

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: Addendum 02 - Narrative

Prepared by: Mario Lewis

Please find included under cover the Addendum 02 drawings which incorporate the RFI responses captured in the Bid RFI responses issued in Batch 2, 3.

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

	SMCC Health Science Center		
	BGS Number: 3809		
	Pre-Bid RFI Log		
Date Received	Questions	Responses	Response Date
5/21/2026	S1 detail S0.1 shows what looks to be clips at the end of the MC6x15.1? Are these welded/bolted? What size are they?	The clip angles are L3x3x5/16 and are to be fillet-welded (3 sides typ) to the connecting and supporting MC6 beams. - FBRA	5/26/2026
5/21/2026	S2 detail needs to be shown marked on the overall floor plan where this detail is to be included?	This detail is a Typical Detail to be applied: 1) at top chord bearing concentrated loading locations associated with Typical Detail S1 (locations are shown on plan), and 2) where any concentrated loads are imposed between panel points at the existing joist bottom chord for hung Architectural/MEP loads. - FBRA	5/26/2026
5/21/2026	On AD1.0 A0.3A H5 note what is this for?	INTERIOR ELEVATION TAG PLACED IN ERROR, NO DEMO INFORMATION IS CONVEYED WITH THIS TAG	5/26/2026
5/21/2026	A0.1 General Notes 9 what does it say?	"9. CONTRACTOR SHALL PROVIDE FULLY ENGINEERED STAMPED DRAWINGS FOR ALL NEW PARTITIONS WITH SPECIAL CONDITIONS AS CALLED FOR IN THE SPECIFICATIONS 09 21 16 SECTION 1.04 SUBMITTALS." Graphic to be updated in Addendum 01	5/26/2026
5/21/2026	Any new fire extinguishers?	1 NEW FIRE EXTINGUISHER AND FIRE EXTINGUISHER CABINET TO BE INSTALLED IN CORRIDOR G01. Graphic to be updated in Addendum 01	5/26/2026

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

5/21/2026	A0.3A Door schedule door type noted as FG2 is it supposed to be FG?	Proceed with FG2. to be updated in Addendum 01	5/26/2026
5/21/2026	Detail C8 A4.2 - Spray applied fireproofing where, on what and how much? - Spray applied fireproofing bridged over the floor system is that what you are looking for?	SPRAY APPLIED FIREPROOFING IS TO BE APPLIED TO THE EXISTING STEEL JOIST FRAMING. REFER TO J1, G1 A0.2A FOR ADDITIONAL SCOPE CLARIFICATION	5/26/2026
5/21/2026	New railing systems to be finish painted?	YES, NEW RAILINGS, NEW GUARDRAILS, AND EXISTING RISERS / STRINGERS TO BE PAINTED TO MATCH EXISTING RISER / STRINGER BLUE.	5/26/2026
5/21/2026	Stringers to get repainted?	YES, NEW RAILINGS, NEW GUARDRAILS, AND EXISTING RISERS / STRINGERS TO BE PAINTED TO MATCH EXISTING RISER / STRINGER BLUE.	5/26/2026
5/21/2026	Detail J1 A4.2 shows spray fireproofing on existing bar joist. Is this for just the space the joist is framed and sheetrocked? Or the entire length of the joist?	REFER TO J1, G1 A0.2A FOR ADDITIONAL FIREPROOFING SCOPE CLARIFICATION	5/26/2026
5/21/2026	A6.3 B5, D1, F8, H5 – Shows 71-8 and 71-16 are these markerboards?	Yes, please see accessories legend on A0.1 for 71-8.	5/26/2026

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

5/21/2026	A8.1 and A8.2 provide grid type and tile of existing.	The existing grid is similar to that which is specified. We are confirming the existing ceiling tile with the client. We will follow up with any updates from the client. -----UPDATE: 6/9/2026----- Client has confirmed, please use ACT-2 Armstrong Optima, where "Match Existing" is indicated.	5/26/2026, 6/9/2026
5/21/2026	FP1.1 notes new sprinkler pipe from street see civil? No civil plans in package? No details on coming through foundation and up into sprinkler room.	This will be provided in a forthcoming Addendum/Bulletin, Date to be determined.	5/26/2026
5/26/2026	Where the X-Ray transformer is physically located? The note on the one-line shows removal of the existing primary feed to that transformer and pulling in a new primary feed. I'm assuming it's in the control room 214B outside the radiation technology simulation lab on the second floor, but I don't see anything on the drawings that shows the location.	The X-Ray transformer is located on the ground floor in Mechanical Room G15. The transformer and disconnect are located plan south on the outside wall of the room. Patrick Cotter, Salas OBrien	5/28/2026
5/27/2026	Need specific roof composition information. Membrane (type, thickness, attachment method) Coverboard (yes/no, type, taper yes/no, thickness, attachment method) Insulations (type, total thickness, attachment method if different from Coverboard) Substrate board (yes/no, type, thickness) Vapor Barrier (yes/no, type, thickness) Deck (type, thickness)	The roof composition as indicated in drawings from a 2008 project indicates the following roofing system makeup: - 0.060 Fully Adhered Gray TPO Membrane - 1/2" OSB - Overlay Tapered Insulation Crickets As Shown (Attachment method unknown) - 7" Polyiso Rigid Insulation (Comprised of 3" layer over a 4" layer with joints offset minimum of 24". Attachment method is unknown) - Existing Sloping Metal Deck (The existing structural drawings indicate the roof deck to be 22 gage Type B roof deck) Whether or not there is a vapor barrier is unknown.	5/28/2026

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

5/26/2026	E6.0 Demo note 9 says to pull back and reuse feeders from XFMR to pull box. New conditions note 2 says to pull in new feeder. Which is correct?	The intent is for the existing feeders to be removed and the existing conduits to be reused to pull the new 1200 amp secondary feeders. Patrick Cotter, Salas OBrien	5/28/2026
5/28/2026	Can you clarify if there will be a set aside parking/staging area available. If not, are there particular parking lots that our workers would be allowed to park in?	The College has indicated that workers can park in any non-permitted visitor spots on campus. The College will offer limited lay down and storage space in lot A. The College will a lot 4 spots in lot E for general contractor vehicles. Refer to attached marked up campus map.	5/28/2026
5/28/2026	The owner's rep did not want us to access the roof. Is it possible for the owner to get pictures of the existing rooftop units and the data tag? We need to see the weights and existing curb dimensions to allow us to plan for cranes etc.	Refer to the attached Image files including a part roof plan of HSC and data tags for the 2 existing units.	5/28/2026
5/28/2026	Can you verify that the Automatic Temperature Control System will be stand alone for this building and not integrated into a campus wide BMS system?	Design intent is for the bidding ATC vendor to provide an Open Non Proprietary BACnet system which when the system is commissioned, to provide the legacy Campus ATC vendor with a full BACnet Points Registry of the SMCC Healthcare Reno. This enables the legacy campus vendor to have full visibility of the system.	5/29/2026
5/26/2026	Demo plans say to leave panel tubs and replace existing panel interiors "one-for-one" for panels L1-L6 and H1-H4. There are no further details provided. Do you have as built drawings or panel schedules you could share for the existing panels including make/model numbers, # of circuits, voltage, MCB/Bus amperage, etc?	Additional information shall be provided in Addendum.	5/29/2026
5/26/2026	ED1.0 - 1.2 include notes to remove all lighting, lighting controls, and FA devices in ceiling for . No details provided on # of fixtures, occ sensors, switches etc. Do you have any more information on # and type of fixtures to be demo'd in each room?	No additional information shall be provided. The rooms noted shall have all the ceilings removed completely, this shall include any lightings, lighting controls and fire alarm devices that are part of the rooms ceiling. Patrick M. Cotter, Salas O'Brien.	5/29/2026

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

5/29/2026	Section 06 41 00 paragraph 2.04.B: Edge banding is spec'd as 3 mm PVC or ABS on door/drawer fronts and cabinet body edges. Confirm acceptability of PUR-applied 3 mm ABS or whether PVC is preferred for sustainability.	PVC is preferred.	5/29/2026
5/29/2026	Sheet A10.1 Finish Legend and Section 12 36 00: Sheet A10.1 references 'Solid Surface' as a countertop option. Section 12 36 00 specifies epoxy resin only. Confirm countertops are epoxy resin throughout with no solid surface, or issue a solid surface spec.	All surfaces are Epoxy Resin throughout.	5/29/2026
5/29/2026	Is there a preferred contractor for the low voltage data work?	Connectivity Point is being engaged by the Client to install all IT system components, cabling and terminations. The Contractor is responsible for installing the infrastructure for all IT services (Conduit and backboxes).	5/29/2026
5/29/2026	Is the data rack on the ground floor mechanical room the preferred location for all of the data lines to terminate?	Connectivity Point is being engaged by the Client to install all IT system components, cabling and terminations. The Contractor is responsible for installing the infrastructure for all IT services (Conduit and backboxes). The terminations for IT cabling will be in the new IT room on the first floor.	5/29/2026
5/29/2026	General note: Floor boxes in Debrief G05 and G03 will require slab cutting and trenching for conduit, this does not appear to be called out on the architectural.	As described in the question, the debrief rooms will require floor boxes that will need to be trenched to the desired locations. The trenching runs and extents are to be determined by the GC as part of their means and methods. Additional notation to this effect will be included in addendum 01.	5/29/2026

