

Addendum 01

DOCUMENT 00 9100

DATE: July 01, 2025

PROJECT: Zane Grey Intermediate School MVHC Clinic Renovation
968 Pine Street
Zanesville, Ohio 43701

PROJECT #: 25006.02

ARCHITECT: Garmann Miller
38 South Lincoln Drive
P.O. Box 71
Minster, Ohio 45865

TO: Prospective Bidders

This addendum form is a part of the Contract Documents and modifies the Bidding Documents titled "Construction Documents," dated June 17, 2025, with amendments and additions noted below.

Acknowledge receipt of this Addendum on the Bid Form. Failure to do so may disqualify the Bidder.

This addendum consists of 2 pages, 2 specification sections, and 6 re-issued drawing sheets.

FOR INFORMATION ONLY

1. Pre-bid meeting minutes and the pre-bid meeting sign-in sheet are attached.

CHANGES TO THE PROJECT MANUAL

1. Section 23 09 13 – Instruments and Control Elements:
 - a. Added section
2. Section 23 09 93 – Sequence of Operations:
 - a. Revised multiple paragraphs throughout section – Refer to attached section for additional information.



CHANGES TO THE DRAWINGS

1. Drawing Sheet A6.1 Door Schedule & Door Details:
 - a. Add hardware sets to door schedule.
 - b. Revise detail 13/A6.1 to include structural steel lintel and plate.
2. Drawing MD1.1 Mechanical Demolition Plan – Unit A:
 - a. Altered the amount of ductwork removed from the existing locker room
3. Drawing Sheet M2.1 First Floor Mechanical Plan – Unit A:
 - a. Updated equipment schedules
 - b. Changed condensing unit from 2 units to 1 unit
 - c. Additional details provided via keynotes
4. Drawing Sheet M3.1 Mechanical Piping Plan & Details
 - a. Updated AHU detail
 - b. Updated AHU Control detail
 - c. Revised tagging of piping plan
5. Drawing Sheet E2.1 Electrical Plans: Detail 3 First Floor Power Plan – Unit A:
 - a. Removed electrical connections associated with CU-2 from roof.
6. Drawing Sheet E3.1 Electrical One-Line Diagram and Schedules: Detail 1 Electrical One-Line Diagram:
 - a. Remove electrical connections and equipment associated with condensing unit CU-2 and change overcurrent protection for condensing unit CU-1 to 20A.

ATTACHMENTS

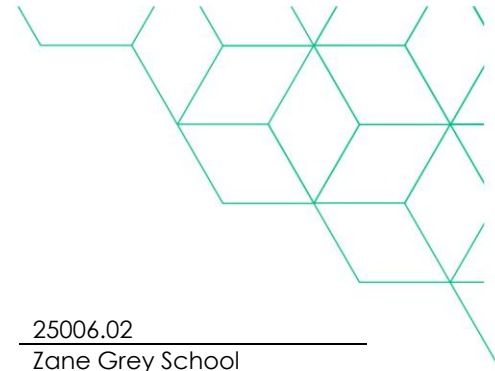
The following attachments are included and are part of this addendum:

Specification Sections: 23 09 13 and 23 09 93

Drawing Sheets: A6.1, MD1.1, M2.1, M3.1, E2.1 and E3.1

END OF ADDENDUM



**Pre-Bid meeting Minutes**

Project name Zane Grey MS MVHC Clinic Reno.
Meeting date 6/26/25

GM project no. 25006.02
Meeting location Zane Grey School

Minutes

1. Attendees: See Attached Sign in sheet
2. Introductions
3. Project overview
4. Bidding
 - a. Date: **2:00 p.m., July 14, 2025**
 - b. Location: **Zanesville City Schools**
Address: **956 Moxahala Avenue**
Address: **Zanesville, Ohio 43701**
 - a. Use the bid form provided
The bid opening will be at **2:00 p.m., July 14, 2025** at **Zanesville City Schools**
 - b. Plans have been submitted to **Muskingum County** for review and permits, costs to be paid by owner.
 - c. **Last day for questions – July 7, 2025**
5. Bid categories
 - a. General construction
6. Alternates
 - a. None
7. Contingency amounts to be included in bid
 - a. General construction: **\$15,000**
8. Contracts will be administered by Garmann/Miller & Associates, Inc.
 - a. All questions and correspondence to go through Garmann Miller
 - b. All RFIs to go through Garmann Miller
 - c. Pay applications to go to Garmann Miller
 - d. Garmann Miller will schedule a preconstruction meeting with the contractor after the notice of award
9. Schedule
 - a. Tentative award date – **June 15, 2025**
 - b. Start of construction – **August 1, 2025**
 - c. Completion date – **December 31, 2025**
 - i. Liquidated Damages – See Supplementary Conditions



10. General conditions
 - a. Waste Removal: Each prime contractor
 - b. General Contractor
 - i. Responsible for construction schedule and general supervision
 - ii. Submit preliminary schedule 10 days after notice to proceed
 - iii. Responsible for scheduling and administering job meetings; prepare agenda, responsible for meeting minutes and distributing copies
 - c. Responsible for field office
 - d. Responsible for telephone service/fax to field office.
 - e. Responsible for sanitary facilities
 - f. Barriers
 - g. Fencing
 - h. Exterior and interior enclosures
 - i. Project sign
11. Temporary electricity
 - a. Contractor may use existing building systems.
 - b. Electrical contractor to provide service, temporary power, temporary lighting as need.
12. Temporary heat
 - i. Contractor may use existing building systems.
13. Temporary water
 - i. Contractor may use existing building systems.
14. Substitution request by 8 days prior to bid.
15. Correspondence
 - a. Correspondence to run through the Garmann Miller
 - b. Architectural/ General – **Ted Musielewicz**, tmusielewicz@creategm.com
16. Questions
 - a. Is this project tax exempt?
 - i. Answer: Yes
 - b. Is this project subject to prevailing wage?
 - i. Answer: no
 - c. Can a blank bid bond form be provided?
 - i. Answer: reference State of Ohio Document 00 43 13 – Bid Security Form: <https://dam.assets.ohio.gov/image/upload/ofcc.ohio.gov/Portals/0/Documents/AgrmntsStdRgrmnts/LimitedScope/M140-00-43-13-Bid-Security-Form.pdf>
 - d. **Will the District salvage lockers?**
 - i. **Yes, turn over lockers & shower fixtures to the District.**

END



Sign-in Sheet

Project Name _____

GM Project No. _____

Meeting Location _____

Meeting Date _____

Purpose _____

Attendees

☐	Name	KERI DUW	Phone	740-373-0849
	Business/Title	GRAE-CAL CONSTRUCTION, LLC.		
	Email	KDUW@GRAECAL.COM		
☐	Name	Eric Roden	Phone	740-802-4974
	Business/Title	Ables H&Cooling		
	Email	eric.r@ablesinc.com		
☐	Name	Carter Paul	Phone	740-819-1935
	Business/Title	PCCI		
	Email	carter@paulconstruction.net		
☐	Name	CURT SPARKS	Phone	740-222-7952
	Business/Title	NEXGEN Construction Group		
	Email	Curt.SPARKS@nexgen-cg.com		
☐	Name		Phone	
	Business/Title			
	Email			
☐	Name		Phone	
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**SECTION 23 09 13
INSTRUMENTS AND CONTROL ELEMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Control panels.
- B. Dampers.
- C. Damper Operators:
- D. Transmitters:
 - 1. Building static pressure transmitters.
- E. Pressure Independent Control Valves (PICCV)
- F. Pressure Independent Control Valves (ePIV)
- G. Pressure Independent Control and Balance Valves (PICBV)
- H. Control valves.
- I. Control valve operators
- J. Control dampers.
- K. Damper operators.
- L. Transmitters
- M. Meters
- N. Building Automation System
- O. Building Automation Equipment
- P. Temperature Control Wiring
- Q. Miscellaneous accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 3516.01 - Material Documentation Sheet
- B. Section 01 5721 - IAQ Construction and Preoccupancy
- C. Section 01 5721.01 - IAQ Planning Checklist
- D. Section 01 5721.02 - IAQ Inspection Checklist
- E. Section 01 5721.03 - IAQ Log.
- F. Section 01 6116.01 - Accessory Material VOC Content Certification Form.
- G. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- H. Section 01 9000 - Commissioning. Contractor shall make themselves familiar with the commissioning specification and include appropriate time to work with the commissioning agent.
- I. Section 23 0548 - Vibration and Seismic Controls.
- J. Section 23 0519 - Meters and Gages: Thermometer sockets, gage taps.
- K. Section 23 05 19 - Meters and Gages: Thermometer sockets and gauge taps.
- L. Section 23 0553 - HVAC Identification
- M. Section 23 21 13 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, and gauge taps.

N. Section 23 33 00 - Air Duct Accessories: Installation of automatic dampers.

1.03 REFERENCE STANDARDS

- A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2012.
- B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- C. ASHRAE Standard 135-2008 BACnet Protocol.
- D. ASHRAE Standard 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Control Diagrams
 - 1. Submit to the Architect/Engineer a complete system diagram, showing control connections and devices and their connection to other equipment, together with a clearly written description of the system and an outline of its function under conditions of operation.
 - 2. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
 - 3. Submittals shall be prepared on, or folded to, 8-1/2 inch by 11 inch size and bound in brochure form. Electronic form, pdf format, shall also be included.
 - 4. DDC logic and control diagrams shall be included for all equipment and sequences of control. Include at a minimum all points shown on DDC control drawings. If any additional points are required to complete the sequence of operation, the control equipment needed to provide this information shall be provided.
 - 5. Upon completion of the Work, provide the complete, accurate, and approved diagrammatic blueprinted layouts on the automatic control system specified herein and as installed. Layouts shall show all control equipment including job installation changes, and the function of each system shall be indicated. Layouts and descriptions shall be included in the project record set and in the operating and maintenance manuals.
- C. Begin no work until submittals have been approved for conformity with design intent. Provide drawings as flash memory. When manufacturer's cutsheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Provide submittals within 12 weeks after contract award.
- D. 100% completed points lists and sequences shall be submitted no later than the point at which system installation is 50% completed.
- E. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module including, but not limited to the following equipment and components indicating arrangements, capabilities, range, voltage, horsepower, and construction.
 - 1. Valves
 - 2. Thermostats
 - 3. Relays
 - 4. Panels
 - 5. Gauges
 - 6. Sensors
 - 7. Dampers

8. Switches
 9. Pressure Controllers
 10. DDC microprocessor
 11. Unitary DDC controllers
 12. Actuators
 13. Blade Server (Supervisory Controller)
 14. Laptop Workstation
 15. Wiring
- F. Wiring diagrams and layouts for each control panel.
- G. Floor plan schematic diagrams indicating field sensor, controller and power supply locations.
- H. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- I. Provide information noting items utilizing BACnet technology are BTL certified and listed.
- J. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
1. Revise shop drawings to reflect actual installation and operating sequences.
 2. After drawings are finalized, provide drawings in pdf format. Include a list of all unit default safety and control settings, whether fixed or adjustable, as shipped from the factory. Where field modifications are required to meet the specification, provide all modification labor and materials, and submit a complete, detailed, step-by-step procedure for modifications.
 3. Drawings shall also be installed in workstation as web pages.
- K. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
1. As-built versions of the submittal product data.
 2. Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.
 3. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point/object reports, trending data, overriding computer control, and changing setpoints and variables.
 4. Programming manual or set of manuals with description of the programming language and syntax of statements for algorithms and calculations used of point/object database creation and modification, of program creation and modification, and editor use.
 5. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points/objects, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
 6. Documentation of all programs created using custom programming language including setpoints, tuning parameters, and object database.
 7. Graphic files, programs and database on magnetic or optical media.
 8. List of recommended spare parts with part numbers and suppliers.
 9. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware, including computer equipment and sensors.
 10. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
 11. Licenses, guarantee, and warranty documents for equipment and systems.

12. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
 13. Operation & Maintenance manuals shall also be installed in workstation as web pages.
- L. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
 - M. After the control submittal has been reviewed and marked "No Exceptions Taken" by the design engineer, the controls contractor shall submit all graphics required for the temperature control system. The graphics shall be reviewed by the owner, commissioning agent, and the design engineer. The temperature control contractor shall not install any graphics until they have been reviewed and approved by the owner, commissioning agent and design engineer.

1.05 SUMMARY

- A. General: The control system shall be as indicated on the drawings and described in the specifications.
- B. The intent of this specification and related sections is to provide a fully integrated, open, interoperable, peer-to-peer networked, distributed Direct Digital Control System. The following communication protocols are acceptable:
 1. ANSI/ASHRAE Standard 135 BACnet - A Data Communication Protocol for Building Automation and Control Networks
 2. ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard
- C. The Direct Digital Control System (DDC) shall be based on a Tridium Niagara N4 framework. Provide an open automation infrastructure that integrates diverse systems and devices (regardless of manufacturer, communication standard or software) into a unified platform that can be easily managed in real time over the internet using a standard web browser.
- D. It is the Owner's express goal to implement an open system that will allow products from various suppliers to be integrated into to a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the JACE, N4 Supervisor, and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the Owner. The Owner shall determine which organizations to be named in the SI organization ID ("orgid") of all software licenses. Owner shall be free to direct the modification of the "orgid" in any software license, regardless of supplier, by Tridium Inc.
- E. The Network Controller (NWC) shall connect to the Owner's local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely shall be accomplished through standard Web browsers and/or the N4 Supervisor, via the Internet and/or local area network.
- F. Each NWC shall communicate to BACnet (B-AAC, B-ASC), devices and/or other open protocol systems/devices as described on the contract drawings and/or in the specifications.
- G. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems for Owner.
- H. The control system shall accommodate a minimum 8 simultaneous multiple user operation utilizing standard web-browser clients. Access to the control system data should be limited only by user ID and operator password. Multiple users shall have access to all valid system data.

An operator shall be able to log onto any work-station on the school's network and have access to all appropriate data. All users shall have an unique ID and password. Owner shall provide user information and permission levels ninety days prior to scheduled completion.

- I. The control system shall be designed such that each mechanical system will be able to operate under stand-alone control. As such, in the event of a network communication failure, the loss of any other controller, or the school district network, the control system shall continue to independently operate under control.
- J. Communication between the control panels and all work-stations shall be over a high speed 100 Mbps (at minimum) Ethernet network. All nodes on this network shall be peers. The operator shall not have to know the panel identifier or location to view or control an object. Application Specific Controllers shall be constantly scanned by the network controllers to update point information and alarm information.
 - 1. The communication network wiring between control panels, and equipment controls with BACnet communication cards (chiller control panel, boiler control panels, domestic water heaters, and VFD's) shall be provided and installed by the temperature control contractor. The use of the owner's network for communication between devices shall be prohibited. Provide a single point of communication between the owner's network and the DDC control system network.
- K. Temperature control contractor shall be responsible for the following:
 - 1. The DDC System shall communicate to the owner's communication network thru a single point of data connection. All wiring and communication downstream of that single point of data connection shall be provided with the DDC control system.
 - 2. Providing of a complete DDC electronic automatic temperature control system.
 - 3. Control of heating water system, chilled water system, variable speed pumps, air handling units, VAV terminals, cabinet heaters, and exhaust fans along with other miscellaneous equipment as denoted on drawings in accordance with requirements herein specified.
 - 4. Providing of control devices, valves, instruments, and the like, as herein specified and as required to comply with required sequences of automatic control.
 - 5. Providing of wiring for secondary control devices, relay switches, safety low limit controls, etc., and such interlock wiring required.
 - 6. Provide all control wiring between all primary network controllers and equipment furnished with Bacnet control panels. Provide a single point connection to owner's LAN.
 - 7. Wire controls for the water pumps including the Variable Frequency Drives.
 - 8. Coordinate communication requirements for the air handling units controls that are provided by the air handling unit manufacturer.
 - 9. Tag all automatic controls, instruments, safeties, panels, actuators and relays. Key to control schematic. Refer to specification 23 0553 - HVAC Identification
 - 10. Furnish adequate supervision on Work performed for him by others to insure proper operation and the neatest and best possible arrangement.
 - 11. Testing and maintenance of system as herein specified.
- L. The documentation is schematic in nature. The Contractor shall provide hardware and software necessary to implement the functions and sequences shown.
- M. The Temperature control contractor shall provide the following control valves:
 - 1. Air Handling Unit Heating and Cooling Coils: Pressure Independent Characterized Control and balance valves with P/T ports or Pressure independent characterized control valves with separate P/T ports on both side of valve.
 - 2. VAR Boxes: Pressure Independent Characterized Control and balance valve with P/T ports or Pressure Independent characterized control valves with separate P/T ports on both sides of valve.

3. Cabinet Heaters: Provide 3-way on/off control valve.
4. Unit Heaters: Provide a 2-way on/off control valve.

1.06 QUALITY ASSURANCE

- A. The temperature control contractor shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems as herein specified. The installation of the control system shall be performed by an authorized dealer of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation or identification number, and sequence of operation all bearing the name of the manufacturer.
- B. All materials and equipment used shall be standard components, regularly manufactured for the specified system. All systems and components shall have been thoroughly tested and proven in actual use of at least 2 years.
- C. The temperature control contractor shall read all other Drawings and Specifications, become familiar with requirements and scope of the Project, and include such coordination work as may be required.
- D. Designer Qualifications: Design system under direct supervision of a Control Engineer experienced in design of this work and is certified by control system manufacturer.
- E. Installer Qualifications
 1. Installing contractor shall have an established working relationship with control system manufacturer of not less than 5 years.
 2. Installing contractor and his sub-contractors shall have successfully completed manufacturer's control system training. Provide certification of completed training, including hours of instruction and course outlines, with bid.
 3. Installing contractor shall have an office within 75 miles of the project site and provide 24 hours response in the event of a customer call, 7 days per week, 365 days per year.
- F. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., UL-916 Energy Management Systems, UL-864UUKL Smoke Systems as suitable for the purpose specified and indicated and shall comply with NFPA 70.
- G. Systems utilizing BACnet technology shall be BTL certified and comply with ASNI/ASHRAE Standard 135, BACnet - A Data Communication Protocol for building Automation and control networks.
- H. Systems utilizing Lonworks shall not be permitted.
- I. Damper components shall meet the requirements of AMCA 500.
- J. Control systems shall meet the requirements of ASHRAE Standard 90.1.
- K. Performance Standards. System shall conform to the following minimum standards over network connections:
 1. Graphic Display. A graphic with 20 dynamic points/objects shall display with current data within 10 seconds.
 2. Graphic Refresh. A graphic with 20 dynamic points/objects shall update with current data within 8 seconds.
 3. Object Command. Devices shall react to command of a binary object within 2 seconds. Devices shall begin reacting to command of an analog object within 2 seconds.
 4. Object Scan. Data used or displayed at a controller or workstation shall have been current within the previous 6 seconds.
 5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 45 seconds

6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 second. Select execution times consistent with the mechanical process under control.
7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per second. Select execution times consistent with the mechanical process under control.
8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 seconds of other workstations.

1.07 CONTRACTOR RESPONSIBILITIES

- A. The temperature control contractor shall be responsible for final design drawings, installation of all control wiring and control devices in accordance with National Electric Code. The temperature control contractor shall also be responsible for startup and complete checkout, and commissioning of the systems.
- B. This Contractor shall furnish complete drawings, component lists, specification sheets and sequences of operation to the Architect/Engineer for approval before start of installation.
- C. All DDC logic diagrams shall be updated as built and included in the Operation and Maintenance Manuals for the Owner.
- D. The temperature control contractor is responsible to use all room numbers developed and approved by the owner in the development of the temperature control system for this building.
- E. The Temperature Control Contractor shall work hand-in-hand with the commissioning agent during their work on the project. The laptop provided shall be setup for access to the temperature control system for use by the commissioning agent.
- F. The temperature control contractor shall demonstrate system to commissioning agent. As part of commissioning agent check-out, TCC shall create logs for any points as requested by CxA.
- G. The temperature Control Contractor shall provide labeling for all control system sensors, panels, actuators, etc. The label names shall match the point names given on the computer and as shown on the temperature control drawings.
- H. The temperature control contractor shall contact the boiler manufacturer to integrate the control and monitoring points specified in the sequence of operations. The connection to the boiler controller shall be thru BACnet/IP, BACnet over ARCNET, BACnet MS/TP.
- I. The temperature control contractor shall contact the chiller manufacturer to integrate the control and monitoring points specified in the sequence of operations. The connection to the chiller controller shall be thru BACnet/IP, BACnet over ARCNET, BACnet MS/TP.
- J. The temperature control contractor shall provide all control valves, balance and control valves, differential pressure controllers balance valves, as indicated on drawings.
- K. Sizing of Valves: Valves shall be furnished to the Division 23- Mechanical Contractor who will mount them as piping is installed. Valves sizes shall be as recommended by the Temperature Control Contractor who shall be responsible for their proper sizing, regardless of indicated valve or line size on the drawings. Water valves shall not exceed 5 psi pressure drop, unless otherwise stipulated.
- L. The temperature control contractor shall be responsible to provide AC Power Supplies as noted on the temperature control drawings. Temperature Control contractor shall be responsible to provide low voltage wiring from power supplies to VAR reheat box controllers. Submit wiring diagram as part of temperature control submittal.

1.08 SOFTWARE LICENSE AGREEMENT

- A. The owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to the owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software. The owner shall receive a copy or multiple copies licensed to them of any local programming tool required to replace or program local controller.
- B. It is the owner's goal to implement an open system that will allow products from various suppliers to be integrated into an unified system in order to provide flexibility for expansion, maintenance, and service of the system.
- C. OPEN NIC STATEMENT: All Niagra 4 software licenses shall have the following NiCS: "accept.station.in=*"; "accept.station.out=*"; "accept.wb.in=*"; "accept.wb.out=*". All open NIC statments shall follow Niagra Open NIC specifications.
- D. The owner shall be named license holder of all software associated with any and all incremental work on the project(s). The owner shall receive a copy or multiple copies licensed to them of any local programming tool required to replace or program local controller.
- E. In addition, the owner shall receive ownership of all job-specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job-specific software code and documentation for all configuration and programming that is generated for a given project.
- F. The owner shall be provided with all usernames and passwords required from complete and unlimited access to the system.

1.09 PRE-SUBMITTAL MEETING

- A. The temperature control contractor shall review the sequence of operation and note any exceptions or planned deviations from the specified sequence. Prior to creating the control submittal the control contractor shall contact the design engineer and setup a meeting to discuss the exceptions and planned deviations. The design engineer will not review any submittals until after this meeting has taken place.

1.10 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period following owner acceptance of entire building.
- C. Warranty shall also include any software upgrades available during the one (1) year period.
- D. Temperature control contractor shall provide support for operation of the system and improvements to energy usage to the owner throughout the first two years of operation after the date of substantial completion.

1.11 MAINTENANCE SERVICE

- A. Provide service and maintenance of control system for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The design intent is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate both the ANSI/ASHRAE Standard 135-2008 BACnet protocol in one open, interoperable system. System shall be capable for future extension by other manufacturer's and shall not be write-protected.
- B. Control Manufacturers (Certified by BACnet testing laboratory):

1. Tridium Niagara 4 Vykon - JACE 8000
 2. Schneider Electric - TAC I/A Series Micronet / MNB Bacnet Controllers
 3. Honeywell - Spyder PUB / PVB Series Bacnet Controllers, WEB-8000 Supervisory.
- C. The owner has made recent updrages to N4 on their existing BAS systems throughout the district to integrate buildinds into a district Supervisor. Air Force One completed those upgrades. The building most recently has work completed by Comfort Systems USA.
- D. The following Installing Contractors are prequalified:
1. Waibel Energy Systems, Building Logix
 2. Control Systems of Ohio
 3. Smith Boughan, Inc
 4. Wadsworth Solutions, Inc
 5. Johnson Controls
 6. Point to Point Systems
 7. EMCOR Services
 8. Building Control Integrators
 9. ASA Controls, Inc.
 10. Enervise, Inc
- E. Substitutions: See Section 01 60 00 - Product Requirements.
- F. All temperature control systems shall be installed by the factory authorized installer or representative serving the Ohio, OH Area.

2.02 EQUIPMENT - GENERAL

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.03 CONTROL PANELS

- A. Control cabinet/enclosure shall be extruded aluminum, galvanized steel or factory-hardened plastic with key locks and hinged doors. Electric panels shall be of code gauge steel construction with UL label. Panels shall be labeled with nameplates and legends as required.
1. The control cabinet/enclosure shall be required to house devices not enclosed as a part of the DDC building automation system panels. Prewire with internal wiring terminated at labeled terminal strips. Thermometers and switches shall be mounted on the cover of the panel. Relays, transformers, and components shall be mounted inside the panel. Devices, whether interior or exterior, shall be provided with legend plates of engraved formica or equal. Cabinets shall be located as approved by the Architect/Engineer or as indicated on the Drawings.
 2. Local type panels need not contain graphic representations or symbols, unless specified below, but must contain approved nameplates, legends, etc., for each device.
 3. Where panels contain any wiring, panels shall be UL approved cubicles.
- B. Provide common keying for all panels.

2.04 PRESSURE INDEPENDENT CHARACTERIZED CONTROL VALVES (PICCV)

- A. Acceptable Manufacturers:
1. Belimo
 2. Bell & Gossett
 3. Danfoss
 4. IMI Hydronics / TA
 5. Substitutions: See Section 01 6000 -

- B. NPS 2 and Smaller: Forged brass body rated at no less than 400 PSI, chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated O-rings and a brass or TEFZEL characterizing disc.
- C. NPS 2-1/2 through 6: GG25 cast iron body according to ANSI Class 125, standard class B, stainless steel ball and blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring packing design, PTFE seats, and a stainless steel flow characterizing disc.
- D. Accuracy: The control valves shall accurately control the flow from 0 to 100% full rated flow with an operating pressure differential range of 5 to 50 PSI differential across the valve with a valve body accuracy of +/- 5% variance due to differential pressure fluctuation or +/- 10% total assembly error incorporating differential pressure fluctuation, manufacturing tolerances, and valve hysteresis
- E. Flow Characteristics: Equal percentage characteristics.
- F. All actuators shall be capable of being electronically programmed in the field by use of external computer software or a dedicated handheld tool for the adjustment of flow.
- G. The manufacturer shall provide a published commissioning procedure following the guidelines of the National Environmental Balancing Bureau (NEBB) and the Testing Adjusting Balancing Bureau (TABB).
- H. Provide P/T ports on both sides of PICCV valve if not included within valve.
- I. The manufacturer shall provide a published commissioning procedure following the guidelines of the National Environmental Balancing Bureau (NEBB) and the Testing Adjusting Balancing Bureau (TABB).
- J. A wet calibrated electronic flow meter shall provide dynamic feedback to measure flow and verify performance.
- K. The control valve shall require no maintenance and shall not include replaceable cartridges.

2.05 ELECTRONIC PRESSURE INDEPENDENT CHARACTERIZED CONTROL VALVES (EPIV)

- A. Acceptable Manufacturers:
 - 1. Belimo
 - 2. Bell & Gossett
 - 3. Danfoss
 - 4. IMI Hydronics / TA
 - 5. Substitutions: See Section 01 6000 -
- B. NPS 2 and Smaller: Forged brass body rated at no less than 400 PSI, chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated O-rings and a brass or TEFZEL characterizing disc.
- C. NPS 2-1/2 through 6: GG25 cast iron body according to ANSI Class 125, standard class B, stainless steel ball and blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring packing design, PTFE seats, and a stainless steel flow characterizing disc.
- D. Accuracy: The control valves shall accurately control the flow from 0 to 100% full rated flow with an operating pressure differential range of 5 to 50 PSI differential across the valve with a valve body accuracy of +/- 5% variance due to differential pressure fluctuation or +/- 10% total assembly error incorporating differential pressure fluctuation, manufacturing tolerances, and valve hysteresis
- E. Flow Characteristics: Equal percentage characteristics.
- F. All actuators shall be capable of being electronically programmed in the field by use of external computer software or a dedicated handheld tool for the adjustment of flow.

- G. Water coil optimization shall be accomplished by utilizing a pressure independent control valve assembly; two temperature sensors providing feedback of coil inlet and outlet water temperatures; and an electronic flow meter to provide analog flow feedback. Software shall control the valve to avoid the coil differential temperature from falling below a programmed set point. The valve assembly shall be capable of accepting an analog signal representing the coil power required. Real-time data and configuration of valve operating parameters shall be available by means of BACnet MS/TP, BACnet/IP or HTTP. Monitored points shall include, but not be limited to inlet and outlet coil water temperatures, absolute flow, absolute valve position, absolute coil power and total heating/cooling energy in BTU/hr. Configuration points shall include but not be limited to valve, flow, and power settings. Historical trend data shall be stored for up to 13 months and be retrievable in a standard time-stamped format.
- H. The manufacturer shall provide a published commissioning procedure following the guidelines of the National Environmental Balancing Bureau (NEBB) and the Testing Adjusting Balancing Bureau (TABB).
- I. Provide P/T ports on both sides of PICCV valve if not included within valve.
- J. The manufacturer shall provide a published commissioning procedure following the guidelines of the National Environmental Balancing Bureau (NEBB) and the Testing Adjusting Balancing Bureau (TABB).
- K. A wet calibrated electronic flow meter shall provide dynamic feedback to measure flow and verify performance.
- L. The control valve shall require no maintenance and shall not include replaceable cartridges.

2.06 PRESSURE INDEPENDENT CONTROL AND BALANCE VALVE (PICBV)

- A. Acceptable Manufacturers:
 - 1. IMI Hydronics / TA (TA-Fusion P / TA-Modulator)
 - 2. Delta T
 - 3. Danfoss
 - 4. Substitutions: See Section 01 6000 - Product Requirements
- B. The control valve shall be provided with an adjustable stepless, pre-settable balancing and built-in dp-controller. It shall be supplied and installed as shown on the drawings to ensure proper balancing and performs the control function for water flows.
- C. The valve shall be pressure independent with integral spring and diaphragm arrangement for integral differential pressure control over built in control section.
- D. The flow for fully open control part shall be adjustable down to 20% of maximum flow.
- E. The valve shall have retained EQM characteristic for all recommended settings.
- F. Test points shall be provided for measuring differential pressure and be integral with the body and incorporate means for positive leak tight shutoff when not in use.
- G. True flow measurement verification must be possible with balancing instrument. Flow deviation max +/- 10% at full open.
- H. The valve shall have a rangeability of minimum 50 for all recommended pre-settings.
- I. The valve shall have the capacity for manual, leak tight shutoff without the actuator attached for maintenance purposes and to allow measurement of available differential pressure for diagnostics.
- J. It should be possible to perform a high speed flush with the valve installed in the system without causing damage to the product and without removing / replacing any parts.

