEATER AFTER 50 DEVICES. TRUNKS CAN NOT BE OVERLOADED. COORDINATE FINAL ROUTING WITH OWNERS REPRESENTATIVE.

4. ALL NON JCI BACNET DEVICES MUST BE SEPARATED ONTO THEIR OWN TRUNK(S) AS SHOWN. LIMIT BACNET TRUNKS TO 40 DEVICES OR 3000 POINTS.

5. MU WILL INSTALL NEW SNE-22000 TO BE INSTALLED IN PLACE OF OLD NAE (SNE-11000) CURRENTLY LOCATED IN GANNETT.

6. NEW FC BUS TO BE INSTALLED, EXISTING NEFF DEVICES TO BE MOVED OVER FROM OLD N2. FC BUS WILL SERVE GANNETT, N2 BUS WILL SERVE NEFF, INCLUDING NEW EQUIPMENT.



F FC BUS SCHEMATIC DIAGRAM
NO SCALE

KEYED NOTES:

1. MU SHALL REPLACE EXISTING CONTROLLER WITH NEW CONTROLLER.
2. DEVICE IS NOT CURRENTLY ON METASYS. MU SHALL PROVIDE A NEW CONTROLLER.
3. PROVIDE NEW FC BUS FROM NAE IN GANNET, THROUGH NEFF ADDITION MECHANICAL ROOM, AND TO NEFF HALL.

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	DESCRIPTION	DATE	APPR
A1	PHASE 2 ADD# 01	03/07/24	MHB

ISSUED FOR 02/09/24

CONSTRUCTION PHASE 2

STATE OF MISSOURI
Matthew Hayes Bridges
NUMBER PE-2010018578
PROFESSIONAL ENGINEER
02/09/2024

NEFF HALL - HVAC UPGRADES PHASE 2

UNIVERSITY OF MISSOURI
309 S 9TH STREET COLUMBIA, MO 65201

Non-Reduced Sheet Size 30" x 42"
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DESIGNED	DRAWN
MHB	MHB
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CHECKED	CHECK DATE
JAK	02/09/24

SHEET TITLE
CONTROLS SCHEMATICS

PROJECT NO.
CP231442
DRAWING ISSUED DATE:
03/07/24
SHEET
M701

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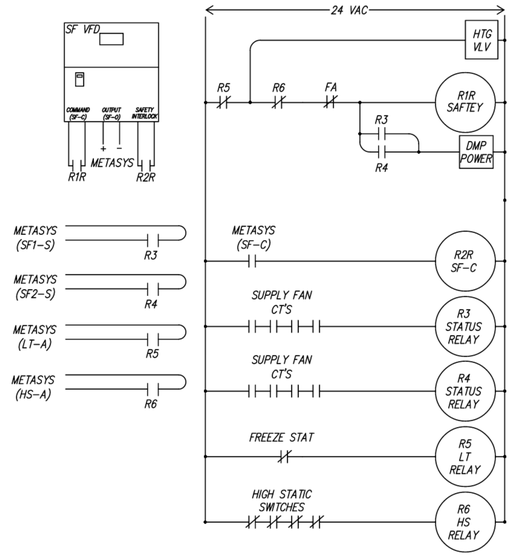


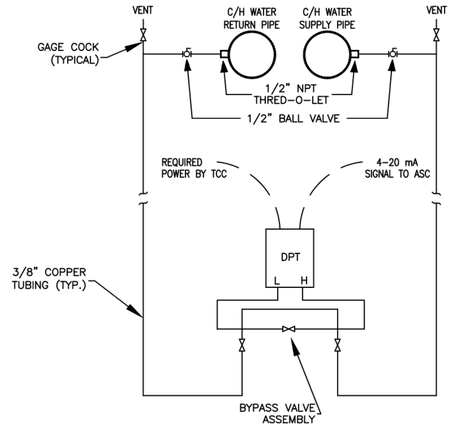
DEVICES (SEE SPECS):

R1R	24VAC RIBU1C
R2R	24VAC RIBU1C
R3	24VAC CONTROL RELAY –2POLE
R4	24VAC CONTROL RELAY –2POLE
R5	24VAC CONTROL RELAY –2POLE
R6	24VAC CONTROL RELAY –2POLE

GENERAL NOTES:

1. KEEP ALL LOW VOLTAGE CONTROL WIRING (UNDER 25V) AND LOW VOLTAGE POWER WIRING (OVER 25V) SEPARATED. (RUN IN SEPARATE CONDUIT.)
2. QUANTITIES OF CONTACTS FOR CT'S, FREEZE STATS, HIGH STATIC PRESSURE SWITCHES, MOTOR OVERLOADS IS GENERIC. COORDIANTE THE QUANTITY OF DEVICES/CONTACTS TO SUIT THE PROJECT'S NEEDS. PROVIDE RELAYS WITH MULTIPLE CONTACTS AS REQUIRED.
3. ANY DISCONNECT WITH AUX CONTACTS WILL BE ADDED TO SAFETY CIRCUIT.
4. MOUNT R1R, R2R, AND R4R ON GUTTER UNDER VFD
5. IF MORE THAN ONE FAN MOTOR IS USED THAT REQUIRE MULTIPLE OVERLOADS, WIRE OVERLOADS IN SERIES.
6. ON UNITS WITH MULTIPLE FANS, WIRE FAN STATUS CT'S IN SERIES. DIVIDE CT'S EQUALLY BETWEEN BI STATUS INPUTS. MAX 4 CT'S PER STATUS BI. ADD STATUS BI'S FOR UNITS WITH MORE THAN 8 FANS.

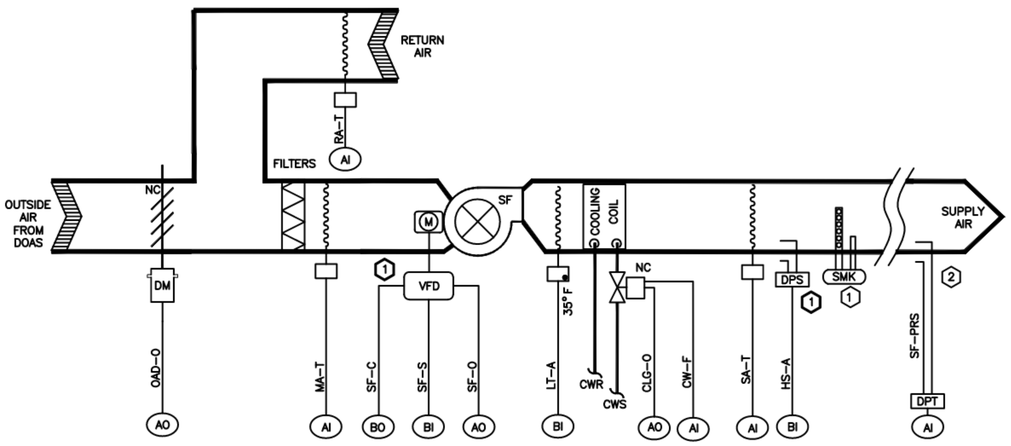
(D) MA VFD START CIRCUIT
NO SCALE



NOTES:

1. LOCATE VENTS AT ALL HIGH POINTS IN TUBING LINES.
2. DPT MUST BE ACCESSIBLE. COORDINATE FINAL INSTALLATION HEIGHT WITH OWNERS REPRESENTATIVE. SEE MECH. DRAWINGS FOR LOCATION.
3. BYPASS VALVE ASSEMBLY TO BE PRE-MANUFACTURED. SEE SPECIFICATIONS. ALL PIPING TO BE COPPER.
4. ENERGIZE DPT PER MANUFACTURER'S RECOMMENDATIONS TO ENSURE MEMBRANE IS NOT DAMAGED.

(I) TYPICAL DPT ARRANGEMENT
NO SCALE



AH 4, 11, 15 SYSTEM DDC POINTS LIST
PANEL LOCATION: MECH ROOM

TYPE	POINT NAME	DESCRIPTION	DEVICE
AI	SA-T	SUPPLY AIR TEMP	RTD/DUCT AVERAGING
AI	SF-PRS	SUPPLY FAN STATIC PRESS	DIFF PRESS TRANSMITTER
AI	RA-T	RETURN AIR TEMP	RTD/DUCT AVERAGING
AI	MA-T	MIXED AIR TEMP	RTD/DUCT AVERAGING
AI	CW-F	CHILLED WATER FLOW	PIC VALVE FLOW METER
AO	OAD-O	OUTSIDE AIR DAMPER OUTPUT	ELECT ACTUATOR W/SPRING RTN
AO	SF-O	SUP FAN OUTPUT	VFD
AO	CLG-O	COOLING VALVE OUTPUT	ELECT ACTUATOR W/SPRING RTN
BI	SF-S	SUPPLY FAN STATUS	CURRENT SWITCH
BI	HS-A	HIGH STATIC ALARM	DUCT DIFF PRESS SWITCH
BI	LT-A	LOW TEMP ALARM	FREEZE STAT
BO	SF-C	SUPPLY FAN COMMAND	CONTROL RELAY

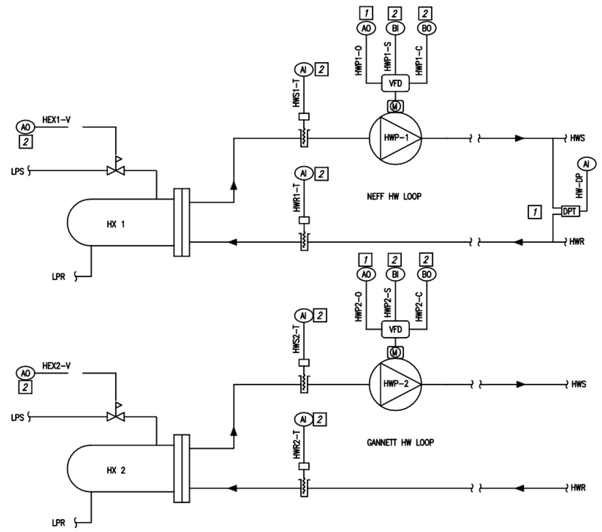
(A) AH 4, 11, 15 CONTROLS
NO SCALE

KEYED NOTES:

1. SEE AHU START CIRCUIT DETAIL.
2. LOCATE AS SHOWN ON MECH PLANS.

GENERAL NOTES:

1. SEE SPECIFICATIONS FOR DEVICE SPECIFICATIONS.
2. ANY DEVICE REQUIRING POWER MUST BE POWERED BY CONTRACTOR.



HOT WATER SYSTEM DDC POINTS LIST

TYPE	POINT NAME	DESCRIPTION	DEVICE
AI	HWS1-T	NEFF HW SUPPLY TEMPERATURE	EXISTING RTD/THERMOWELL
AI	HWR1-T	NEFF HW RETURN TEMPERATURE	EXISTING RTD/THERMOWELL
AI	HW-DP	NEFF HW DIFFERENTIAL PRESSURE	NEW DP TRANSMITTER
AO	HEX1-V	NEFF HEX PRV VALVE	EXISTING 0-10V PILOT
AO	HWP1-O	NEFF HW PUMP OUTPUT	NEW VFD
BI	HWP1-S	NEFF HW PUMP STATUS	EXISTING CURRENT SWITCH
BO	HWP1-C	NEFF HW PUMP COMMAND	EXISTING CONTROL RELAY
AI	HWS2-T	GANNETT HW SUPPLY TEMPERATURE	EXISTING RTD/THERMOWELL
AI	HWR2-T	GANNETT HW RETURN TEMPERATURE	EXISTING RTD/THERMOWELL
AO	HEX2-V	GANNETT HEX PRV VALVE	EXISTING 0-10V PILOT
AO	HWP2-O	GANNETT HW PUMP OUTPUT	NEW VFD
BI	HWP2-S	GANNETT HW PUMP STATUS	EXISTING CURRENT SWITCH
BO	HWP2-C	GANNETT HW PUMP COMMAND	EXISTING CONTROL RELAY

KEYED NOTES
1. NEW CONTROL DEVICE/POINT.
2. EXISTING CONTROL DEVICE/POINT.

(D) HOT WATER SYSTEM CONTROL SCHEMATIC
NO SCALE

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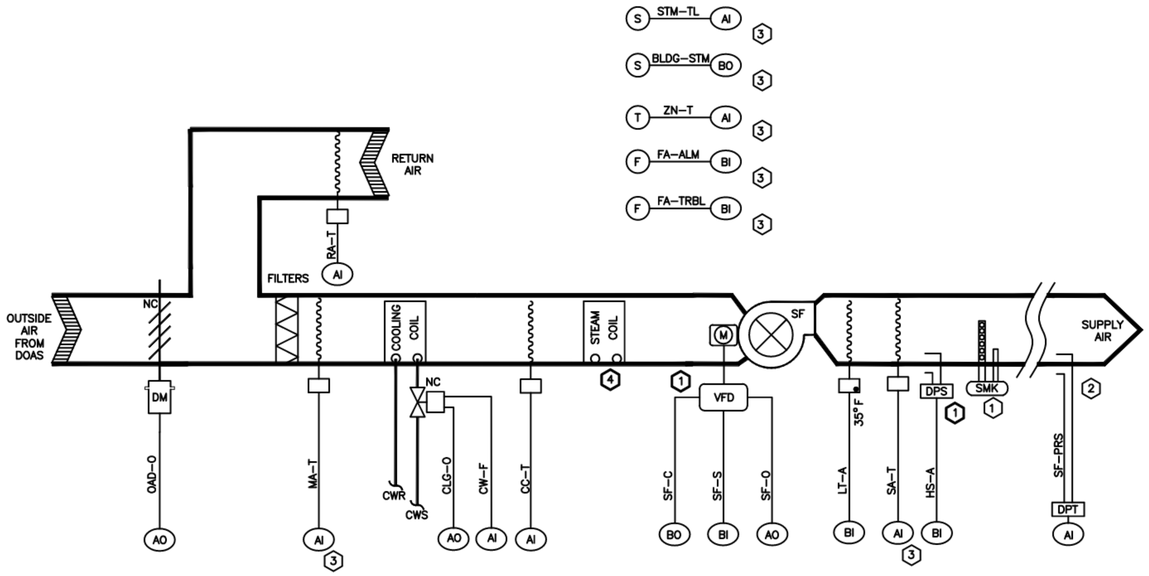
PROJECT NO. **CP231442**
DRAWING ISSUED DATE: **03/07/24**
SHEET
M702



A AH-5 CONTROLS
NO SCALE

AH-5 SYSTEM DDC POINTS LIST
PANEL LOCATION: MECH ROOM

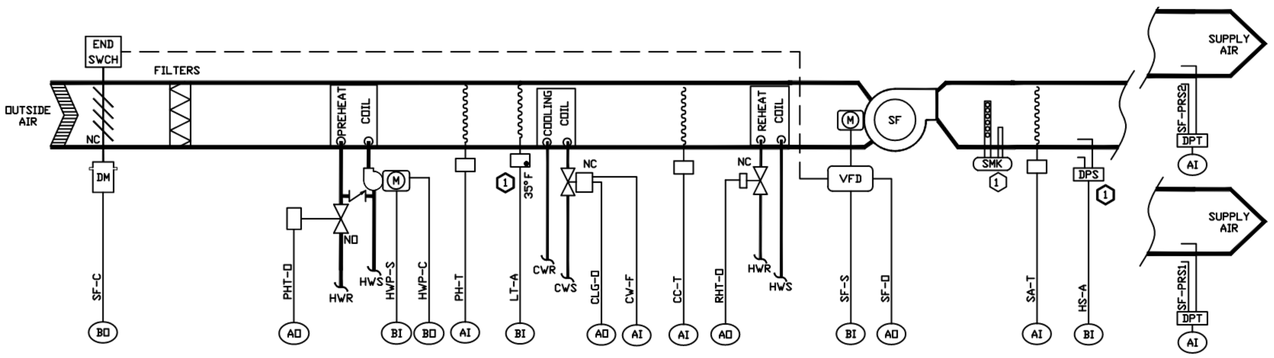
TYPE	POINT NAME	DESCRIPTION	DEVICE
AI	SA-T	SUPPLY AIR TEMP	EXISTING RTD/DUCT AVERAGING
AI	SF-PRS	SUPPLY FAN STATIC PRESS	DIFF PRESS TRANSMITTER
AI	RA-T	RETURN AIR TEMP	RTD/DUCT AVERAGING
AI	MA-T	MIXED AIR TEMP	EXISTING RTD/DUCT AVERAGING
AI	CC-T	COOLING COIL TEMP	RTD/DUCT AVERAGING
AI	ZN-T	ZONE TEMPERATURE	EXISTING ZONE TEMP SENSOR
AI	STM-TL	STEAM TOTALIZATION	EXISTING TOTALIZATION POINT
AI	CW-F	CHILLED WATER FLOW	PIC VALVE FLOW METER
AO	OAD-O	OUTSIDE AIR DAMPER OUTPUT	ELECT ACTUATOR W/SPRING RTN
AO	SF-O	SUP FAN OUTPUT	VFD
AO	CLG-O	COOLING VALVE OUTPUT	ELECT ACTUATOR W/SPRING RTN
BI	SF-S	SUPPLY FAN STATUS	CURRENT SWITCH
BI	HS-A	HIGH STATIC ALARM	DUCT DIFF PRESS SWITCH
BI	LT-A	LOW TEMP ALARM	FREEZE STAT
BI	FA-ALM	FIRE ALARM	EXISTING FIRE ALARM CONTROL PANEL
BI	FA-TRBL	FIRE ALARM TROUBLE	EXISTING FIRE ALARM CONTROL PANEL
BO	SF-C	SUPPLY FAN COMMAND	CONTROL RELAY
BO	BLDG-STM	BUILDING STEAM ENABLE	EXISTING CONTROL RELAY

KEYED NOTES:

1. SEE AHU START CIRCUIT DETAIL.
2. LOCATE AS SHOWN ON MECH PLANS.
3. EXISTING DEVICE/POINT TO REMAIN AND BE CONNECTED TO NEW CONTROLLER.
4. STEAM COIL ABANDONED IN PLACE.

GENERAL NOTES:

1. SEE SPECIFICATIONS FOR DEVICE SPECIFICATIONS.
2. ANY DEVICE REQUIRING POWER MUST BE POWERED BY CONTRACTOR.
3. EXISTING AH-5 CONTROLLER TO BE RELOCATED AND UPGRADED WITH NEW CONTROLLER. EXISTING CONTROL WIRING CAN BE RE-USED IF WIRE LENGTH IS ADEQUATE. RE-PULL WIRES THAT ARE TO SHORT. NO SPLICES ARE ALLOWED.