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

5/29/2026	Is there supposed to be a new ceiling in Toilet G13E?	Yes, the toilet room is to receive a new 2x2 ACT ceiling with a diffuser / return system, 2 new 2x2 light fixtures, and associated hardware. The ceiling height is to be 7'-10" aff and will be clarified in addendum 01. Refer to MEP dwgs for additional information.	5/29/2026
5/29/2026	The C5 Detail in Corridor G01 appears to want a 10” trim but the detail it refers to seems to be incorrect. Can you confirm intent?	Details C5/A8.0 and B1/A8.0 have been inadvertently swapped. This will be clarified in Addendum 01	5/29/2026
5/29/2026	The C5 Detail in Corridor G02 appears to want a 4” trim but (once again) the detail it refers to seems to be incorrect. Can you confirm intent?	Details C5/A8.0 and B1/A8.0 have been inadvertently swapped. This will be clarified in Addendum 01	5/29/2026

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

5/29/2026	Section 06 41 00 and 12 36 00: Both spec sections require BABAA compliance certification. Confirm which specific hardware items must carry BABAA certification (hinges, slides, locks, pulls, shelf pins). Confirm substitution path under Section 01 60 00 if the listed basis-of-design products do not have BABAA certification available.	Yes, all materials shall comply with BABAA requirements to the extent required by the BABAA guidelines.	6/4/2026
5/29/2026	Sheet AI0.1 Finish Legend and Spec TOC: Sheet AI0.1 references Section 06 20 00 Finish Carpentry, but no such section appears in the spec book. Confirm there is no Finish Carpentry scope. If there is, request the spec section.	There is no 06 20 00 Finish Carpentry scope. This has been clarified in Addendum 1.	6/4/2026
5/29/2026	Section 06 41 00 paragraph 2.05.E: Confirm 20 percent of cabinets to receive locks is a base bid carry, and that final lock count and locations will be set in shop drawing review with no scope adjustment to Windham above 20 percent.	No locks are required.	6/4/2026

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

5/29/2026	Sheets A6.1 and A6.2 Patient Sim Lab rooms: G01A, G01D, G01F show OFCI medical headwall and 'provide blocking' notes for monitors and laptop mounts. Confirm millwork scope at the headwall walls is limited to the wall PLAM panel shown on elevations and excludes any frame, shelving, accessory hanging at the headwall, or coordination with medical gas piping.	There are no PLAM panels in the Sim Lab rooms in the project. The headwall is equipment being provided by the Owner for installation by the Contractor.	6/4/2026
5/29/2026	Section 06 41 00 paragraph 1.09 mock-up: Confirm mock-up location and whether the mock-up will remain as part of installed work. Mock-up cost will be carried in base bid.	Full Mock-up will not be required. Only mock-up of cabinet construction details will be required. Joinery and edge protection (cubbies and drawer) will be key components to review.	6/4/2026

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

5/29/2026	Is there a preferred contractor for the high voltage utility work? Would the owner like to keep the old transformer or have it hauled off. Is it known if there are any PCB's in the existing unit?	SMCC's campus electrical contractor is Electrical System of Maine. SMCC would like to have the transformer hauled off. It is unknown whether the existing transformer contains PCB's.	6/4/2026
5/29/2026	Is there a preferred distributor for the existing fire alarm system?	Encore Fire Systems is the existing fire alarm service vendor for the SMCC. SMCC does not have a preferred distributor for fire alarm systems.	6/4/2026
5/29/2026	There is a new sprinkler system is being added, but I don't see new fire alarm system connections being provided to this. Should these be added?	The new sprinkler system will require connection to the existing building fire alarm system. Exact number of connections to the fire alarm system shall be confirmed with the approved Fire Protection shop drawings as this is a delegated design. Revisions to drawings will be provided in Addendum 01.	6/4/2026
5/29/2026	Panel L4 is not on the floor plan. Panel L5A is not on the 1-line. Are these the same panel?	Existing Panel L4 resides in (E) CUSTODIAL ROOM 121. Panel tag has been updated and will be issued with Addendum 01. Online updates showing Panel L5A will be issued with Addendum 01	6/4/2026
5/29/2026	Will the contractor be responsible for the cost of the building permit?	The Owner will pay for the State Fire Marshal's and Local general construction permit through the Architects office. The Contractor will be responsible for cost of the electrical, plumbing and protection permits.	6/4/2026

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

5/29/2026	Are any of the walls indicated to be removed CMU walls? If so, how thick, and are they structurally bearing?	The majority of walls that are labeled to be demolished on the ground floor and 2 nd floor are CMU walls to above ceiling. They vary in thickness between 6" to 8". This will be clarified on the demo plans and demo schedule in addendum 01	6/3/2026
5/29/2026	Please clarify the extent of security the Contractor is required to provide. See section 01 50 00 paragraph 1.10. Are we expected to provide 24 hour staffing or surveillance?	Contractor is not responsible for 24-hour security and surveillance. SMCC has general campus security. Contractor is responsible for securing materials and tools.	6/4/2026
5/29/2026	Will the Contractor be able to utilize existing power and water supplies in the building? Will the Contractor be responsible for all water and power usage fees?	GC can hook up to existing services that are within the building. They may not hook up to other buildings.	6/4/2026
5/29/2026	Referencing Section 01 50 00 3.04 paragraph G; Are these badges a part of an existing security system within the building, or is this a separate system the Contractor must come up with?	These badges are a separate system the Contractor must come up with.	6/4/2026
5/29/2026	Please confirm that all materials in the project must be BABAA compliant.	Yes, all materials shall comply with BABAA requirements to the extent required by the BABAA guidelines.	6/3/2026
6/1/2026	What is the extent of the Fire Alarm scope? No devices are shown on the plans. What is the brand of the system being tied into?	Fire Alarm devices are shown in renovated areas of the project. Existing Fire Alarm Control Panel has been identified on drawings and will be issued with Addendum 01	6/3/2026
6/1/2026	FP1.1, FP1.2, FP1.3 are not listed Drawing list on page A0.0. I wanted to confirm these are part of this bid and if there are any other drawings not listed?	This is confirmed. the fire protection drawings are part of the project scope. The Cover sheet schedule will be updated to reflect this.	6/4/2026
6/2/2026	What company designed the building's current controls system and is that being tied into or replaced entirely?	Maine Controls designed the buildings current controls system. Work associated with this project will be tied into that system.	6/4/2026

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

6/2/2026	Confirm the GC owns the cost of all temporary equipment, electric, water, heat etc. Will the GC be allowed to hook up to the existing services for construction purposes ?	GC can hook up to existing services that are within the building. They may not hook up to other buildings.	6/4/2026
6/2/2026	Confirm the GC will be able to use the existing bathroom facilities during the construction phase	GC can utilize bathroom facilities but they need to be kept clean. This allowance will be revoked if facilities are not kept clean and at GC expense.	6/4/2026
6/2/2026	Confirm Builders Risk insurance is to be carried by the general contractor	Insurance is to be carried as stated in the bid requirements and by BGS policy.	6/4/2026
6/2/2026	Confirm OCP insurance is required to be carried by the general contractor	Insurance is to be carried as stated in the bid requirements and by BGS policy.	6/4/2026
6/2/2026	Will the General Contractor be required to provide snow plowing during the course of construction	Snow plowing is done by campus staff around the building and campus. They will do the general area but special plowing to move GC equipment or vehicles will be the responsibility of the GC	6/4/2026
6/2/2026	Are there any requirements for the contractor to provide for any clerk of the works.	The contractor will not be required to provide any clerk of the works services.	6/4/2026
6/2/2026	Will existing FF/E be moved by the owner prior to the start of construction, or will the GC need to assist in the process?	The existing FF/E will be moved around the building as needed by the GC by the owner.	6/4/2026
6/2/2026	There does not appear to be a specified wage rate for the fireproofing installer, please advise.	For any other specific trade on this project not listed in Section 00 73 46 Wage Determination Schedule, contact the Bureau of Labor Standards for further clarification.	6/4/2026
6/2/2026	Various areas call out for patching as needed, or only in disturbed areas. Can an allowance be provided to all bidders ? As this will be challenging to accurately quantify.	An allowance will not be provided. The Contractor shall cover the cost of patching within their respective bids.	6/4/2026

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

6/2/2026	In previous question answers there is mentioning of a future addendum and potential for more drawings to be released, when is the intended date these will be released?	Addendum 1 is planned to be issued on 6/3/26.	6/4/2026
6/2/2026	All preexisting RFI questions that have been answered so far, have been distributed in individual emails, will there be a master addendum encompassing all questions and answers ?	We will issue a PDF of those responses issued to date.	6/3/2026
5/29/2026	Detail c1 on page EP1.0 shows lots of symbols that aren't on the floor plan. It appears some symbols have a bold outline. It seems, with the exception of the headwall unit connection, that the symbols on the floor plan match the elevation items with bold outline very well. Should we ignore the other items? For example, Light switch is indicated but no circuit or light is shown, what should these switches be connected to? AV/hdmi symbols are not on floor plan, what should be provided for these? I assume orange cover plates are to only being used to simulate an emergency receptacle.	Yes, the "orange" cover plates are to be utilized to simulate an emergency receptacle. EP1.0 will be revised in Addendum #2 to clarify the headwall details and coordinate with the Architectural Headwall details more accurately.	6/10/2026