- K. The valve shall have a pressure balanced cone to provide low force actuating and easy maneuvering.
- L. The valve shall have a minimum valve authority rating of 0.3.
- M. Material: Valve body with connection in sizes 1 1/2" to 2" shall be made in dezincification resistant alloy brass with a pressure rating of 235 psi. Sizes 2 1/2" - 6" shall consist of ductile iron housings and stainless steel valve plugs with a pressure rating of 365 psi. The minimum differential pressure shall be 5 psi.
- N. Material: Valve body and insert with connection sizes 3/8" to 1 1/4" shall be of dezincification resistant alloy brass with stainless steel valve plug, spindle, and spring. EPDM membrane and o-rings with a pressure rating of 230 psi. The minimum differential pressure shall be 5 psi.
- O. Threaded connections shall be NPT in accordance with ANSI/ASME B1.20.1-1983.
- P. All valves shall be manufactured in accordance with ISO 9001 and ISO 14001.
- Q. Valve actuators shall be full modulating, low voltage (24VAC) and compatible with control valve.
- R. For valve sizes 2" and smaller, the controls contractor shall provide coil hookup packages as provided by the control valve manufacturer. The supply side of the coil shall contain a strainer/drain and an integrated isolation ball valve/manual air vent with a P/T port. The return side of the coil shall contain a union fitting with a P/T port and manual air vent, pressure-independent balancing control valve, and shutoff valve.

2.07 COMBINED TWO-WAY MODULATING CONTROL AND BALANCE VALVE

- A. Manufacturers:
 - 1. IMI Hydronics / TA (TBV-CM)
 - 2. Delta T
 - 3. Danfoss
 - 4. Substitutions: See Section 01 6000 - Product Requirements
- B. Valve shall contain manual balancing, shutoff, and modulating control capability with EQM characteristics. P/T ports shall be included in the valve body for flow verification and measurement of available head pressure.
- C. The valve shall have a minimum valve authority rating of 0.3.
- D. Balancing portion shall have manual readout and valve shall be provided with removable handle.
- E. Material: Valve body and insert with connections 1/2" to 1" shall be of dezincification resistant alloy brass with stainless steel spring, valve Insert. EPDM valve seat.
- F. Threaded connections shall be NPT in accordance with ANSI/ASME B1.20.1-1983.
- G. Valve actuators shall be full modulating, low voltage (24VAC) and compatible with control valve.
- H. For valve sizes 2" and smaller, the controls contractor shall provide coil hookup packages as provided by the control valve manufacturer. The supply side of the coil shall contain a strainer/drain and an integrated isolation ball valve/manual air vent with a P/T port. The return side of the coil shall contain a union fitting with a P/T port and manual air vent, balancing control valve, and shutoff valve.

2.08 DAMPERS - ALL RELIEF AIR APPLICATIONS

- A. Extruded aluminum (6063-T5) damper frame shall not be less than 0.080" (2.03 mm) in thickness. Damper frame shall be 4" (101.6 mm) deep x 1" (25.4 mm), with duct mounting flanges on both sides of frame. Frame to be assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.

- B. Entire frame shall be thermally broken by means of polyurethane resin pockets complete with thermal cuts.
- C. Blades shall be maximum 6" (152.4 mm) deep extruded aluminum (6063-T5) air-foil profiles with a minimum wall thickness of 0.06" (1.52mm). Blades shall be internally insulated with expanded polyurethane foam and shall be thermally broken. Complete blade shall have an insulating factor of R-2.29. All blades shall be symmetrically pivoted.
- D. Blade seals shall be extruded silicone, secured in an integral slot within the aluminum blade extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper.
- E. Frame seals shall be extruded silicone, secured in an integral slot within the aluminum frame extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.
- F. Bearings shall be a dual bearing system composed of a Celcon inner bearing (fixed around a 7/16" (11.11 mm) aluminum hexagon blade pivot pin), rotating within a polycarbonate outer bearing inserted in the frame. Single axle bearing, rotating in an extruded or punched hole shall not be acceptable.
- G. Hexagonal control shaft shall be 7/16" (11.11 mm). It shall have an adjustable length and shall be an integral part of the blade axle. A field-applied control shaft shall not be acceptable. All parts shall be zinc-plated steel.
- H. Linkage hardware shall be aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream, and accessible after installation. Linkage hardware shall be complete with cup-point trunnion screws to prevent linkage slippage and a Celcon bearing between moving parts to reduce wear and increase longevity. Linkage that consists of metal rubbing metal will not be approved.
- I. Dampers shall be designed for operation in temperatures ranging from -40°F (-40°C) to 212°F (100°C).
- J. Dampers shall be AMCA rated for Leakage Class 1A at 1 in w.g. static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.
- K. Dampers shall be opposed blade action or parallel blade action, as indicated on the plans.
- L. Dampers shall be Flanged to Duct install type only.
- M. Design based on TAMCO Series 9000 BF Thermally Insulated Damper with Thermally Broken Frame.

2.09 DAMPERS - ALL EXCEPT RELIEF AIR APPLICATIONS

- A. Dampers shall be low leakage type, as required to meet the requirements of ASHRAE Standard 90.1, not less than 22 gauge galvanized steel frames.
- B. Performance: Test in accordance with AMCA 500-D.
- C. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage, 0.1046 inch.
- D. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 22 gage, 0.0299 inch, attached to minimum 1/2 inch shafts with set screws.
- E. Blade Seals: Synthetic elastomeric or neoprene mechanically attached, field replaceable.
- F. Jamb Seals: Spring stainless steel.
- G. Shaft Bearings: Oil impregnated sintered bronze or nylon bushings.
- H. Linkage Bearings: Graphite impregnated nylon or oil impregnated sintered iron.

- I. Leakage: Dampers shall be low leakage dampers and shall be designed for tight shut-off such that for a 1500 FPM damper leakage does not exceed 1 percent at 6 inches w.g.
- J. Maximum Pressure Differential: 6 inches wg.
- K. Temperature Limits: Minus 40 to 200 degrees F.
- L. Modulating dampers shall be opposed blade type.
- M. Whenever possible, damper size shall match ductwork size. The Temperature Control Contractor shall verify air velocity and notify the engineer of sizing concerns prior to installation of dampers
- N. Automatic dampers installed in equipment furnished by the manufacturer shall be checked for proper size and design by the Temperature Control Contractor. Should any features of these dampers appear to be unsatisfactory, full details shall be given to the Engineer in writing and suggestions made for any necessary corrections.

2.10 DAMPER OPERATORS

- A. General: Provide smooth proportional control with "continuous control action" and sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Actuator response shall be linear in response to sensed load and damper stroke shall be smooth and efficient throughout its entire range. Damper operators shall be electronic, direct coupled type designed for 100,000 full stroke cycles at rated torque, low voltage type. Provide spring return for two position control and for fail safe operation. Damper operators on outside air intakes shall spring return closed.
 - 1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
 - 2. Provide one operator for maximum 25 sq ft damper section.
 - 3. Damper operators on outside air intakes and exhaust outlets where required shall be spring return closed.
- B. Size for torque required for damper seal at load conditions with one actuator per damper section. Mechanically paralleled or 'piggybacked' actuators are not permitted.
- C. Coupling: V-bolt dual nut clamp with a V-shaped toothed cradle. Aluminum clamps or set screws are not acceptable.
- D. Overload Protection: Microprocessor or an electronic based motor controller providing burnout protection if stalled before full rotation is reached. The actuator shall be electronically cut off at full open to eliminate noise generation with the holding noise level to be inaudible.
- E. Power Requirements: 0.23A (running) and 0.09A (holding) at 24V-ac or 27 VA (running) and 10 VA (holding) at 120V-ac.
- F. Actuator timing shall be 15 sec.
- G. Temperature Rating: Actuator shall have a UL555S listing by the damper manufacturer for 350°F [250°F].
- H. Proportional Smoke Damper Actuators shall meet all requirements specified above and shall modulate 0-100% open in response to a 2-10vdc or 4-20mA control signal. A 2-10vdc feedback output shall provide a 2-10vdc signal for position indication.
 - 1. Power Requirements (Proportional): Maximum (running) 12 VA at 24-V ac or 8 W at 24-V dc. Maximum (holding) 5VA at 24-V ac or 3 W at 24-V dc.
 - 2. A manual override winder and locking mechanism shall be provided for override operation of the actuator on a loss of power.

2.11 RELAYS

- A. Where required, provide relays for energizing or re-energizing the various branch circuits in response to master control panels. Relays shall be UL labeled and sized for not less than 140 percent of the connected amperage load. Relays shall be rated for the system voltage and have proper throw and poles.

2.12 TRANSMITTERS

- A. Electronic Temperature Sensors
 - 1. Provide temperature sensors and other temperature indicating sensors of commercial grade quality located at the point of measurement and installed according to the manufacturer's recommendations. Sensors to be vibration and corrosion resistant.
 - 2. Thermistor temperature accuracy shall be ± 0.36 F between the range of 32.0 - 158.0 F.
 - 3. Provide temperature sensors such that the BAS shall be able to convert the resistive input signal available from the element into a digital signal for use by the BAS.
 - 4. Provide outside air temperature sensors with a watertight fitting and adequate protection from the effects of solar radiation.
 - 5. Provide water temperature sensors of the bulb type, mounted within stainless steel wells filled with a heat conductive compound and in direct contact with the water within the pipe.
 - 6. All field mounted sensors shall be labeled as to their function and name used in the control program.
- B. Electronic Room Temperature Sensors
 - 1. Room Temperature Sensors shall be used in classrooms, office spaces, kitchen spaces, student dining, and gymnasiums.
 - 2. Temperature sensors shall be equal to PreCon type-IV thermistors utilizing a 20K ohm thermistor or platinum RTD's of 2000 ohm resistance.
 - 3. Housing: Sensors shall be manufactured in a durable epoxy housing and shall be enclosed for protection from elements when installed in the sensors operating environment. The sensor cover shall be provided with tamperproof screws. Sensors shall not include a display or keypad.
 - 4. Temperature sensors shall be provided with an override button that will switch the mechanical system into occupied mode of control. Other than the override button the thermostat face shall be blank, with no temperature adjustment, readout panels, etc.
 - 5. Sensor cover shall be color "Pure White".
- C. Electronic Wall Plate Temperature Sensors
 - 1. Wall Plate Temperature Sensors shall be used in corridors, vestibules.
 - 2. Temperature sensors shall be equal to PreCon type-IV thermistors utilizing a 20K ohm thermistor or platinum RTD's of 2000 ohm resistance.
 - 3. Housing: Concealed in wall with stainless steel louvered cover plate. 1/4" closed cell foam insulation backin.
- D. Electronic Duct Temperature Sensors
 - 1. All duct sensors shall be true averaging type sensors with capillary lengths not less than 20 feet long. The only exceptions will be return air, and outdoor air sensors, which may be single point temperature sensors.
 - 2. All duct sensors shall be installed within enclosures that are suitable for the application.
- E. Electric Thermostats
 - 1. Electric thermostats shall be line voltage type of single pole single throw design.
 - 2. The sensing element shall be liquid-filled.
 - 3. Covers and base plates shall be of standard design and finish.
 - 4. Electric thermostats shall be denoted on the Drawings with a sub "E".

5. Electric thermostats (where noted) for operation of propeller unit heaters and cabinet unit heaters shall be provided and installed by the temperature control contractor.
 6. Sensor cover shall be color "Pure White".
- F. Electric Reverse Acting Thermostats
1. Electric thermostats shall be line voltage type of single pole single throw design.
 2. The sensing element shall be liquid filled.
 3. Covers and base plates shall be of standard design and finish.
 4. Adjustable temperature dial.
 5. Reverse acting thermostats shall be denoted on the drawings with sub "R".
 6. Sensor cover shall be color "Pure White".
- G. Sensor Guards
1. Provide guard of clear color, mounted with back frame to wall and tamperproof screws on all wall mounted sensors located in gymnasiums, student dining, locker rooms, and corridors where wall plate sensor not utilized. Also, where denoted on the Drawings with a sub "G".
- H. Safety Low Limit Thermostats
1. Automatic reset safety low limit thermostats with flexible sensing elements shall serpentine full length of duct or coil. Instrument to be sensitive to lowest temperature at any 12 inch increment on its 20 foot length. Thermostat shall have a range of 34 degrees F. to 60 degrees F. with a fixed 5 degrees F. differential. Provide one for every 20 square feet of coil.
 - a. Safety low limit thermostats shall be capable of being reset through software at the building energy management computer.
- I. Electronic Pressure Sensors
1. Provide pressure sensors and other pressure indicating sensors of commercial grade quality located at the point of measurement and installed according to the manufacturer's recommendations.
 2. Provide pressure sensors of the direct acting or reverse acting, unidirectional or bidirectional type such that the BAS shall be able to convert input signal into a digital signal for use by the BAS.
 3. Provide pressure sensors utilizing the smallest possible operating range which will sufficiently cover the range required for normal operating conditions.
 4. Provide pressure sensors of the ultra precision type with a tolerance at 70 degrees F of no greater than plus/minus .8 percent of full scale and an end-to-end accuracy of plus/minus 2 percent of full scale.
- J. Duct Differential Pressure/Air Velocity Transmitters
1. Differential Pressure/Air Velocity Transmitters shall be provided by the Temperature Control Contractor to monitor the difference between two pressures, duct air velocity and generate a linear output proportional to the difference in pressures.
 2. Design range shall be -5 inches water column to 4 inches water column.
 3. Minimum accuracy shall be +/-1.0 percent of calibrated span. Includes combined effects of linearity, hysteresis and repeatability.
 4. Unit shall be provided with a LCD display.
- K. Humidity Sensors
1. Shall be a "Current Type" humidity transducer. Sensor shall produce a linear 4-20mA current representing the span of the sensor. This signal shall be produced by the sensor itself through a current converter supplied with the sensor.

2. Space humidity sensor shall be enclosed in a durable enclosure for mounting in interior zones. Sensor shall have a range of 0 to 100 percent relative humidity and shall be accurate with + 2 percent of span.
 3. Duct humidity sensor shall be a probe type with all wiring enclosed in an electrical box. Sensor shall have a range of 0 to 100 percent with an accuracy of + 3 percent of span.
 4. Outdoor humidity sensor shall be enclosed in a weather proof enclosure for mounting outdoors. Sensor shall have a range of 0 to 100 percent with an accuracy of +/- 3 percent of span.
- L. Carbon Dioxide Sensors
1. Sensor type shall be Non-dispersive infrared (NDIR), diffusion sampling with a measurement range from 0-2000 PPM.
 2. Minimum Accuracy: +/- 75 PPM of calibrated span.
 3. Input Voltage: 20 to 30 VAC/DC; 100 mA max.
 4. Analog Output: 0-5 VDC, 0-10 VAC or 4-20 mA user selectable.
 5. Sensor shall have self-calibrating capabilities.
 6. Sensor shall have capability of sensing an alarm to the BAS in the event of a calibration problem or malfunction.
 7. At the time of Project Completion, the TCC shall verify the calibration of all CO2 sensors.
 8. TCC to verify with sensor manufacturer the best signal wiring to be used to prevent signal irregularities and errors.
- M. Current Status Switch
1. Shall be capable of detecting changes in flow of current to motors in determining accurate and reliable equipment status.
 2. Ampere rating for 2.5 - 135 amps continuous.
 3. Sensor supply voltage shall be included from monitor conductor.
 4. Minimum current required is 1 amp.
 5. Trip setpoint shall be adjustable to +/- 1 percent of range.
- N. Air Flow Monitoring Station - Indoor Units
1. Manufacturers:
 - a. Tek-Air
 - b. Paragon Controls (OA-FE-1500, FE-1000, FE-1050, FIT-1003D)
 - c. Ebtron (GTx116-P+)
 - d. Air Monitor (VOLU-flo/OAM, VOLU-probe/VS Pitot, Veltron DPT 2500)
 - e. Kele (KOAMS, KMS)
 2. Air flow measuring system including microprocessor panel, signal processor with CFM output and air flow measuring sensor struts as required to measure outside air intake, Return air, and exhaust air flow as denoted on the drawings.
 3. Air flow measuring system shall have velocity range from 200 to 2000 ft./min. with duct measurement accuracy (including repeatability, zero offset, and temperature compensation) of plus or minus 3 percent.
 4. The location, type and quantity of flow sensing elements shall be per ASHRAE Standard 111 and subject to actual field measurements.
 5. Outside Air Measurement: Provide where indicated air flow stations similar to above specifications except where three straight runs of duct are not present, provide large area impact sensing probes between outdoor louver and damper (one probe per 16 square feet of louver) with NEMA-4 transducer located in the outside air stream with temperature sensor and microprocessor based monitor to generate a 4-20 ma signal linear to cfm that has been corrected for air density. Provide access for cleaning of impact probes.

6. TCC shall verify all air velocities are above the minimum (fpm) allowed by the selected AFMS. The minimum air flow must be used for the verification. If a minimum airflow determined by the balancer yields a velocity below the minimum allowable by the AFMS, the TCC shall have the min airflow adjusted such that it does not fall outside of the limits of the AFMS. The TCC shall coordinate this with the balancer and it shall be noted in the balance report.
- O. Remote Water Differential Pressure Transmitter (DPT)
1. The Basis of design variable speed pumps have integral sensorless control and do not require DPTs. If another pump manufacturer is used these may be required.
 2. Differential Pressure Transmitters shall be provided by the temperature control contractor and installed by the Division 23-mechanical contractor. Transmitters to be completely self-contained, variable capacitance type. Wiring terminals and electronics shall be in separate compartments, so the electronics remain sealed during installation. Reverse polarity protection shall be included to keep wiring mishaps from damaging the transmitter. The 4-20mA DC signal shall be transmitted over a pair of No. 22 gauge or larger wire directly to the control enclosure.
 3. Design range shall be as required by system. External zero and span adjustments, over pressure to 2,000 PSI and no humidity effects.
 4. Minimum accuracy shall be +/-0.25 percent of calibrated span. Includes combined effects of linearity, hysteresis and repeatability. Stability shall be +/-0.25 percent of upper range limit for 6 months. No internal mechanical linkages shall be used in the transmitter.
- P. Flow Meter (FT)
1. Flow sensor shall be supplied and wired by the temperature control contractor and installed by the mechanical contractor where indicated on the drawings or as required by the sensor manufacturer.
 2. The flow sensor shall utilize a nonmagnetic sensing mechanism with a forward-swept rotating impeller to produce a frequency signal proportional to flow. The flow sensor shall have an achievable accuracy of +/-1 percent of flow rate with flow velocities of 1 to 30 fps.
 3. The flow sensor shall be constructed of brass with a glass reinforced impeller, tungsten carbide shaft and glass reinforced polyphenylene sulfide housing.
 4. Provide minimum of 10 straight pipe diameters upstream and 5 diameters downstream for each field installed flow transducer.
- Q. Building Static Pressure Transmitters:
1. One pipe, direct acting, double bell, scale range 0.01 to 6.0 inch wg positive or negative, and sensitivity of 0.0005 inch wg. Transmit electronic signal to receiver with matching scale range.

2.13 METERS

- A. Positive Displacement Meters (Liquid)
1. AWWA C700, positive displacement disc type suitable for fluid with bronze case and cast iron frost-proof, breakaway bottom cap, hermetically sealed register, remote reading to AWWA C706.
 2. Meter: Brass body turbine meter with magnetic drive register.
 - a. Accuracy: 1-1/2 percent.
 - b. Maximum Counter Reading: 10 million gallons.
- B. Heat Consumption Meters
1. Meter: Brass body turbine meter with magnetic drive register, platinum temperature sensors.
 - a. Maximum Service Temperature: 200 degrees F.
 - b. Accuracy: 1-1/2 percent.

- c. Maximum Counter Reading: 1 million btuh.
 - d. Size: 1/2 inch.
 - e. Power: 24 Volt convertor.
- C. Liquid Flow Meters
- 1. ASME MFC-3M Calibrated venturi orifice plate and flanges with valved taps, chart for conversion of differential pressure readings to flow rate, with pressure gage in case.
 - 2. Annular element flow stations with meter set.
 - a. Measuring Station: Type 316 stainless steel pitot type flow element inserted through welded threaded couplet, with safety shut-off valves and quick coupling connections, and permanent metal tag indicating design flow rate, reading for design flow rate, metered fluid, line size, station or location number.
 - 1) Pressure rating: 275 psi.
 - 2) Maximum temperature: 400 degrees F.
 - 3) Accuracy: Plus 0.55 percent to minus 2.30 percent.
- D. Gas Thermal Mass Flow Meter
- 1. The flow meter shall be hand-insertable up to 250 psi. Materials of construction for wetted metal components shall be 316 SS. The flow meter shall provide SFPM flow readings from a pair of encapsulated platinum sensors and shall not require additional temperature or pressure compensation. In addition, the meter shall continuously display information that can be used to validate the calibration of the meter. Each flow meter shall be individually wet-calibrated against a standard that is directly traceable to National Institute of Standards and Technology. A certificate of calibration shall be provided with each flow meter. Provide all hardware necessary to enable insertion and removal of the meter without system shutdown.
 - a. Accuracy shall be within $\pm 1\%$ of rate from 500-7000 SFPM and $\pm 2\%$ of rate from 100-500 SFPM.
 - b. Overall turndown shall exceed 1000:1.
 - c. Output signals shall consist of the following: (1) analog 4-20mA output and (1) scalable pulse output for totalization. The meter shall be equipped with an integrally mounted graphical display that may be optionally remote mounted up to 1000 ft from the sensor.
 - 1) Provide a display module for local or remote indication of flow rate and total. Output signals shall be either serial network (protocol conforming to BACnet MS/TP, BACnet/IP, or via individual analog and pulse outputs.
 - d. Each flow meter shall be covered by the manufacturer's two-year warranty.
 - e. Installation of flow meter must comply to all manufacturer guidelines. Install meter with required straight length distances upstream and downstream of meter. Provide shutoff valve to allow removal of meter without the requirement to shut down gas service.

2.14 BUILDING AUTOMATION SYSTEM

- A. Furnish a complete Direct Digital Control system.
 - 1. The entire system shall be totally DDC with electric/electronic actuation. No pneumatics shall be utilized except where noted on the associated drawings.
 - 2. The DDC System shall support the ASHRAE Standard 135-1995 BACnet protocol.
 - 3. The DDC System shall communicate to the owner's communication network thru a single point of data connection. All wiring and communication downstream of that single point of data connection shall be provided with the DDC control system.
 - 4. The Local Area Network shall be a 100 Mbps Ethernet network.

5. The system shall be backward compatible. Whenever a system upgrade is provided, the system shall be capable of communicating to existing device level controllers without the requirement to provide any new equipment and controllers.
 6. The system shall be capable of operating on the latest version of IE explorer, Firefox, or Google Chrome. System shall be capable of operating without JAVA.
- B. The following HVAC equipment shall be controlled by the Building Automation System including sequences. A graphic shall be provided for each piece of equipment listed below:
1. Air Handling Units with built in Energy Recovery.
- C. Operator Workstation
1. Data Network Equipment Contractor to furnish a dedicated virtualized server to host web services and storage for temperature control use at minimum (1 TB) partition. Temperature Control Contractor shall be responsible to coordinate with Data Network Equipment Contractor and the owner's representative on requirements for server. Temperature Control Contractor to coordinate with Data Network Equipment Contractor for server resource requirements. Data Network Equipment Contractor to provide Microsoft Operating System only. Temperature Control Contractor to provide all necessary programming, additional licensing, and software required for a fully functional system.
 2. A laptop computer shall be provided as part of this project. This contractor shall install network server software on the laptop as part of this project to allow interface with this project. Provide any additional cables necessary to connect to any of the controllers on the system. The laptop shall be made available to the commissioning agent for their use as well.
 - a. Critical alarms shall be reported to the laptop, cell phones, and email accounts of the maintenance department employees. All critical alarms shall be wired so that unit fans, pumps, etc. cannot be turned on in hand mode when safety device is tripped.
 - b. The laptop computer shall include the ability to access the temperature control system via the owners network. User interface shall be seamless and the user shall be capable of performing all functions that can be performed locally.
 3. The computer designated shall be used for command entry, information management, network alarm management, and data base management functions. All real-time control functions shall be resident in the standalone DDC panels to facilitate greater fault tolerance and reliability.
 - a. The laptop computer shall have a minimum Intel Core i5 processor with a 500.0 GB hard drive, 8 GB Ram, 24x CD-RW/DVD drive, parallel port, serial port, USB port, wireless 802.11 A/G/N network card, an RJ45 10/100/1000 internal network card, and high capacity Lithium Ion battery. The laptop shall include a minimum 15.4" WXGA LCD panel. Furnish Nylon laptop carrying case. Acceptable manufacturers shall be IBM/Lenovo, HP, Dell, and Toshiba. Computer platform shall be certified by DDC system manufacturer. Furnish Microsoft Windows 7 operating system as a minimum.
- D. Laptop computer Hardware - Communications
1. The new personal computers shall provide a minimum of two communication ports, one EIA-232C for local direct connect communications and one for remote dial-up communications. All communication ports shall be bidirectional data communicators.
 2. Storage of software programs and communication logic shall be maintained without battery backed assistance.
- E. Server Software
1. Server software shall take advantage of daily energy management report generation capability of the Global Control Panel (GCP) and all remote DDC controllers. The host

- computer shall automatically poll direct or remotely connected sites, gather the data, archive it and generate daily, weekly, monthly and yearly summaries as needed.
2. The host software shall permit acquisition and long term storage of unlimited independent trend logs. Trends shall be operated by the host directly or automatically uploaded from the GCP or remote DDC controllers at user specified intervals. Trend data shall be graphically represented using a dynamic process graphics report generator in a bar chart or line format including HTML, XML, PlainText, or HTTP formats.
 3. Host software will contain alarm and exception processing systems. Events including point alarm, point faults, device diagnostics, maintenance time reminders, actual control programs and log on/off shall be recorded in the system status log. The System Status log shall define automatically generated exception reports based on user selectable criteria such as point type, operator, time and date of occurrence, etc. The program shall prioritize alarms for display with the most critical alarm first. An operator shall also be able to user define individual alarms to interrupt a user and display the system status log.
 4. Provide icon selection of users programs such as database programming and monitoring. Provide menus with highlighted active commands, context commands descriptions and help files. A standard mouse interface and normal keyboard operation shall access all programs. Provide continuous display of system status, and text monitoring screens with highlighted alarm conditions and report generation.
 5. Any action taken by an operator shall be logged to the systems status log to render an audit trail of operator actions. User access definitions shall be completely definable and modifiable by the system's manager.
 6. The Graphical User Interface (GUI) shall run on Microsoft Windows 7 or most recent.
 7. The GUI shall employ standard browsers including Windows Explorer and Firefox. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
 8. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:
 - a. Minimum Required Graphics:
 - 1) All setpoints shall be shown on the respected graphic page for each piece of equipment. All setpoints shall be adjustable and acceptable range of adjustment shall be noted in as-built sequence of operation.
 - 2) Home Screen with background image of school building or school logo and include following:
 - (a) Information on current weather conditions
 - (b) Link to building floor plan
 - (c) Link to each individual air handling unit screen.
 - (d) Link to chilled water plant screen.
 - (e) Link to heating water plant screen.
 - (f) Link to energy dashboard.
 - (g) Link to alarms page
 - (h) Link to schedules page
 - (i) Snow Day Schedule Button.
 - 3) Floor Plan: Overall floor plan shall be provided with units broke out in different colors. Link to each individual enlarged unit plan. Enlarged Unit plans shall contain:Unit shall Color graphic floor plan and zone floorplans showing all space

temperatures, space CO2 levels and humidity levels where indicated on temperature control drawings.

- (a) Floor plan showing all spaces with room numbers matching owner's final room number designations.
 - (b) Temperature of each space. Either space or text shall change color based on deviation away from setpoint. Space or text shall change to blue if room below setpoint by 2 F (adj) and change to red if above 2 F (adj) setpoint. Text to be green for space setpoint met.
 - (c) Show space humidity at locations of space humidity sensors.
 - (d) Link back to overall floor plan.
 - (e) Link to equipment page serving the room by clicking on the individual space.
 - (f) Link to alarm page.
- 4) Space Equipment Screen: Screen showing the individual equipment serving the space. Information on screen shall include:
- (a) Graphic of equipment including heating / cooling coils, valves, fans, and dampers. Graphics shall be dynamic.
 - (b) Heating and Cooling Valve Position. If valve is a three-way valve, graphic to represent three way valve.
 - (c) Fan operation including fan speed if variable speed.
 - (d) Damper Positions.
 - (e) Primary airflow value. Also minimum and maximum airflow settings.
 - (f) Discharge air temperature.
 - (g) Current space temperature, space setpoint, and setback temperature setpoints
 - (h) Override button with override temperature
 - (i) Current CO2 level (if specified), high and low level CO2 setpoints
 - (j) Link to associated air handling unit.
 - (k) Link back to overall floor plan screen.
 - (l) Link to alarm screen.
- 5) Air Handling Unit Screen:
- (a) Graphic of equipment including heating / cooling coils, valves, dampers, fans, filters, airflow stations and other sensors. Graphic shall be dynamic
 - (b) Heating and Cooling Valve Position. If valve is a three-way valve, graphic to represent three way valve.
 - (c) Fan operation including fan speed if variable speed.
 - (d) Provide a link to VFD screen. On VFD screen provide in a table format all information from VFD.
 - (e) Damper Positions.
 - (f) Energy Recovery wheel status
 - (g) Airflow values and temperature values as shown on temperature control drawing schematics.
 - (h) If air handling unit is set up as a VAV air handling unit, include the following information:
 - (1) Supply air temperature
 - (2) Supply air temperature setpoint
 - (3) Supply air static pressure
 - (4) Supply air fan static pressure setpoint.
 - (i) If air handling unit serves a single zone, include the following information on the equipment screen:

- (1) Space Temperature
 - (2) Space Temperature setpoint.
 - (3) Unoccupied space temperature and humidity setpoints.
 - (4) Space Humidity level.
 - (5) Space Humidity setpoint.
 - (6) Space CO2 level.
 - (7) Space CO2 setpoint.
- (j) Filter differential pressure. Include alarm if DP hits high limit.
- (k) Link to associated chilled water plant.
- (l) Link to associated heating water plant.
- (m) Link to sequence of operation page.
- (n) Link to alarm page.
- (o) Link back to overall floor plan.
- 6) Heating Water Plant Screen:
 - (a) Graphic of plant including boilers, pumps, and piping between pumps and boilers. All graphics shall be dynamic.
 - (b) Boiler firing rate, status. Include a link to a separate page for each boiler. This separate page shall include all information received from the boiler. Refer to boiler specification section for list of minimum data.
 - (c) Pump operation including speed.
 - (d) Provide a link to VFD screen. On VFD screen provide in a table format all information from VFD.
 - (e) Heating water supply static pressure.
 - (f) Heating water supply static pressure setpoint.
 - (g) Heating water supply static pressure override.
 - (h) Heating water supply and return water temperatures as shown on the temperature control schematics.
 - (i) Flowrates (GPM) as shown on the temperature control schematic.
 - (j) Boiler alarms. Provide a link to the alarm page.
 - (k) Link to sequence of operation page.
 - (l) Link back to overall floor plan.
- 7) Chilled Water Plant Screen:
 - (a) Graphic of plant including chiller(s), pumps, glycol feed system, heat exchanger, and air /dirt separator. All graphics shall be dynamic.
 - (b) Chiller information as stated in the chiller specification.
 - (c) Primary and secondary pump operation including pump speed.
 - (d) Provide a link to VFD screen. On VFD screen provide in a table format all information from VFD.
 - (e) Secondary chilled water supply static pressure.
 - (f) Secondary chilled water supply static pressure setpoint.
 - (g) Secondary chilled water supply static pressure override.
 - (h) Chilled water supply and return water temperatures as shown on the temperature control schematic.
 - (i) Chiller Alarms. Provide link to alarm page.
 - (j) Link to sequence of operation page.
 - (k) Link back to overall floor plan.
- 8) Miscellaneous Equipment
 - (a) Include status, on/off button where noted in the sequence of operation, space temperature, space temperature setpoint for:
 - (1) Exhaust fans

- (2) cabinet heaters
 - (3) unit heaters
 - (4) dust collection equipment.
 - (5) welding exhaust equipment.
 - (6) Technology space cooling equipment.
- 9) Alarms Page
 - (a) The system will be provided with a dedicated alarm screen. This screen will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm.
 - (b) All critical alarms shall be wired so that unit fans, pumps, etc. cannot be turned on in hand mode when safety device is tripped.
 - (c) All critical alarms as determined by the owner shall be sent to email accounts, cell phones, and pagers via text messaging capabilities.
- 10) Schedules Page
 - (a) Provide calendars for all air handling equipment.
- 11) Energy Dashboard
 - (a) Provide information as stated below.
 - (b) A separate color graphic with real time building data shall be provided as part of the temperature control system that can be accessed by the teaching staff for educational purposes. The graphic shall include, at a minimum, information on energy usage, gas usage, carbon dioxide being produced, and efficiency of building compared to other buildings of similar size and function. The temperature control system shall be able to download the information to the EPA EnergyStar website (<http://www.energy star.gov>) to compare buildings of similar size and function and determine energy star rating.
- b. The sequence of operations shall be located as a pull down feature at each piece of equipment or provide a link to a pdf document of the sequence of operations.
- c. Provide As-Built wiring diagrams complete with material part numbers.
- d. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands. Dynamic temperature values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.
- e. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
- f. Graphic screens shall contain objects for text, real-time values, animation, color spectrum objects or "thermo-graphics", logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
- g. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
- h. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
 - 1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - 2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
 - 3) Snow Day Operation shall be set by clicking on a "Snow Day" button located on screen of graphics.