A DOAS-1 CONTROLS
NO SCALE
ELECTRICAL ROOMS

DOAS-1 SYSTEM DDC POINTS LIST
PANEL LOCATION: ATTIC

TYPE	POINT NAME	DESCRIPTION	DEVICE
AI	OA-T	OUTSIDE AIR TEMP	SOFTWARE POINT
AI	PH-T	PREHEAT TEMP	RTD/DUCT AVERAGING
AI	SA-T	SUPPLY AIR TEMP	RTD/DUCT AVERAGING
AI	CC-T	COOLING COIL TEMP	RTD/DUCT AVERAGING
AI	SF-PRS1	SFAN STATIC PRESS	DIFF PRESS TRANSMITTER
AI	SF-PRS2	SFAN STATIC PRESS	DIFF PRESS TRANSMITTER
AI	CW-F	CHILLED WATER FLOW	PIC VALVE FLOW METER
AO	SF-SC	SFAN SPD CNTRL	VFD
AO	CLG-O	COOLING OUTPUT	ELEC ACTUATOR W/ SPRING RTN
AO	PHT-O	PREHEAT OUTPUT	ELEC ACTUATOR W/ SPRING RTN
AO	RHT-O	REHEAT OUTPUT	ELEC ACTUATOR W/ SPRING RTN
BI	SF-S	SUPPLY FAN STATUS	CURRENT SWITCH
BI	HWP-S	HOT WATER PUMP STATUS	CURRENT SWITCH
BI	HS-A	HIGH STATIC ALARM	DUCT DIFF PRESS SWITCH
BO	SF-C	SUPPLY FAN COMMAND	CONTROL RELAY
BO	HWP-C	HOT WATER PUMP COMMAND	CONTROL RELAY

KEYED NOTES:

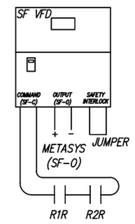
1. SEE AHU START CIRCUIT DETAIL.

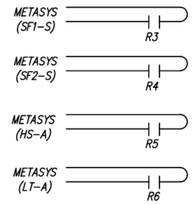
GENERAL NOTES:

1. SEE SPECIFICATIONS FOR DEVICE SPECIFICATIONS.
2. ANY DEVICE REQUIRING POWER MUST BE POWERED BY CONTRACTOR.

DEVICES (SEE SPECS):

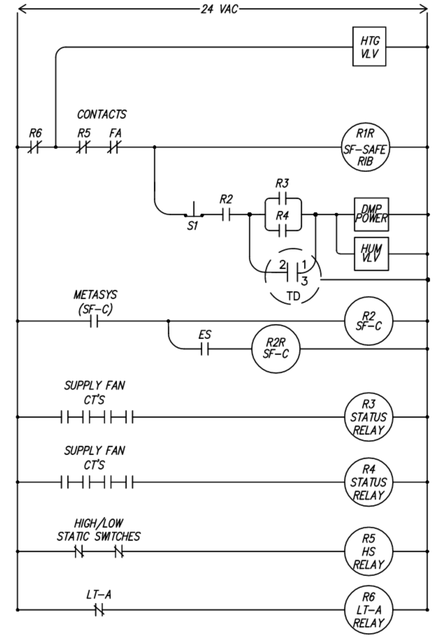
ES	OA DAMPER END SWITCH
FA	FIRE ALARM RELAY SIGNAL
S1	NC PUSH BUTTON SWITCH
TD	SOLID STATE TIMER-CONTACTS CLOSE FOR 2 MIN, WHEN PWR IS APPLIED
R1R	24VAC RIBIUC
R2R	24VAC RIBIUC
R2	24VAC CONTROL RELAY -2POLE
R3	24VAC CONTROL RELAY -2POLE
R4	24VAC CONTROL RELAY -2POLE
R5	24VAC CONTROL RELAY -2POLE
R6	24VAC CONTROL RELAY -2POLE





GENERAL NOTES:

1. KEEP ALL LOW VOLTAGE CONTROL WIRING (UNDER 25V) AND LOW VOLTAGE POWER WIRING (OVER 25V) SEPARATED. (RUN IN SEPARATE CONDUIT.)
2. PROVIDE RELAYS WITH MULTIPLE CONTACTS AS REQUIRED.
3. NOT ALL DEVICES ARE REQUIRED FOR EACH AHU. SEE AHU CONTROL DIAGRAMS
4. MOUNT S1 RESET IN I\O DOOR
5. ANY DISCONNECT WITH AUX CONTACTS WILL BE ADDED TO SAFETY CIRCUIT
6. MOUNT RELAY R1R AND R2R ON GUTTER UNDER VFD
7. HAM STM ISO SHOULD GO THROUGH SF-S RELAY
8. ON UNITS WITH MULTIPLE FANS, WIRE FAN STATUS CT'S IN SERIES. DIVIDE CT'S EQUALLY BETWEEN BI STATUS INPUTS. MAX 4 CT'S PER STATUS BI. ADD STATUS BI'S FOR UNITS WITH MORE THAN 8 FANS.



D DOAS WITH VFD START CIRCUIT
NO SCALE

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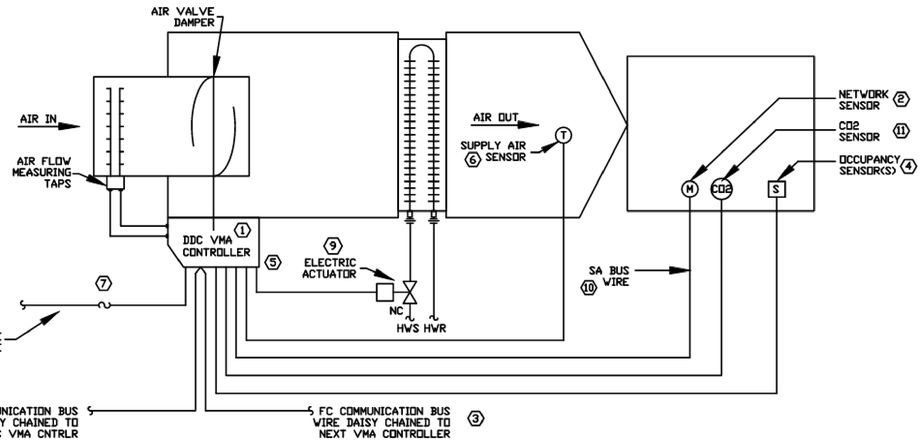


(B) VAV BOX CONTROL DIAGRAM WITH REHEAT
NO SCALE

NOTES:

1. VMA TERMINAL INCLUDES CONSTANT VOLUME (CV) UNITS & VARIABLE AIR VOLUME (VAV) UNITS. UNLESS OTHERWISE NOTED, ALL CONTROL WORK SHALL BE BY CONTRACTOR.
2. CAPS FOR VAV DP TEST PORTS MUST BE NEOPREME CAPS OR 1/4" BRASS PLUGS. NO RUBBER CAPS ALLOWED.

KEYED NOTES:

(1) CONTROLLER WILL BE FURNISHED BY OWNER. CONTROLLER WILL BE JCI MODEL MS-VMA-16XX SERIES OR M4-CVM-3050. PROGRAMMING WILL BE PROVIDED BY OWNER.

(2) NETWORK SENSOR WILL BE FURNISHED BY OWNER & INSTALLED BY CONTRACTOR. NETWORK SENSOR WILL BE JCI NS SERIES.

(3) FC COMMUNICATION BUS WIRE SHALL BE 22 AWG, PLENUM RATED, TWISTED SHIELDED, 3 CONDUCTOR, WITH BLUE OUTER CASING, DESCRIPTED AS 22-03 OAS STR PLNM NEON BLU JK DISTRIBUTED BY WINDY CITY WIRE CONSTRUCTED BY CABLE-TEK, OR APPROVED EQUIVALENT.

(4) INSTALLATION OF OCC SENSOR IS WORK OF DIVISION 26, SEE E-SERIES SHEETS FOR FINAL LOCATIONS. A CONTROL CIRCUIT SHALL BE CONNECTED TO ALL OCC SENSORS AS WORK OF DIVISION 23. A CONTROL SIGNAL SHALL BE RELAYED TO THE VAV TERMINAL UNIT THAT SERVES THAT SPACE. IN LOCATIONS WHERE MULTIPLE OCC SENSORS ARE PRESENT, ALL SENSORS SHALL BE MONITORED AND TRANSMIT A SIGNAL TO THE VAV TERMINAL UNIT WITHIN THAT SPACE. ALL SENSORS SHALL BE WIRED IN PARALLEL.
OCCUPANCY SENSOR WIRING MUST BE RAN BACK TO VAV CONTROLLER FOR OWNER TERMINATION.
PRIOR TO CEILING GRID INSTALLATION. OCC SENSOR INSTALLATION AND TERMINATIONS BY CONTRACTOR.

(5) CONTROLLER MUST HAVE A MINIMUM OF 18 INCHES OF ACCESSIBLE CLEARANCE.

(6) VAV SUPPLY TEMP SENSOR 1000 OHM PLATINUM RTD LOCATED APPROX. 8 FT. FROM VAV BOX DISCHARGE. PROVIDED, INSTALLED, & WIRED TO CONTROLLER BY CONTRACTOR.

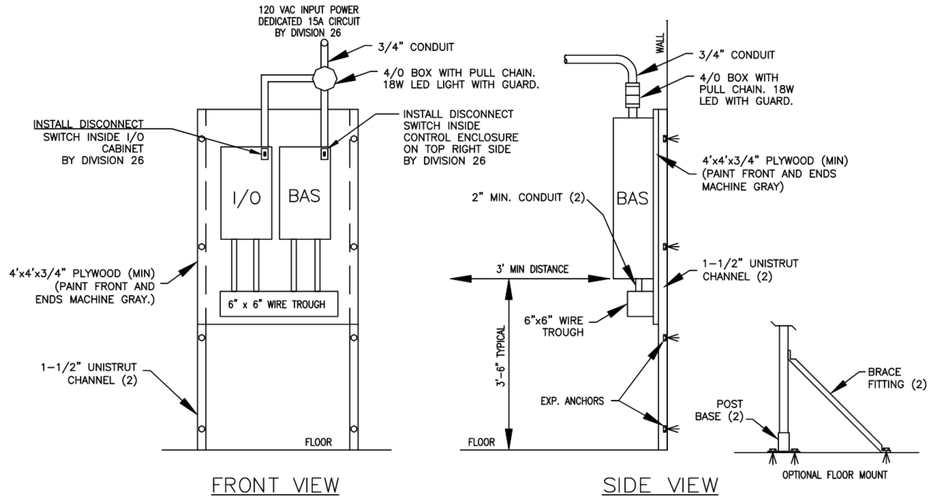
(7) FUSE LOCATED WITHIN 2 FT. OF VMA CONTROLLER. IN LINE REMOVABLE FUSE, NOT FIXED TO FUSE HOLDER.