Project: 25-062-00 / BGS 3809

Date: 06/10/2026

Subject: BID RFI Responses – Batch 3 (Comprehensive)

Prepared by: Mario Lewis

6/2/2026	Confirm who will be paying for third party testing, we note that IBC 2021 Section 1704.2 requires special inspections to be performed by an approved agency retained by the Owner or Owner's agent, "other than contractor", in accordance with the independence requirements of IBC 2021 Section 1703.1.1. Given that these services typically are to be performed by the Owner's retained agency, and that the scope and frequency of required testing are not fully defined, please confirm whether the Owner will retain and pay for these services directly, or if the Contractor is to carry an allowance or other defined value for inclusion in the proposal.	Owner will be paying for the 3rd party testing.	6/10/2026
6/4/2026	Please confirm steel show on S1.3 for RTU-G, CU-1, RTU-2 is all existing.	G.C. to verify in field. - FBRA	6/8/2026
6/4/2026	Are there any security and or separation requirements for work that will be complete during the active school year?	The building will not have classes during construction, unless it exceeds the current forecasted completion date. No security or separation requirements.	6/8/2026
6/5/2026	Please confirm that the building will not be occupied during construction. I'm asking in relation to Continuity of Services as described in Specification 230500 1.10/E. Will these temporary utility connections be required?	The building will not be occupied during construction. I couldn't find the section to answer the utility portion.	6/8/2026

SECTION 23 09 00

DIRECT DIGITAL CONTROL (DDC) SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide all labor, materials, special tools, equipment, enclosures, power supplies, interfaces, wiring, tubing, installation, labeling, calibration, documentation, submittals, testing, verification, training services, warranty, specified services and items required by the Contract that are required for the functional turn-key operation of the complete and fully functional Controls Systems. Documents are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans, which are required to meet the functional intent, shall be provided without additional cost to the Owner.
- B. *Provide seamless integration with the existing Southern Maine Community College Niagara Building Automation System (BAS) to enable monitoring and control of equipment associated with this project through the campus BAS. Provide all labor, materials, equipment, and service necessary for a fully complete and operating BAS, fully integrated into the existing campus Niagara system.***
- C. Provide wiring, technical expertise, and components for complete functioning, stand-alone systems. Review the equipment manufacturer's instructions, modify/provide proper sequencing per manufacturer's requirements. Provide items as required for the sequences and control components in the equipment specification sections.
- D. Functions called for in sequence of operations are minimum requirements and not to limit additional system capabilities. Determine, through operation of the system, proportional bands, interval time, integral periods, adjustment rates, and any other input information required to provide stable operation of the control programs.
- E. All setpoints shall be monitored and adjustable. Setpoints listed herein are approximate. It is the responsibility of the contractor to calibrate the system and all setpoints to actual working conditions once the system is on line.
- F. Sequences of operation are intended to be performance based. Provide components and wiring to meet sequences and system intent. Implementations that provide the same functional result using different underlying detailed logic will be acceptable.
- G. Provide a new Building Automation System (BAS) to integrate and control all mechanical equipment associated with this project.
 - 1. The Building Automation System shall be as indicated on the drawings and described in these specifications. System must be fully integrated and coordinated with mechanical equipment DDC controllers furnished and installed in the equipment manufacturer's factory as specified in those sections. The intent of the BAS is to integrate all mechanical equipment into one system for global monitoring, control, and alarming associated with the building. It is the BAS manufacturer's responsibility to provide all the design, engineering, and field coordination required to ensure all equipment sequence of operations are met as specified and the designated BAS operators have the capability of managing the building mechanical system to ensure occupant comfort while maintaining energy efficiency.

2. The BAS shall meet open standard protocol communication standards (As defined in System Communications Section) to ensure the system maintains “interoperability” to avoid proprietary arrangements that will make it difficult for the Owner to consider other BAS manufacturers in future projects.
3. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems and terminal devices on this project.
4. Approved vendors, products and web services shall comply with SOC2 Type II as defined by the AICPA. SOC2 Type II compliance is a certification that confirms that a service provider has established and implemented effective controls to secure their clients' data in accordance with the Trust Services Criteria (TSC).
 - a. SOC2 Type II compliance provides assurance to customers that the service provider has established and implemented effective security controls and is committed to protecting their data.
 - b. To achieve SOC2 Type II compliance, the manufacturer shall have completed an independent audit to assess design and implementation of their controls, policies, and procedures.
5. The BAS shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by the security permissions of the operator role. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the control system and have access to all appropriate data.

H. Related Sections include the following:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
2. Division 13 Section "Fire Alarm"
3. Division 23 Section "Common Work Results for Mechanical"
4. Division 23 Sections controls shall be integrated by this section.
5. Division 23 Section "Testing, Adjusting, and Balancing"
6. Division 26
7. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays and interface to DDC controllers.
- C. Narrative sequence of operation.
- D. Schedule and design calculations for control valves and actuators.
- E. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- F. BAS manufacturer shall provide shop drawings and manufacturers' standard specification data sheets on all hardware and software being provided for this project. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications.
 1. Provide three (3) printed copies of submittal package for review and approval.

- a. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review shall not relieve the BAS manufacturer of furnishing quantities required based upon contract documents.
2. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with the specifications or which is deemed valuable in documenting and understanding the system to be installed.
3. All shop drawings shall be provided to the Owner electronically as .dwg or .dxf file formats once they have been approved and as-built drawings have been completed.
4. Submit the following within 90 days of contract award:
 - a. A complete bill of materials of equipment to be used indicating quantities, manufacturers and model numbers.
 - b. A schedule of all control valves including the valve size, pressure drop, model number (including pattern and connections), flow, CV, body pressure rating, and location.
 - c. A schedule of all control dampers including damper size, pressure drop, manufacturer, and model number.
 - d. Provide all manufacturers' technical cut sheets for major system components. When technical cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Include:
 - 1) Building Controllers
 - 2) Custom Application Controllers
 - 3) Application Specific Controllers
 - 4) Operator Workstations
 - 5) Portable Operator Terminals
 - 6) Auxiliary Control Devices
5. Provide proposed Building Automation System architectural diagram depicting various controller types, workstations, device locations, addresses, and communication cable requirements
6. Provide detailed termination drawings showing all required field and factory terminations, as well as terminal tie-ins to DDC controls provided by mechanical equipment manufacturers. Terminal numbers shall be clearly labeled.
7. Provide a sequence of operation for each controlled mechanical system and terminal end devices.
8. Provide a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet system level device (i.e. Building Controller & Operator Workstations) type. This defines the points list for proper coordination of interoperability with other building systems if applicable for this project.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data
- B. Project Record Documents: Upon completion of installation, submit three (3) copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:
 1. Project Record Drawings - These shall be as-built versions of the submittal shop drawings. One set of electronic media including CAD .dwg and .pdf drawing files shall be provided.

2. Testing and Commissioning Reports and Checklists signed off by trained factory (equipment manufacturers) and field (BAS) commissioning personnel.
 3. Operating and Maintenance (O & M) Manuals - These shall be as-built versions of the submittal product data. In addition to the information required for the submittals, Operating & Maintenance manual shall include:
 - a. Procedures for operating the BAS including logging on/off, alarm management, generation of reports, trends, overrides of computer control, modification of setpoints, and other interactive system requirements.
 - b. Explanation of how to design and install new points, new DDC controllers, and other BAS hardware.
 - c. Documentation, installation, and maintenance information for all third party hardware/software products provided including personal computers, printers, hubs, sensors, valves, etc.
 - d. Original issue media for all software provided, including operating systems, programming language, operator workstation software, and graphics software.
 - e. Licenses, Guarantee, and Warranty documents for all equipment and systems.
- C. Training Manuals: The BAS manufacturer shall provide a course outline and copies of training manuals at least two weeks prior to the start of any corporate training class to be attended by the Owner.

1.04 QUALITY ASSURANCE

- A. All products used in this project installation shall be new and currently under manufacture and shall have been applied in similar installations for a minimum of two years. This installation shall not be used as a test site for any new products unless explicitly approved by the owner's representative in writing. Spare parts shall be available for at least five years after completion of this contract.
- B. Use only employees who are qualified, skilled, experienced, and familiar with the specific equipment, software and configurations to be provided for this Project.
- C. Provide a complete, neat and workmanlike installation.
- D. All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Comply with NFPA 90A and IMC-2021.
- G. Comply with ASHRAE 135 for DDC system control components.
- H. The contractor shall protect all work and material from damage by his/her work or employees. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

- I. Codes and Standards: Meet requirements of all applicable standards and codes, except when more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section.
 1. Underwriters Laboratories: Products shall be UL-916-PAZX listed.
 2. National Electrical Code -- NFPA 70.
 3. Federal Communications Commission -- Part J.
 4. ASHRAE/ANSI 135-2012 (BACnet) - Controllers shall conform to the listed version of the BACnet specification to improve interoperability with various building system manufacturers' control systems and devices.

- J. BACnet Specific Definitions:
 1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data and services over a network.
 2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
 3. BACnet MS/TP: MS/TP bus protocol is part of the BACnet ANSI/ASHRAE™ Standard 135-2008 that uses the EIA-485 (RS-485) physical layer standard for data transmission (called the segment). Multiple segments can be logically tied together.
 4. BACnet-IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
 5. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.