- i. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
 - j. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.
- 9. System Configuration: At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
 - a. Create, delete or modify control strategies.
 - b. Add/delete objects to the system.
 - c. Tune control loops through the adjustment of control loop parameters.
 - d. Enable or disable control strategies.
 - e. Generate hard copy records or control strategies on a printer.
 - f. Select points to be alarmable and define the alarm state.
 - g. Select points to be trended over a period of time and initiate the recording of values automatically.
- 10. On-Line Help: Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.
- 11. Security: Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
- 12. System Diagnostics. The system shall automatically monitor the operation of all workstations, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

2.15 BUILDING AUTOMATION EQUIPMENT

- A. System Network Controller (SNC)
 - 1. These controllers are designed to manage communications between the programmable equipment controllers (PEC), application specific controllers (ASC) and advanced unitary controllers (AUC) which are connected to its communications trunks, manage communications between itself and other system network controllers (SNC) and with any operator workstations (OWS) that are part of the BAS, and perform control and operating strategies for the system based on information from any controller connected to the BAS.
 - 2. The controllers shall be fully programmable to meet the unique requirements of the facility it shall control.
 - 3. All devices shall meet the requirements of clause 22.1.5 of ASHRAE 135-2012. Use Analog inputs and outputs. If Analog Output objects are used, these must be writeable.
 - 4. The controllers shall be capable of peer-to-peer communications with other SNC's and with any OWS connected to the BAS, whether the OWS is directly connected, connected via cellular modem or connected via the Internet.
 - 5. The communication protocols utilized for peer-to-peer communications between SNC's will be Niagara 4 Fox, BACnet TCP/IP and SNMP. Use of a proprietary communication protocol for peer-to-peer communications between SNC's is not allowed.

6. The SNC shall employ a device count capacity license model that supports expansion capabilities.
7. The SNC shall be enabled to support and shall be licensed with the following Open protocol drivers (client and server) by default:
 - a. BACnet
 - b. SNMP
8. The SNC shall be capable of executing application control programs to provide:
 - a. Calendar functions.
 - b. Scheduling.
 - c. Trending.
 - d. Alarm monitoring and routing.
 - e. Time synchronization.
 - f. Integration of BACnet controller data.
 - g. Network management functions for all SNC, PEC and ASC based devices.
9. The SNC shall provide the following hardware features as a minimum:
 - a. Two 10/100 Mbps Ethernet ports.
 - b. Two Isolated RS-485 ports with biasing switches.
 - c. 1 GB RAM
 - d. 4 GB Flash Total Storage / 2 GB User Storage
 - e. Wi-Fi (Client or WAP)
 - f. USB Flash Drive
 - g. High Speed Field Bus Expansion
 - h. -20-60°C Ambient Operating Temperature
 - i. Integrated 24 VAC/DC Global Power Supply
 - j. MicroSD Memory Card Employing Encrypted Safe Boot Technology
10. The SNC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.
11. The SNC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers
12. The SNC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via cellular modem, or wide-area network.
 - a. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
 - 1) Alarm.
 - 2) Return to normal.
 - 3) To default.
 - b. Alarms shall be annunciated in any of the following manners as defined by the user:
 - 1) Screen message text.
 - 2) Email of complete alarm message to multiple recipients.
 - c. The following shall be recorded by the SNC for each alarm (at a minimum):
 - 1) Time and date.
 - 2) Equipment (air handler #, access way, etc.).
 - 3) Acknowledge time, date, and user who issued acknowledgement
13. Programming software and all controller "Setup Wizards" shall be embedded into the SNC.
14. The SNC shall support the following security functions.
 - a. Module code signing to verify the author of programming tool and confirm that the code has not been altered or corrupted.
 - b. Role-Based Access Control (RBAC) for managing user roles and permissions.
 - c. Require users to use strong credentials.

- d. Data in Motion and Sensitive Data at Rest be encrypted.
 - e. LDAP and Kerberos integration of access management
 - 15. The SNC shall support the following data modeling structures to utilize Search; Hierarchy; Template; and Permission functionality:
 - a. Metadata: Descriptive tags to define the structure of properties.
 - b. Tagging: Process to apply metadata to components
 - c. Tag Dictionary
 - 16. The SNC shall employ template functionality. Templates are a containerized set of configured data tags, graphics, histories, alarms... that are set to be deployed as a unit based upon manufacturer's controller and relationships. All lower level communicating controllers (PEC, AUC, AVAV, VFD...) shall have an associated template file for reuse on future project additions.
 - 17. The SNC shall be provided with a 5 Year Software Maintenance license. Labor to implement not included.
- B. Primary Controllers (Air Handling Units)
- 1. Each primary controller shall be a dedicated, stand-alone, microprocessor-based DDC controller that is BACnet certified (B-BC / B-AAC) with sufficient capacity to handle all points and programming associated with the control sequences as specified. In addition, each controller shall have a minimum 15% spare point capacity. Primary controllers shall be capable of being mounted within the equipment housing and shall have the capability to be programmed on-line and/or off-line (simulation capability) as required to meet unique HVAC application needs as well as the various ASHRAE control cycles. Primary controllers shall be capable of communicating global and critical variables to other primary controllers residing on the same network without the intervention of a higher level controller (Peer to Peer communication).
 - 2. All devices shall meet the requirements of clause 22.1.5 of ASHRAE 135-2012. Use Analog inputs and outputs. If Analog Output objects are used, these must be writeable.
 - 3. All primary controllers shall be application programmable and shall at all times maintain their certification. All control sequences within or programmed into the primary controller shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.
 - 4. Software incorporated into the controller shall include the following:
 - a. Real time operating system software
 - b. Real time clock/calendar and network time synchronization
 - c. Primary control unit diagnostic software
 - d. LAN/WAN communication software
 - e. Alarm processing and buffer software
 - f. Energy management software
 - g. Data trending, reporting, and buffering software
 - h. Input/output database (physical and virtual points)
 - 5. Primary controller shall have expansion capability to support additional I/O requirements thru remote expansion input/output modules.
 - 6. The controller shall have a mix of digital inputs (DI), digital Triac outputs (DO), analog outputs (AO), and universal inputs (UI).
 - a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
 - b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
 - c. Input and Output wiring terminals shall be designated with color coded labels.
 - d. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA).

7. The controller shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.
 8. An RJ-11 type connection serial port shall allow a local portable operator terminal to access all program blocks and attributes for complete programmability. The port shall also support complete up/downloading capability.
 9. All input/output and control parameters may be utilized or shared throughout the network. All primary controllers shall be accessible throughout the network.
- C. Secondary Controllers (miscellaneous equipment)
1. Each secondary controller shall be a stand-alone, microprocessor-based DDC controller that is BACnet certified (B-AAC / B-ASC) with sufficient capacity to handle all points associated with the control sequences as specified. Secondary controllers shall be capable of being programmed on-line and/or off-line (simulation capability) as required to meet the specific HVAC application needs as well as the various ASHRAE control cycles. Secondary controllers shall be capable of communicating with other secondary controllers through an interface or higher level controller.
 2. All devices shall meet the requirements of clause 22.1.5 of ASHRAE 135-2012. Use Analog inputs and outputs. If Analog Output objects are used, these must be writeable.
 3. Secondary controllers shall be microprocessor-based, programmable DDC controllers with all operating parameters, setpoints and schedules stored in memory which resides on the controller.
 4. Software incorporated into the controller shall include the following:
 - a. Real time operating system software
 - b. Secondary control unit diagnostic software
 - c. LAN/WAN communication software
 - d. Control software applicable to the unit it serves that will support one mode of operation
 - e. Input/output database (physical and virtual points) to support one mode of operation
 5. The controller shall have digital inputs (DI), digital Triac outputs (DO), three analog outputs (AO), and universal inputs (UI).
 - a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
 - b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
 - c. Input and Output wiring terminals shall be designated with color coded labels.
 6. The controller shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.
 7. The controller platform shall have a standard HVAC application program(s) that are modifiable to support both the traditional and specialized "sequence of operations" as outlined in the specification. The controller shall have the capability to communication thru read/write the following:
 - a. Reset room setpoint
 - b. Read/log/trend room temperature
 - c. Override day or night operation
 - d. Read the discharge air temperature at each terminal unit
 - e. Room CO2 control.
 - f. Assign daily occupied/unoccupied times
 - g. Read terminal type i.e. fan powered, reheat, etc.
 8. Should communications to the secondary controller fail in any manner, the controller will have its configuration in non volatile memory and shall maintain room setpoint.

2.16 TEMPERATURE CONTROL WIRING

- A. The DDC System shall communicate to the owner's communication network thru a single point of data connection. All wiring and communication downstream of that single point of data connection shall be provided with the DDC control system.
- B. Control wiring shall meet the requirements of Article 725, Class 1, Class 2, Class 3 Remote-Control, signaling, and power-limited circuits of the NEC.
- C. Control wiring shall be UL listed plenum rated cable or installed in conduit. Wiring shall be routed in conduit where exposed to occupied spaces and in mechanical rooms. Conduit shall be 1/2 inch minimum size and shall be furnished and installed under this section. Exposed wiring in occupied spaces and mechanical rooms will not be accepted.
- D. Concealed wiring and wiring in non-plenum ceiling cavities, which is operating under 100 volts, may be open wired if in compliance with Article 725, NFPA-70 (NEC). Open wiring shall be secured with plastic tie wraps to the permanent building structure as approved by the Architect/Engineer.
- E. Terminations shall be performed by the Temperature Control Contractor.
- F. Wire and conduit not indicated on the Drawings or in the Specifications, but required by the controls supplier, shall be paid for by the Temperature Control Contractor. This includes power supply wiring which is not indicated in the Division 26 drawings but which is necessary for system operation.
- G. Temperature control cable is to be properly supported per industry standards and practices. Cable tray shall not be used for installation of temperature control wiring.
 - 1. Bridle rings shall be used to support wiring in all return air plenums.
- H. Temperature control wiring Color Identification Guide:
 - 1. Wiring between AHU equipment, pumps, chillers, and miscellaneous equipment shall be white.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that systems are ready to receive work.
- B. Beginning of installation means installer accepts existing conditions.
- C. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- D. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- E. Ensure installation of components is complementary to installation of similar components.
- F. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Airflow measurement sensing elements location and sizing of airflow measurement elements shall be confirmed in the field by local factory representative. Velocity calculation and corresponding differential pressure calculations will be calculated accordingly.
- C. Installing contractor shall remote mount the transducer in an acceptable location and provide all pneumatic tubing & wiring required between the transducer and airflow sensors.

- D. Wiring for differential pressure sensors that control heating and chilled water pump operation shall be wired back directly to the chilled water or heating water plant controller. Wiring to nearest controller will not be permitted.
- E. Check and verify location of thermostats with plans and room details before installation. Locate bottom at 44 inches above floor. Align with lighting switches.
- F. Mount freeze protection thermostats using flanges and element holders.
- G. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
- H. Provide separable sockets for liquids and flanges for air bulb elements.
- I. Provide guards on thermostats where indicated.
- J. Provide valves with position indicators and with pilot positioners where sequenced with other controls.
- K. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors. _____ .
- L. Install damper motors on outside of duct in conditioned spaces. Do not install motors in locations at outdoor temperatures.
- M. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- N. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
- O. Temperature control contractor shall make themselves familiar with the commissioning specification and provide all items for the commissioning agents use as noted.

3.03 SEQUENCE OF OPERATION

- A. Refer to Specification Section 23 0993 for all equipment sequences of operation.

3.04 OCCUPIED / UNOCCUPIED ZONES

- A. Manual Overrides:
 - 1. Provide manual, push button overrides as a part of each room temperature sensor. Pressing of override button will place zone on which sensor is located into a programmed override that is adjustable through the software.
 - 2. All zones shall include computer controlled overrides.
- B. Refer to specification section 23 0993 for specified zones.

3.05 GUARANTEE

- A. It is intended that the Temperature Control Contractor include as part of his bid two (2) year full service warranty. All labor and material shall be guaranteed against defects in workmanship for two (2) year period from the date of Substantial Completion and acceptance by the Owner. Any material proving defective shall be repaired or replaced during that period. This shall not, however, apply to material that has been damaged due to willful negligence.
- B. The Contractor will provide hardware and software support during the two year guarantee after the date of acceptance. Hardware support includes replacing of any major or minor components, relays, sensors, etc., that fail to operate properly. Software support includes upgrading of software during warranty period such that system is loaded with latest available revision at end of warranty period.

- C. Software support during the two year warranty shall include any programming changes to correct control operation resulting in alarms. All changes shall be cooresponded with the design engineer and owner.
- D. Support is also defined to include Owner personnel training needed to operate the system effectively as outlined in this Specification. Explicitly included is the training needed to analyze a building's operation with a view to minimizing energy costs.

3.06 TRAINING

- A. The Temperature Control Contractor shall, during the one-year guarantee period, provide no less than (8) 4-hour training sessions to be held at the building site after system is in full operation. A total of two 4 hour training sessions shall be given quarterly during the first 12 months of operation to familiarize maintenance personnel on the operation of the mechanical and control systems through the host computer.
- B. Training shall include a hands on process to get owner involved with making changes, setting schedules, monitoring and acknowledging alarms, setting up trends, and monitoring trends.
- C. All training shall be video-taped by the control Contractor. Two copies shall be turned over to the owner's maintenance staff.

3.07 SERVICE CHECKS

- A. Prior to final inspection, this Contractor shall perform the following service work, including, but not limited to, the following items:
 - 1. Check and oil electric motors furnished under control system.
 - 2. Lubricate damper bearings as required.
 - 3. Check damper travel, adjust and tighten set screws.
 - 4. Lubricate valve stems, as required, check packing; repair as required.
 - 5. Calibration of instruments.
 - 6. Check and verify circuitry.
 - 7. Calibrate and checkout controllers, fusing, etc.
 - 8. Test and debug microprocessor and software.
 - 9. Startup and test operation of variable frequency drive with factory authorized personnel.

3.08 FINAL COMPLETION

- A. When the work is completed, and at a time directed by the Owner or the Architect/Engineer, the Contractor shall carefully adjust all parts of the equipment and systems. This includes adjustment of automatic controls and safety devices, proper setting of adjustable devices, dampers and valves, and other necessary operations so the systems are fully operable and automatic in operation. Upon completion of the Work, notify the Owner, and/or Architect/Engineer that system is ready for final tests and inspection.
- B. At the time of final inspection, this Contractor shall be represented by a person with the proper authority, who shall demonstrate, as directed by the Architect/Engineer, that his Work fully complies with the purpose and intent of the Specifications and Drawings. Labor, services, instruments, and tools necessary for demonstrations and tests shall be provided by the Contractor.
- C. The Contractor shall test and adjust each instrument specialty and equipment furnished by him, prior to final acceptance. The Contractor shall demonstrate, for approval by the Architect/Engineer, that subsystems operate as a coordinated and properly functioning, integrated system.
- D. The Contractor shall furnish labor, provide adjustments and incidentals necessary to obtain the desired and intended results.

- E. The Contractor shall turn over a printed copy and electronic copy of the completed and debugged operating software to the Owner at the conclusion of the first year warranty.
- F. The contractor shall provide a list of all devices and their addresses to the owner. This shall be included in the O&M manual.
- G. The Contractor shall coordinate with the Commissioning Agent to run requested trends for demonstration of the functions.

END OF SECTION

SECTION 23 09 93
SEQUENCE OF OPERATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sequence of operation for:
 - 1. Constant Volume Air Handling Units with Energy Recovery
 - 2. Heating Water System.

1.02 RELATED REQUIREMENTS

- A. Section 23 09 13 - Instruments and Control Elements.
- B. Section 23 7323 - Custom Air Handling Units

1.03 SYSTEM DESCRIPTION

- A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.
- B. Sequence of operation shall meet the requirements of ASHRAE Standard 90.1-2007.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Temperature Control Contractor shall coordinate a meeting with the Engineer before submitting control sequence to ensure all sequences are understood and to address areas of concern. Sequence of Operation will not be reviewed until this meeting has taken place.
- C. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
- D. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
 - 1. Label with settings, adjustable range of control and limits.
 - 2. Include written description of control sequence.
 - 3. Include flow diagrams for each control system, graphically depicting control logic.
 - 4. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
- E. Points List: Submit list of all control points indicating at least the following for each point. The point names used in the field must match the point names served up by the control system.
 - 1. Name of controlled system.
 - 2. Point abbreviation.
 - 3. Point description; such as dry bulb temperature, airflow, etc.
 - 4. Display unit.
 - 5. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
 - 6. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
 - 7. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
 - 8. Calculated point (Yes / No); i.e. a "virtual" point generated from calculations of other point values.

- F. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

1.05 QUALITY ASSURANCE

- A. The installing contractor shall be an experienced, licensed dealer for the BAS system specified. Contractor to have a minimum of five years experience in both installation and maintenance of the units required for this project.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 AIR HANDLING UNITS WITH ENERGY RECOVERY AND EXHAUST: AHU-1

- A. Provide a microprocessor based direct digital control system that shall provide the following:
1. Direct Digital Controller interface.
 2. Occupied-unoccupied control.
 3. Necessary operating interlocks.
- B. Supply and Exhaust Fans are provided with motor impeller control panels provided by the manufacturer.
- C. The temperature control contractor shall be responsible to coordinate controller type with the unit manufacturer. Provide necessary gateways if required.
- D. Heating Warm-Up
1. The DDC control system shall implement an optimum start program. The program shall calculate the minimum run time required to warm up the space as a function of both internal and external air temperatures. Incorporate either a self learning or adaptive feature.
 2. The air handling unit supply fan shall be indexed to run 100%.
 3. The energy recovery wheel and exhaust fan shall not run. The energy recovery wheel bypass dampers shall be closed.
 4. The air handler return air damper shall be 100% open.
 5. The air handler outside air damper shall remain closed.
 6. The heating water valve shall be indexed open to provide heating.
 7. Upon space reaching setpoint, air handling unit supply fan shall be modulated to minimum speed and heating water valve modulate to maintain space setpoint until unit is indexed to occupied mode.
 8. When the air handler schedule enters occupied mode, the unit shall be changed over to occupied mode and the outside air damper opened to provide the design ventilation air as denoted on the drawings.
- E. Cooling Pull-Down
1. The DDC control system shall implement an optimum start program. The program shall calculate the minimum run time required to cool down the space as a function of both internal and external air temperatures. Incorporate either a self learning or adaptive feature.
 2. The air handling unit supply fan shall be indexed to run 100%.
 3. The energy recovery wheel and exhaust fan shall not run. The energy recovery wheel bypass dampers shall be closed.
 4. If the outside air temperature is below 60 degrees F (adj.), the air handler return air damper shall be closed, the energy recovery wheel supply air bypass damper shall be 100% open, and the outside air damper shall modulate to utilize "free cooling". Above 60 degrees F, the air handler outside air damper shall be closed, the return air damper shall

- be 100% open, and the DX split system cooling system energized until the return air temperature is 77 degrees F (adj.).
5. Upon space reaching setpoint, air handling unit supply fan shall be modulated to minimum speed and DX split system cooling coil modulate to maintain space setpoint until unit is indexed to occupied mode.
 6. When the air handler schedule enters occupied mode, the unit shall be changed over to occupied mode and the outside air damper opened to provide the design ventilation air as denoted on the drawings.
- F. Occupied Cycle
1. The direct digital controller shall automatically program the unit to the occupied control mode.
 2. Anytime the unit is indexed to occupied mode, the outside air control damper shall be ramped open over a 10 minute (adj.) period to prevent nuisance low limit trips. The exhaust air outlet damper shall be indexed open and proven open with an end switch before exhaust fan is indexed on.
 3. The return air bypass damper shall be indexed closed.
 4. The supply fan and exhaust fan shall be indexed on.
 5. The air handling unit supply fan shall operate to supply 100% of design supply airflow.
 6. The exhaust fan shall run continuously.
 7. The heating coil, DX cooling coil, energy recovery wheel, ERW bypass dampers, and economizer shall be controlled in sequence to maintain the desired discharge air temperature.
 8. Space Temperature set points:
 - a. Occupied Heating: 70° F (adj.)
 - b. Occupied Cooling: 74° F (adj.)
 - c. Unoccupied Heating: 66° F (adj.)
 - d. Unoccupied Heating: 78° F (adj.)
 9. Heating Mode:
 - a. As the space temperature drops below the heating space temperature set point, the unit shall enter the heating mode. The heat wheel, bypass dampers, and heating water control valve shall be sequenced in the following order to maintain discharge air temperature.
 - 1) Enable Energy Recovery Wheel,
 - 2) Modulate the heat wheel bypass dampers closed.
 - 3) Modulate the heating water control valve open to maintain discharge air temperature of 85 degrees F (adj.).
 10. Cooling Mode:
 - a. The unit shall be indexed to cooling mode whenever the discharge air temperature (DA-T) is greater than the DA-T set point.
 - 1) Mechanical cooling shall be locked out below 50 degrees F (adj.) outdoor air temperature.
 - 2) When the outdoor air temperature (OAT) is less than or equal to the Return Air Temperature (RA-T) minus six degrees ($OAT \leq RA-T - 6$) (adj.), the unit shall:
 - (a) First enable the economizer and modulate the outdoor air damper to maintain the DA-T set point. If the DA-T set point cannot be maintained with the outdoor air damper at 100% open, the unit shall modulate the DX cooling units to maintain DAT set point.
 - (1) DX cooling control: Provide a 3* proportional band. Enable stage 1 when 66% (2 degrees) from setpoint and stage 2 when 100% from setpoint (3 degrees) from setpoint. When cooling discharge air

temperature gets below the proportional band, cooling stages shall be disabled in reverse order.

- (b) The economizer mode shall have a mixed air temperature low limit of 40 degrees F (adj.) temperature. The low limit mixed air temperature sensor shall be an averaging type sufficient length. The length of the sensor shall be the greater of 20' minimum or 1' per 1 sq. ft. of coil face area.
 - 3) When the OAT is greater than the RA-T minus six degrees F ($OAT > RA-T - 6$) (adj.), the unit shall:
 - (a) Disable the economizer and modulate the DX cooling unit to maintain DAT set point.
 - (1) DX cooling control: Provide a 3* proportional band. Enable stage 1 when 66% (2 degrees) from setpoint and stage 2 when 100% from setpoint (3 degrees) from setpoint. When cooling discharge air temperature gets below the proportional band, cooling stages shall be disabled in reverse order.
 - 4) Supply Air Temperature Setpoint Reset: During occupied mode, the setpoint is reset from T-min (design temperature shown on AHU schedule (adj.)) when the outdoor air temperature is 70 degrees F (adj.) and above proportionally up to T-max when the outdoor air temperature is 65 degrees F (adj.) and below. T-max shall be reset using trim and respond logic within the range of 55 degrees F (adj.) and 65 degrees F (adj.). When the fan is off, freeze T-max at the maximum value (65 degrees F (adj.)). While fan is proven on, every 5 minutes, increase setpoint by 1 degree F (adj.) if there are no zone cooling requests. A cooling request is generated when the cooling control loop of any zone served by the AHU is >99%. All values adjustable from the fan graphic.
 - (a) Note: 99% is used rather than 100% because some control systems have rounding errors that sometimes prevent a software value from ever reaching exactly 100%.
 - (b) The operator shall be capable of excluding any "rogue" zones from the cooling requests poll.
11. Deadband Mode:
- a. When the space temperature is between the heating and cooling setpoint, the supply fan and exhaust fan shall operate at 100%, and the energy recovery wheel shall operate if OAT is above 78 degrees F (adj.) or below 55 degrees F (adj.)
 - 1) The supply fan and exhaust fan shall operate at 100% speed.
 - 2) If the OAT is above 78 degrees F (adj.) or below 55 degrees F (adj.), the energy recovery wheel shall operate and the energy recovery wheel bypass dampers closed.
 - 3) The heating water valve or DX cooling stages shall modulate to supply space neutral temperature of 70 degrees F (adj.).

G. Unoccupied Schedule

- 1. The direct digital controller shall automatically program the unit to the unoccupied control mode.
- 2. The unit may be manually placed into occupied mode from the BAS for a pre-programmed period of time.
- 3. The supply and exhaust fans shall be indexed off.
- 4. The heating water valve shall be spring return open in event of power failure or low limit temperature.
- 5. The heating water valve shall modulate to maintain a 40 degree F (adj.) temperature in the cabinet as measured by the energy recovery wheel entering exhaust air temperature sensor. An alarm shall be generated if the EAT is 35 degrees F or below.

6. The DX cooling shall be turned off.
7. The outside air damper, energy recovery wheel bypass dampers, and exhaust air outlet damper shall be closed.
8. The return air damper shall be 100% open.
9. Supply fan shall be indexed to 50% speed and the heating water valve modulated whenever a space requires heating to maintain a minimum space unoccupied temperature of 66 degrees F (adj.).
10. Supply fan shall be indexed to 50% speed and the DX cooling modulated whenever the space requires cooling to maintain a maximum space unoccupied temperature of 78 degrees F.
11. During the Unoccupied cycle the Temperature Control System shall monitor the humidity via a humidistat mounted in the zone(s) controlled by air handler. Above 65% (adj.) the temperature control system shall run the air handler and modulate the cooling until the humidity in the space falls below 60% (adj.). Unit shall then be indexed back to unoccupied mode.

H. Safeties

1. Provide a software reset safety high limit in the discharge air duct to stop the supply fan, exhaust fan, and heat wheel if discharge static pressure goes above 6 inches W.C. (adj.). System shall be capable of being reset through software at the temperature control computer.
2. Provide a software reset safety low limit in the exhaust air duct to stop the supply fan, exhaust fan, and heat wheel if the suction static pressure goes below -4 inches W.C. (adj.). System shall be capable of being reset through software at the temperature control computer.
3. Provide a software reset safety low limit thermostat upstream of cooling coil and downstream of heating coil set to close the outside air damper, stop the energy recovery unit, stop the supply fan, and open the heating water valve 100% if the air temperature drops below 35 degrees (adj.). System shall be manually reset when freezing condition has been eliminated.
4. Provide differential pressure sensing across air filters and send alarm to BAS panel requesting filter change. Include independent alarm for each filter bank at each air handling unit. Pre-filters and final filters shall be monitored independently with a total of three alarms per air handling unit. Alarms and setpoints shall be capable of being reset through software at the temperature control computer. At the time of substantial completion (after the control system has been operational for sometime), the contractor shall review the calibration and setpoints of all these sensors and shall adjust as necessary to eliminate any nuisance alarms to the owner.
5. The system provided must be capable of manually positioning all damper operators, and the cooling/heating valve actuator if all levels of DDC control fail.
6. A fan proving device will indicate the fan status for each fan and send an alarm to the central BAS panel indicating fan failure.
7. All dampers internal to the air handling unit shall be factory installed. All actuators and control wiring shall be provided and installed by temperature control contractor. Refer to drawings for air handler layout.
8. All safeties shall be wired in such a way that the unit fans cannot be turned on in hand mode whenever any safeties are tripped.
9. All existing ductwork mounted dampers shall be reused where possible. New ductwork mounted dampers to be provided and controlled by temperature control contractor and installed by Sheet Metal Contractor. Dampers internal to the air handling unit shall be factory installed.

10. Heat Wheel Frost Protection: Unit to measure pressure drop across exhaust side of the energy recovery wheel. Upon increase in pressure drop to 0.5" w.c. (adj.) above the designed full airflow operating setpoint (coordinate this value with AHU manufacturer), the unit shall enter a defrost mode. During the defrost mode, the outside air damper will close, the return air damper will open, exhaust fan will remain on, exhaust damper will remain open, heat wheel will rotate with bypass dampers closed. Once pressure drop returns to normal, indicating frosting conditions has been corrected, the system will return to occupied mode of operation. Alarm shall be generated at the building automation workstation.
11. MICP Manual Override Alarm: Network with MICP interface and provide alarm if MICP is locally left in manual speed control or "hand mode".
12. An inline coil circulating pump shall be provided on the cooling coil. The pump shall be energized to run continuously below 40 deg F (adj.) outside air temperature.