(8) LOW VOLTAGE WIRE BY DIVISION 23. SEE ELECTRICAL DRAWINGS FOR SOURCE.

(9) VALVE WITH PROPORTIONAL 0-10 VOLT ACTUATOR OR EQUIVALENT.

(10) SA BUS WIRE SHALL BE 22 AWG, PLENUM RATED, TWISTED SHIELDED, 4 CONDUCTOR.

(11) CO2 SENSOR. SEE PLANS FOR LOCATIONS.

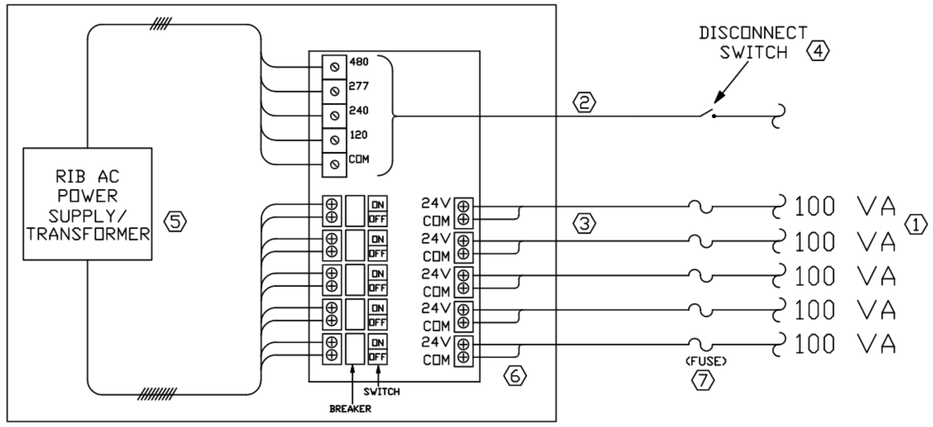


NOTES:

1. BAS CONTROLLERS AND CABINET ARE SUPPLIED BY OWNER AND MOUNTED BY CONTRACTOR. I/O CABINET AND COMPONENTS PROVIDED BY CONTRACTOR.
2. KEEP ALL LOW VOLTAGE CONTROL WIRING (UNDER 25V) AND LOW VOLTAGE POWER WIRING (OVER 25V) SEPARATED. (RUN IN SEPARATE CONDUIT).
3. PLYWOOD SIZE IS BASED ON THE NUMBER OF CONTROLLERS IN EACH LOCATION. COORDINATE WITH OWNERS REPRESENTATIVE.

(E) BAS PANEL MOUNTING DETAIL
NO SCALE

PSH500A
ENCLOSED AC POWER SUPPLY



NOTES:

1. SECONDARY LINE CAN BE RAN IN SAME CONDUIT AS FC BUS
2. ENCLOSED POWER SUPPLY MUST BE LOCATED IN ELECTRICAL ROOM, MECHANICAL ROOM, OR JANITOR'S CLOSET AND BE ACCESSIBLE. ANY OTHER LOACAION MUST BE APPROVED BY THE OWNER'S REPRESENTATIVE

KEYED NOTES:

(1) EACH SECONDARY OUTPUT LINE CAN POWER 3-5 VAV CONTROLLERS MAXIMUM. (100 VA)

(2) PRIMARY LINE INFO: 480/277/240/120 Vac, #12 AWG MINIMUM

(3) SECONDARY LINE INFO: 24 Vac, #12-26 AWG, 100 VA. MAX LENGTH 175 FEET USING #14 AWG

(4) DISCONNECT SWITCH REQUIRED, EXTERNALLY MOUNTED WITHIN 12 INCHES OF RIB POWER SUPPLY

(5) 500VA POWER SUPPLY - INCLUDED IN RIB MODEL# PSH500A OR APPROVED EQUIVALENT

(6) ALL SECONDARY LINES MUST BE LABELED IN ENCLOSURE AS TO WHICH VAV'S THEY POWER PRIOR TO ENERGIZING POWER SUPPLY

(7) A SEPARATE 3 AMP FUSE IS REQUIRED WITHIN 3 FEET OF EACH VAV

(C) VAV BOX POWER SUPPLY DIAGRAM
NO SCALE

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02/09/2024

NEFF HALL - HVAC UPGRADES PHASE 2
UNIVERSITY OF MISSOURI
309 S 9TH STREET COLUMBIA, MO 65201

Non-Reduced Sheet Size 30" x 42"
Full sized plans have been prepared using standard scales. Reduced sized plans may not conform to standard scales.

DESIGNED	DRAWN
MHB	MHB
FIELD	FIELD BOOK
CHECKED JAK	CHECK DATE 02/09/24

SHEET TITLE
CONTROLS SCHEMATICS

PROJECT NO. CP231442
DRAWING ISSUED DATE: 03/07/24
SHEET
M704

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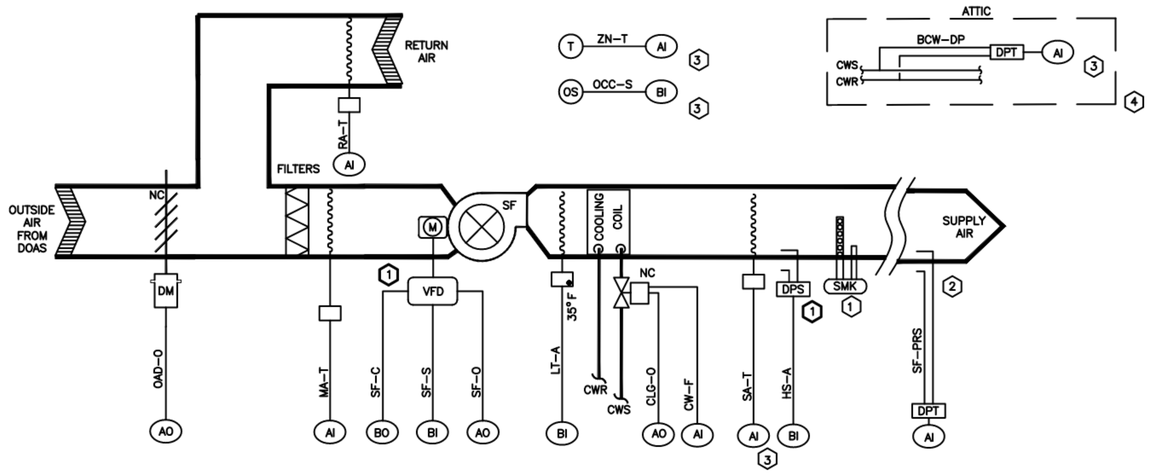


AH-6 & AH-9 SYSTEM DDC POINTS LIST

PANEL LOCATION: ATTIC

TYPE	POINT NAME	DESCRIPTION	DEVICE
AI	SA-T	SUPPLY AIR TEMP	EXISTING RTD/DUCT AVERAGING
AI	SF-PRS	SUPPLY FAN STATIC PRESS	DIFF PRESS TRANSMITTER
AI	RA-T	RETURN AIR TEMP	RTD/DUCT AVERAGING
AI	MA-T	MIXED AIR TEMP	RTD/DUCT AVERAGING
AI	ZN-T	ZONE TEMPERATURE	EXISTING ZONE TEMPERATURE SENSOR
AI	CW-F	CHILLED WATER FLOW	PIC VALVE FLOW METER
AO	OAD-O	OUTSIDE AIR DAMPER OUTPUT	ELECT ACTUATOR W/SPRING RTN
AO	SF-O	SUPPLY FAN OUTPUT	VFD
AO	CLG-O	COOLING VALVE OUTPUT	ELECT ACTUATOR W/SPRING RTN
BI	SF-S	SUPPLY FAN STATUS	CURRENT SWITCH
BI	HS-A	HIGH STATIC ALARM	DUCT DIFF PRESS SWITCH
BI	LT-A	LOW TEMP ALARM	FREEZE STAT
BI	OCC-S	OCCUPANCY STATUS	EXISTING OCCUPANCY SENSOR
BO	SF-C	SUPPLY FAN COMMAND	CONTROL RELAY

AH-6 ADDITIONAL POINTS

PANEL LOCATION: ATTIC

TYPE	POINT NAME	DESCRIPTION	DEVICE
AI	BCW-DP	BUILDING CW DIFF PRESS	EXISTING DIFF PRESS TRANSMITTER

(A) AH-6 & AH-9 CONTROLS

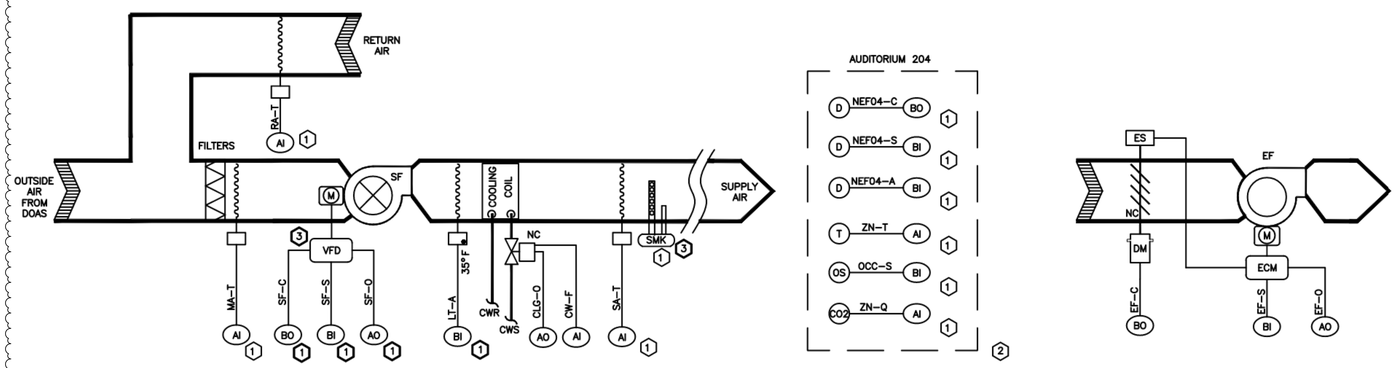
NO SCALE

KEYED NOTES:

1. SEE AHU START CIRCUIT DETAIL.
2. LOCATE AS SHOWN ON MECH PLANS.
3. EXISTING DEVICE/POINT TO REMAIN AND BE CONNECTED TO NEW CONTROLLER.
4. DEVICE/POINT TO BE LANDED ON AH-6.