1.05 CONTRACTOR QUALIFICATIONS

- A. Qualified Bidders: System shall be as manufactured, installed, and serviced by:
 1. Trane (Basis of Design)
 2. Johnson Controls, Inc.
 3. Honeywell
 4. Siemens
 5. **Maine Controls – Schneider Electric**

- B. The BAS Manufacturer shall have factory trained and certified personnel providing all engineering, service, startup, and commissioning field labor for the project from their local office location. BAS manufacturer shall be able to provide training certifications for all local office personnel upon request.

- C. The BAS shall be provided by a single manufacturer and this manufacturer's equipment must consist of operator workstation software, web-based hardware/software, open standard protocol hardware/software, custom application programming language, graphical programming language, building controllers, custom application controllers, and application specific controllers. All other products specified herein (i.e., sensors, valves, dampers, actuators, etc.) need not be manufactured by the BAS manufacturer listed in this specification.

- D. The BAS manufacturer shall have an established business office within 50.00 miles of the project site and must provide 24 hours/day, 7 days/week response in the event of a customer warranty or service call.

- E. The BAS Manufacturer shall have factory trained and certified personnel providing all engineering, service, startup, and commissioning field labor for the project from their local office location. BAS manufacturer shall be able to provide training certifications for all local office personnel upon request.
- F. The BAS shall be provided by a single manufacturer and this manufacturer's equipment must consist of operator workstation software, Web-based hardware/software, Open Standard Protocol hardware/software, Custom application Programming Language, Graphical Programming Language, Building Controllers, Custom Application Controllers, and Application Specific Controllers. All other products specified herein (i.e., sensors, valves, dampers, actuators, etc.) need not be manufactured by the BAS manufacturer listed in this specification.

1.06 COORDINATION

- A. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition.
- B. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.
- C. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.
- D. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the controls system specified in this section. These controls shall be integrated into the system and coordinated by the contractor.
- E. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.
- F. Electrical Subcontractor: Complying with the principle of "unit responsibility" all electrical work for automatic controls, except as otherwise specified, or shown on the electrical drawings shall be included in Division 23. Electrical work shall, in general, comply with the following, unless otherwise directed by Division 26:
 - 1. Power wiring.
 - 2. All electrical work shall comply with the N.E.C. and local electrical codes.
- G. Coordinate with controls specified in other sections of divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated as follows:
 - 1. All communication media and equipment shall be provided as specified hereinafter.
 - 2. Each supplier of a control product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.
 - 3. Coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.

1.07 WARRANTY

- A. Refer to Division 1 Requirements.

1.08 SYSTEM MAINTENANCE AND REMOTE ANALYSIS

- A. The BAS Manufacture shall provide Building Automation System remote technical support and system analysis for a period of 1 year (beginning the date of substantial completion).
- B. The BAS manufacturer shall setup a secure remote connection for data collection, analytics and remote technical support for the HVAC systems included in this contract.
 - 1. Provide technician support during the warranty period to diagnose issues remotely through the secure remote connection.
 - 2. The building owner is responsible for providing adequate internet access.
- C. Connectivity / Remote Access / Network Security
 - 1. Provide and maintain secure remote access to the facilities Building Automation System (BAS) or other building systems. Users accessing service through this connection shall not have access to the building owners network. Secure remote access to the BAS shall not require ANY inbound ports on a firewall to be “exposed” or “forwarded”.
 - 2. Secure remote access to the BAS shall be available anywhere, anytime, using a compatible client device (PC/tablet/phone)
 - 3. The Owner will provide up to Three (3) IP drops and IP addresses on the owners network to gain access to the internet. The BAS manufacture shall coordinate with the Owners IT team, verify the proposed system shall meet all network security requirements and any other network configuration information necessary to each control contractor for the purpose of configuring each Area Controller on the network. It shall be the responsibility of the BAS manufacture to coordinate with the owner for network connectivity.
- D. The BAS Manufacture shall provide a professional analysis for the facility HVAC systems.
 - 1. The analysis shall consist of an evaluation of HVAC systems including charts and graphs which indicate both current building performance and opportunities for building and HVAC system performance improvement.
- E. The following shall be provided after substantial completion of the project:
 - 1. Orientation meeting with the building owner’s representative to identify the HVAC systems that will be evaluated.
 - 2. System setup for data collection and analytics. BAS Manufacture to setup a secure remote data collection and analytics for identified systems.
 - 3. Assessment analysis shall be performed by trained personnel with relevant professional credentials in HVAC systems, energy management and building optimization methodologies.
 - 4. Consultation meeting with owner to review performance reports and improvement opportunities.
- F. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of owner.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Products shall operate without performance degradation under ambient environmental temperature, pressure and humidity conditions encountered for installed location. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled and ventilated as required by product and application. Products shall be protected with NEMA enclosures suitable for the location where installed.
- B. Continuity of Operation after Electric Power Interruption: Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems shall automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.
- C. Performance Standards. The BAS system shall conform to the following:
 - 1. Graphic Display. The system shall display a graphic with a minimum of 20 dynamic points. All current data shall be displayed within 10 seconds of the operator's request.
 - 2. Graphic Refresh. The system shall update all dynamic points with current data within 10 seconds.
 - 3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 5 seconds. Analog objects shall start to adjust within 5 seconds.
 - 4. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current within the prior 10 seconds.
 - 5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 10 seconds.
 - 6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
 - 7. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
 - 8. Multiple Alarm Annunciations. All workstations on the network shall receive alarms within 5 seconds of each other.

2.02 SYSTEM COMMUNICATION

- A. Each workstation, building controller, and equipment controller communication interface shall utilize the BACnet™ protocol with an Ethernet (IEEE 802.3), Wi-Fi (IEEE 802.11), RS485 (EIA-485), or Zigbee® (802.15.4) physical interface and an appropriate data link technology as defined

in ANSI®/ASHRAE® Standard 135-2012. (e.g. BACnet over IP, BACnet over IPv6, BACnet SC, BACnet over MS/TP, BACnet Zigbee).

- B. All system controllers shall be BTL listed as a BACnet Building Controller (B-BC) as defined in ANSI®/ASHRAE® Standard 135-2012.
- C. The system shall support both BACnet over IP and BACnet over MS/TP, allowing for a hybrid approach to meet various performance and cost requirements. Supporting both twisted-pair and Ethernet topologies to offer flexibility and cost-effectiveness.
- D. All documented status and control points, schedule, alarm, and data-log services or objects shall be available as standard object types as defined in ANSI®/ASHRAE® Standard 135-2012.
- E. The control system shall be capable of obtaining and using data from a RESTful API data server (e.g. current weather, forecast weather, etc.) to enhance energy efficiency, cost savings, and/or user comfort. The control system shall account for a communication loss to the API server such that the system will continue to operate.
- F. All Operator Workstations (B-OWS, B-AWS) and Building Controllers (B-BC) shall support BACnet Secure Connect (BACnet SC), a secure and encrypted datalink layer specifically designed for those networks.
- G. Each System Controller shall communicate with a network of Custom Application and Application Specific Controllers utilizing one or more of the interfaces documented within Field Bus Communications below.
- H. Field Bus Communications
 - 1. BACnet™
 - a. All equipment and plant controllers shall be BTL listed as a BACnet Application Specific Controller (B-ASC) or a BACnet Advanced Application Controller (B-AAC) as defined in ANSI®/ASHRAE® Standard 135-2012.
 - b. All communication shall conform to ANSI®/ASHRAE® Standard 135-2012.
 - c. System Controller shall function as a BACnet router to each unit controller providing a globally unique BACnet Device ID for all BACnet controllers within the system.
 - d. BACnet Zigbee®
 - 1) Communication between System Controller and equipment/plant controllers shall utilize BACnet Zigbee as defined in ANSI®/ASHRAE® Standard 135-2012.
 - 2) Each equipment controller wireless communication interface shall self-heal to maintain operation in the event of network communication failure.
 - 3) Each zone sensor wireless communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications. Sensing options shall include temperature, relative humidity, CO2, and occupancy.
 - e. BACnet MS/TP
 - 1) Communication between System Controller and equipment/plant controllers shall utilize BACnet MS/TP as defined in ANSI®/ASHRAE® Standard 135-2012.