3.02 AIR COOLED CONDENSING UNIT

- A. The condensing unit shall be supplied complete with all operating and safety controls.
 1. A Bacnet Protocol controller will be provided with the condensing unit. At a minimum, the following points (along with any others necessary to accomplish the control sequences) shall be made available by the temperature control contractor on the BAS:
 2. Outputs (adjustable):
 - a. Cooling Setpoint
 - b. Demand Limit on/off
 - c. Capacity Limit Setpoint
 - d. Emergency Stop
 - e. Enable/Disable
 - f. Clear Alarm
 3. Inputs:
 - a. Cooling Demand
 - b. Active Setpoint
 - c. Circuit A run hours
 - d. Circuit A starts
 - e. Circuit B run hours
 - f. Circuit B starts
 - g. Compressor starts (each compressor)
 - h. Compressor run hours (each compressor)
 - i. Compressor On/Off Status (each compressor)
 - j. Return gas temperature (each compressor)
 - k. Discharge Pressure - Circuit A
 - l. Discharge Pressure - Circuit B
 - m. Communication Status
 - n. Machine Operating Hours
 - o. Machine Starts
 - p. % total capacity - Circuit A
 - q. % total capacity - Circuit B
 - r. Suction pressure - Circuit A
 - s. Suction pressure - Circuit B
 - t. Suction Super Heat - Circuit A
 - u. Suction Super Heat - Circuit B
 - v. Error Code
 - w. Alarm Present

- x. Shutdown Alarm Present
 - y. Last Diagnostic
- B. The BAS shall enable the ACCU control circuit on a call for cooling any time the outdoor air temperature is above 50 degrees F (adj.).
 - 1. When there is no call for cooling for 30 minutes (adj.) the ACCU shall be disabled.
- C. Once energized, the ACCU shall automatically operate to maintain required AHU DAT temperature, per the AHU sequence of operation.
- D. Lock out the ACCU below 50 degrees F (adj.) outside air temperature from the BAS.
- E. ACCU shall be enable during unoccupied mode upon a call for cooling from the AHU DDC control system

3.03 CRITICAL ALARMS

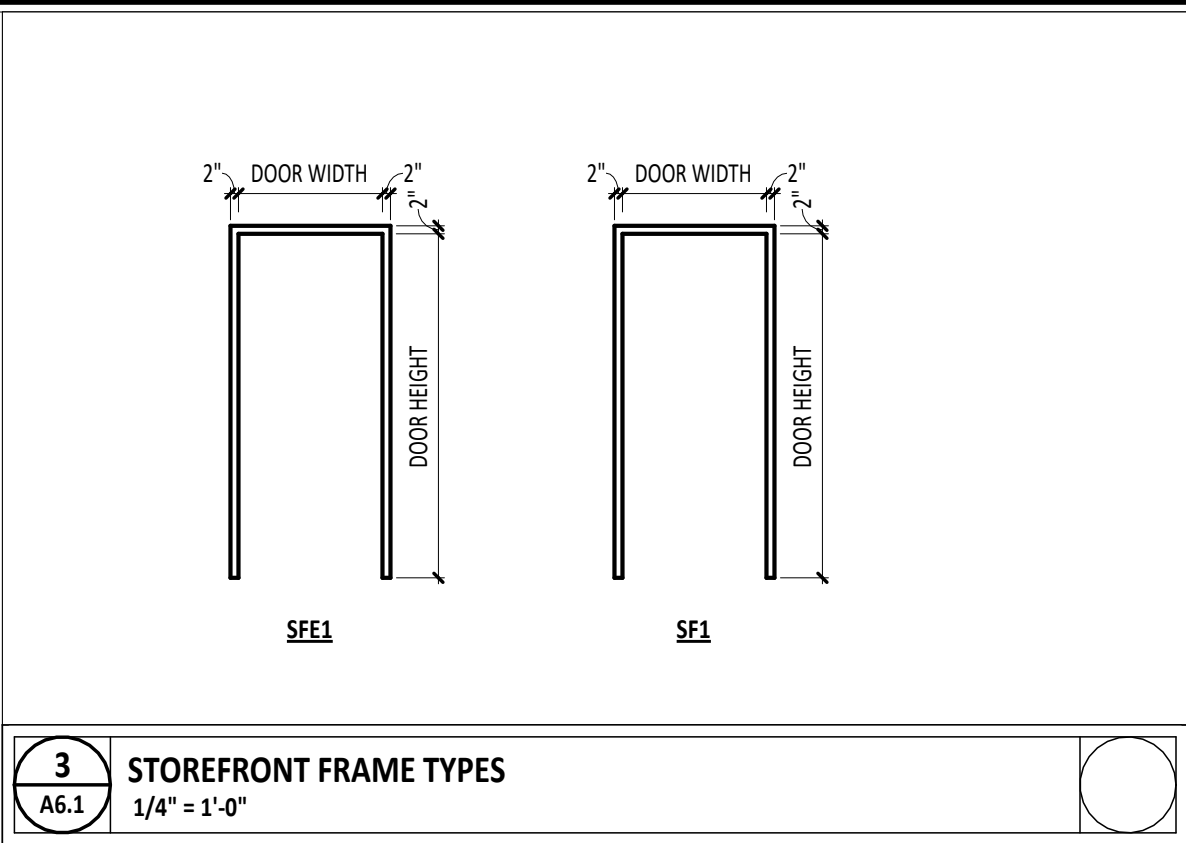
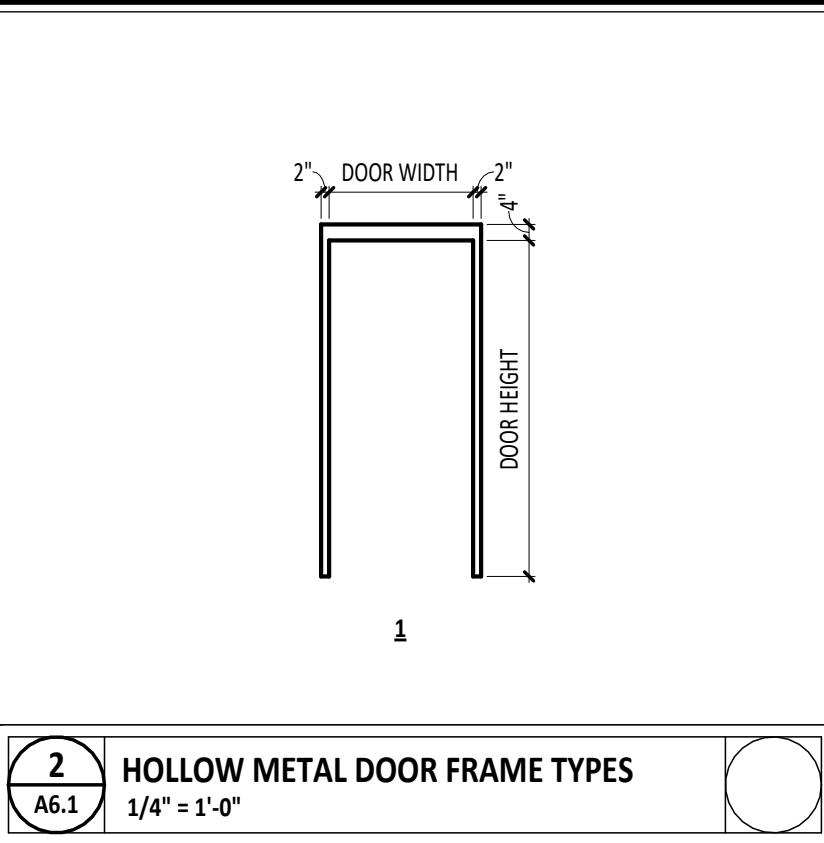
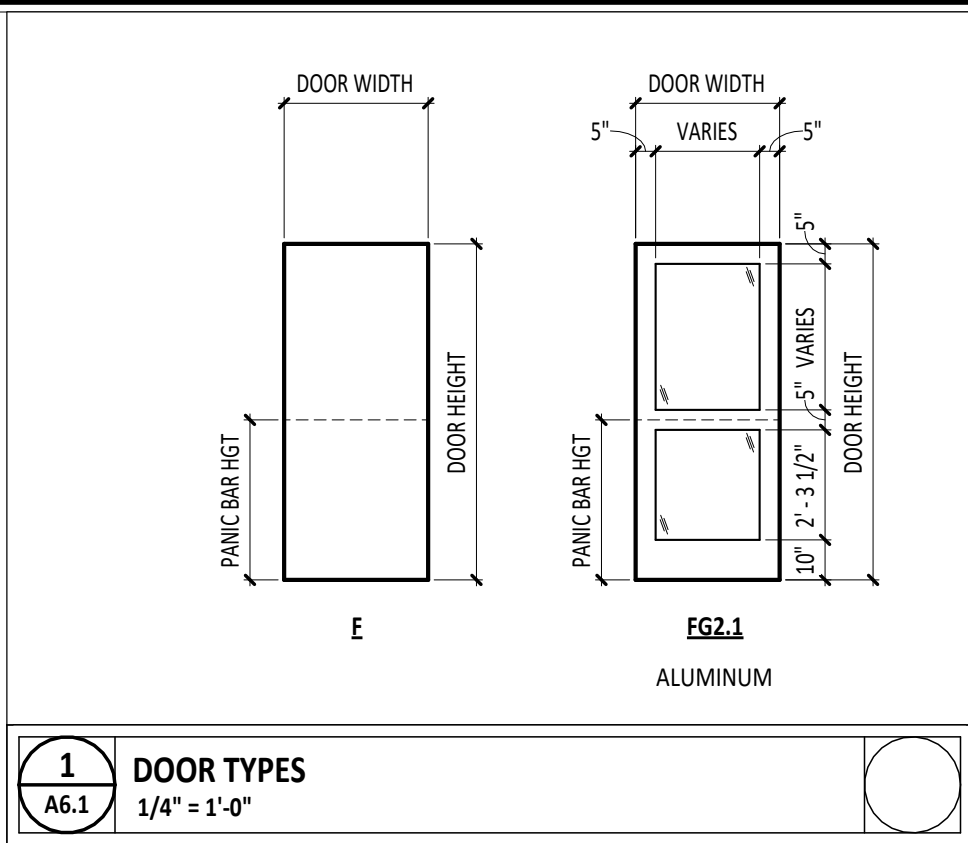
- A. Critical alarms shall dial personal cell telephones, pagers, or home telephones and send email messages to selected school district employees.
- B. The following Alarms shall be considered critical alarms:
 - 1. Any space temperature dropping below 48 degrees F (adj.)
 - 2. Any additional alarms deemed critical by the school district and/or the Architect/Engineer.

3.04 DAY/NIGHT ZONES

- A. The following shall be the accepted zone control. Zone control shall include all air handling units and air cooled condensing units. All zones to include capabilities through the direct digital controller for override setting to full occupied cycle during unoccupied cycle.
- B. Zones:
 - 1. Zone 1 - Clinic and Lockerroom

END OF SECTION

DOOR/OPENING SCHEDULE																	
NUMBER	DOOR					FRAME											
	SIZE	THK	MATL	TYPE	GLASS	DEPTH	MATL	TYPE	GLASS	DETAIL NUMBER			HARDWARE SET	ROOM KEY SIDE	FUNCTION	LABEL (MIN)	NOTES
A100	3'-0" x 7'-2"	1 3/4"	AL	FG2.1	EG-2	4 1/2"	AL	SF1	EG-2	8/A6.1	9/A6.1	10/A6.1	01	-	Exterior	-	
A101	3'-0" x 7'-2"	1 3/4"	AL	FG2.1	G-1	4 1/2"	AL	SF1	G-1	12/A6.1	11/A6.1	-	02	-	Interior	-	
A102	3'-0" x 7'-0"	1 3/4"	HM	F	-	8 3/4"	HM	1	-	5/A6.1	6/A6.1	-	03	-	Interior	-	
A103	3'-4" X 8'-10"	1 11/16"	WD	-	-	4"	AL	-	-	-	-	-	-	-	Interior	-	1
A104	3'-4" X 8'-10"	1 11/16"	WD	-	-	4"	AL	-	-	-	-	-	-	-	Interior	-	1
A105	3'-4" X 8'-10"	1 11/16"	WD	-	-	4"	AL	-	-	-	-	-	-	-	Interior	-	1
A106	3'-0" x 7'-0"	1 3/4"	HM	F	-	8 3/4"	HM	1	-	3/A6.1	6/A6.1	-	04	-	Interior	-	
A109	8'-0" x 8'-0"	2"	STL	CD	-	0"	-	-	-	13/A6.1	15/A6.1	14/A6.1	-	-	Interior	-	



DOOR GENERAL NOTES

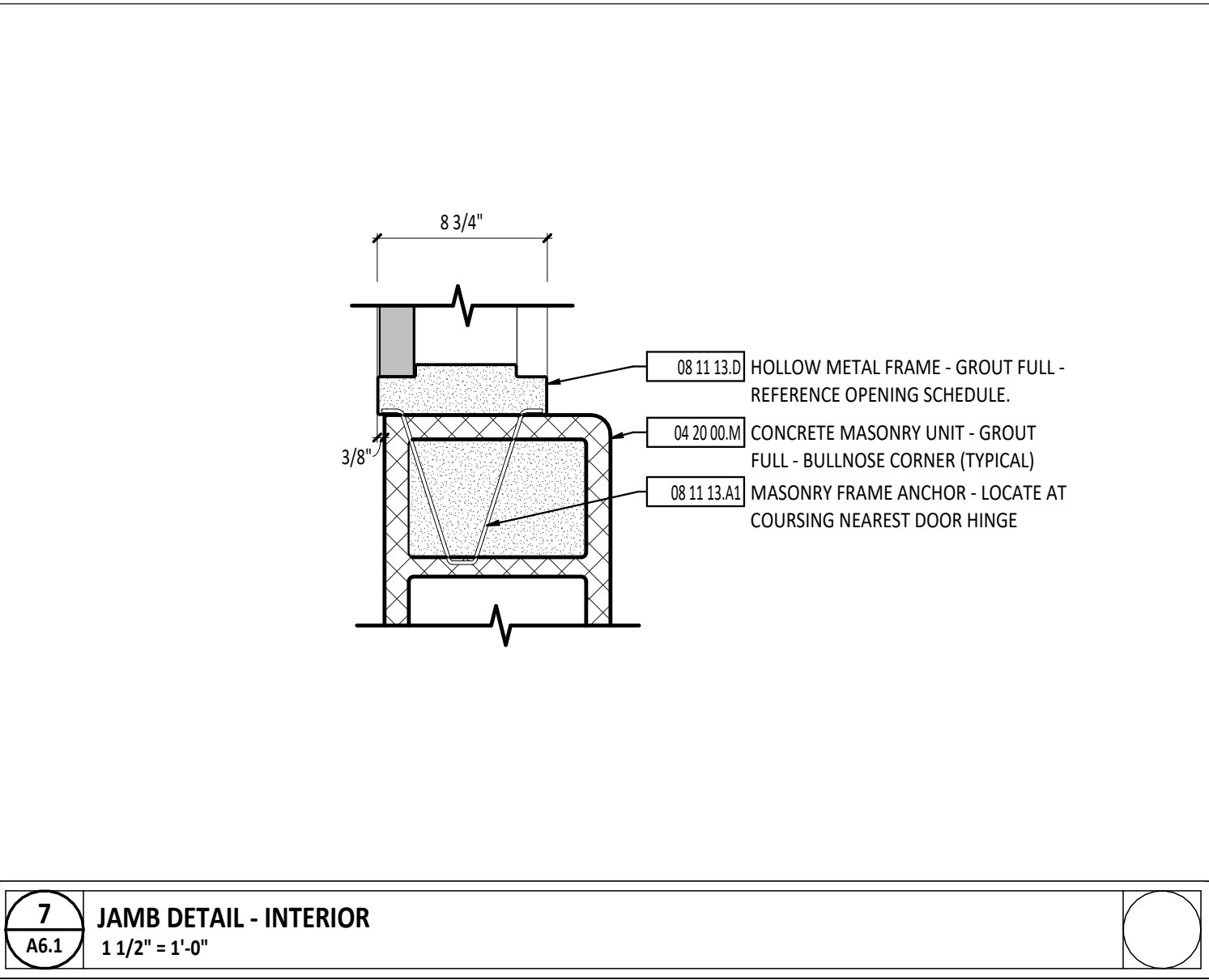
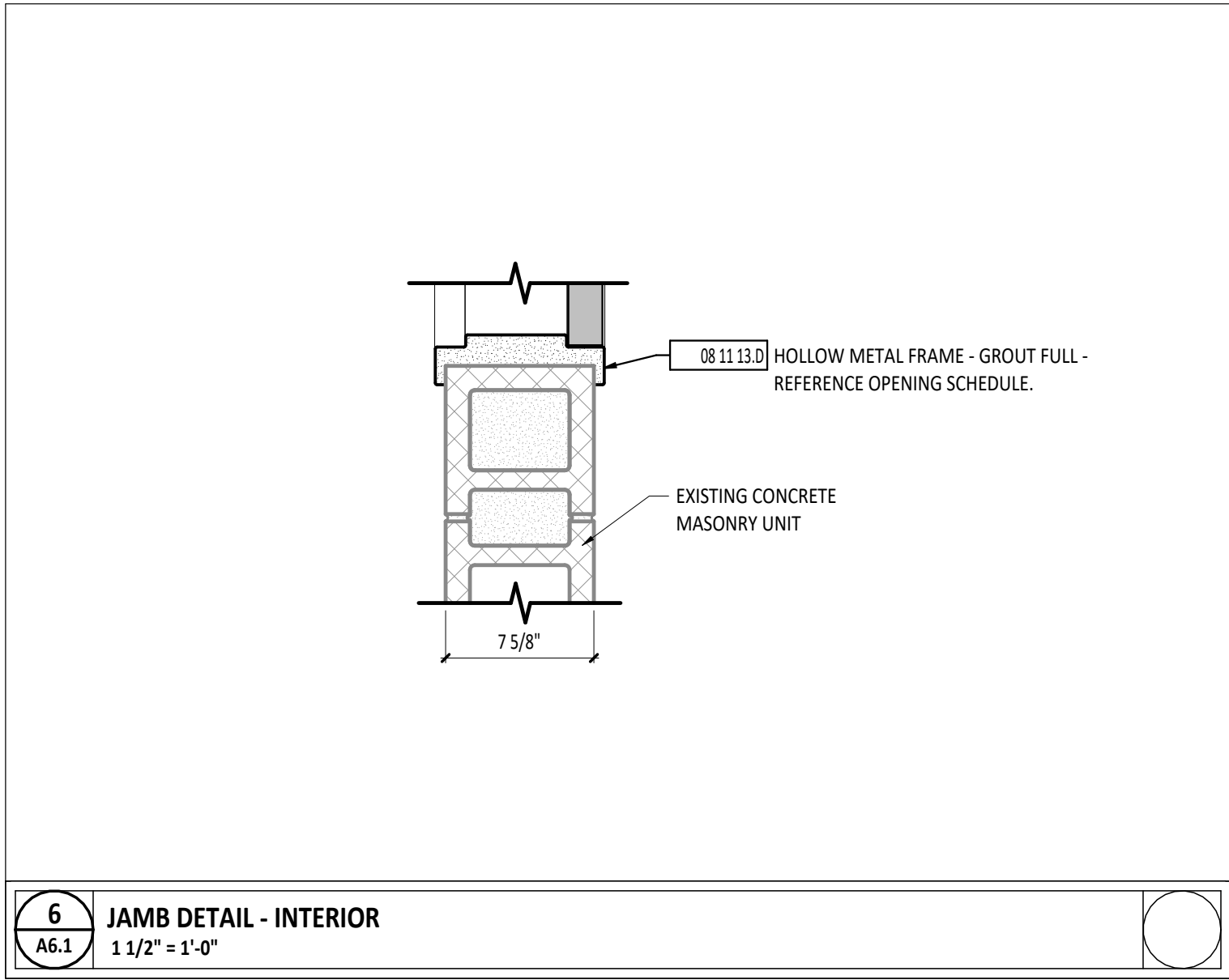
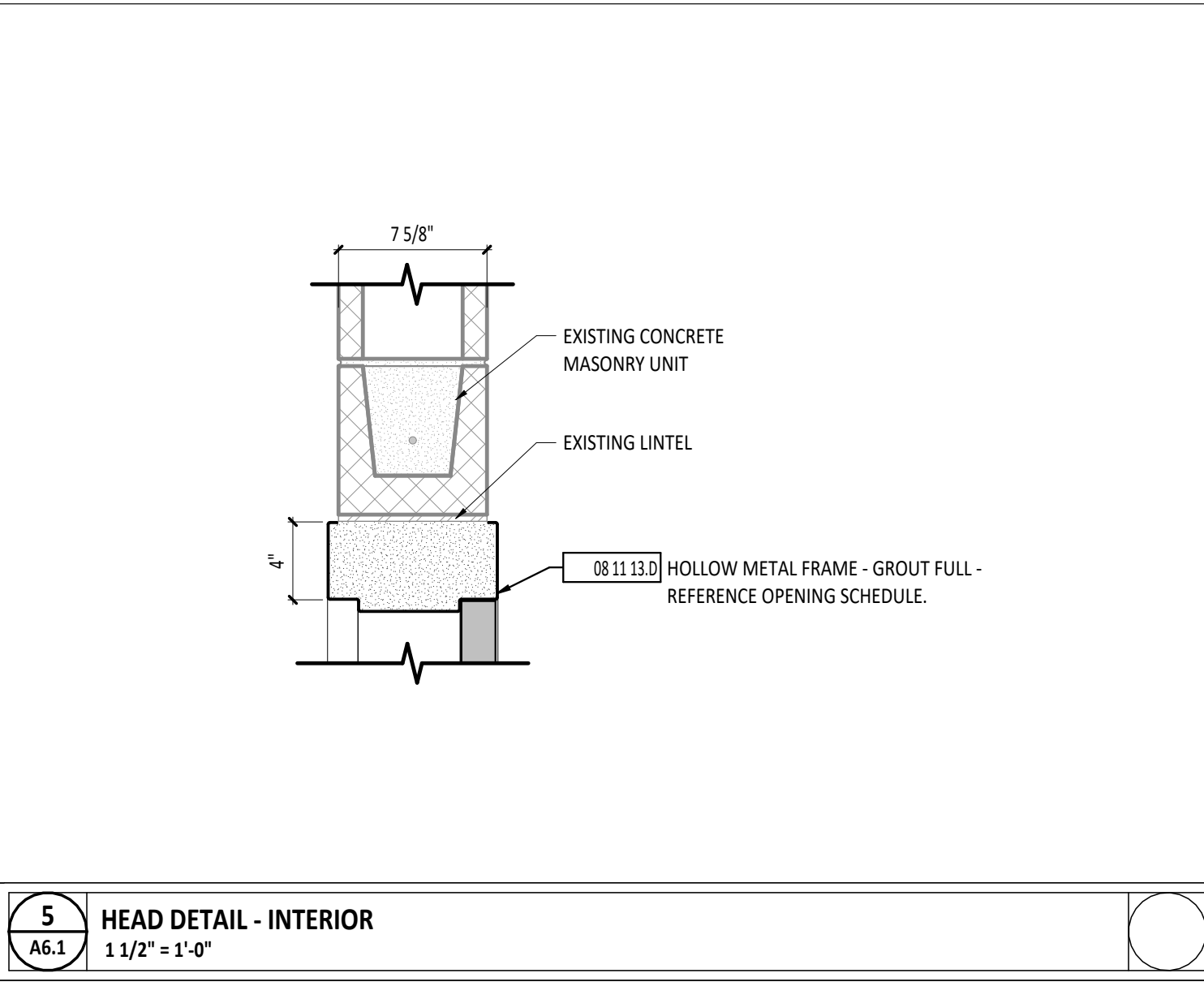
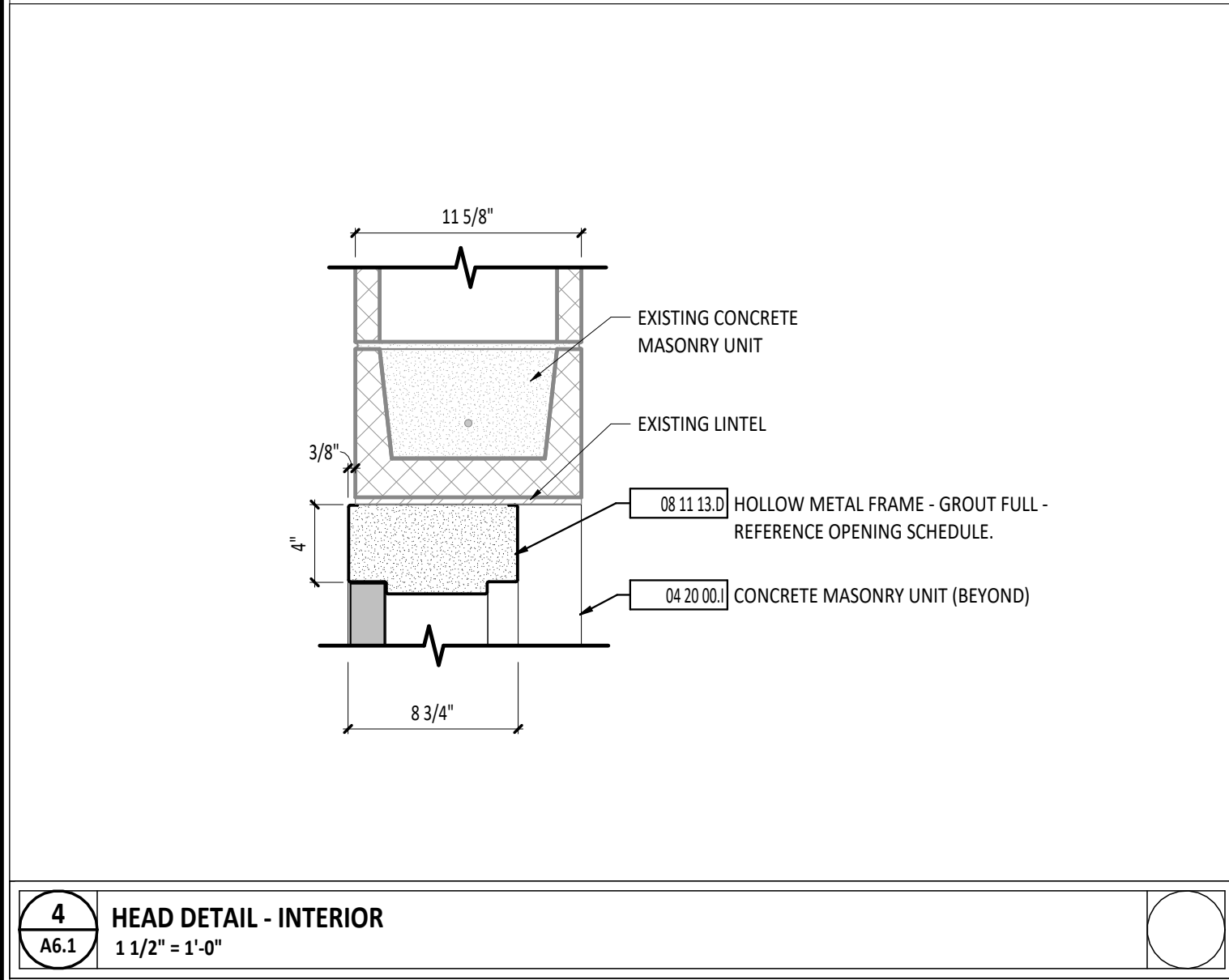
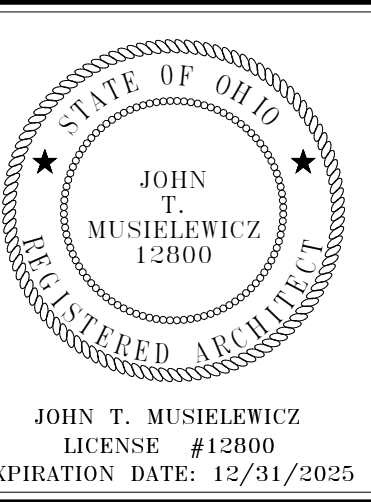
A REFERENCE A6 SHEETS FOR DOOR AND STOREFRONT DETAILS.
B REFERENCE SPECIFICATION SECTION 08 71 00 FOR HARDWARE SETS.
C VERIFY EXISTING CONDITIONS PRIOR TO ORDERING MATERIALS OR PERFORMING WORK

DOOR/OPENING SCHEDULE ABBREVIATIONS

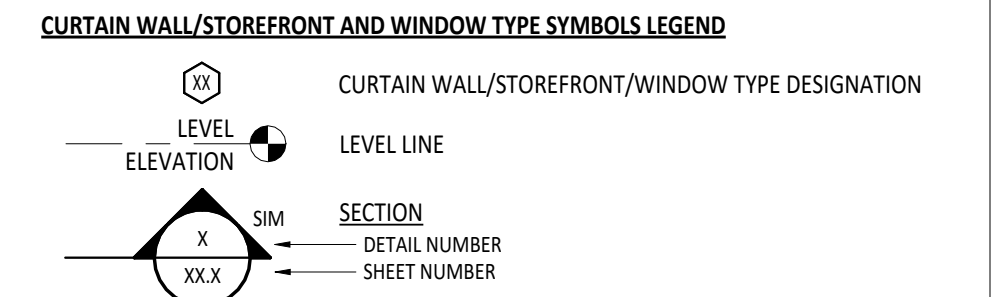
AL ALUMINUM
F FLUSH
HM HOLLOW METAL
W WOOD
SLD SLIDING
STL STEEL
CD COILING DOOR

DOOR/OPENING SCHEDULE NOTES

1. DOOR, FRAME, AND HARDWARE PROVIDED WITH DIRT WALL SYSTEM



#	KEYNOTE DESCRIPTION
04 20 00 G2	NOMINAL 6" CONCRETE MASONRY UNIT
04 20 00 J	CONCRETE MASONRY UNIT (BEYOND)
04 20 00 M	CONCRETE MASONRY UNIT - GROUT FULL - BULLNOSE CORNER (TYPICAL)
05 12 00 D2	MASONRY SUPPORT W8X15 STEEL LINTEL AND 3/8X11 BOTTOM PLATE
05 12 00 F1	GALVANIZED STEEL BENT PLATE
06 10 00 A	WOOD SHIM
06 10 00 C1	PRESERVATIVE TREATED WOOD SHIM - FOAMED-IN-PLACE INSULATION BETWEEN SHIMS
07 92 00 A	BACKER ROD WITH SEALANT
08 11 13 A1	MASONRY FRAME ANCHOR - LOCATE AT COURSING NEAREST DOOR HINGE
08 11 13 D	HOLLOW METAL FRAME - GROUT FULL - REFERENCE OPENING SCHEDULE.
08 33 23 A	OVERHEAD COILING DOOR WITH HOUSING
08 33 23 B	OVERHEAD COILING COUNTER SHUTTER
08 43 13 B	ALUMINUM STOREFRONT DOOR AND FRAME - REFERENCE OPENING SCHEDULE.
08 71 00 A	DOOR THRESHOLD