GENERAL NOTES:

1. SEE SPECIFICATIONS FOR DEVICE SPECIFICATIONS.
2. ANY DEVICE REQUIRING POWER MUST BE POWERED BY CONTRACTOR.
3. EXISTING AH-9 CONTROLLER TO BE RELOCATED AND UPGRADED WITH NEW CONTROLLER. EXISTING CONTROL WIRING CAN BE RE-USED IF WIRE LENGTH IS ADEQUATE. RE-PULL WIRES THAT ARE TO SHORT. NO SPLICES ARE ALLOWED.
4. REPLACE EXISTING AH-6 CONTROLLER IN EXISTING LOCATION. EXISTING CONTROL WIRING CAN BE RE-USED IF WIRE LENGTH IS ADEQUATE. RE-PULL WIRES THAT ARE TOO SHORT. NO SPLICES ARE ALLOWED.



(A) AH-7 & AH-8 CONTROLS

NO SCALE

AH 7 & 8 SYSTEM DDC POINTS LIST

PANEL LOCATION: ATTIC

TYPE	POINT NAME	DESCRIPTION	DEVICE
AI	SA-T	SUPPLY AIR TEMP	EXISTING RTD/DUCT AVERAGING
AI	RA-T	RETURN AIR TEMP	EXISTING RTD/DUCT AVERAGING
AI	MA-T	MIXED AIR TEMP	EXISTING RTD/DUCT AVERAGING
AI	CW-F	CHILLED WATER FLOW	PIC VALVE FLOW METER
AO	SF-O	SUPPLY FAN SPEED OUTPUT	EXISTING VFD
AO	CLG-O	COOLING VALVE OUTPUT	ELECT ACTUATOR W/SPRING RTN
AO	EF-O	EXHAUST FAN SPEED OUTPUT	EC MOTOR
BI	SF-S	SUPPLY FAN STATUS	EXISTING CURRENT SWITCH
BI	EF-S	EXHAUST FAN STATUS	CURRENT SWITCH
BI	LT-A	LOW TEMP ALARM	EXISTING FREEZE STAT
BO	SF-C	SUPPLY FAN COMMAND	EXISTING CONTROL RELAY
BO	EF-C	EXHAUST FAN COMMAND	CONTROL RELAY

AH 7 ADDITIONAL POINTS

PANEL LOCATION: ATTIC

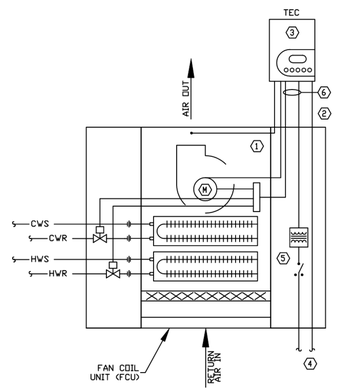
TYPE	POINT NAME	DESCRIPTION	DEVICE
AI	ZN-T	ZONE TEMP SENSOR	EXISTING ZONE TEMPERATURE SENSOR
AI	ZN-Q	ZONE CO2 LEVEL	EXISTING SPACE CO2 SENSOR
BI	OCC-S	OCCUPANCY SENSOR	EXISTING OCCUPANCY SENSOR
BI	NEF04-S	AUD 204 DOOR STATUS	EXISTING CURRENT SWITCH
BI	NEF04-A	AUD 204 DOOR ALARM	EXISTING DOOR ALARM
BO	NEF04-C	AUD 204 DOOR COMMAND	EXISTING CONTROL RELAY

KEYED NOTES:

1. EXISTING DEVICE/POINT TO REMAIN AND BE CONNECTED TO NEW CONTROLLER.
2. DEVICE/POINT TO BE LANDED ON AH-7.
3. SEE AHU START CIRCUIT DETAIL.

GENERAL NOTES:

1. SEE SPECIFICATIONS FOR DEVICE SPECIFICATIONS.
2. ANY DEVICE REQUIRING POWER MUST BE POWERED BY CONTRACTOR.
3. EXISTING AH-7 & AH-8 CONTROLLER TO BE RELOCATED AND UPGRADED WITH NEW CONTROLLERS. EXISTING CONTROL WIRING CAN BE RE-USED IF WIRE LENGTH IS ADEQUATE. RE-PULL WIRES THAT ARE TO SHORT. NO SPLICES ARE ALLOWED.



KEYED NOTES:

1. FAN RELAYS AND CONTROL VALVE WIRING SHALL BE CONNNECTED TO A TERMINAL STRIP IN THE FCU AT THE FACTORY.
2. ALL CONDUIT AND WIRING SHALL BE BY CONTRACTOR. WIRING SHALL BE PROVIDED FROM FCU TERMINAL STRIP TO THE THERMOSTAT LOCATION WITH AN EXTRA 3-FOOT LENGTH OF WIRE AT THE THERMOSTAT LOCATION.
3. THERMOSTAT CONTROLLER WILL BE FURNISHED AND INSTALLED BY OWNER. CONTROLLER WILL BE JCI MODEL TEC SERIES. CONTRACTOR SHALL ROUGH-IN CONDUIT AND BOX FOR MOUNTING REMOTELY LOCATED THERMOSTATS. OWNER WILL TERMINATE, PROGRAM, AND COMMISION CONTROLLER AFTER POWER IS ENERGIZED TO FCU.
4. FC COMMUNICATION BUS WIRE SHALL BE 22 AWG PLENUM RATED, TWISTED SHIELDED, 3 CONDUCTOR. FC BUS TO BE PULLED BY CONTRACTOR AND SHALL BE CONTINUOUS DAISY CHAIN WITHOUT SPLICES. SEE FC LAYOUT DETAIL. LEAVE EXTRA 3-FOOT OF WIRE AT THERMOSTAT LOCATION.
5. SERVICE DISCONNECT/SWITCH AND TRANSFORMER PROVIDED AND INSTALLED BY CONTRACTOR.
6. 8 CONDUCTOR 22 GAUGE TWISTED, SHIELDED, STRANDED WIRE
7. PROVIDE DISCHARGE AIR TEMPERATURE SENSOR.
8. PROVIDE CURRENT SWITCH FOR FAN STATUS.

(D) FAN COIL UNIT DETAIL

NO SCALE

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REVISION HISTORY

	DESCRIPTION	DATE	APPR
A1	PHASE 2 ADD# 01	03/07/24	MHB

ISSUED FOR 02/09/24
CONSTRUCTION PHASE 2

STATE OF MISSOURI
Matthew Hayes Bridges
NUMBER PE-2010018578
PROFESSIONAL ENGINEER
02/09/2024