~~I. Variable Refrigerant Flow (VRF) Communications~~

- ~~1. The VRF system shall communicate with the BAS using one of the following communications methods.
 - ~~a. The VRF system and the BAS shall utilize ANSI®/ASHRAE® Standard 135 (BACnet) protocol revision 12 or greater.~~
 - ~~b. Recognizing that VRF manufacturers utilize proprietary protocols to pass information between VRF equipment components. A gateway device is an accepted method to convert proprietary data to BACnet data. BACnet data shall conform to BACnet protocol revision 12 or greater.~~
 - ~~c. When a device is capable of data exchange with the BACnet protocol across non-IP network segments, the BACnet protocol shall be used to exchange data. If a device does not support the BACnet protocol an alternative protocol may be used. Data exchanged using the alternative protocol shall be converted to the BACnet protocol to allow integration to the BAS.~~~~
- ~~2. To promote BAS interoperability, each instance of the following VRF system components shall be visible to the BAS network as a virtual BACnet device.
 - ~~a. Indoor equipment~~
 - ~~b. Outdoor equipment~~
 - ~~c. Refrigerant manifold devices~~
 - ~~d. Outdoor air ventilation systems~~~~
- ~~3. Virtual BACnet device functionality shall conform to BACnet protocol revision 12 or greater and meet the minimum functionality defined by BACnet device profile B-ASC.~~
- ~~4. The VRF indoor equipment shall support wireless zone sensors. Sensing options shall include temperature, relative humidity, CO2, and occupancy. Each zone sensor wireless communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications.~~

2.03 OPERATOR INTERFACE

A. Provide Building Operator Web Interface

1. Manufacturer shall provide a user interface with time-of-day schedules, data collection, dashboards, reports and building summary, system applications, and self-expiring timed overrides. Manufacturer shall provide a published user and applications guide(s) that detail the system application operation, configuration, setup and troubleshooting.
2. The building operator web interface shall be accessible via a web browser without requiring any "plug-ins" (i.e. JAVA Runtime Environment (JRE), Adobe Flash).
3. User Roles
 - a. The system shall include pre-defined "roles" that allow a system administrator to quickly assign permissions to a user.
 - b. User logon/logoff attempts shall be recorded.
 - c. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
4. On-Line Help and Training
 - a. Provide a context sensitive, on line help system to assist the operator in operation and configuration of the system.

- b. On-line help shall be available for all system functions and shall provide the relevant data for each particular screen.

5. Equipment and Application Pages

- a. The building operator web interface shall include standard pages for all equipment and applications. These pages shall allow an operator to obtain information relevant to the operation of the equipment and/or application, including:

- 1) Animated Equipment Graphics for each major piece of equipment and floor plan in the System. This includes:
 - a) Each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, and Cooling Tower. These graphics shall show all points dynamically as specified in the points list.
 - b) Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as valve or damper positions. Graphics shall be capable of launching other web pages.
- 2) Alarms relevant to the equipment or application without requiring a user to navigate to an alarm page and perform a filter.
- 3) Historical Data (As defined in Trend Logs section of CONTROLLER SOFTWARE) for the equipment or application without requiring a user to navigate to a Data Log page and perform a filter.

- b. VAV Air System. An operator shall be able to view and control (where applicable) the following parameters via the building operator web interface:

- 1) System Mode
- 2) System Occupancy
- 3) Ventilation (Outdoor air flow) setpoint
- 4) Ventilation (Outdoor air flow) status
- 5) Air Handler Static pressure setpoint
- 6) Air Handler Static pressure status
- 7) Air Handler occupancy status
- 8) Air Handler Supply air cooling and heating set points
- 9) Air Handler minimum, maximum and nominal static pressure setpoints
- 10) VAV box minimum and maximum flow
- 11) VAV box drive open and close overrides
- 12) VAV box occupancy status
- 13) VAV box Airflow to space
- 14) Average space temperature
- 15) Minimum space temperature
- 16) Maximum space temperature

- 6. System Graphics. Building operator web interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building area included in this contract. Indicate thermal comfort on floor plan summary graphics using colors to represent zone temperature relative to zone set point.

- a. Graphic imagery – graphics shall use 3D images for all standard and custom graphics. The only allowable exceptions will be photo images, maps, schematic drawings, and selected floor plans.
 - b. Animation. Graphics shall be able to animate by displaying different Image lies for changed object status.
 - c. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.
7. Graphics Library. Furnish a library of standard HVAC equipment such as chillers, air handlers, terminals, fan coils, unit ventilators, rooftop units, and VAV boxes, in 3-dimensional graphic depictions. The library shall be furnished in a file format compatible with the graphics generation package program.
8. Manual Control and Override
- a. Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. The point status shall be available by menu, on graphics or through custom programs.
 - b. Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period of time.
 - c. Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.
 - d. Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.
9. Scheduling. - The scheduling application shall provide graphical representation of the day, week, month and exception events.
10. Alarm/Event Notification
- a. Alarm/Event Log. The operator shall be able to view all logged system alarms/events from any building operator web interface.
 - 1) The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in a minimum of 4 categories based on severity.
 - 2) The operator shall be able to acknowledge and add comments to alarms
 - 3) Alarm/event messages shall use full language, easily recognized descriptors.
 - b. Alarm Suppression. Alarms shall be able to be suppressed based on load/source relationships to present the likely root cause to the building operator as described in ASHRAE Guideline 36. Load/Source relationships shall be configurable by the user through a web interface.
11. Reports and Logs.
- a. The building operator web interface shall provide a reporting package that allows the operator to select reports.
 - b. The building operator web interface shall provide the ability to schedule reports to run at specified intervals of time.
 - c. The following standard reports shall be available without requiring a user to manually configure the report:
 - 1) All Points in Alarm Report: Provide an on demand report showing all current alarms.
 - 2) All Points in Override Report: Provide an on demand report showing all overrides in effect.

- 3) Commissioning Report: Provide a one-time report that lists all equipment with the unit configuration and present operation.
 - 4) Points report: Provide a report that lists the current value of all points
- d. The controls vendor shall provide a hardening report that summarizes the port configuration details to ensure sites have not been exposed to the Internet in alignment with Cyber Security best practices.
- B. Provide Mobile App Interface
1. Provide mobile (smart phone or tablet) interfaces to the building automation system, compatible with iOS and Android™ operating systems.
 2. Controls manufacturer shall provide a phone/tablet interface with the ability to view/override status and setpoints, view/change schedules, view/acknowledge/comment on alarms, and view graphics for all spaces and equipment.
 3. This phone/tablet interface shall resize itself appropriately for the size of the interface (i.e. no "pinching and zooming" required).
 4. This phone/tablet interface shall function remotely from the facility while following IT security best practices (e.g. no ports exposed to the internet).
 5. The operator interface shall support system access on a mobile device via a mobile app to:
 - a. Alarm log
 - b. System Status
 - c. Equipment status
 - d. Space Status
 - e. Standard Equipment graphics
 - f. Override set points
 - g. Override occupancy
 - h. Acknowledge Alarms
 - i. Add Comment(s) to Alarms

2.04 BUILDING CONTROLLER SOFTWARE

- A. Manufacturer shall provide standard applications to deliver HVAC system control. Standard applications include Time of Day Scheduling with Optimal Start/Stop, VAV Air Systems Control, Chiller Plant Control, Historical Trend Logs and Trim and Respond. Manufacturer shall provide system optimization strategies for functions such as fan pressure optimization and ventilation optimization.
- B. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the building operator interface.
1. VAV Air Systems Applications
 - a. The BAS shall provide air system applications that coordinate air handlers (AHU)/rooftop units (RTU) and Variable Air Volume Terminal equipment.
 - b. The air system applications shall perform the following functions:
 - 1) Startup and shutdown the air handler safely. Ensure the VAV boxes are open sufficiently when the air handler is running, to prevent damage to the ductwork and VAV boxes due to high air pressure.

- 2) Fan Pressure Optimization (ASHRAE 90.1, Guideline 36) - Minimize energy usage by controlling system static pressure to the lowest level while maintaining zone airflow requirements. Trim and respond reset logic shall reset setpoint within the range of min and max values based on zone requests.
 - 3) During commissioning, and with the engineer/owner, the controls contractor shall confirm the performance of Fan Pressure Optimization by conducting a field functional test that demonstrates critical zone reset.
 - 4) Ventilation Optimization (ASHRAE 62) – properly ventilate all spaces while minimizing operating energy costs, using measured outdoor air flow. Dynamically calculate the system outdoor air requirement based on “real time” conditions in the spaces (i.e., number of occupants, CO2 levels, etc.) minimizing the amount of unconditioned outdoor air that must be brought into the building.
 - 5) Demand Controlled Ventilation – the active ventilation setpoint shall modulate between the occupied ventilation and occupied standby ventilation setpoint; Resetting the setpoint based on CO2 levels in the space.
 - 6) Discharge Air Temperature Reset (ASHRAE 90.1, Guideline 36) - Minimize energy usage by controlling discharge air temperature in response to building loads and outdoor air temperature. Trim and respond reset logic shall reset setpoint within the range of min and max values based on zone requests.
 - 7) If applicable mitigation sequences for A2L mildly flammable refrigerants, including BACnet COV (change of value) functionality and A2L Unoccupied Override to ensure rapid response and compliance with safety standards.
- c. The Air Systems application shall provide a user interface that includes status of current system operation with real time data of key operating parameters. Key operating parameters for Guideline 36 include:
- 1) Duct Static Pressure
 - 2) Duct Static Optimization Setpoint
 - 3) Outdoor Airflow
 - 4) Ventilation Optimization Setpoint
 - 5) Duct Static Optimization Maximum VAV Damper/Source VAV Box
 - 6) Ventilation Optimization Maximum VAV Vent Ratio/Source VAV box
 - 7) Discharge Air Temperature
 - 8) Discharge Air Temperature Optimization Setpoint
 - 9) Duct Static Optimization System Requests
 - 10) Discharge Air Temperature Optimization System Requests
- d. The air system application status screens shall explain what optimization calculations are occurring, critical parameters, and source equipment members. The optimization status, inputs, and results shall be displayed for VAV Ventilation Optimization (calculating proper outside air intake), VAV Discharge Air Temperature Optimization (calculating proper discharge air temperature) and VAV Duct Static Pressure Optimization (calculating proper fan static pressure).
- e. The air systems applications shall provide a user interface that enables configuration changes made by swipe and type fields, selection list, and check box entry for feature definition:
- 1) VAV Auxiliary Night Heat
 - 2) VAV Source Temperature Distribution
 - 3) Changeover System control
 - 4) Start/Stop Delay operation
 - 5) Enable/Disable Optimization Strategies (Duct Static Optimization, Discharge Air Temperature Optimization and Ventilation Optimization)