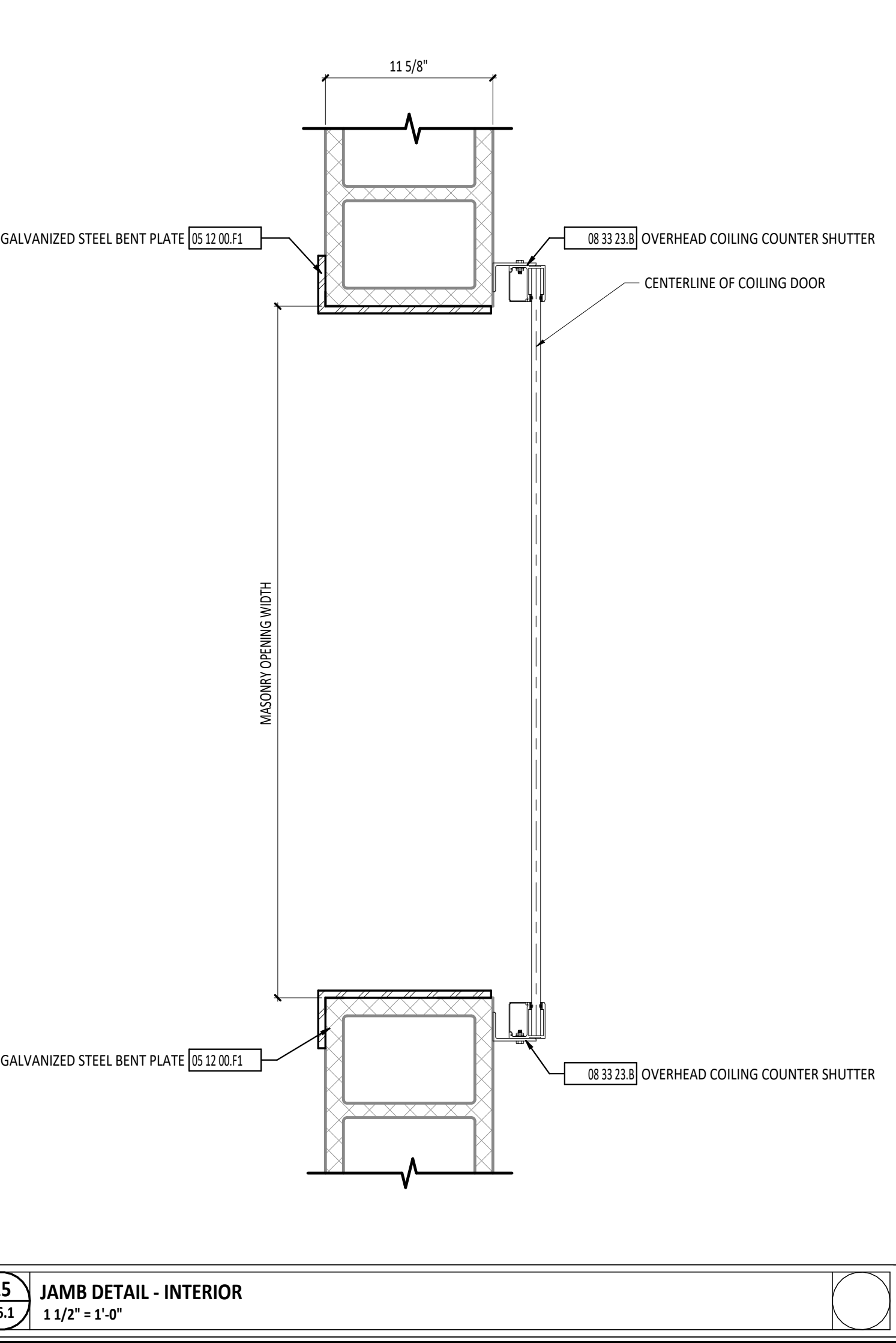
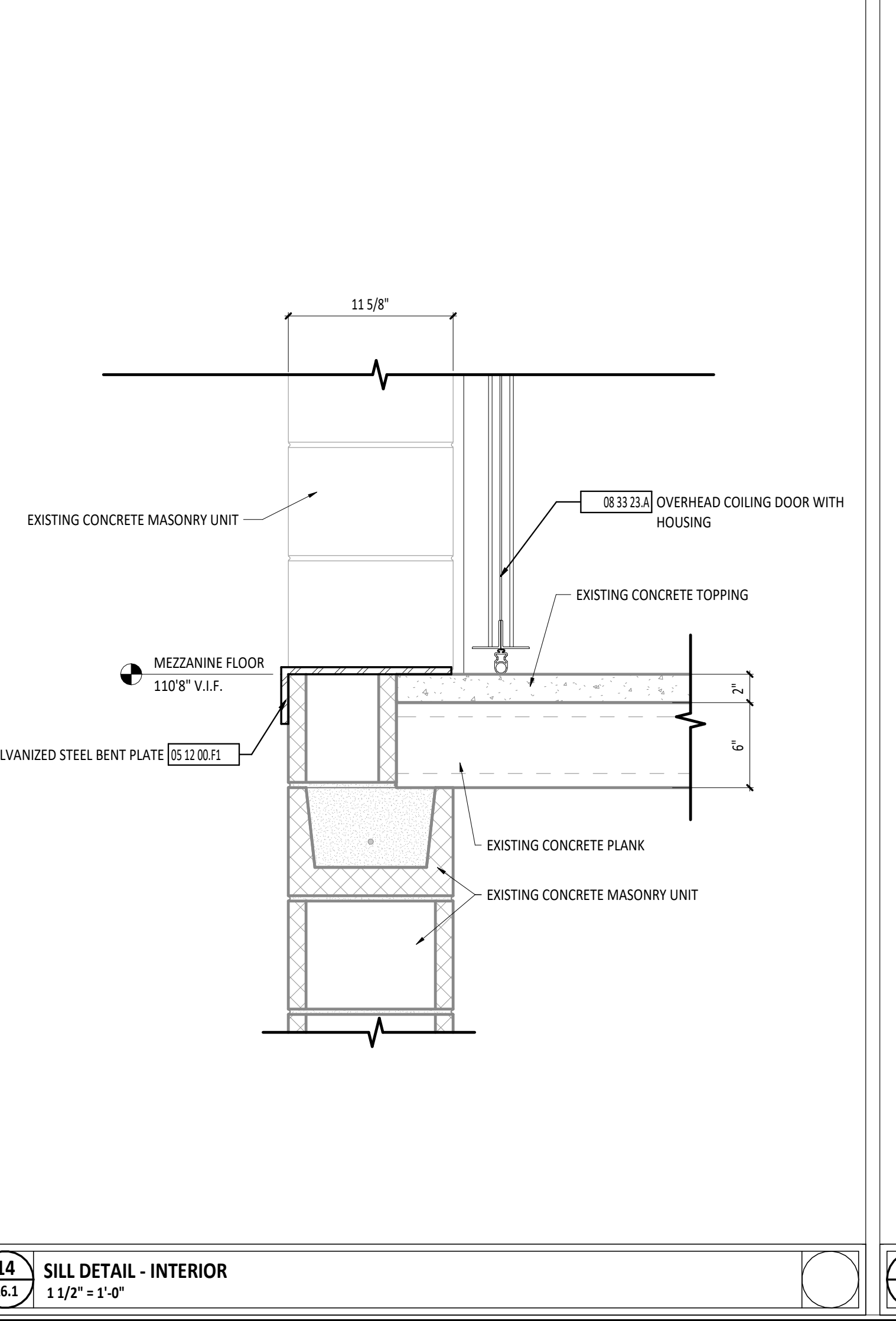
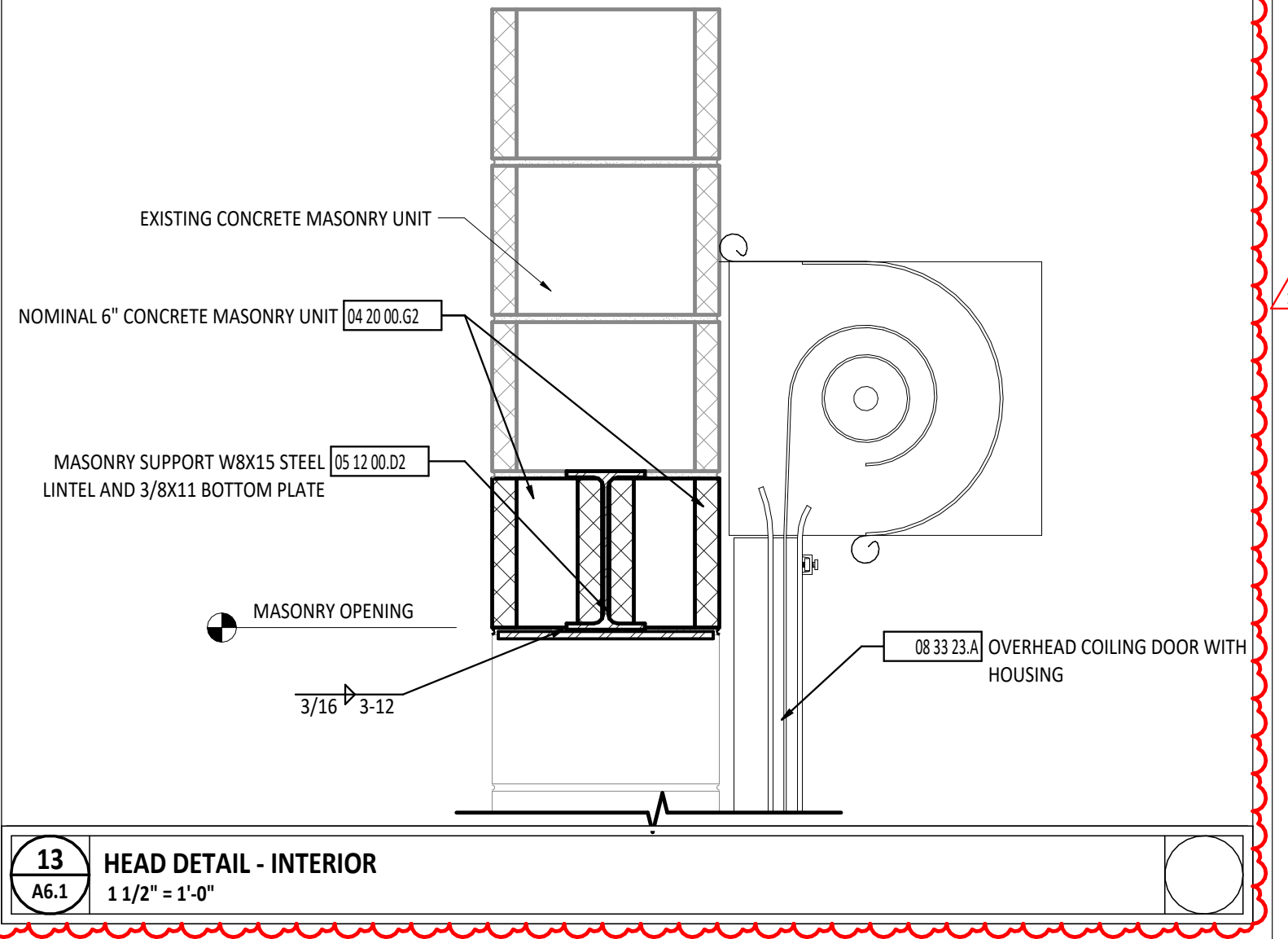
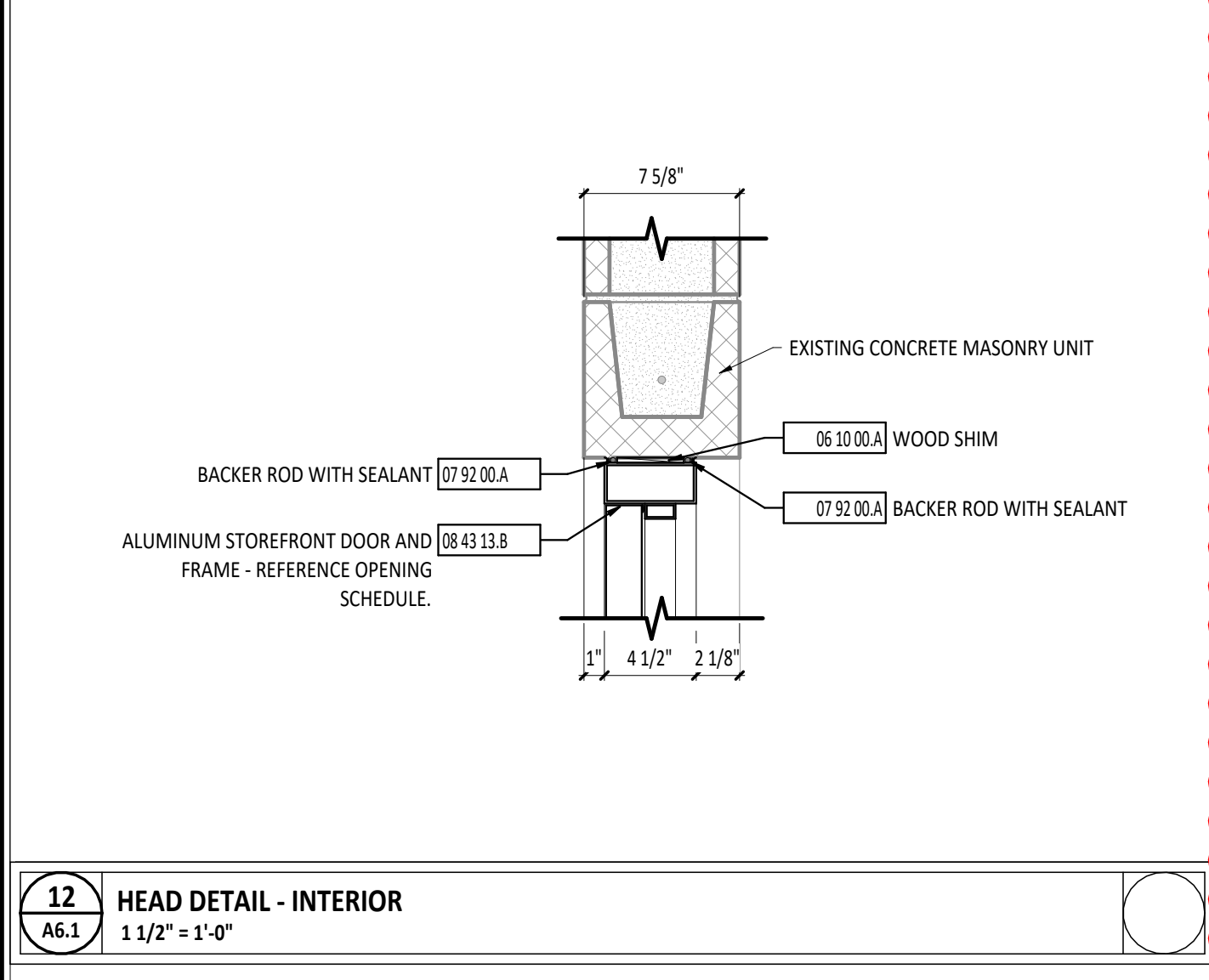
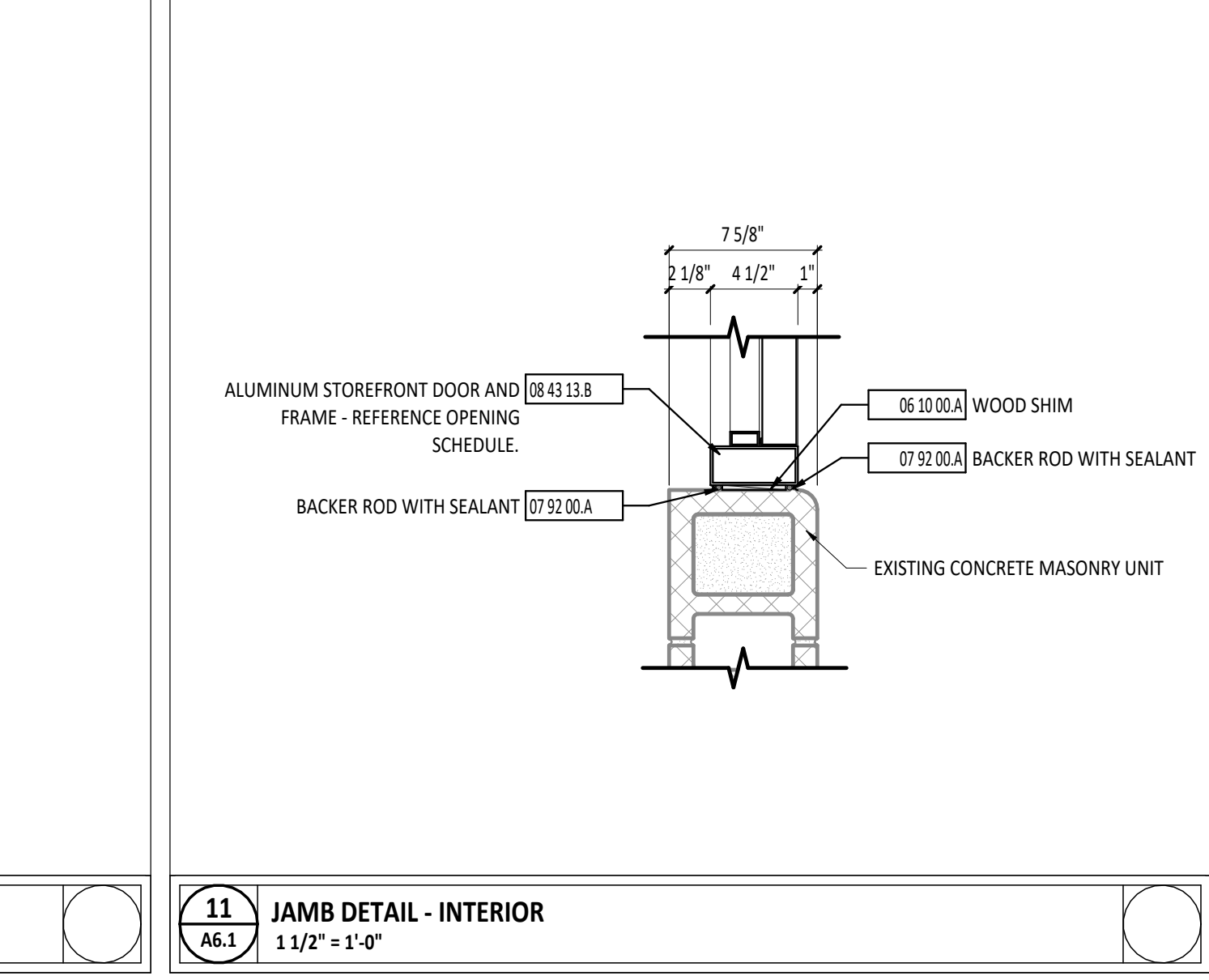
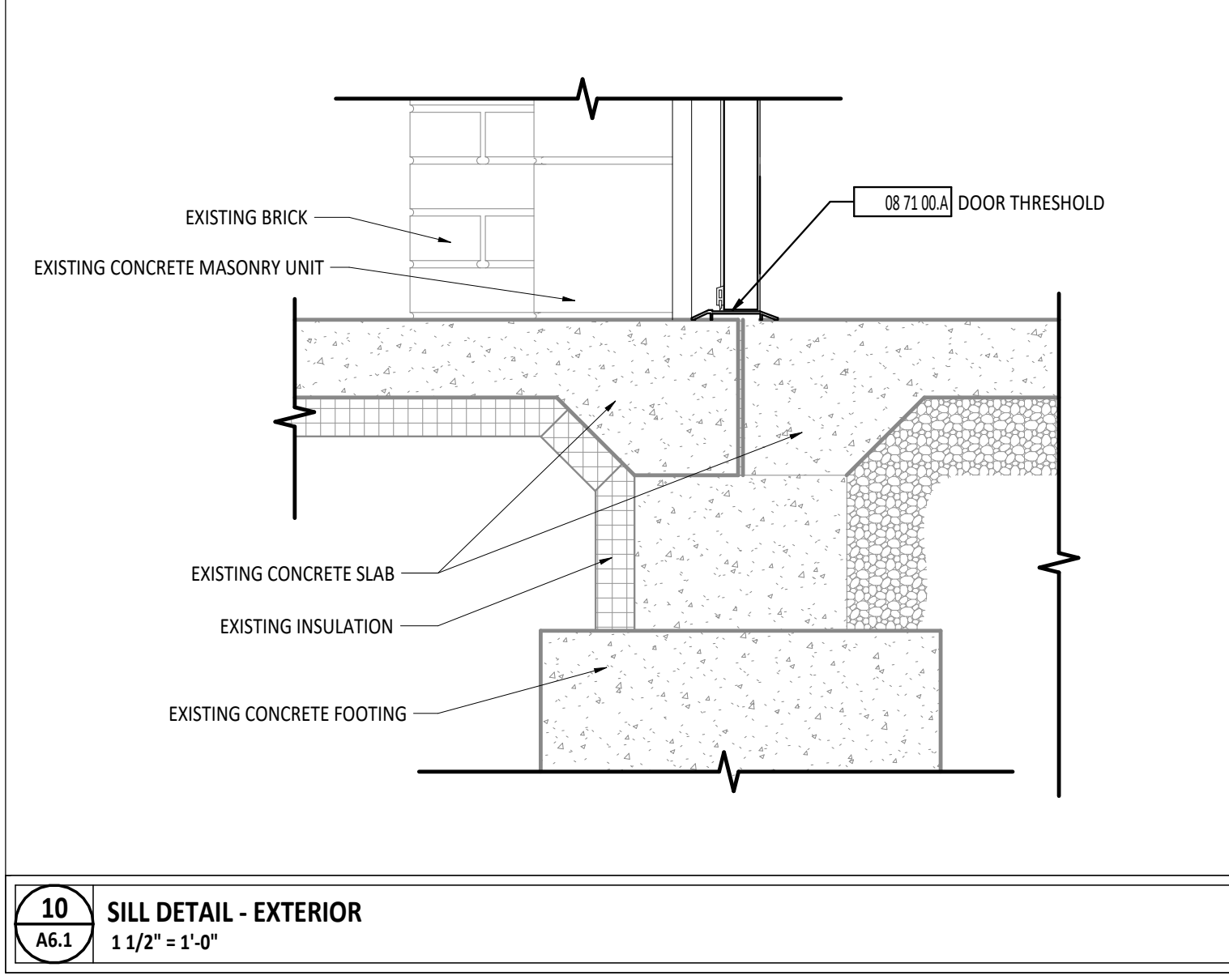
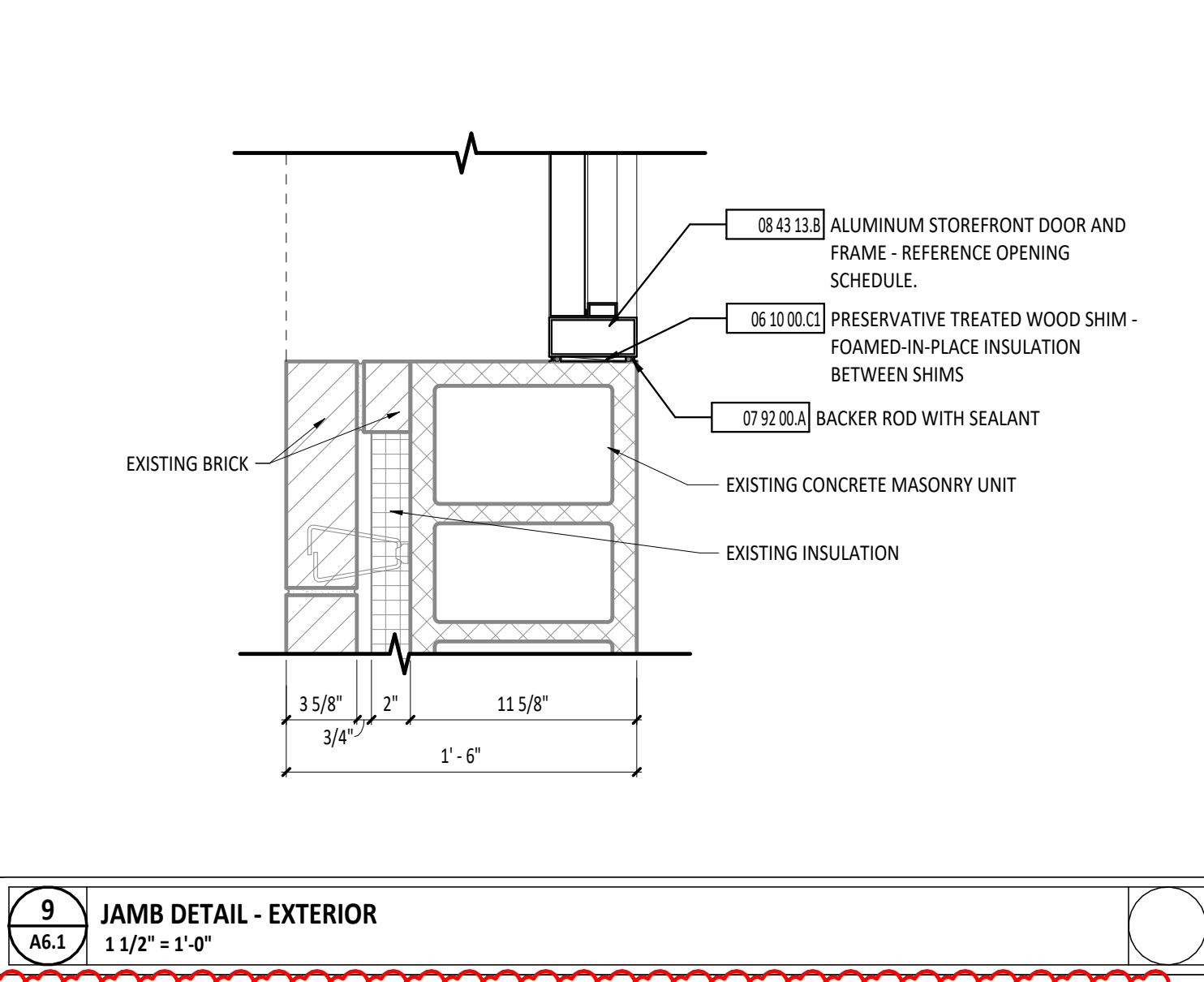
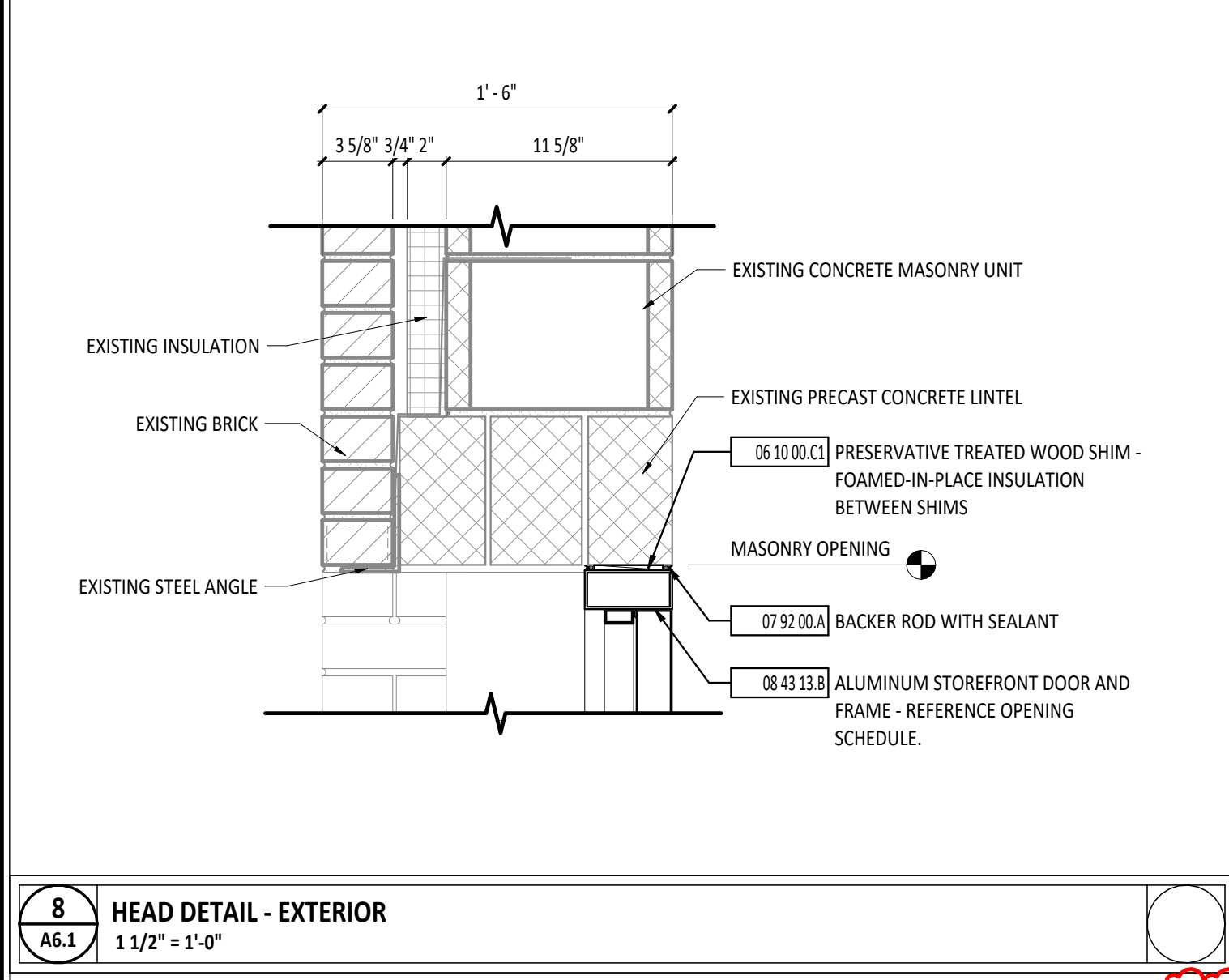


EXTERIOR GLAZING TYPES

EG-2 - LAMINATED GLAZING

INTERIOR GLAZING TYPES

G-1 - TEMPERED GLAZING



RENOVATION FOR

ZANE GREY INTERMEDIATE SCHOOL - MVHC CLINIC RENOVATIONS

568 ONE STREET, ZANESVILLE, OH 43701

ISSUANCES/REVISIONS		
PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
25006.02	MLE	JTM