NEFF HALL - HVAC UPGRADES PHASE 2
UNIVERSITY OF MISSOURI
309 S 9TH STREET COLUMBIA, MO 65201

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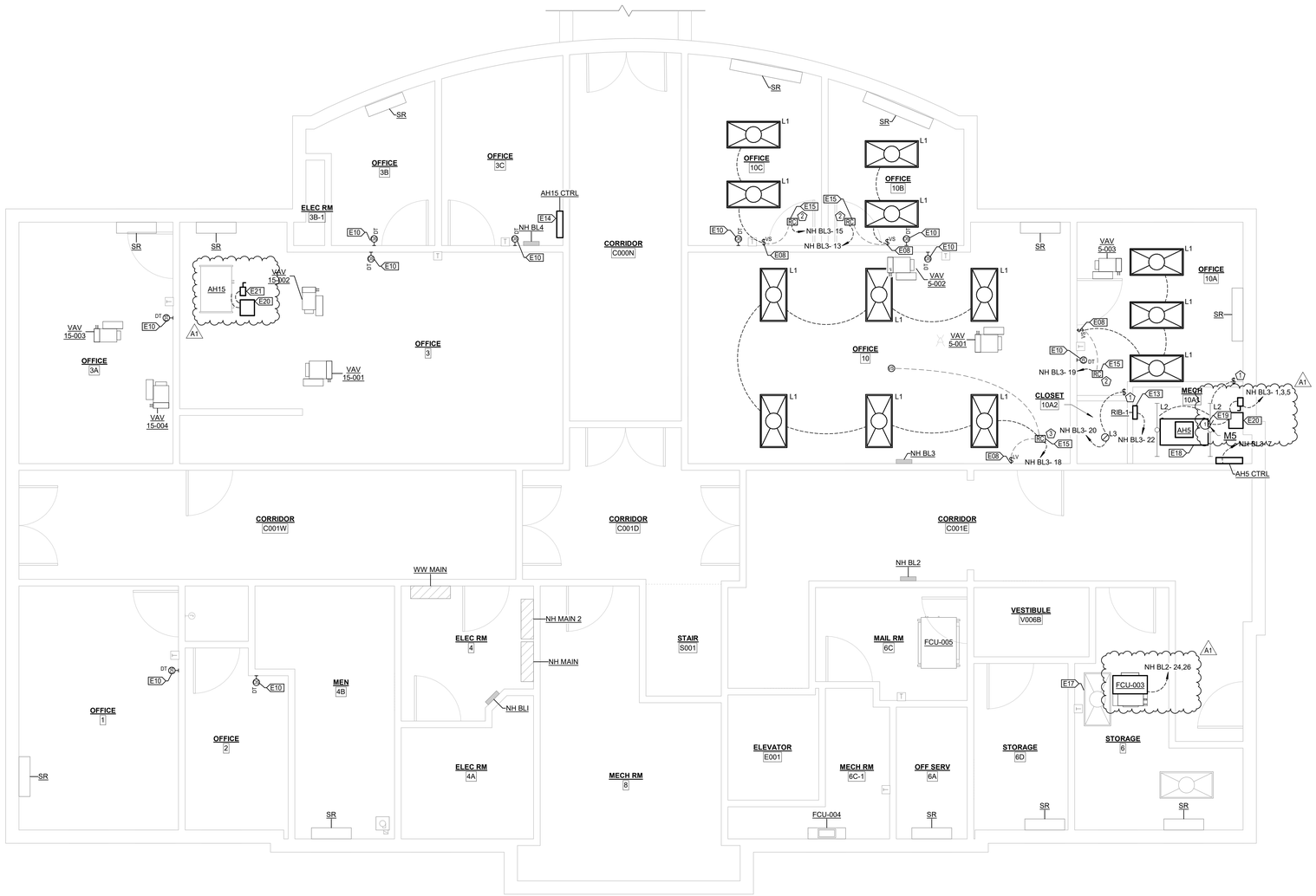
SHEET TITLE
CONTROLS SCHEMATICS

PROJECT NO. CP231442
DRAWING ISSUED DATE: 03/07/24
SHEET M705

KEYNOTE LEGEND

VALUE	DESCRIPTION
E08	FURNISH AND INSTALL NEW LIGHT SWITCH IN EXISTING WALL BOX.
E10	FURNISH AND INSTALL OCCUPANCY SENSOR. FURNISH AND INSTALL COMMUNIATION WIRING BACK TO LOCAL CONTROL PANEL. FURNISH AND INSTALL COMMUNICATION WIRING IN WIREMOLD. PAINT WIREMOLD TO MATCH WALL COLOR.
E13	FURNISH, INSTALL, AND WIRE NEW RIB POWER SUPPLY AND CONNECT TO ALL VAV BOXES ON FLOOR LEVEL.
E14	EXTEND EXISTING ELECTRICAL FEEDERS AS REQUIRED TO CONNECT TO NEW CONTROL PANEL.
E15	FURNISH AND INSTALL WATTSTOPPER DLM ROOM CONTROLLER.
E17	RELOCATE EXISTING LIGHT FIXTURE AS REQUIRED TO FACILITATE INSTALLATION OF NEW FAN COIL UNIT.
E18	REPLACE EXISTING SUPPLY FAN MOTOR WITH 1/2 HP, GENERAL PURPOSE, THREE PHASE, OPEN DRIP PROOF MOTOR.
E19	FURNISH AND INSTALL NEW SUPPLY FAN MOTOR. WIRE MOTOR TO NEW VARIABLE FREQUENCY DRIVE.
E20	FURNISH AND INSTALL NEW SUPPLY FAN MOTOR VARIABLE FREQUENCY DRIVE. WIRE TO NEW DISCONNECT SWITCH.
E21	RECONNECT EXISTING FEEDERS TO NEW 20 AMP DISCONNECT SWITCH.



1 BASEMENT ELECTRICAL PLAN
1/4" = 1'-0"

0 2' 4' 8'
SCALE: 1/4" = 1'-0"

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REVISION HISTORY

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CONSTRUCTION PHASE 2

STATE OF MISSOURI
Matthew Hayes Bridges
NUMBER PE-2010018578
PROFESSIONAL ENGINEER
02/09/2024

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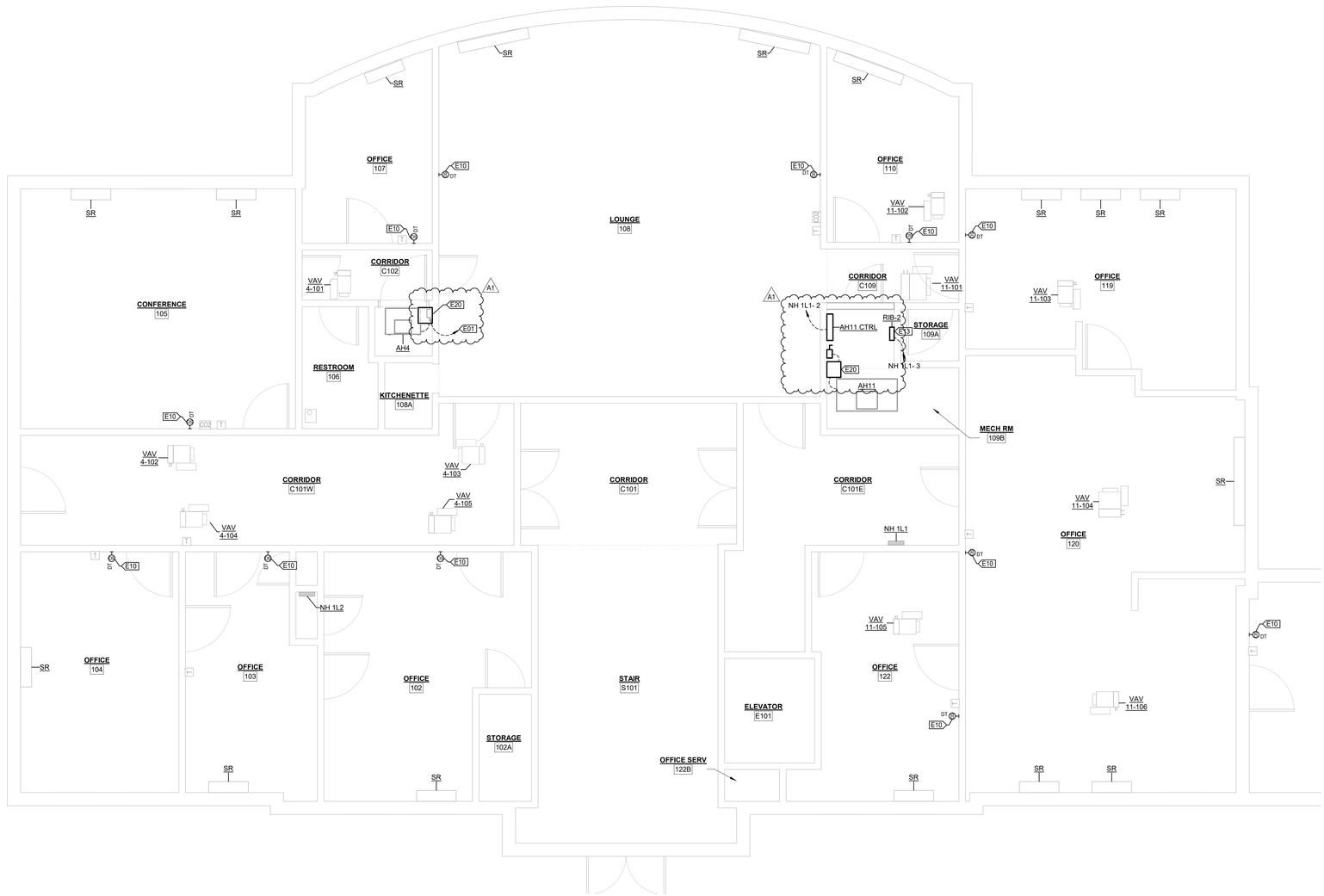
SHEET TITLE
BASEMENT ELECTRICAL PLAN

PROJECT NO. **CP231442**
DRAWING ISSUED DATE: **03/07/24**
SHEET
E101

KEYNOTE LEGEND

VALUE	DESCRIPTION
E01	EXTEND EXISTING ELECTRICAL FEEDERS FROM PREVIOUS AH4 LOCATION, IN BASEMENT, TO NEW AH4 LOCATION.
E10	FURNISH AND INSTALL OCCUPANCY SENSOR. FURNISH AND INSTALL COMMUNIATION WIRING BACK TO LOCAL CONTROL PANEL. FURNISH AND INSTALL COMMUNICATION WIRING IN WIREMOLD. PAINT WIREMOLD TO MATCH WALL COLOR.
E13	FURNISH, INSTALL, AND WIRE NEW RIB POWER SUPPLY AND CONNECT TO ALL VAV BOXES ON FLOOR CLOSED.
E20	FURNISH AND INSTALL NEW SUPPLY FAN MOTOR VARIABLE FREQUENCY DRIVE. WIRE TO NEW DISCONNECT SWITCH.