- f. The operation of VAV Terminal equipment members of the VAV Air System shall be selected by check box to optionally participate in the following functions when for Guideline 36 applications:
- 1) System calculations (min, max, average)
 - 2) Duct Pressure Optimization
 - 3) Ventilation Optimization
 - 4) Drive to Maximum Override
 - 5) Common Source Temperature
 - 6) Common Space
 - 7) Discharge Air Temperature Optimization
 - 8) Hot Water Temperature Optimization
 - 9) Chilled Water Temperature Optimization
- g. The air system application vendor shall provide a published applications guide that details the air system application operation, configuration, setup, and troubleshooting. The applications guide documentation shall be maintained under version control, and updated by the manufacture to reflect most recent feature updates as made available. Contents of the guide shall include:
- 1) Description of System Operation
 - 2) Required Components
 - 3) Sequences of Operation
 - 4) Installation
 - 5) Controller Setup
 - 6) Required Programming
 - 7) Commissioning
 - 8) Optimization Strategies
 - 9) Special Applications
 - 10) Troubleshooting
- h. The air system application shall present in plain user language the current operation with source zone information and reset events.

2. Trend Logs

- a. The system shall harvest trend logs for defined key measurements for each controlled HVAC device and HVAC application. Trend logs shall be captured for a minimum of 5 key operating points for each piece of HVAC equipment and HVAC application and stored for no less than 1 year at 15-minute intervals. Data Logs shall be capable of being configured on an interval or change of value basis.
- 1) Fan Coil
 - a) Discharge Air Temperature
 - b) Space Temperature Active
 - c) Space Temperature Setpoint Active
 - d) Air Flow Setpoint Active
 - e) Discharge Air Flow
 - 2) Air Handling Unit/Rooftop (VAV)
 - a) Discharge Air Temperature
 - b) Discharge Air Temperature Setpoint Active
 - c) Space Temperature Active

- d) Cooling Capacity Status
- e) Discharge Air Flow
- 3) Air Handling Unit/Rooftop (CV)
 - a) Discharge Air Temperature
 - b) Space Temperature Active
 - c) Space Temperature Setpoint Active
 - d) Cooling Capacity Status
 - e) Heating Capacity Primary Status
 - f) Outdoor Air Damper Position
- 4) VAV Box
 - a) Discharge Air Temperature
 - b) Space Temperature Active
 - c) Space Temperature Setpoint Active
 - d) Air Flow Setpoint Active
 - e) Discharge Air Flow
- 3. Trim and Respond
 - a. The BAS shall provide a setpoint reset application program based on 'trim and respond' functionality as outlined in ASHRAE Guideline 36.

2.05 DDC EQUIPMENT

- A. Control Units: Modular easy expansion, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
 - 1. Connectivity: Supports BACnet, Modbus, LonWorks, and multiple protocols, and has built-in WiFi and ethernet capabilities.
- B. Building / System Controllers:
 - 1. There shall be one or more independent, standalone microprocessor based System Controllers to manage the global strategies described in CONTROLLER SOFTWARE section.
 - a. The controller shall provide a USB communications port for connection to a PC.
 - b. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
 - c. All System Controllers shall have a real time clock and shall be able to accept a BACnet time synchronization command for automatic time synchronization.
 - d. Data shall be shared between networked System Controllers.
 - e. Serviceability – The System Controller shall have a display on the main board that indicates the current operating mode of the controller.
 - 2. Controls manufacturer shall provide secure remote access to the Building Automation System (BAS). Secure remote access shall not require IP ports to be "exposed" (i.e. port-forwarded or external public IP addresses) to the Internet. Controls manufacturer shall

update secure remote access software as necessary to follow cyber security best practices and respond to cyber security events.

C. Advanced Application Controllers:

1. Advance Application Controllers shall be used to control all equipment or applications of medium and high complexity, including but not limited to Air Handlers, Boiler Plants and Chiller Plants.
2. The Advanced Application Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).
3. When the Advanced Application Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:
 - a. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).
 - b. Application Controller will provide equipment status parameters to the BAS through BACnet communication.
 - c. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.
 - d. In case of communications failure, stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.
4. For Stand-Alone Operation of Advanced Application Controllers:
 - a. Shall operate a schedule in a standalone application using a Real Time Clock with a 7 day power backup.
 - 1) The Controller shall have a built in schedule (assessable with or without a display)
 - 2) Support will be for at least 3 schedules with up to 10 events for each day of the week.
 - 3) Each of the 3 schedules can be Analog, Binary or Multi-State
 - 4) The controller shall support a minimum of 25 exceptions each with up to 10 events.
5. For ease of troubleshooting, the Controller shall support data trend logging.
 - a. With a minimum of 20,000 trending points total on a controller
 - b. Trends shall be capable of being collected at a minimum sample rate of once every second
 - c. Shall be capable of trending all BACnet points used by controller
 - d. Trends shall be capable of being scheduled or triggered.
6. To meet the sequence of operation for each application, the Controller shall use library programs provided by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.
7. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.
 - a. Operating conditions:
 - 1) Temperature: -40°F to 158°F (-40°C to 70°C)
 - 2) Relative Humidity: 5% to 100% RH (non-condensing)

- b. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
 - c. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° F to 158° F [-40° C to 70° C].
8. Input/Output: The Controller shall have on board or through expansion module all I/O capable of performing all functionality needed for the application. Controls provided by the equipment manufacture must supply the required I/O for the equipment. In addition other controls must meet the following requirements:
- a. Shall support flexibility in valve type, the controllers shall be capable of supporting the following valve control types: 0-10VDC, 0-5VDC, 4-20mA, 24VAC - 2 position.
 - b. Shall support flexibility in sensor type, the Controller shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, 50ms or longer pulses, 200 to 20Kohm and RTD input.
 - c. Shall support flexibility in sensor type, all Analog Outputs shall have the additional capability of being programmed to operate as Universal Inputs or Pulse Width Modulation Outputs.
 - d. Shall support flexibility in sensor type, the Controller and/or expansion modules shall support dry and wetted (24VAC) binary inputs.
 - e. The controller shall support pulse accumulator for connecting devices like energy meters.
 - f. In order to support a wide range of devices, the Controller's binary output shall be able to drive at least 10VA each.
 - g. For future needs, any unused I/O that is not needed for the functionality of the equipment shall be available to be used by custom programs on the Controller and by any other controller on the network.
 - h. The Controller shall provide 24VAC and 24VDC power terminals sensors and other devices required.
 - i. The Controller shall provide a dedicated static pressure input.
9. Input/Output Expandability – The Controller shall provide the following functionality in order to meet current and future application needs:
- a. For the application flexibility, the Controller shall be capable of expanding to a total of at least 100 hardware I/O terminations.
 - b. Expansion I/O can be mounted up to 650 ft. (200m) from control.
 - c. For optimized system operation, expansion I/O must communicate via an internal controller communication bus (point expansion via the BACnet MS/TP network is not allowed).
10. Serviceability – The Controller shall provide the following in order to improve serviceability of the Controller.
- a. Diagnostic LEDs for power/normal operation/status, BACnet communications, sensor bus communications, and binary outputs. All wiring connections shall be clearly labeled and made to be field removable.
 - b. Binary and analog inputs and outputs shall use removable connectors or be connected to terminal strip external to the control box.
 - c. Software service tool connection through the following methods: direct cable connection to the Controller, connection through another controller on BACnet link
 - d. For safety purposes, the controller shall be capable of being powered by a portable computer's USB port for the purposes of configuration, programming and testing programs so that this work can be accomplished with the power off to the associated equipment.

- e. The Controller software tool service port shall utilize standard off-the-shelf USB printer cable.
 - f. Capabilities to temporarily override the BACnet point values with built-in time expiration in the Controller.
 - g. To aid in service replacement, the Controller shall easily attached to standard DIN rail mounting.
 - h. For future expansion, the Controller shall be capable of adding sequence of operation programming utilizing service tools software with a graphical programming interface (editing or programming in line code is not permissible).
 - i. To aid in service replacement, the Controller shall allow for setting its BACnet address via controller mounted rotary switches that correspond to the numerical value of the address. (DIP switch methodologies are not allowed). Setting of the address shall be accomplished without the need of a service tool or power applied to the controller.
 - j. Controller data shall be maintained through a power failure.
11. Software Retention: All Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
12. Controller must meet the following Agency Compliance:
- a. UL916 PAZX, Open Energy Management Equipment
 - b. UL94-5V, Flammability
 - c. FCC Part 15, Subpart B, Class B Limit
 - d. BACnet Testing Laboratory (BTL) listed as BACnet Advanced Application Controller (B-AAC)

D. Application Specific Controllers:

1. General Description
- a. Application Specific Controllers (ASC) shall be microprocessor-based DDC controllers which, through hardware or firmware design, control specified equipment. They are not user programmable, but are customized for operation within the confines of the equipment they are designed to serve.
 - b. Zone Controllers are controllers that operate equipment that control the space temperature of single zone. Examples are controllers for VAV, Fan coil, Blower Coils, Unit Ventilators, Heat Pumps, and Water Source Heat Pumps.
2. The Application Specific Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).
3. When the Application Specific Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:
- a. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).
 - b. Application Controller will provide equipment status parameters to the BAS through BACnet communication.
 - c. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.
 - d. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.