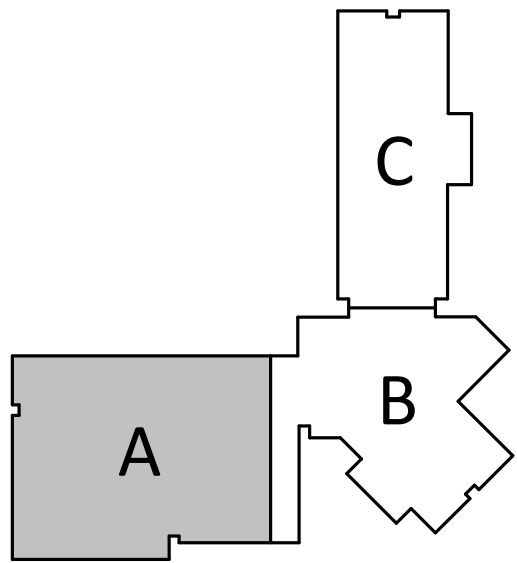
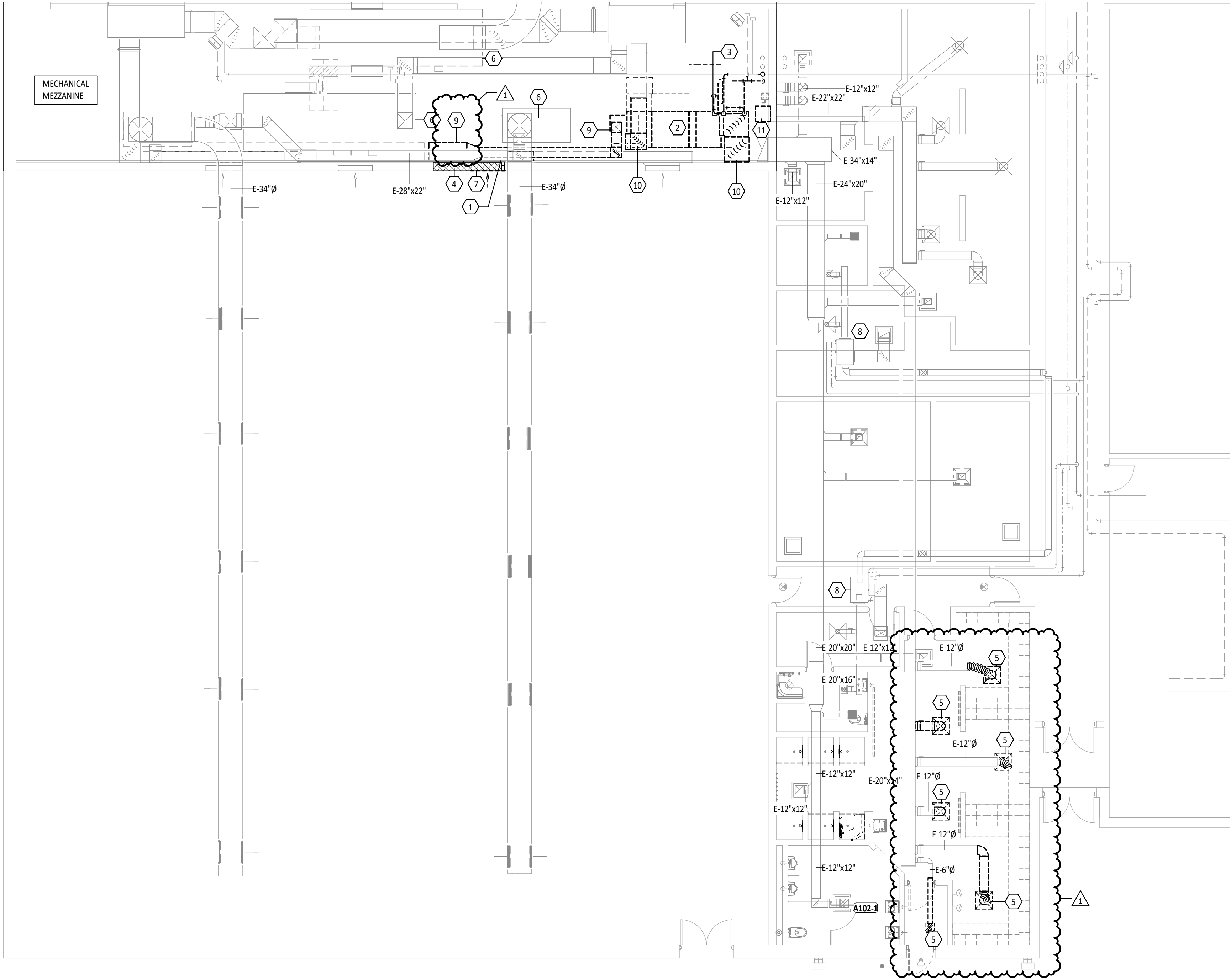
CONSTRUCTION DOCUMENTS	06/17/2025
CONSTRUCTION DOCUMENTS	07/01/2025
ADDENDUM #01	

SHEET TITLE:

DOOR SCHEDULE & DOOR DETAILS

SHEET NUMBER:

A6.1



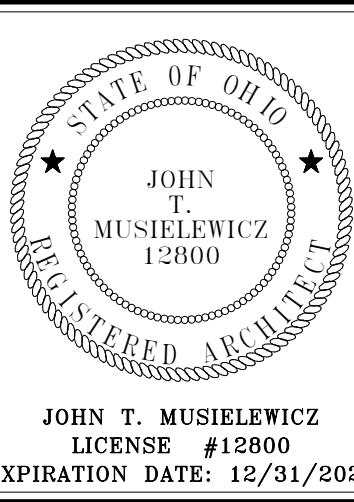
KEY PLAN

FIRST FLOOR PLAN ROOM INDEX - UNIT A (EXISTING)		
ROOM NUMBER	ROOM NAME	AREA
A100	VESTIBULE	35 SF
A101	LOCKER ROOM	582 SF
A102	RESTROOM	148 SF
A103	SHOWERS	121 SF
A104	STAFF RESTROOM	73 SF
A105	ATHLETIC OFFICE	91 SF
A109	EQUIPMENT MEZZANINE	1,585 SF
A110	GYMNASIUM	7,987 SF

HVAC DEMOLITION GENERAL NOTES

- A ALL EXISTING DUCTWORK AND PIPING SIZES ARE SHOWN BASED ON EXISTING DRAWINGS AND SELECTIVE SITE VERIFICATION. EXACT SIZE, TYPE, AND LOCATION SHALL BE VERIFIED ON SITE PRIOR TO CONSTRUCTION. WHERE CONTRACTOR IS TO CONNECT TO EXISTING, TRANSITIONS SHALL BE PROVIDED AS REQUIRED.
- B REMOVAL OF ANY AND ALL MECHANICAL SYSTEMS WITH ELECTRICAL CONNECTIONS SHALL BE COORDINATED WITH DIVISION 26 ELECTRICAL CONTRACTOR UNLESS OTHERWISE NOTED.
- C COORDINATE THE REMOVAL AND REPLACEMENT OF ALL EXISTING CEILINGS, WALLS, ETC. AS REQUIRED FOR MECHANICAL DEMOLITION WITH GENERAL CONTRACTOR.
- D ANY MECHANICAL SYSTEMS REMOVED SHALL BE DISPOSED OFF-SITE UNLESS OTHERWISE NOTED.

#	KEYNOTE DESCRIPTION
1	APPROXIMATE SECTION OF EXISTING RETURN AIR DUCTWORK TO BE DISCONNECTED, REMOVED, AND PROTECTED TO ALLOW FOR EXISTING AHU REMOVAL AND REPLACEMENT. DUCTWORK TO BE REINSTALLED AFTER NEW AHU HAS BEEN INSTALLED. VERIFY EXACT LOCATION ON SITE. COORDINATE WORK WITH GENERAL CONTRACTOR.
2	EXISTING AHU TO BE REMOVED AND DISPOSED OF OFF-SITE. DISCONNECTION OF HIGH VOLTAGE WIRING TO BE DONE BY DIVISION 26 ELECTRICAL CONTRACTOR. DISCONNECTION OF LOW VOLTAGE WIRING TO BE DONE BY DIVISION 23 MECHANICAL CONTRACTOR.
3	EXISTING INLINE CIRCULATOR PUMP AND ASSOCIATED PIPING TO BE REMOVED AND DISPOSED OF OFF-SITE. PIPING TO BE REMOVED BACK TO MAIN BRANCH ENTERING MECHANICAL MEZZANINE. PREPARE MAIN FOR RECONNECTION TO NEW HYDRONIC PIPING. VERIFY EXACT SIZE, TYPE, AND LOCATION ON SITE. COORDINATE WORK WITH GENERAL CONTRACTOR.
4	OPENING TO BE CUT IN MASONRY WALL IN APPROXIMATE LOCATION SHOWN. OPENING TO BE CUT BY GENERAL CONTRACTOR. COORDINATE WORK WITH GENERAL CONTRACTOR AND OTHER DISCIPLINES. VERIFY EXACT SIZE AND LOCATION ON SITE.
5	EXISTING DIFFUSER AND ASSOCIATED DUCTWORK TO APPROXIMATE LOCATION SHOWN TO BE REMOVED AND DISPOSED OF OFF-SITE. VERIFY EXACT LOCATION ON SITE. COORDINATE WORK WITH GENERAL CONTRACTOR. PREPARE DUCTWORK FOR CONNECTION TO NEW DUCTWORK. REFER TO M2.1 FOR ADDITIONAL INFORMATION.
6	MECHANICAL EQUIPMENT TO BE PROTECTED DURING CONSTRUCTION. ANY DAMAGE TO EQUIPMENT TO BE REPAIRED AND/OR REPLACED AT NO EXPENSE TO THE OWNER. VERIFY EXACT LOCATION ON SITE.
7	EXISTING RETURN AIR GRILLE TO BE REMOVED AND RETURNED TO OWNER. VERIFY EXACT LOCATION ON SITE. COORDINATE WORK WITH GENERAL CONTRACTOR.
8	EXISTING HEAT PUMP AND ASSOCIATED DUCTWORK, DUCT ACCESSORIES, AND GRILLES/DIFFUSERS NOT INCLUDED IN THE SCOPE OF WORK OF THIS PROJECT. HEAT PUMP AND ACCESSORIES TO BE PROTECTED DURING CONSTRUCTION. ANY DAMAGE TO HEAT PUMP OR ACCESSORIES TO BE REPAIRED AND/OR REPLACED AT NO EXPENSE TO THE OWNER.
9	OUTSIDE AIR DUCTWORK TO BE REMOVED AND DISPOSED OF OFF-SITE TO APPROXIMATE LOCATION SHOWN. VERIFY EXACT SIZE, TYPE, AND LOCATION ON SITE. COORDINATE WORK WITH GENERAL CONTRACTOR.
10	EXHAUST AIR DUCTWORK TO BE REMOVED AND DISPOSED OF OFF-SITE TO APPROXIMATE LOCATION SHOWN. VERIFY EXACT SIZE, TYPE, AND LOCATION ON SITE. COORDINATE WORK WITH GENERAL CONTRACTOR.
11	SUPPLY AIR DUCTWORK TO BE REMOVED AND DISPOSED OF OFF-SITE TO APPROXIMATE LOCATION SHOWN AS REQUIRED FOR INSTALLATION OF NEW UNIT AND RECONNECTION TO NEW AHU. VERIFY EXACT SIZE, TYPE, AND LOCATION ON SITE. COORDINATE WORK WITH GENERAL CONTRACTOR.



RENOVATION FOR
ZANESVILLE SCHOOLS - MVHC CLINIC
RENOVATIONS

580 PINE ST. ZANESVILLE, OH 43701

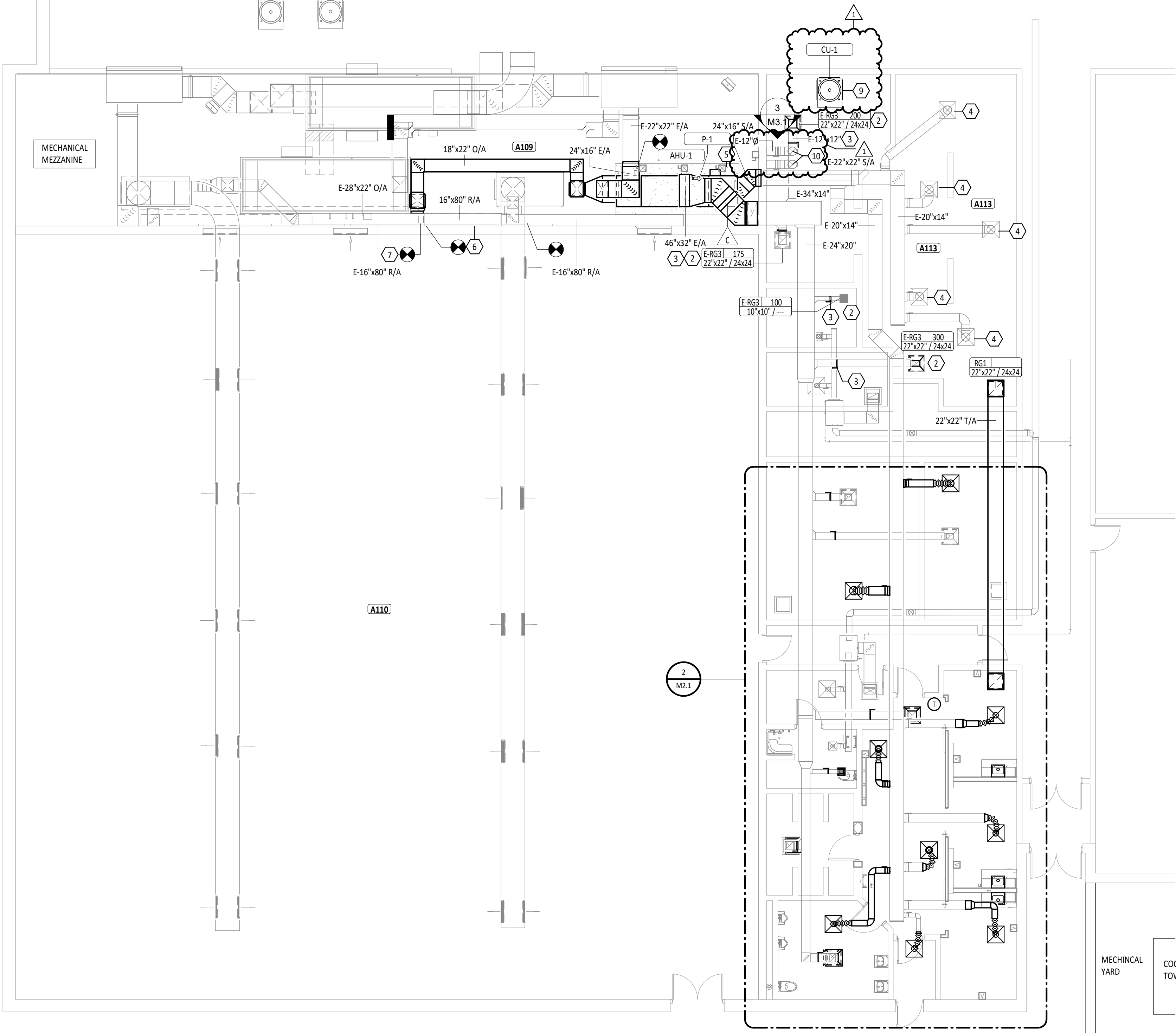
ISSUANCES/REVISIONS		
CONSTRUCTION DOCUMENTS	06/17/2025	
1 CONSTRUCTION DOCUMENTS - ADDENDUM #01	07/01/2025	

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
25006.02	ICW	LGW

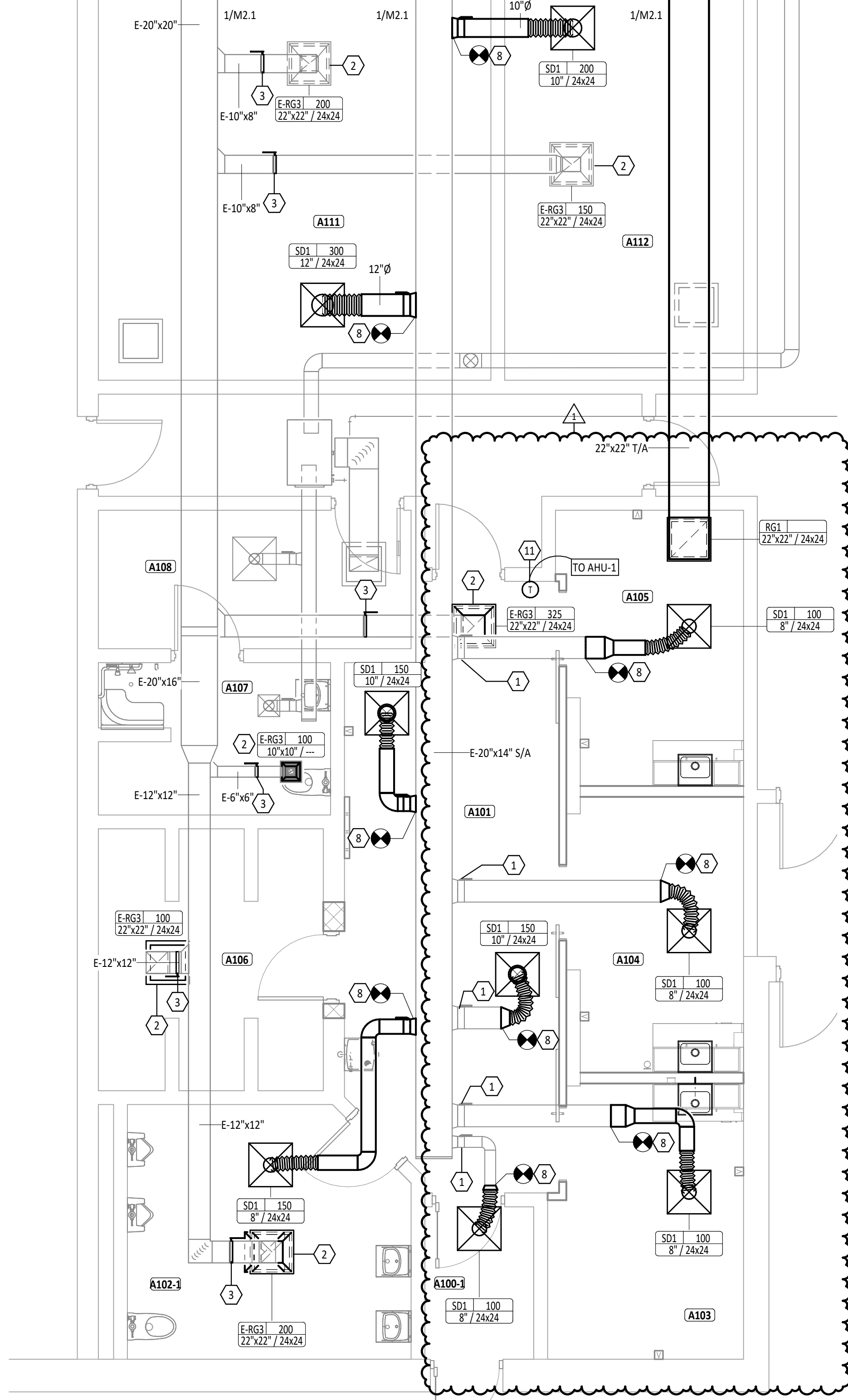
SHEET TITLE:
MECHANICAL
DEMOLITION PLAN
- UNIT A

SHEET NUMBER:
MD1.1

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1 MECHANICAL PLAN - UNIT A
1/8" = 1'-0"



2 ENLARGED FIRST FLOOR MECHANICAL PLAN
1/4" = 1'-0"

AIR HANDLING UNIT WITH ENERGY RECOVERY SCHEDULE (PART 1 OF 2)

				OUTSIDE AIR										SUPPLY FAN ARRAY										EXHAUST FAN ARRAY										ENERGY RECOVERY WHEEL																																																											
														AIRFLOW										PRESS										INDIVIDUAL MOTOR										AIRFLOW										PRESS										INDIVIDUAL MOTOR										SUMMER CONDITIONS										WINTER CONDITIONS									
ID	SERVES	MANUFACTURER	MODEL NO.	SUPPLY AIRFLOW	FLOW	DCV	MIN	DESCRIPTION	DESIGN	ESP	TP	FEI	QTY	POWER	ECM	VOLT	PH	FLA	SUPPLY FAN AIRBOX MCA	SUPPLY FAN AIRBOX MOP	DESCRIPTION	DESIGN	ESP	TP	FEI	QTY	POWER	ECM	VOLT	PH	FLA	EXHAUST FAN AIRBOX MCA	EXHAUST FAN AIRBOX MOP	ERW MOTOR	ERW VOLTAGE	ERW PHASE	ERW OA (CFM)	ERW EA (CFM)	ERW BYPASS	ERW OA (DB) SUMMER	ERW OA (WB) SUMMER	ERW EA (WB) SUMMER	ERW SUPPLY SUMMER	ERW SUPPLY (WB) SUMMER	ERW TOTAL ENERGY RECOVERED SUMMER	ERW OA (DB) WINTER	ERW OA (WB) WINTER	ERW EA (WB) WINTER	ERW SUPPLY WINTER	ERW SUPPLY (WB) WINTER	ERW TOTAL ENERGY RECOVERED WINTER																																										
AHU-1	LOCKER ROOM/CLINIC	TRANE	CSAA006	2250 CFM	2250 CFM	Yes	0 CFM	MOTORIZED IMPELLER CONTROL PANEL	2250 CFM	1.40 in-wg	4.30 in-wg	1.41	1	4.02 hp	Yes	460 V	3	4.78 A	5.8 A	15 A	MOTORIZED IMPELLER CONTROL PANEL	3000 CFM	0.50 in-wg	2.14 in-wg	1.10	1	4.02 hp	Yes	460 V	3	4.25 A	5.3 A	15 A	0.50 hp	460 V	3	2250 CFM	3000 CFM	Yes	88.0 °F	73.0 °F	82.4 °F	68.9 °F	78.4 °F	66.0 °F	57950.0 Btu/h	1.0 °F	0.0 °F	29.8 °F	27.1 °F	51.1 °F	41.6 °F	126620.0 Btu/h																																								

AIR HANDLING UNIT WITH ENERGY RECOVERY SCHEDULE (PART 2 OF 2)

				COOLING COIL								HEATING COIL										PRE-FILTER		FILTER		UNIT WEIGHT	REMARKS
				CAPACITY				AIRSIDE				CAP	AIRSIDE				WATERSIDE				TYPE	THICKNESS	TYPE	THICKNESS			
ID	SERVES	MANUFACTURER	MODEL NO.	TOTAL	SENSIBLE	EAT(db)	EAT(wb)	LAT(db)	LAT(wb)	FV	PD		EAT(db)	LAT(db)	FV	PD	FLOW	EWT	LWT	PD					VOL		
AHU-1	LOCKER ROOM/CLINIC	TRANE	CSAA006	79370 Btu/h	50340 Btu/h	78.4 °F	66.0 °F	58.0 °F	54.5 °F	372 FPM	0.28 in-wg	192770 Btu/h	1.0 °F	80.0 °F	422 FPM	0.23 in-wg	19.3 GPM	140 °F	120 °F	0.4 ftH2O	2.4 gal	MERV 8	2"	MERV 13	4"	2117 lb	UNIT TO REQUIRE THREE SEPARATE POWER CONNECTIONS. DIVISION 26 ELECTRICAL CONTRACTOR TO PROVIDE DISCONNECT FOR ENERGY RECOVERY WHEEL POWER CONNECTION. DIVISION 26 CONTRACTOR TO PROVIDE FIELD PROVIDED STARTER FOR ENERGY WHEEL.

AIR COOLED CONDENSING UNIT

				AUXILIARY FAN				COMPRESSOR							SUMMER AMBIENT		SEACOAST						INTERLOCK		REMARKS
ID	SERVES	MANUFACTURER	MODEL NO.	TYPE	QTY	DRIVE TYPE	MOTOR ECM	CAP	TYPE	REFRIGERANT	CHARGE	CIRCUIT QTY	UNLOADING STEPS	MOTOR RLA	LOW AMBIENT KIT	DBT	PROT	FLA	MCA	MOCAP	VOLT	PH	ID		
CU-1	AHU-1	TRANE	TTA090K4DAA	AIR COOLED	1	DIRECT	ECM	8 ton	SINGLE COMPRESSOR	R-454B	0 lb	2	2	7 A	NO	95.0 °F	NO	1.1 A	18 A	20 A	460 V	3	AHU-1		
REFRIGERANT LEAK DETECTION SYSTEM SHALL BE FACTORY INSTALLED, FACTORY INSTALLED STEEL HAIL GUARDS, NEOPRENE-IN-SHEAR OR SPRING FLEX CHOICE VIBRATION ISOLATORS.																									

CIRCULATING PUMP SCHEDULE

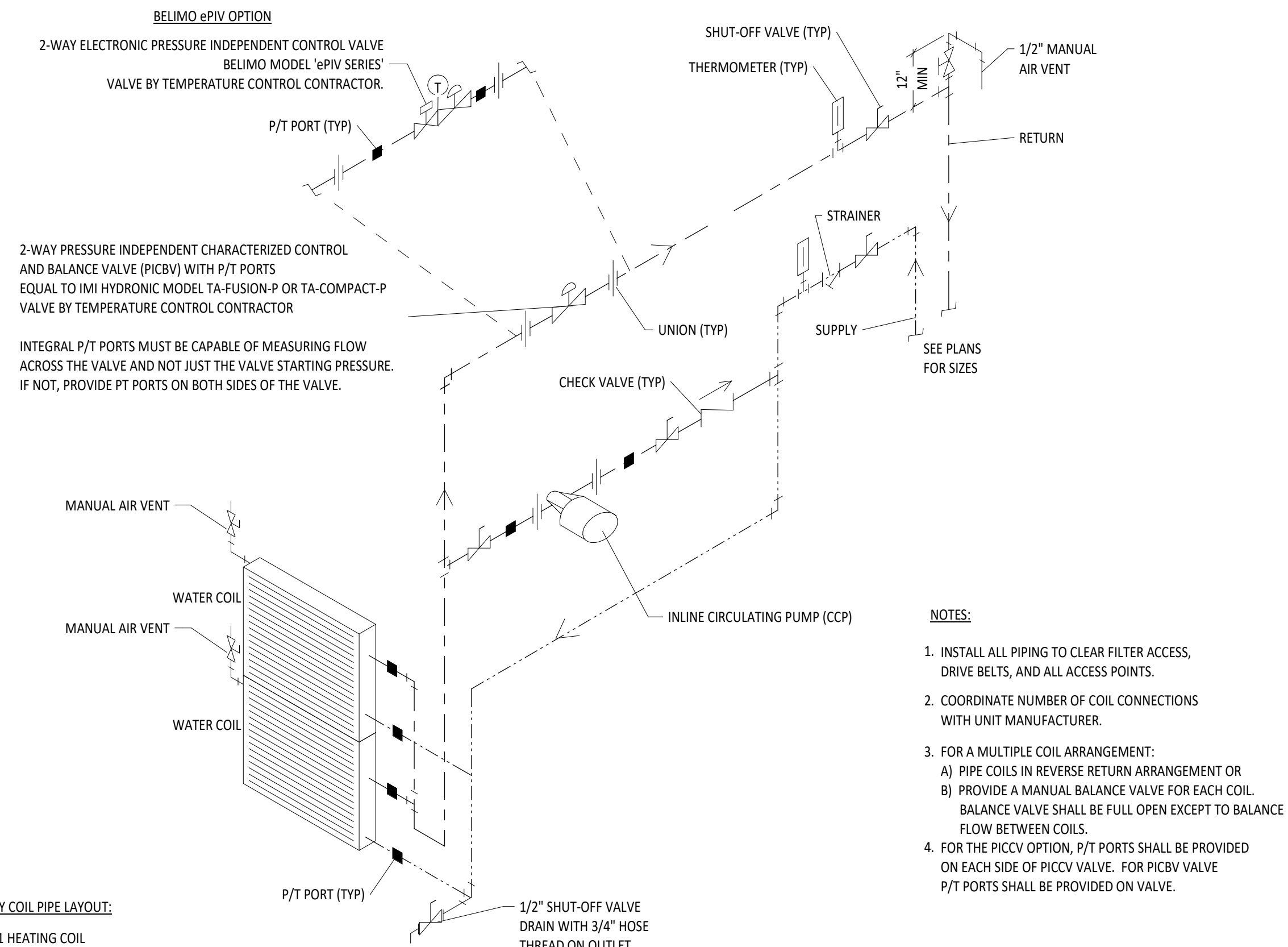
MARK	SERVES	MFG	SIZE	TYPE	PUMP			FLUID TYPE	MOTOR			UNIT WEIGHT	VOLT	PH	REMARKS
					TYPE	FLOW	HEAD		POWER	RPM	VFD (WALL MOUNT)				
						DESIGN									
P-1	AHU-1	BELL & GOSSETT	ECOIRC XL 55-45	ECM	HIGH EFFICIENCY LARGE WET ROTOR CIRCULATOR	24.0 GPM	30.0 FT	100% WATER	0.50 hp	3822	No	22 lb	208 V	1	PUMP INSTALLED IN ACCESSIBLE LOCATION ABOVE AIR HANDLER. VARIABLE SPEED. CONTROLLED BY ENERGY RECOVERY WHEEL ENTERING EXHAUST AIR TEMPERATURE OF THE AIR HANDLER.