1 FIRST FLOOR ELECTRICAL PLAN
1/4" = 1'-0"

N

0 2' 4' 8'
SCALE: 1/4" = 1'-0"

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Matthew Hayes Bridges
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309 S 9TH STREET COLUMBIA, MO 65201

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FIRST FLOOR ELECTRICAL PLAN

PROJECT NO. **CP231442**
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SHEET

E102

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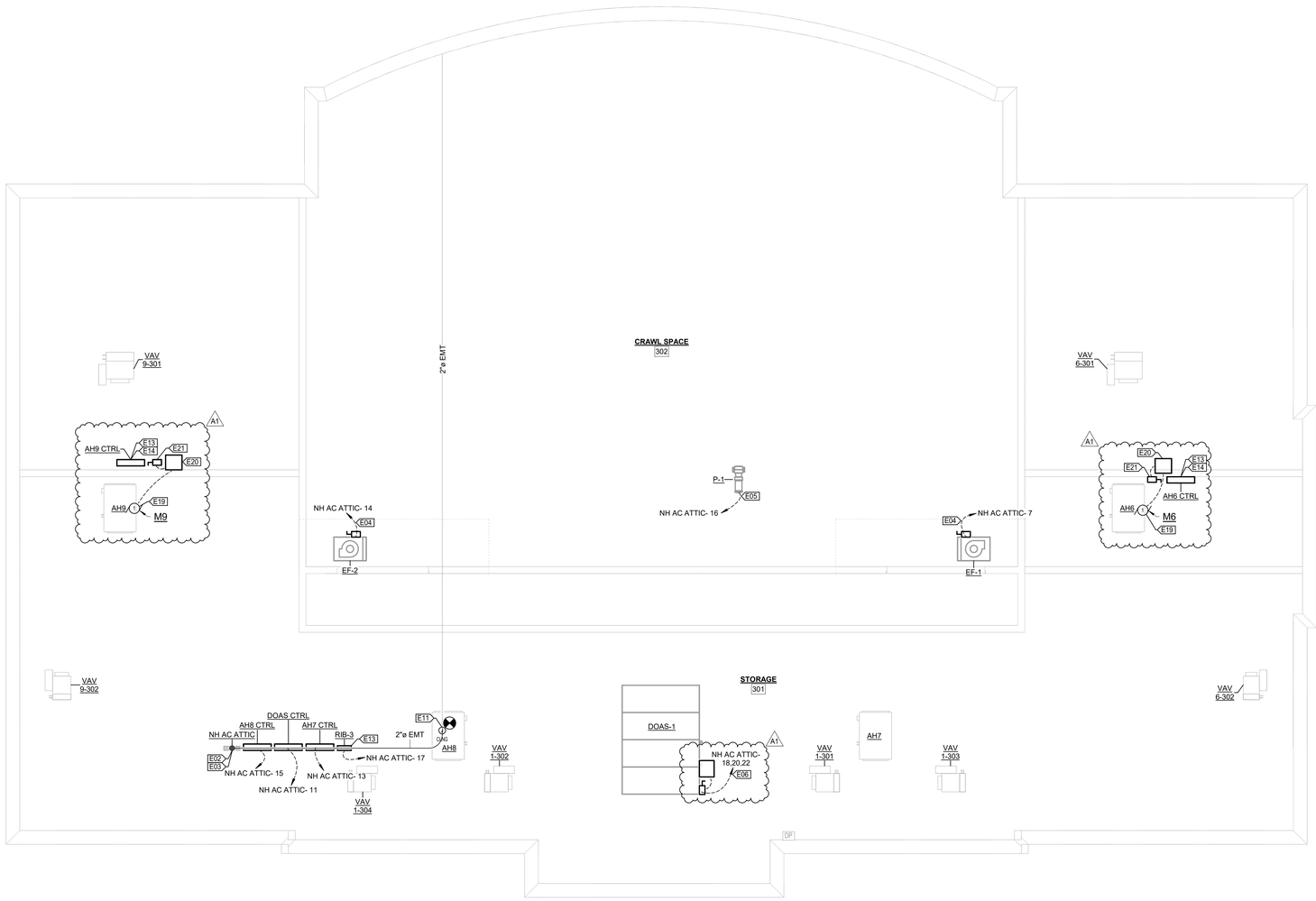
KEYNOTE LEGEND

VALUE	DESCRIPTION
E02	NEW LOCATION FOR EXISTING 208V, 3PH, 100 AMP, 30 POLE SQUARE D PANEL IN ATTIC. FABRICATE AND INSTALL STRUT FRAME TO MOUNT NH ATTIC PANEL, BUS BAR, AND NEW CONTROL PANEL IN NEW LOCATION.
E03	FURNISH AND INSTALL NEW 20 AMP, SINGLE POLE SPARE CIRCUIT BREAKERS IN SLOTS 21, 23, AND 25.
E04	CONNECT TO EXISTING 20 AMP, SINGLE POLE SPARE CIRCUIT BREAKER.
E05	FURNISH AND INSTALL NEW 20 AMP, SINGLE POLE CIRCUIT BREAKER IN EXISTING PANEL SPACE.
E06	FURNISH AND INSTALL NEW 30 AMP, THREE POLE CIRCUIT BREAKER IN EXISTING PANEL SPACE.
E11	FURNISH AND INSTALL NEW CEILING MOUNTED JUNCTION BOX. FURNISH AND INSTALL NEW FEEDERS AND CONDUIT TO NEW PANEL LOCATION.
E13	FURNISH, INSTALL, AND WIRE NEW RIB POWER SUPPLY AND CONNECT TO ALL VAV BOXES ON FLOOR LEVEL.
E14	EXTEND EXISTING ELECTRICAL FEEDERS AS REQUIRED TO CONNECT TO NEW CONTROL PANEL.
E19	FURNISH AND INSTALL NEW SUPPLY FAN MOTOR. WIRE MOTOR TO NEW VARIABLE FREQUENCY DRIVE.
E20	FURNISH AND INSTALL NEW SUPPLY FAN MOTOR VARIABLE FREQUENCY DRIVE. WIRE TO NEW DISCONNECT SWITCH.
E21	RECONNECT EXISTING FEEDERS TO NEW 20 AMP DISCONNECT SWITCH.



1 ATTIC ELECTRICAL PLAN
1/4" = 1'-0"

0 2' 4' 8'
SCALE: 1/4" = 1'-0"

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CONSTRUCTION PHASE 2

STATE OF MISSOURI
Matthew Hayes Bridges
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PROFESSIONAL ENGINEER
02/09/2024

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SHEET TITLE

ATTIC ELECTRICAL PLAN

PROJECT NO. **CP231442**
DRAWING ISSUED DATE: **03/07/24**
SHEET

E104

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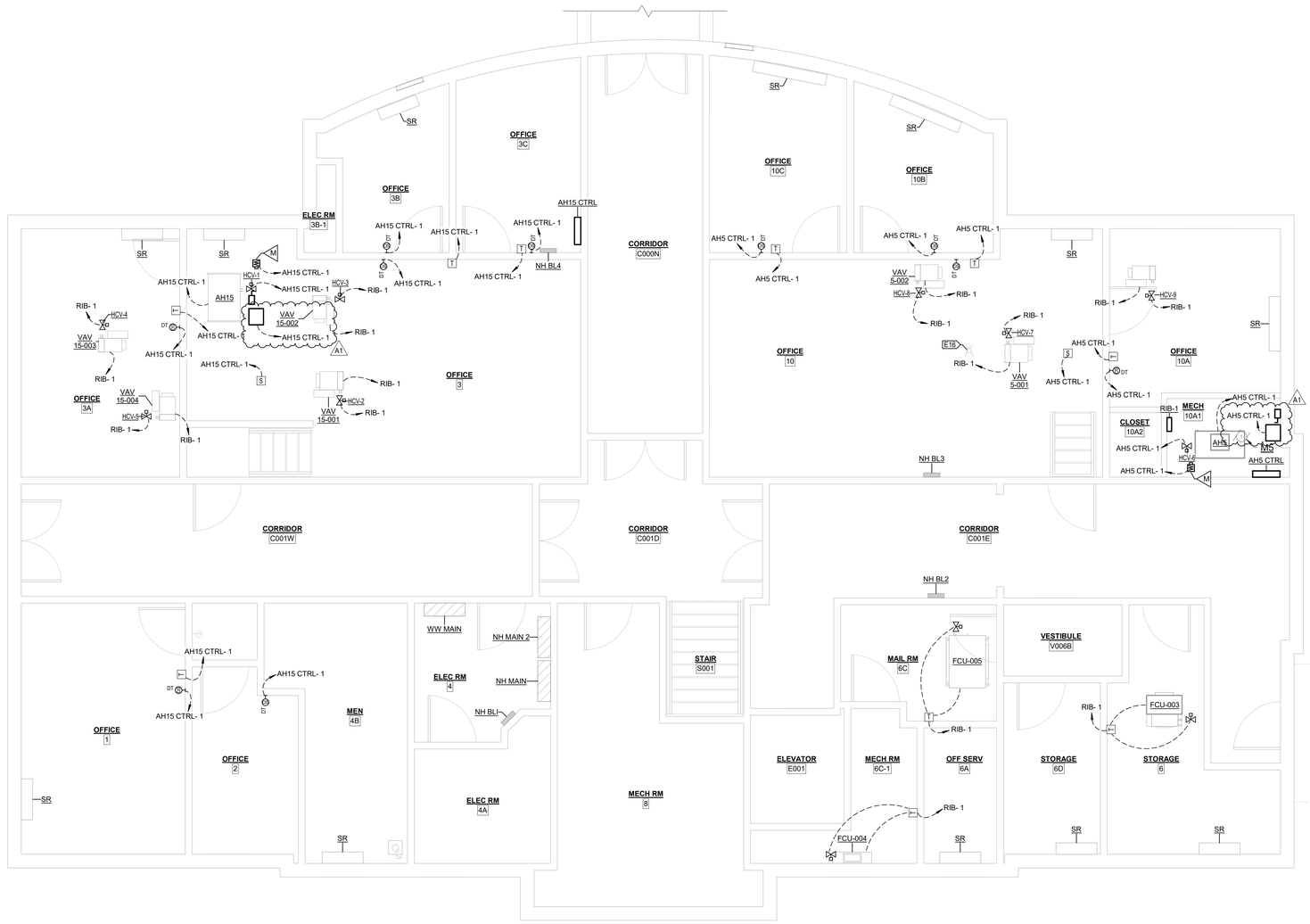
KEYNOTE LEGEND	
VALUE	DESCRIPTION
E16	RELOCATE AND REINSTALL EXISTING WIRELESS ACCESS POINT AS REQUIRED.