GRILLES, REGISTERS AND DIFFUSERS SCHEDULE

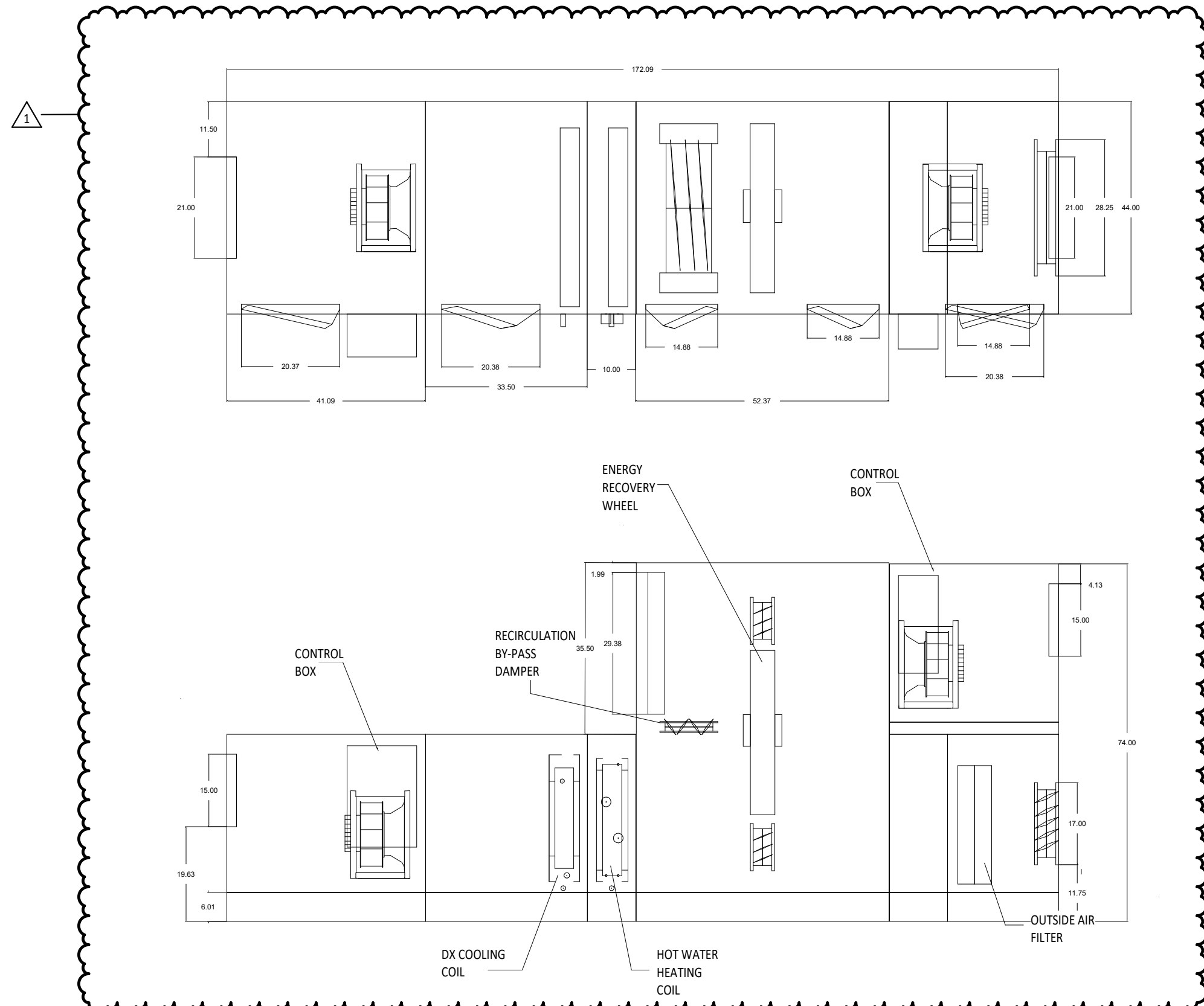
				NECK										BLADE DESIGN										INSTALLATION										NOTES									
				FACE										DEFLECTION ANGLE										BORDER TYPE																			
ID	DESCRIPTION	MANUFACTURER	MODEL	QTY	SIZE	SIZE	WIDTH	HEIGHT	THICKNESS	SPACING	SINGLE	DOUBLE	ORIENTATION																														
SD1	3-CONE DIFFUSER	TITUS	TMS-AA	1	24x24	12"								TYPE 3 (LAY-IN)																													
SD1	3-CONE DIFFUSER	TITUS	TMS-AA	3	24x24	10"								TYPE 3 (LAY-IN)																													
SD1	3-CONE DIFFUSER	TITUS	TMS-AA	5	24x24	8"								TYPE 3 (LAY-IN)																													
RG1	EGGCRATE RETURN GRILLE	TITUS	SOF	2	24x24		22"	22"	---	1/2"	0.0"			GRID										TYPE 3 (LAY-IN)																			

ASHRAE 62.1 VENTILATION RATE PROCEDURE SUMMARY

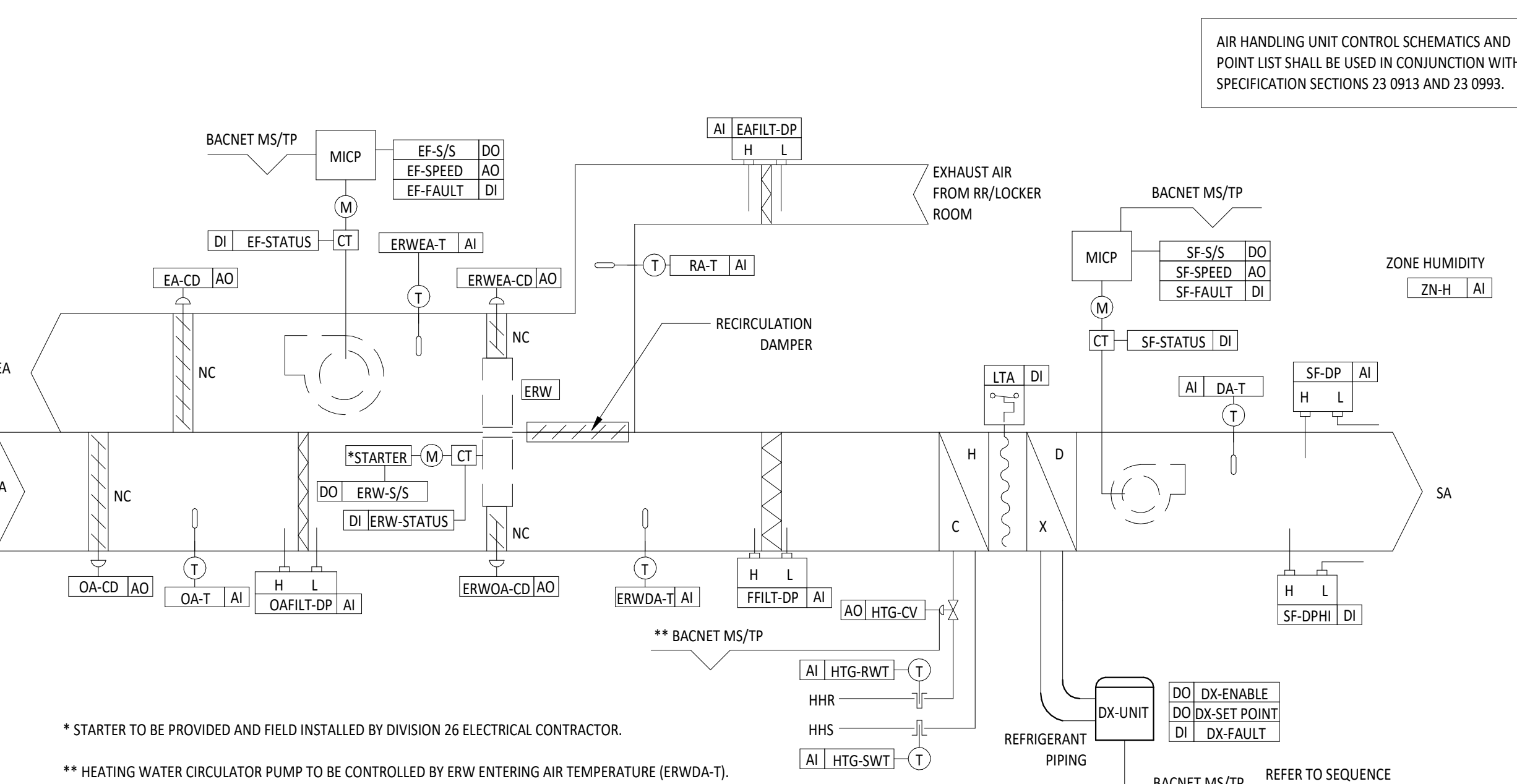
ROOM IDENTITY	LOCATION	Occupancy Category	Area, A _z	Selected Supply Airflow, L _s	Number of People, P _z	Outdoor Airflow Rate Per Person, R _p	Outdoor Airflow Rate Per Unit Area, R _a	Zone Air Distribution Effectiveness, E _z	Breathing Zone Outdoor Airflow, V _{oz}	Required Outdoor Air Intake Flow, V _{ot}	OA Delivered	Specified Airflow
A100	VESTIBULE-1	Corridors	36 SF	100 CFM	0	0.0 CFM	0.06 CFM/SF	0.8	2 CFM	3 CFM	0 CFM	0 CFM
A101	CORRIDOR	Corridors	254 SF	250 CFM	0	0.0 CFM	0.06 CFM/SF	0.8	15 CFM	19 CFM	300 CFM	0 CFM
A102	RESTROOM-1	Toilets (public)	146 SF	150 CFM	0	0.0 CFM	0.06 CFM/SF	0.8	14 CFM	17 CFM	225 CFM	0 CFM
A103	EXAM ROOM	Daycare sickroom	109 SF	100 CFM	2	10.0 CFM	0.18 CFM/SF	0.8	40 CFM	50 CFM	0 CFM	0 CFM
A104	EXAM ROOM	Daycare sickroom	100 SF	100 CFM	2	10.0 CFM	0.18 CFM/SF	0.8	38 CFM	47 CFM	0 CFM	0 CFM
A105	EXAM ROOM	Daycare sickroom	102 SF	100 CFM	2	10.0 CFM	0.18 CFM/SF	0.8	38 CFM	48 CFM	0 CFM	0 CFM
A106	SUPPLIES	Storage rooms	116 SF	100 CFM	0	0.0 CFM	0.12 CFM/SF	0.8	14 CFM	17 CFM	100 CFM	0 CFM
A107	STAFF RESTROOM	Toilets (public)	73 SF	0 CFM	0	0.0 CFM	0.06 CFM/SF	0.8	0 CFM	0 CFM	100 CFM	0 CFM
A111	GYMNASIUM STORAGE	Storage rooms	337 SF	300 CFM	0	0.0 CFM	0.12 CFM/SF	0.8	40 CFM	51 CFM	0 CFM	0 CFM
A112	CENTRAL STORAGE	Storage rooms	205 SF	200 CFM	0	0.0 CFM	0.12 CFM/SF	0.8	25 CFM	31 CFM	300 CFM	0 CFM
A113	STUDENT LOCKER	Locker Rooms	627 SF	850 CFM	0	0.0 CFM	0.12 CFM/SF	0.8	0 CFM	0 CFM	1950 CFM	0 CFM
AHU-1: 11			2104 SF	2250 CFM	6				212 CFM	265 CFM	0 CFM	2975 CFM



1 AIR HANDLER COIL PIPING DETAIL - WITH COIL CIRCULATING PUMP
M3.1 NTS



2 AHU-1 ELEVATION AND PLAN VIEW DETAIL
M3.1 NTS

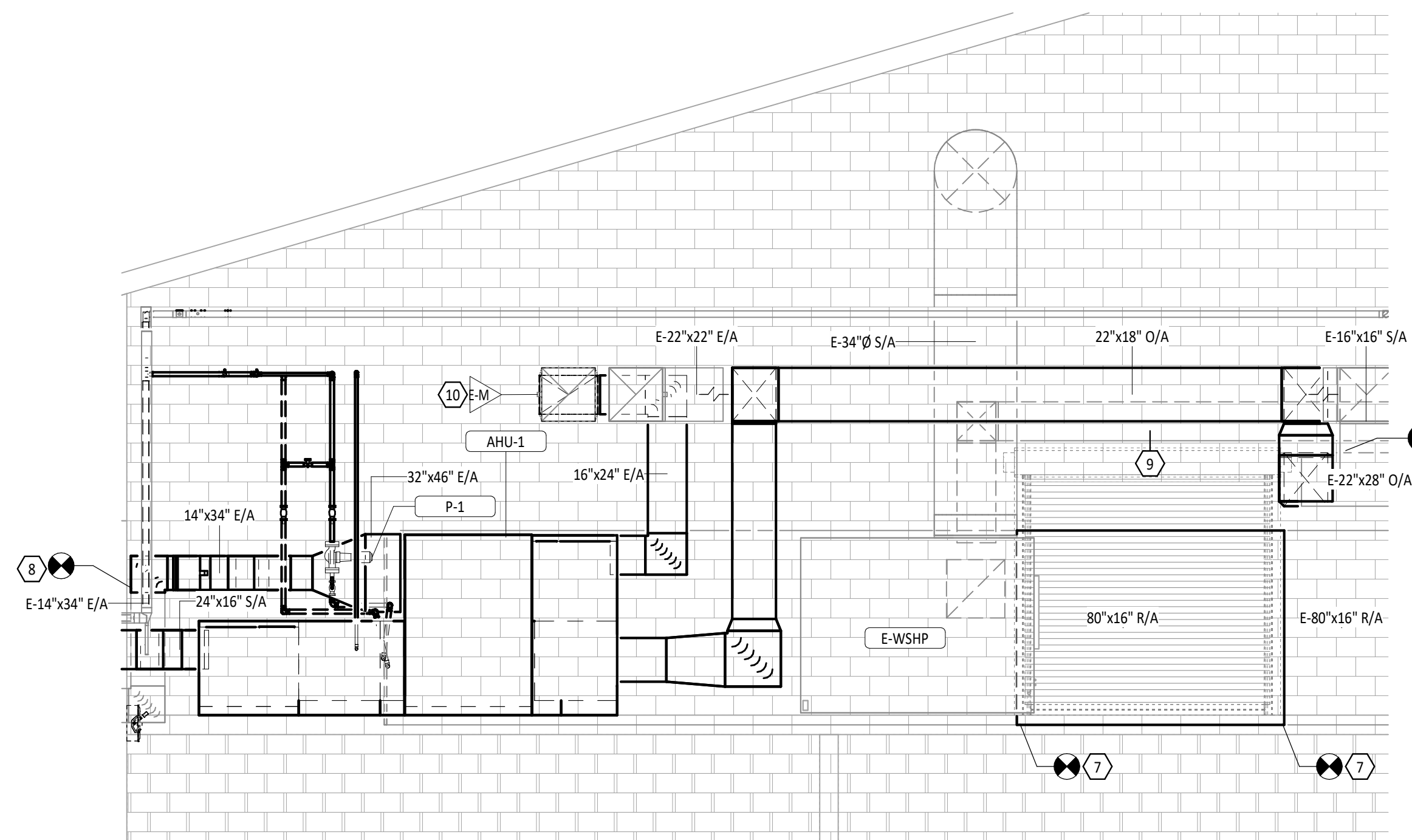


AHU W/ ERW AND EXHAUST SCHEMATIC

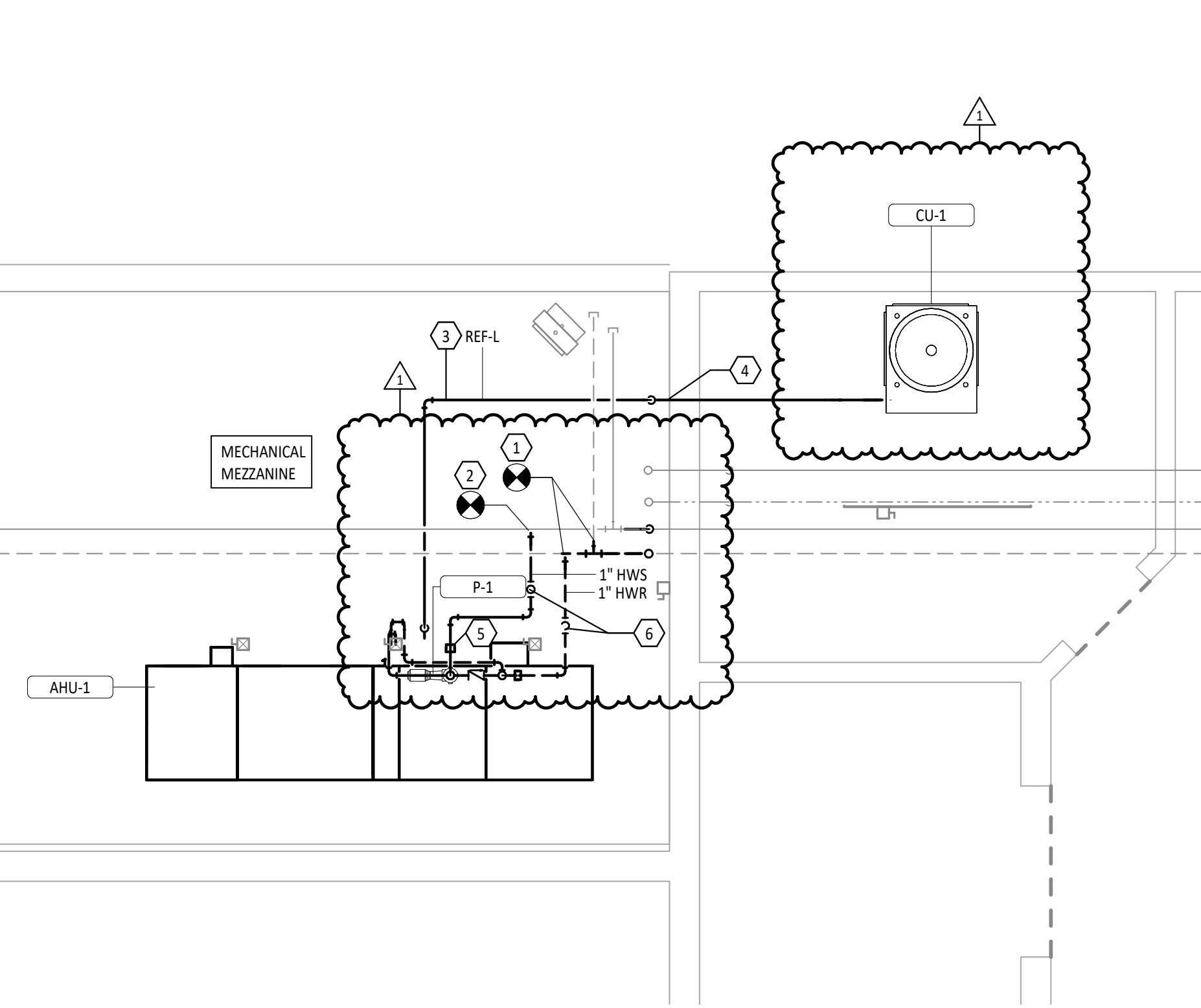
4 AIR HANDLING UNIT CONTROL SCHEMATIC - AHU-1
M3.1 NTS

POINT LIST		HARDWARE POINTS					SOFTWARE POINTS				
		DI	AI	DO	AO	DV	AV	ALARM	TREND	GRAPHIC	
CC-LAT	COOLING COIL LEAVING AIR TEMPERATURE		X							X	
DA-T	DISCHARGE AIR TEMPERATURE		X						X	X	
DX-ENABLE	CONDENSING UNIT ENABLE/DISABLE		X					X	X	X	
DX-SET POINT	CONDENSING UNIT DEMAND SET POINT			X					X	X	
DX-FAULT	CONDENSING UNIT FAULT/ALARM		X				X	X	X	X	
EA-CD	EXHAUST AIR CONTROL DAMPER				X				X	X	
EF-FAULT	EXHAUST FAN MICP FAULT	X					X		X	X	
EF-S/S	EXHAUST FAN START / STOP		X						X	X	
EF-STATUS	EXHAUST FAN STATUS	X					X	X	X	X	
EF-SPEED	EXHAUST FAN MICP SPEED			X					X	X	
ERWEA-T	ENERGY RECOVERY WHEEL EXHAUST AIR TEMP		X						X	X	
ERWEA-CD	ENERGY RECOVERY WHEEL EXHAUST AIR BYPASS			X				X	X	X	
ERWDA-CD	ENERGY RECOVERY WHEEL OUTSIDE AIR BYPASS			X				X	X	X	
ERWDA-T	ENERGY RECOVERY WHEEL DISCHARGE AIR TEMP		X						X	X	
ERW-S/S	ENERGY RECOVERY WHEEL START / STOP		X						X	X	
ERW-STATUS	ENERGY RECOVERY WHEEL STATUS	X						X	X	X	
FFILT-DP	SUPPLY AIR FILTER DIFFERENTIAL PRESSURE		X				X	X	X	X	
HTG-CV	HEATING WATER CONTROL VALVE			X				X	X	X	
HTG-SWT	HEATING WATER SUPPLY WATER TEMPERATURE		X						X	X	
HTG-RWT	HEATING WATER RETURN WATER TEMPERATURE		X						X	X	
LTA	LOW TEMPERATURE FREEZE STAT	X					X				

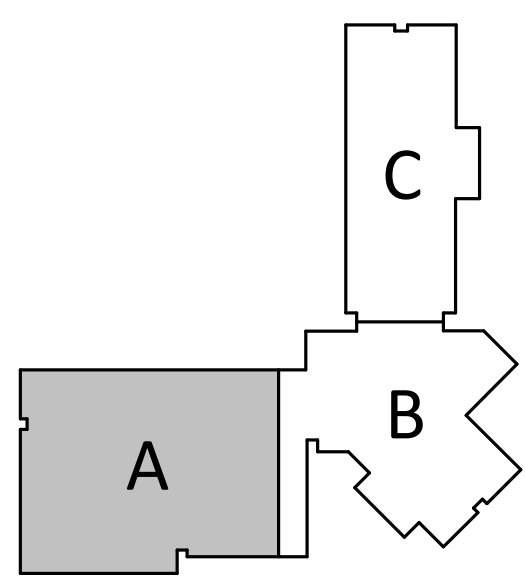
POINT LIST		HARDWARE POINTS					SOFTWARE POINTS				
POINT TAG	POINT DESCRIPTION	DI	AI	DO	AO	DV	AV	ALARM	TREND	GRAPHIC	
OA-CD	OUTSIDE AIR CONTROL DAMPER				X				X	X	
OA-T	OUTSIDE AIR TEMPERATURE		X						X	X	
OAFLT-DP	OUTSIDE AIR PREFILTER DP SENSOR		X						X	X	
RA-T	RETURN AIR TEMPERATURE		X						X	X	
SF-DP	SUPPLY FAN DP		X						X	X	
SF-DPHI	SUPPLY FAN HIGH LEVEL DP ALARM	X							X	X	
SF-FAULT	SUPPLY FAN FAULT	X							X	X	
SF-SPEED	SUPPLY FAN MICP SPEED			X					X	X	
SF-S/S	SUPPLY FAN START / STOP			X					X	X	
SF-STATUS	SUPPLY FAN STATUS	X							X	X	
ZN-H	HUMIDITY SENSOR		X						X	X	
	DISCHARGE AIR TEMPERATURE SETPOINT						X		X	X	
	DEHUMIDIFICATION SETPOINT						X		X	X	
	FILTER DIFFERENTIAL PRESSURE ALARM SETPOINT						X		X	X	
	HIGH STATIC SUPPLY FAN ALARM SETPOINT						X		X	X	
	SUPPLY FAN STATIC SETPOINT						X		X	X	
	UNOCCUPIED HEATING SETPOINT						X		X	X	
	UNOCCUPIED COOLING SETPOINT						X		X	X	



3 MECHANICAL MEZZANINE SECTION
M3.1 1/4" = 1'-0"



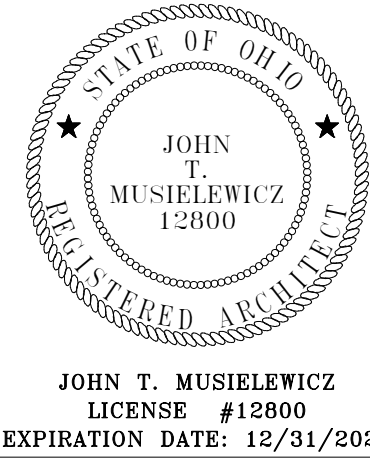
5 MECHANICAL PIPING PLAN - MEZZANINE
M3.1 1/4" = 1'-0"



KEY PLAN

- PIPING GENERAL NOTES**
- CONDENSATE PIPING SHALL BE ROUTED ABOVE CEILING AT 1/8" PER LINEAR FOOT SLOPE. INSULATE CONDENSATE PIPING PER SPECIFICATIONS.
 - CONDENSATE DRAINS SHALL BE SUPPLIED FOR ALL COOLING EQUIPMENT. CONTRACTOR SHALL ENSURE PROPER INSTALLATION AND DRAINAGE AS REQUIRED BY FEDERAL, STATE, AND LOCAL CODES. CONDENSATE PIPING SHALL BE TYPE "L" COPPER.
 - LOCATE PIPING AND MECHANICAL EQUIPMENT AWAY FROM THE SPACE ABOVE ELECTRICAL PANELS, TRANSFORMERS AND OTHER ELECTRICAL EQUIPMENT.
 - FIRE SEAL AROUND PIPING PENETRATIONS OF FIRE RATED WALLS. REFERENCE SPECIFICATION.
 - PROVIDE SLEEVES AND/OR OPENINGS TO RUN PIPES THROUGH FOUNDATIONS, FLOORS, WALLS, AND ROOF.
 - THE ORIENTATION OF ALL PUMP-MOUNTED VFD'S SHALL BE COORDINATED PRIOR TO ORDERING THE PUMPS. THE VFD'S MUST HAVE ALL MINIMUM CLEARANCES REQUIRED BY ELECTRICAL CODE MAINTAINED.
 - UNLESS OTHERWISE INDICATED, ALL HEATING WATER RUNOUTS SHALL BE MADE WITH TOP-OF-PIPE CONNECTIONS AT THE SUPPLY AND RETURN MAIN.

#	KEYNOTE DESCRIPTION
1	NEW HYDRONIC HEATING RETURN PIPING TO CONNECT TO EXISTING RETURN PIPING IN APPROXIMATE LOCATION SHOWN. VERIFY EXACT SIZE, TYPE, AND LOCATION ON SITE. COORDINATE PIPE ROUTING WITH EXISTING CONDITIONS.
2	NEW HYDRONIC HEATING SUPPLY PIPING TO CONNECT TO EXISTING SUPPLY PIPING IN APPROXIMATE LOCATION SHOWN. VERIFY EXACT SIZE, TYPE, AND LOCATION ON SITE. COORDINATE PIPE ROUTING WITH EXISTING CONDITIONS.
3	REFRIGERANT LINE SET TO BE SIZED PER MANUFACTURERS RECOMMENDATION. COORDINATE ROUTING OF PIPING WITH EXISTING CONDITIONS.
4	REFRIGERANT PIPING TO PENETRATE WALL OF MECHANICAL MEZZANINE IN APPROXIMATE LOCATION SHOWN. VERIFY EXACT SIZE AND LOCATION ON SITE. COORDINATE WORK WITH GENERAL CONTRACTOR. PENETRATION TO BE SEALED PER SPECIFICATIONS.
5	PROVIDE NEW DRAIN PIPING AND VALVES FOR HYDRONIC HEATING SUPPLY AND RETURN PIPING TO FLOOR DRAIN IN APPROXIMATE LOCATION. VERIFY EXACT SIZE, TYPE, AND LOCATION ON SITE. COORDINATE ROUTING WITH EXISTING CONDITIONS.
6	PROVIDE SHUTOFF VALVE FOR MAINTENANCE ISOLATION NEAR THE MAIN.
7	REINSTALL DUCTWORK REMOVED ON SHEET M3.1 IN THE APPROXIMATE LOCATION SHOWN. VERIFY EXISTING SIZE, TYPE, AND LOCATION ON SITE. MODIFY DUCTWORK AS NEEDED TO REINSTALL. COORDINATE WORK WITH THE GENERAL CONTRACTOR.
8	CONNECT TO EXISTING DUCTWORK IN THE APPROXIMATE LOCATION SHOWN. MODIFY EXISTING DUCTWORK AS NEEDED AND REPAIR INSULATION. VERIFY EXISTING SIZE, TYPE, AND LOCATION ON SITE. COORDINATE WORK WITH GENERAL CONTRACTOR.
9	SUPPLY AIR DUCTWORK TO HEAT PUMP TO BE MODIFIED AS NEEDED TO AVOID THE NEW COIL ROLLING DOOR. VERIFY EXISTING SIZE, TYPE, AND LOCATION ON SITE. COORDINATE WORK WITH THE GENERAL CONTRACTOR.
10	EXISTING EXHAUST AIR MOTORIZED CONTROL DAMPER LOCATED OUTSIDE OF THE UNIT NEAR THE EXHAUST AIR WALL LOUVER. INTEGRATE DAMPER INTO NEW AHU CONTROL.



ZANESVILLE SCHOOLS - MVHC CLINIC
RENOVATIONS

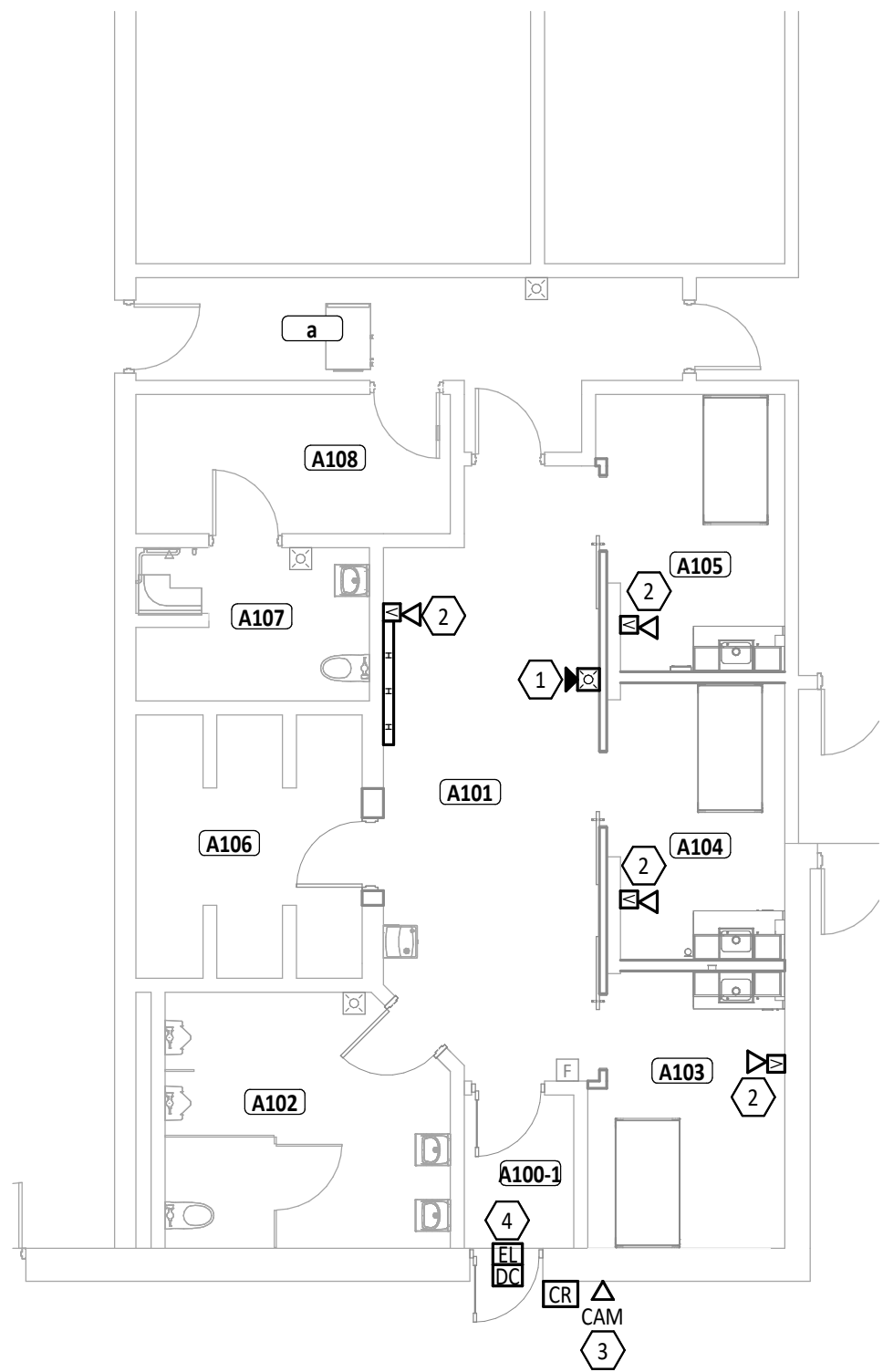
ISSUANCES/REVISIONS		
1	CONSTRUCTION DOCUMENTS CONSTRUCTION DOCUMENTS - ADDENDUM #01	06/17/2025 07/01/2025

PROJECT NUMBER: 25006.02	DRAWN BY: ICW	CHECKED BY: LGW
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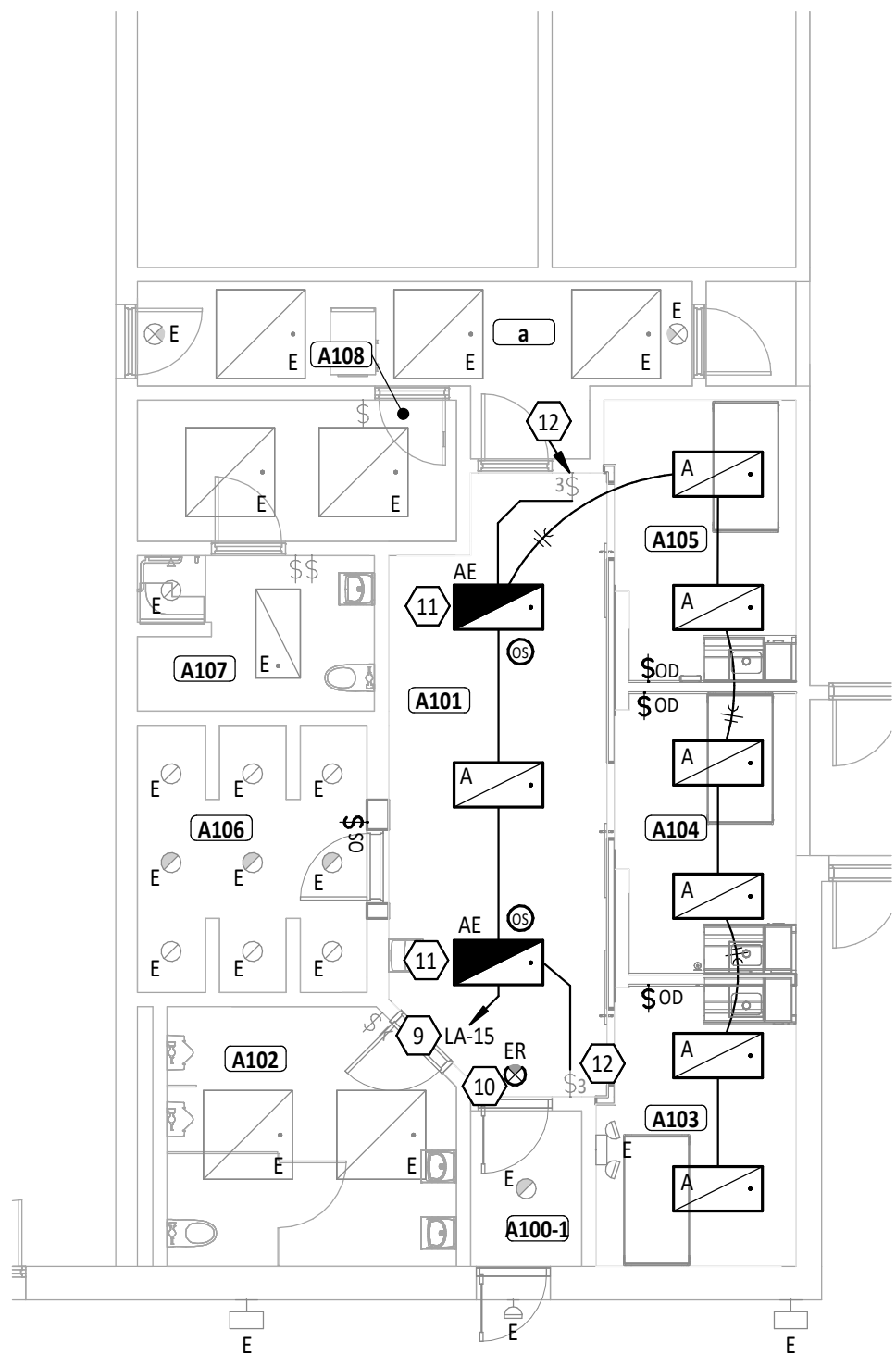
SHEET TITLE:
**MECHANICAL
PIPING PLAN &
DETAILS**

SHEET NUMBER:
M3.1

1
E2.1
SYSTEMS PLAN - UNIT A
1/8" = 1'-0"



2
E2.1
FIRST FLOOR LIGHTING PLAN - UNIT A
1/8" = 1'-0"



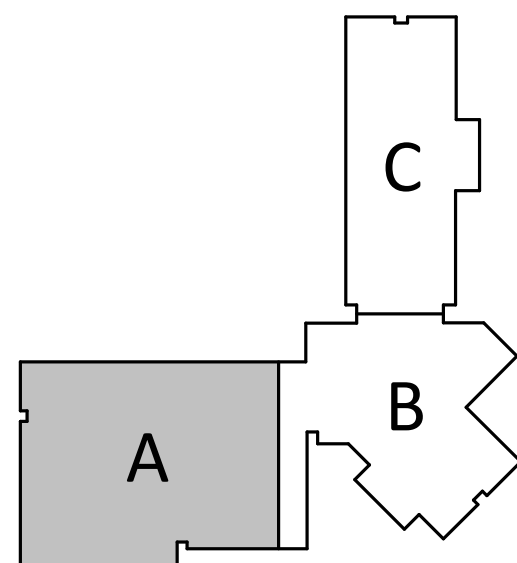
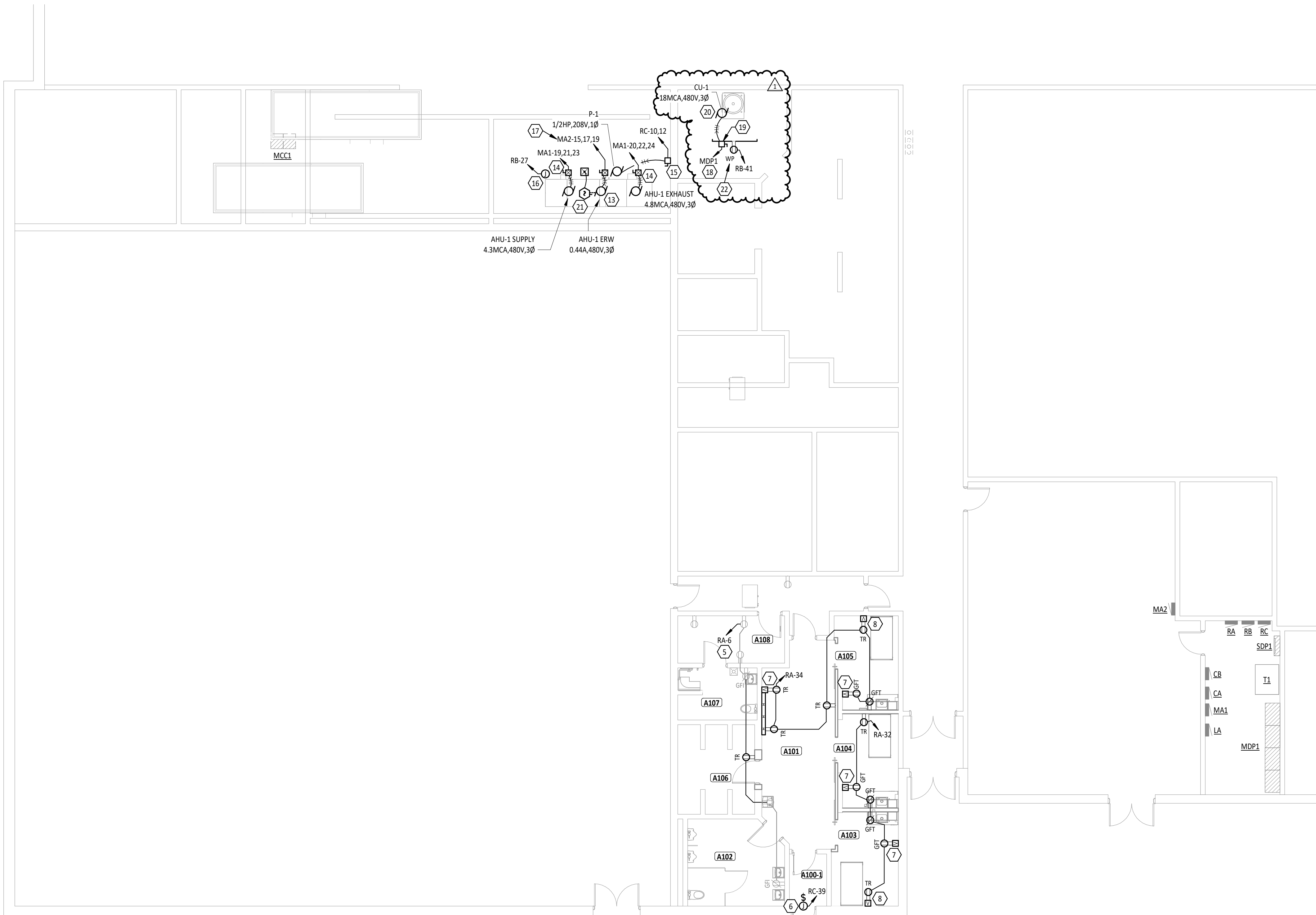
#	KEYNOTE DESCRIPTION
1	REINSTALL EXISTING FIRE ALARM DEVICE IN THIS LOCATION. MODIFY AND EXTEND RACEWAY AND CABLING AS REQUIRED. CONNECT TO EXISTING FIRE ALARM CIRCUIT AND PROVIDE PROGRAMMING AS REQUIRED.
2	REFER TO DETAIL 3 ON THIS SHEET FOR SURFACE RACEWAY REQUIREMENTS.
3	PROVIDE SINGLE GANG, FLUSH MOUNTED JUNCTION BOX ON EXTERIOR OF BUILDING WITH 3" CONDUIT STUBBED TO INSIDE. MOUNT THE BOX AND CABLE SLEEVE ABOVE THE CEILING FOR EXTERIOR CAMERA. PROVIDE PLASTIC BUSHING ON END OF CONDUIT AND WEATHERPROOF BLANK COVER FOR EXTERIOR BOX. REFERENCE TECHNOLOGY DRAWINGS FOR MORE DETAILS. COORDINATE WORK WITH TECHNOLOGY CONTRACTOR PRIOR TO ROUGH-IN.
4	DOOR PROVIDED WITH ELECTRIC STRIKE AND POWER PACK BY DOOR HARDWARE SUPPLIER. DIVISION 26 TO PROVIDE POWER TO POWER PACK ABOVE CEILING, BACK BOXES, RACEWAYS, BUSHINGS AND PULL STRINGS FOR CABLING FROM ABOVE CEILING/POWER PACK TO ELECTRIC STRIKE IN DOOR FRAME. CABLING BY SECURITY/ACCESS CONTROL CONTRACTOR. COORDINATE WORK WITH DOOR HARDWARE INSTALLER AND SECURITY/ACCESS CONTROL CONTRACTOR. REFERENCE DETAIL 3 ON THIS SHEET FOR 120-VOLT POWER REQUIREMENTS.
5	UTILIZE EXISTING RECEPTACLE CIRCUIT TO FEED NEW RECEPTACLES AS SHOWN. MODIFY AND EXTEND RACEWAY AND WIRING AS REQUIRED.
6	PROVIDE POWER CONNECTION ABOVE CEILING FOR ELECTRIC STRIKE POWER PACK(S), TRANSFORMER(S) AND ACCESS CONTROL PANEL(S). REFER TO DETAIL 1 ON THIS SHEET FOR EXACT QUANTITIES.
7	NEW DEVICE ON EXISTING WALL. CONCEAL WIRING INSIDE WALL IF POSSIBLE. OTHERWISE, PROVIDE WIREMOLD 4000 SERIES SURFACE MOUNT RACEWAY (OR EQ) WITH DIVIDER AND NECESSARY ACCESSORIES FOR POWER AND TECHNOLOGY. RACEWAY SHALL BE MOUNTED VERTICALLY FROM BOX HEIGHT TO ABOVE ACCESSIBLE CEILING.
8	NEW DEVICE ON EXISTING WALL. CONCEAL WIRING INSIDE WALL IF POSSIBLE. OTHERWISE, PROVIDE WIREMOLD 700 SERIES SURFACE MOUNT RACEWAY (OR EQ) WITH DIVIDER AND NECESSARY ACCESSORIES FOR POWER AND TECHNOLOGY. RACEWAY SHALL BE MOUNTED VERTICALLY FROM BOX HEIGHT TO ABOVE ACCESSIBLE CEILING.
9	CONNECT TO EXISTING LIGHTING CIRCUIT MADE AVAILABLE FROM DEMOLITION WORK.
10	RELOCATED EXIT SIGN SALVAGED FROM DEMOLITION WORK. REFER TO ED1.1 FOR ADDITIONAL INFORMATION. MODIFY EXISTING CIRCUIT AS NECESSARY.
11	SHADED FIXTURE TO BE PROVIDED WITH INTEGRAL BATTERY BACKUP (90 MINUTES MINIMUM). REFERENCE LUMINAIRE SCHEDULE FOR ADDITIONAL INFORMATION.
12	EXISTING SWITCH TO CONTROL NEW LIGHT FIXTURES. MODIFY CONDUIT AND WIRING AS REQUIRED.
13	PROVIDE COMBINATION MOTOR STARTER/DISCONNECT RATED FOR LOAD IN NEMA 1 ENCLOSURE FOR ENERGY RECOVERY WHEEL. PROVIDE WIRING BETWEEN MOTOR AND STARTER. COORDINATE MOUNTING LOCATION AND WORK WITH MECHANICAL CONTRACTOR.

#	KEYNOTE DESCRIPTION
14	COMBINATION MOTOR STARTER/DISCONNECT PROVIDED WITH AIR HANDLER UNIT. WIRING BETWEEN MOTOR AND STARTER PRE-WIRED AT FACTORY. PROVIDE ELECTRICAL CONNECTION AT STARTER. COORDINATE WORK WITH MECHANICAL CONTRACTOR.
15	PROVIDE HEAVY DUTY 30A, 208V DISCONNECT IN NEMA 1 ENCLOSURE. COORDINATE LOCATION WITH EXISTING EQUIPMENT WITHIN ROOM. COORDINATE WORK WITH MECHANICAL CONTRACTOR.
16	PROVIDE A 120V CONNECTION TO AIR HANDLER UNIT FOR RECEPTACLE AND LIGHTING CONNECTIONS. COORDINATE EXACT LOCATION ON UNIT AND REQUIREMENTS WITH MECHANICAL CONTRACTOR. UTILIZE EXISTING CIRCUIT MADE AVAILABLE FROM DEMOLITION.
17	UTILIZE EXISTING CIRCUIT MADE AVAILABLE FROM DEMOLITION WORK.
18	REFERENCE ONE LINE DIAGRAM FOR ADDITIONAL INFORMATION.
19	PROVIDE HEAVY DUTY 30A, 480V, 3-POLE NONFUSED DISCONNECT IN NEMA 3R ENCLOSURE FOR CONDENSING UNIT. MOUNT TO STRUT RACK. COORDINATE WITH ROOFING INSTALLER FOR SEALING ROOF AND MECHANICAL CONTRACTOR FOR LOCATION.
20	PROVIDE POWER CONNECTION TO CONDENSING UNIT LOCATED ON ROOF. COORDINATE PENETRATIONS WITH ROOFING CONTRACTOR. COORDINATE WORK WITH MECHANICAL CONTRACTOR.
21	PROVIDE AND INSTALL DUCT MOUNTED SMOKE DETECTOR(S) IN RETURN AIR OF MECHANICAL UNIT. COORDINATE LOCATION AND QUANTITY WITH DUCT SIZE. REFERENCE DETAIL 4/E1.1. PROVIDE A REMOTE STATUS INDICATOR ON SIDE OF AHU, APPROXIMATELY 44" A.F.F. COORDINATE WITH DIVISION 23. CONNECT TO EXISTING FIRE ALARM CIRCUIT AND PROVIDE PROGRAMMING AS REQUIRED.
22	RECEPTACLE TO BE MOUNTED TO STRUT RACK. COORDINATE WITH ROOFING INSTALLER FOR SEALING ROOF.

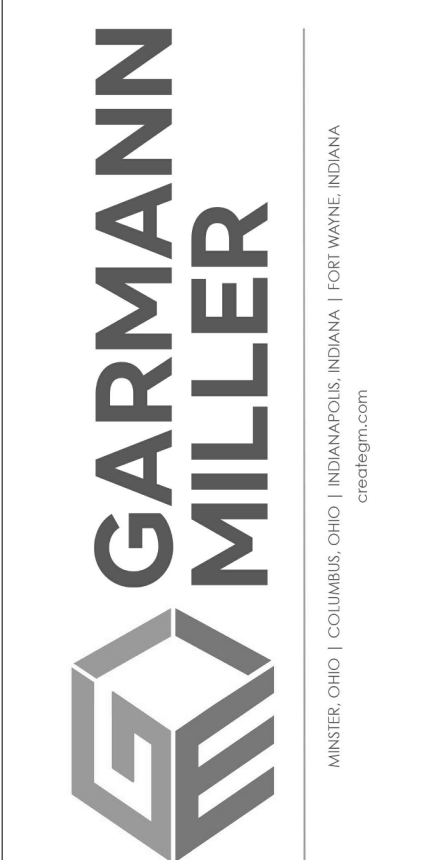
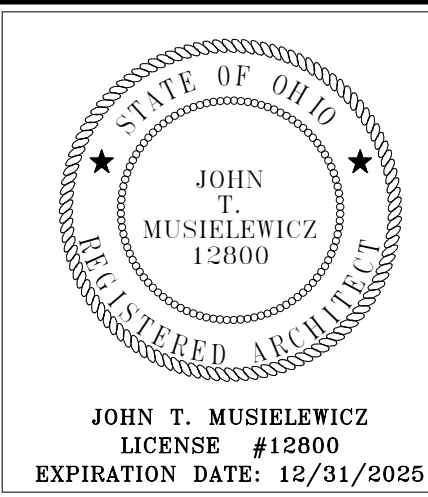
FIRST FLOOR PLAN ROOM INDEX - UNIT A		
ROOM NUMBER	ROOM NAME	AREA
A100	VESTIBULE	36 SF
A101	CORRIDOR	254 SF
A102	RESTROOM	146 SF
A103	EXAM ROOM	109 SF
A104	EXAM ROOM	100 SF
A105	EXAM ROOM	102 SF
A106	SUPPLIES	116 SF
A107	STAFF RESTROOM	73 SF
A108	ATHLETIC OFFICE	91 SF
A109	EQUIPMENT MEZZANINE	1,585 SF
A110	GYMNASIUM	7,987 SF

- LIGHTING GENERAL NOTES**
- A REFER TO ARCHITECTURAL REFLECTED CEILING PLANS ON THE A7 SERIES DRAWINGS FOR ADDITIONAL INFORMATION AND EXACT LOCATION OF LUMINAIRES.
 - B VERIFY EXACT LOCATION OF ALL LIGHT SWITCHES AND CONTROLS DEVICES WITH ARCHITECTURAL DRAWINGS PRIOR TO ROUGH-IN.
 - C WHERE MULTIPLE SWITCHES ARE GROUPED TOGETHER AT A SINGLE LOCATION, ALL SWITCHES SHALL BE INSTALLED UNDER A COMMON FACEPLATE.
 - D CIRCUIT ALL EMERGENCY LIGHTS, NIGHT LIGHTS (IF APPLICABLE) AND EXIT LIGHTS TO AN UNSWITCHED HOT CONDUCTOR, UPSTREAM OF ALL CONTROLS.
 - E REFER TO SHEET E3.2 FOR LUMINAIRE SCHEDULE AND ADDITIONAL INFORMATION.
 - F ALL LIGHTING CONTROL DEVICES, RELAYS, ETC. ABOVE LAV-IN CEILINGS SHALL BE MARKED WITH A BLACK 3/4" DIAMETER, PRESSURE-SENSITIVE ADHESIVE PAPER CIRCLE.
 - G ALL MOUNTING HEIGHTS REFER TO BOTTOM OF LIGHT FIXTURE, UNO.
- POWER & SYSTEMS GENERAL NOTES**
- A WHERE DEVICES ARE SHOWN UNDER CABINETS, CASEWORK, FURNITURE AND THE LIKE, REFER TO ARCHITECTURAL ELEVATIONS FOR EXACT PLACEMENT SO THAT DEVICES SHALL BE LOCATED WITHIN KNEE SPACE OR OPEN AREA.
 - B CASEWORK INSTALLER SHALL CUT HOLES IN CASEWORK FOR RECEPTACLES, DEVICES, ETC., UNLESS NOTED OTHERWISE.
 - C ALL CONDUCTORS FOR EQUIPMENT CONNECTIONS SHALL BE COPPER UNLESS NOTED OTHERWISE AND APPROVED BY THE MANUFACTURER.
 - D COORDINATE WITH ALL OTHER TRADES TO MAINTAIN ALL REQUIRED CLEARANCES ABOUT ELECTRICAL EQUIPMENT WITH ACCORDANCE TO THE NATIONAL ELECTRICAL CODE.
 - E REFER TO MECHANICAL, PLUMBING, AND OTHER APPLICABLE DRAWINGS FOR EXACT EQUIPMENT LOCATIONS.
 - F MAINTAIN ALL FIRE RATINGS WHERE CONDUIT PENETRATES WALL, CEILINGS, AND FLOORS WITH ONLY U.L. LISTED FIRE ASSEMBLIES.
 - G ALL LOW VOLTAGE CABLING FOR THE SCOPE OF WORK BY DIVISION 26, 27, AND 28 IN EXPOSED CEILING SPACES SHALL BE ROUTED INSIDE CONDUIT. COORDINATE WITH INSTALLER OF EACH SYSTEM PRIOR TO ROUGH-IN. PAINT CONDUIT TO MATCH SURROUNDING AREA.
 - H CONDUIT IN EXPOSED CEILING SPACES SHALL BE CONCEALED INSIDE WALLS. EXPOSED CONDUIT SHALL ONLY BE ALLOWED IN JOIST SPACE NEAR ROOF.
 - I ALL CONDUIT ENDS FOR CABLING NOT CONNECTED TO A BOX OR FITTING SHALL BE PROVIDED WITH NYLON BUSHINGS TO PROTECT CABLING FROM DAMAGE.
 - J ALL MOUNTING HEIGHTS REFER TO BOTTOM OF BOX, UNO.

3
E2.1
FIRST FLOOR POWER PLAN - UNIT A
1/8" = 1'-0"



KEY PLAN



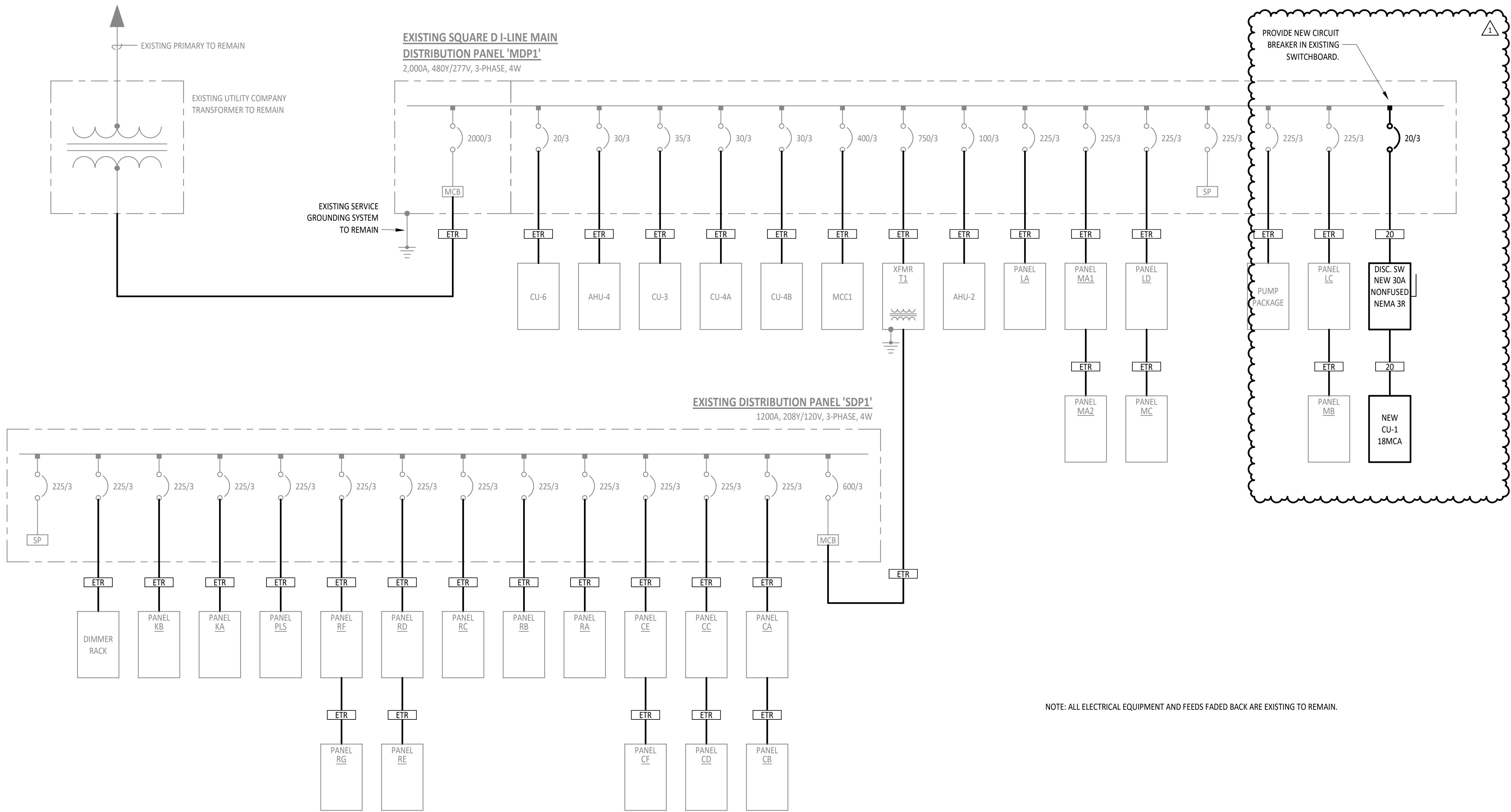
RENOVATION FOR
ZANESVILLE SCHOOLS - MVHC CLINIC
RENOVATIONS
969 WEST ZANESVILLE, OH 43701

ISSUANCES/REVISIONS		
1	CONSTRUCTION DOCUMENTS CONSTRUCTION DOCUMENTS - ADDENDUM #01	06/17/2025 07/01/2025

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:
25006.02	AEI	SH

SHEET TITLE:
ELECTRICAL PLANS

SHEET NUMBER:
E2.1



FEEDER SCHEDULE	
GENERAL NOTES: • ELECTRICAL CONTRACTOR SHALL PROVIDE THE NUMBER OF LUGS AND PROPER LUG SIZES TO ACCEPT CONDUCTOR SIZES SHOWN. • ALL CONDUCTORS ARE BASED ON COPPER, UNLESS NOTED OTHERWISE.	
MARK	FEEDER DESCRIPTION
20	(3) #12, #12G, 3/4" C
ETR	EXISTING FEED TO REMAIN

NOTE: ALL ELECTRICAL EQUIPMENT AND FEEDS FADED BACK ARE EXISTING TO REMAIN.

1 ELECTRICAL ONE-LINE DIAGRAM
E3.1 NTS

PANEL RA										AIC RATING: EXISTING VOLTAGE: 208Y/120V 3PH 4W MAINS RATING: 225 A MAINS TYPE: MLO OTHER:									
MOUNTING: SURFACE FED FROM: SDP1 ENCLOSURE: NEMA 1 LOCATION: RM 78A ELECTRICAL																			
PANEL NOTES: EXISTING PANELBOARD IS SQUARE D - NO SERIES. PANEL SCHEDULE BASED ON RECORD DRAWINGS AND CASUAL FIELD OBSERVATION. ELECTRICIAN TO VERIFY CIRCUITS PRIOR TO START OF WORK.																			
N O T E	CIRCUIT DESCRIPTION	P O S E	A M P	C K T	A	B	C	C K T	P O S E	CIRCUIT DESCRIPTION	N O T E								
E	EXISTING	1	20	1	1000 / 1200			2	20	1	EXISTING	E							
E	EXISTING	1	20	3		1200 / 1200		4	20	1	EXISTING	E							
E	EXISTING	1	20	5			1200 / 1080	6	20	1	RECP - 72, 73, 76, CLINIC	1							
E	EXISTING	1	20	7	1000 / 1200			8	20	1	EXISTING	E							
E	EXISTING	1	20	9		600 / 1200		10	20	1	EXISTING	E							
E	EXISTING	1	20	11			600 / 1200	12	20	1	EXISTING	E							
E	EXISTING	1	20	13	800 / 800			14	20	1	EXISTING	E							
E	EXISTING	1	20	15		1000 / 1000		16	20	1	EXISTING	E							
E	EXISTING	1	20	17			1000 / 1000	18	20	1	EXISTING	E							
E	EXISTING	1	20	19	800 / 800			20	20	1	EXISTING	E							
E	EXISTING	1	20	21		800 / 1000		22	20	1	EXISTING	E							
E	EXISTING	1	20	23			800 / 600	24	20	1	EXISTING	E							
E	EXISTING	1	20	25	1200 / 1000			26	20	1	EXISTING	E							
E	EXISTING	1	20	27		1200 / 1000		28	20	1	EXISTING	E							
E	EXISTING	1	20	29			600 / 800	30	20	1	EXISTING	E							
E	EXISTING	1	20	31	600 / 1080			32	20	1	RECP - EXAM ROOMS	2							
E	EXISTING	1	20	33		600 / 1080		34	20	1	RECP - EXAM ROOM, CLINIC	2							
E	EXISTING	1	20	35			600 / 2400	36	20	2	EXISTING	E							
E	EXISTING	1	20	37	600 / 2400			38											
E	EXISTING	1	20	39		600 / 5000		40											
	SPARE BREAKER	1	20	41			0 / 5000	42		60	2	EXISTING	E						
VA SUBTOTALS:					14480 VA	17480 VA	16880 VA												
AMP SUBTOTALS:					121 A	149 A	144 A												
CONNECTED VA		DEMAND FACTOR	DEMAND VA	DEMAND AMPS	SUBTOTAL	PHASE		CIRCUIT NOTES:											
RECEPTACLE	3240 VA	100.0%	3240 VA	9 A	14480 VA	A		(1) EXISTING CIRCUIT BREAKER, NEW LOAD AND LABEL											
EXISTING LOAD	45600 VA	100.0%	45600 VA	127 A	17480 VA	B													
					16880 VA	C		(2) UTILIZE EXISTING SPARE CIRCUIT BREAKER											
					PANEL TOTALS														
					CONNECTED														
					48840 VA														
					DEMAND														
					136 A														
					CONNECTED														
					136 A														
					DEMAND														