1 BASEMENT LOW VOLTAGE PLAN
1/4" = 1'-0"

0 2' 4' 8'
SCALE: 1/4" = 1'-0"

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STATE OF MISSOURI
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02/09/2024

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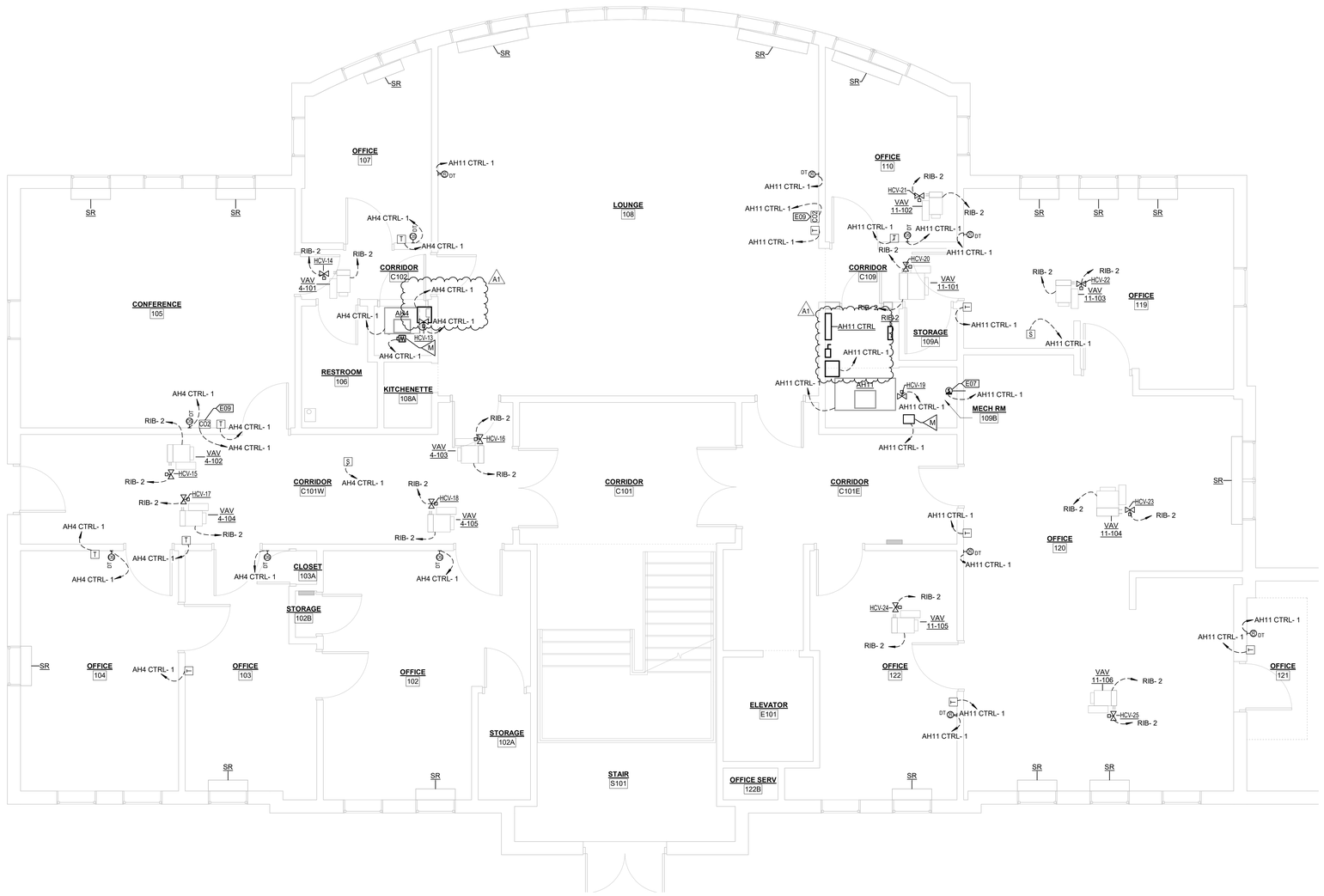
BASEMENT LOW VOLTAGE PLAN

PROJECT NO.
CP231442

DRAWING ISSUED DATE:
03/07/24

SHEET
E105

KEYNOTE LEGEND	
VALUE	DESCRIPTION
E07	FURNISH AND INSTALL NEW DUCT MOUNTED SMOKE DETECTOR ON AIR HANDLING UNIT RETURN DUCT.
E09	FURNISH AND INSTALL CARBON DIOXIDE SENSOR. FURNISH AND INSTALL COMMUNIATION WIRING BACK TO LOCAL CONTROL PANEL.



1 FIRST FLOOR LOW VOLTAGE PLAN
1/4" = 1'-0"

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FIRST FLOOR LOW VOLTAGE PLAN

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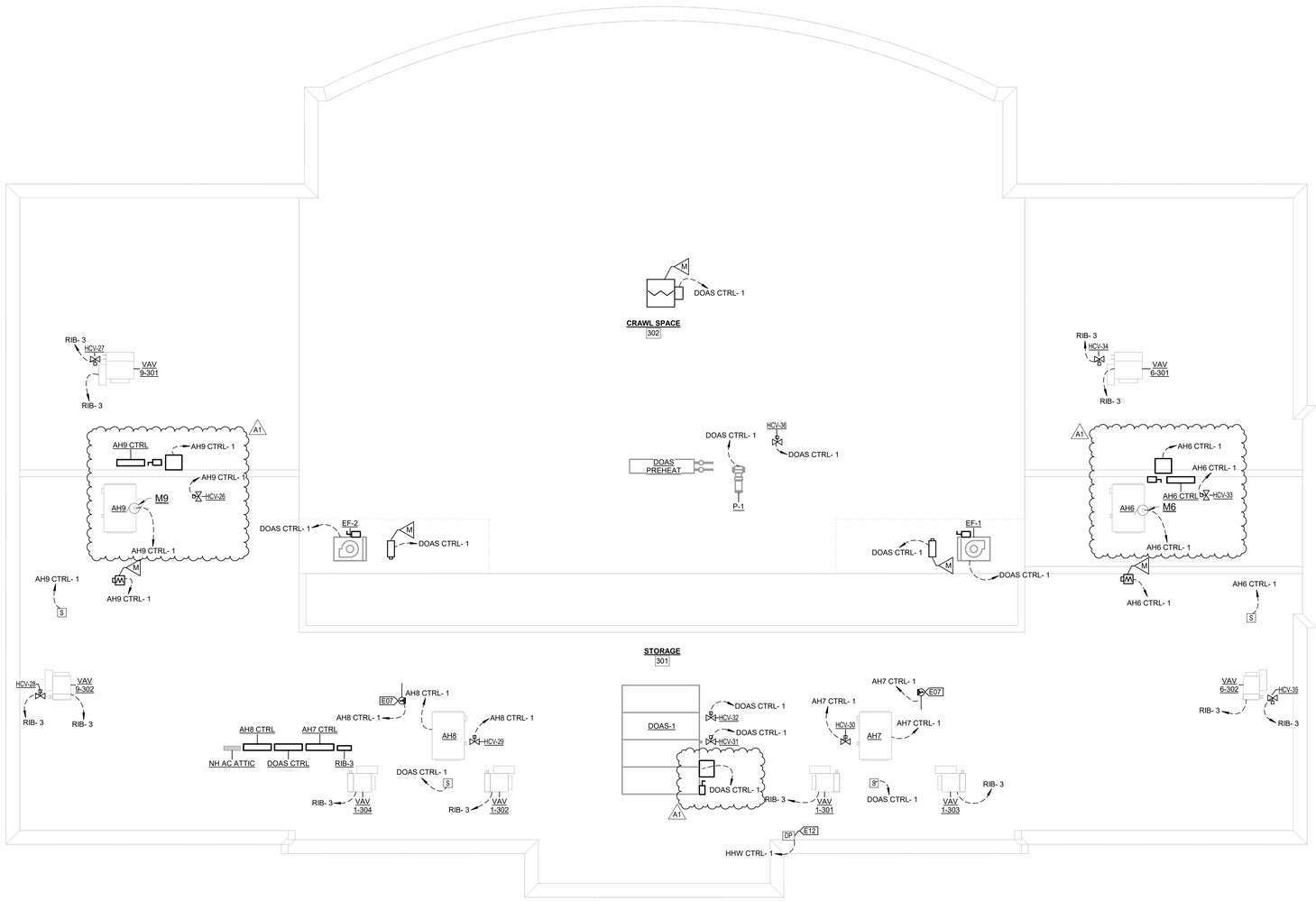
SHEET
E106

KEYNOTE LEGEND	
VALUE	DESCRIPTION
E07	FURNISH AND INSTALL NEW DUCT MOUNTED SMOKE DETECTOR ON AIR HANDLING UNIT RETURN DUCT.
E12	WIRE HEATING WATER DIFFERENTIAL PRESSURE SENSOR TO NEFF ADDITION MECHANICAL ROOM CONTROLLER FOR HEATING WATER PUMPS.



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E108

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