4. Stand-Alone Operation: Each piece of equipment specified in section "A" shall be controlled by a single controller and provide stand-alone control in the event that a BAS is not present.
5. Software
 - a. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.
 - b. For controlling ancillary devices and for flexibility to change the sequence of operation in the future, the controller shall be capable running custom programs written in a graphical programming language.
6. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
 - a. Storage: -55° to 203° F and 5 to 95% Rh, non-condensing.
 - b. Operating: -40° to 158° F and 5 to 95% Rh, non-condensing.
 - c. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
 - d. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F.
7. Input/Output:
 - a. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following valve control types 0-10VDC, 0-5VDC, 4-20mA, 24VAC floating point, 24VAC - 2 position (Normally Open or Normally Closed).
 - b. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to 10V, 0 to 20mA, pulse counts, and 200 to 20Kohm.
 - c. For flexibility in selection and replacement of binary devices, the controller shall support dry and wetted (24VAC) binary inputs.
 - d. For flexibility in selection and replacement devices, the controller's shall have binary output which are able to drive at least 12VA each.
 - e. For flexibility in selection and replacement of motors, the controller shall be capable of outputting 24VAC (binary output), DC voltage (0 to 10VDC minimum range) and PWM (in the 80 to 100 Hz range).
 - f. For future needs, any I/O that is unused by functionality of equipment control shall be available to be used by custom program on the controller and by another controller on the network.
 - g. For future expansion and flexibility, the controller shall have either on board or through expansion, 20 hardware input/output points. Expansion points must communicate with the controller via an internal communications bus. Expansion points must be capable of being mounted up to 650ft. (200 m) from the controller. Expansion points that require the BACnet network for communication with the controller are not allowed.
8. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.
 - a. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.
 - b. All binary output shall have LED's indicating the output state.
 - c. All wiring connectors shall removable without the use of a tool.
 - d. Software service tool connection through all of the following methods: direct cable connection to the controller, connection through another controller on BACnet link

- e. For safety purposes, the controller shall be capable of being powered by a portable computer for the purposes of configuration, programming, and testing programs so that this work can be accomplished with the power off to the equipment.
 - f. Capabilities to temporarily override of BACnet point values with built-in time expiration in the controller.
 - g. BACnet MAC Address shall be set using decimal (0-9) based rotary switches.
 - 1) Configuration change shall not be made in a programming environment, but rather by a configuration page utilizing dropdown list, check boxes, and numeric boxes.
 - h. For ease of troubleshooting, the Controller shall support BACnet data trend logging.
 - 1) With a minimum of 20,000 trending points total on controller
 - 2) Trends shall be capable of being collected at a minimum sample rate of once every second.
 - 3) Shall be capable of trending all BACnet points used by controller
 - 4) Trends shall be capable of being scheduled or triggered
9. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
10. Application controller shall meet the following Agency Compliance:
- a. UL916 PAZX, Open Energy Management Equipment
 - b. UL94-5V, Flammability
 - c. FCC Part 15, Subpart B, Class B Limit
 - d. BACnet Testing Laboratory (BTL) listed as BACnet Application Specific Controller (B-ASC)
- E. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
- F. Variable Air Volume Terminal Unit Controllers:
- 1. General Description
 - a. Variable Air Volume (VAV) controllers shall be microprocessor-based DDC controllers which, through hardware or firmware design, control specified equipment. They are typically not user programmable, but are configurable for operation of VAV terminal units.
 - b. Variable Air Volume (VAV) controllers are controllers that operate equipment that control the space temperature of single zone.
 - c. ***Provide wireless controller for connecting VAV box to zone thermostat.***
 - 2. The VAV controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).
 - 3. When the VAV controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:
 - a. The VAV controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the following: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).

- b. The VAV controller will provide equipment status parameters to the BAS through BACnet communication.
 - c. The VAV controller will operate as a stand-alone controller in the event of communication failure with the BAS.
 - d. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.
4. Stand-Alone Operation: Each VAV Terminal Unit shall be controlled by a single controller and provide stand-alone control in the event that a BAS is not present.
5. The VAV controller shall communicate to the building automation system via one of the following protocols: BACnet™ MS/TP, BACnet™ Zigbee or BACnet™ IP as defined in ANSI®/ASHRAE® Standard 135-2020.
 - a. BACnet™ MS/TP
 - 1) To allow maximum communications speed and co-existence with other controllers, the controller shall support at a minimum the following BACnet MS/TP manager baud rates: 9600, 19200, 38400, 76800.
 - b. BACnet™ IP
 - 1) BACnet IP controllers provide BACnet communications over Internet Protocol via Local Area Networks (LAN), an open standard building automation communication protocol that enables connections to other building automation systems and controllers.
 - c. BACnet™ Zigbee
 - 1) VAV controller wireless communication interface shall self-form and self-heal to maintain operation in the event of network communication failure.
 - 2) IEEE 802.15.4 radios to minimize risk of interference, reliability, and range.
 - 3) Operating range shall be a minimum of 200 feet; open range shall be 2,500 ft. (762 m) with less than 2% packet error rate.
 - 4) To protect against harmful interference, certifications shall include Energy Management Equipment FCC CFR47, Section 15.247 & subpart E, Digital Modulation Transmission with no SAR (FCC ID: TPF-251701)
6. Each VAV terminal unit shall use a space zone sensor(s) to measure the space condition it is serving.
 - a. The VAV controller shall use a wired or wireless communication interface to connect to its space zone sensor.
 - b. Each zone sensor communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications. Sensing options shall include temperature, relative humidity, CO2, and occupancy.
 - c. Wireless zone sensors
 - 1) To check for proper operation, wireless zone temperature sensors shall include a signal strength and battery condition indicators on the zone sensor.
 - 2) The wireless zone sensor battery life shall provide at least 15 years life under normal operating conditions and must be readily available Lithium size AA, 1.5V.

- 3) The wireless zone sensor and receiver addresses shall be held in non-volatile memory to ensure operation through system voltage disturbances and to minimize the risk of incorrect association.
 - 4) To ensure proper system performance, the wireless zone sensor shall automatically determine when the space temperature is rapidly changing. When the space temperature is readily changing, the space temperature shall be transmitted at least once each 30 seconds. The maximum time between transmissions shall be 15 minutes.
 - 5) Zone temperature sensing accuracy shall be +/- 0.5F (+/- 0.28C).
7. Software
- a. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.
 - b. For controlling ancillary devices and for flexibility to change the sequence of operation in the future, the controller shall be capable running custom programs written in a graphical programming language.
8. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
- a. Storage: -55° to 203° F and 5 to 95% Rh, non-condensing.
 - b. Operating: -40° to 158° F and 5 to 95% Rh, non-condensing.
 - c. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
 - d. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F.
9. Input/Output:
- a. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following valve control types 0-10VDC, 0-5VDC, 4-20mA, 24VAC floating point, 24VAC - 2 position (Normally Open or Normally Closed).
 - b. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to 10V, 0 to 20mA, and 200 to 20Kohm.
 - c. For flexibility in selection and replacement of binary devices, the controller shall support dry and wetted (24VAC) binary inputs.
 - d. For flexibility in selection and replacement devices, the controller shall have binary output which are able to drive at least 12VA each.
 - e. For flexibility in selection and replacement of motors, the controller shall be capable of outputting 24VAC (binary output), DC voltage (0 to 10VDC minimum range) and PWM (in the 80 to 100 Hz range).
10. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.
- a. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.
 - b. All binary output shall have LED's indicating the output state.
 - c. All wiring connectors shall removable without the use of a tool.
 - d. Software service tool connection through all of the following methods: direct cable connection to the controller, connection through another controller on BACnet link and through the controller's zone sensor.
 - e. For safety purposes, the controller shall be capable of being powered by a portable computer for the purposes of configuration, programming, and testing programs so that this work can be accomplished with the power off to the equipment.

- f. Capabilities to temporarily override of BACnet point values with built-in time expiration in the controller.
 - g. BACnet MAC Address shall be set using decimal (0-9) based rotary switches.
 - 1) Configuration change shall not be made in a programming environment, but rather by a configuration page utilizing dropdown list, check boxes, and numeric boxes.
 - h. For ease of troubleshooting, the Controller shall support BACnet data trend logging.
 - 1) Trends shall be capable of being collected at a minimum sample rate of once every second.
 - 2) Shall be capable of trending all BACnet points used by controller
 - 3) Trends shall be capable of being scheduled or triggered
11. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
12. Controller shall meet the following Agency Compliance:
- a. UL916 PAZX, Open Energy Management Equipment
 - b. UL94-5V, Flammability
 - c. FCC Part 15, Subpart B, Class B Limit
 - d. AS/NZS CISPR 32:2016
 - e. VCCI-CSPR 32:2016
 - f. CAN ICES-003(B)/NMB-003(B)
 - g. To ensure integration to the building automation system the controller must be BTL (BACnet Testing Lab) listed. The following BACnet profiles are in order of most functionality (B-BC) to least functionality (B-ASC).
 - 1) BACnet Building Controller (B-BC)
 - 2) BACnet Advance Applications Controller (B-AAC)
 - 3) BACnet Application Specific Controller (B-ASC)

G. Input/Output Interface:

- 1. Hardwired inputs and outputs may tie into the system through building, custom application, or ASCs.
- 2. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.
- 3. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.
- 4. Pulse accumulation input objects. This type of object shall conform to all the requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation.
- 5. Analog inputs shall allow the monitoring of low voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
- 6. Binary outputs shall provide for on/off operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers shall have status lights. Outputs shall be selectable for either normally open or normally closed operation.

7. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.
 8. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
 9. System Object Capacity. The system size shall be expandable to at least twice the number of input/ output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.
- H. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity.
1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in overvoltage and overcurrent protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.
 - a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration.
 - b. Line voltage units shall be UL recognized and CSA approved.
- I. System shall be capable of being integrated with larger system with graphics (for future).

2.06 SENSING DEVICES

- A. Temperature Sensor Details
1. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.
 2. Duct Averaging Type: Continuous averaging sensors shall be one foot in length for each 4 square feet of duct cross-sectional area, and a minimum length of 6 ft.
 3. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior.
 4. Outside Air Type: Provide the sensing element on the building's north side with a protective weather shade that positions the sensor approximately 3 inches off the wall surface, does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain.
- B. Transmitters: Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated, and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-

interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 degrees F a year.

- C. Relative Humidity Transmitters: Provide transmitters with an accuracy equal to plus or minus 3 percent from 0 to 90% scale, and less than one percent drift per year. Sensing elements shall be the polymer type. Vaisala Model HMD50U or equal.
- D. Freeze Protection Thermostats: Provide special purpose thermostats with flexible capillary elements 20 feet minimum length for coil face areas up to 40 square feet. Provide longer elements for larger coils at 1-foot of element for every 4 square feet of coil face area, or provide additional thermostats. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat requires manual resetting before the HVAC equipment can restart.

2.07 OUTPUT HARDWARE

- A. Motorized control dampers, unless otherwise specified elsewhere, shall be as follows:
 - 1. Submittals shall include leakage, maximum airflow and maximum pressure ratings based on AMCA Publication 500. Dampers shall meet the leakage requirements of the International Energy Conservation Code by leaking less than 3 cfm/sq. ft. at 1" of static pressure and shall be AMCA licensed as Class 1A. Dampers shall be Ruskin model CD60, or approved equal.
 - 2. Control dampers shall be the parallel or opposed blade type as follows: Outdoor and/or return air mixing dampers shall be parallel blade, arranged to direct airstreams toward each other. Other modulating dampers shall be the opposed blade type. Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.
 - 3. Frame: 5 inches x minimum 16 gage roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13 gage U-channel. Damper blades shall not exceed 8 inches in width or 48 inches in length. Blades shall be suitable for medium velocity performance 2000 fpm. Blades shall be not less than 16-gauge.
 - 4. Bearings shall be corrosion resistant, permanently lubricated stainless steel sleeve type turning in an extruded hole in the damper frame.
 - 5. All blade edges, top, and bottom of the frame shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel.
 - 6. Individual damper sections shall not be larger than 48 in. x 60 in. Provide a minimum of one damper actuator per section.
 - 7. Modulating dampers shall provide a linear flow characteristic where possible.
 - 8. Dampers shall have exposed linkages. Dampers over 48" in applications where sectioning is not applicable shall be supplied with a jackshaft to provide sufficient force throughout the intended operating range.
- B. Electronic damper/valve actuation shall be provided.
 - 1. Manufactured, brand labeled or distributed by BELIMO, or approved equal.
 - 2. Size for torque required for damper seal at load conditions.
 - 3. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle.
 - 4. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
 - 5. Overload protected electronically throughout rotation.
 - 6. Fail-Safe Operation: Mechanical, spring-return mechanism.
 - 7. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear

- release. Spring-return actuators with more than 60 in.-lb. torque capacity shall have a manual crank.
8. Proportional Actuators shall be fully programmable through an EEPROM without the use of actuator mounted switches.
 9. Proportional actuators shall have an external, built-in switch to allow the reversing of direction of rotation.
 10. Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range. An actuator capable of accepting a pulse width modulating control signal and providing full proportional operation of the damper is acceptable. All actuators shall provide a 2 to 10 VDC position feedback signal.
 11. Temperature Rating: -22 to +122°F -30 to +50°C [-58 to +122°F -50 to +50°C]
 12. Housing: Minimum requirement NEMA type 2 mounted in any orientation. .
 13. Agency Listings: ISO 9001, cULus, CE or CSA
 14. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
- C. Control Valves: Control valves shall be two-way or three-way type for two-position or modulating service as shown.
1. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
 - a. Two-way: 150% of total system (pump) head.
 - b. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
 2. Water Valves: Body and trim style and materials shall be in accordance with manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - a. Sizing Criteria:
 - 1) Two-position service: Line size.
 - 2) Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 5 psi, whichever is greater.
 - 3) Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 5 psi maximum.
 - b. Valves ½ in. through 2 in. shall be bronze body or cast brass ANSI Class 250, spring-loaded, PTFE packing, quick opening for two-position service. Two-way valves to have replaceable composition disc or stainless steel ball.
 - c. Water valves shall fail normally open or closed, as specified.
- D. Output Switches: Control Relays; Relays shall be double pole, double throw, UL864 listed, with contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

2.08 STATUS SENSORS

- A. Status Inputs for Electric Motors: Veris Hawkeye 908 Series, or approved equal; split-core adjustable current sensors designed to provide accurate, reliable and maintenance-free fan and

pump status indication. Comply with ISA 50.00.01, current-sensing split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

- B. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- C. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

2.09 ELECTRICAL POWER AND DISTRIBUTION

- A. Provide per Division 26.
- B. Wiring And Raceways:
 - 1. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of this specification.
 - 2. All insulated wire to be copper conductors, UL labeled for 90°C (194°F) minimum service.
 - 3. Fiber Optic Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. The sheath shall be UL Listed OFNP in accordance with NEC Article 770. The optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125 µm.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started. Verify that duct-, pipe-, and equipment-mounted devices and wiring are installed before proceeding with installation.
- C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by—and the expense of—this contractor.

3.02 INSTALLATION

- A. Provide all components in accordance with the manufacturer's recommendations. Perform the installation under the supervision of competent technicians regularly employed in the installation of similar control systems.

- B. Provide equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.
- C. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices. Contractor shall continually monitor the field installation for code compliance and quality of workmanship. Contractor shall have work inspected by local and/or state authorities having jurisdiction over the work.
- E. Temperature Sensors: Provide temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.
- F. Room Temperature Sensors: Verify location of thermostats and other exposed control sensors with plans and room details before installation. Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of the sensor 48 inches above the floor to meet ADA requirements.
- G. Duct Temperature Sensors
 - 1. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration air tight. Seal the duct insulation penetration vapor tight.
 - 2. Averaging Type (and coil freeze protection thermostats): Weave the capillary tube sensing element in a serpentine fashion perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports. Prevent contact between the capillary and the duct or air handler internals. Provide a duct access door at the sensor location. The access door shall be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit; maximum 18 x 18 inches. For sensors inside air handlers, the sensors shall be fully accessible through the air handler's access doors without removing any of the air handler's internals.
- H. Outside Air Temperature Sensors: Provide outside air temperature sensors in weatherproof enclosures on the north side of the building, away from exhaust hoods and other areas that may affect the reading. Provide a shield to shade the sensor from direct sunlight.
- I. Gas Monitor/Transmitters: Verify location of transmitter with room layout and details before installation. Do not exceed the manufactures' recommended maximum surveillance radius. Provide proper quantity as required. Mounting height shall be at manufacturer recommended height for the gas being sensed.

3.03 WIRING

- A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification.
- B. Communication Wiring:
 - 1. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.

2. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.
3. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer shall not be exceeded during installation.
4. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.
5. When a cable enters or exits a building, a lightning arrestor must be installed between the line and ground.
6. All runs of communication wiring shall be unspliced length when the length is commercially available.
7. All communication wiring shall be labeled to indicate origin and destination.

3.04 FIBER OPTIC CABLE

- A. All cabling shall be installed in a neat and workmanlike manner. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.
- B. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post installation residual cable tension shall be within cable manufacturer's specifications.
- C. Fiber optic cabinets, hardware, and cable entering the cabinet shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.
 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 2. Test and adjust controls and safeties.
 3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 6. Test each system for compliance with sequence of operation.
 7. Test software and hardware interlocks.
- B. Verification:
 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 2. Check temperature instruments and material and length of sensing elements.
 3. Check control valves. Verify that they are in correct direction.
- C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.06 ADJUSTING

- A. Calibrating and Adjusting:
 - 1. Calibrate instruments.
 - 2. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
 - 3. Control System Inputs and Outputs:
 - a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.
 - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
 - 4. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.
 - 5. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
 - 6. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
 - 7. Provide diagnostic and test instruments for calibration and adjustment of system.
- B. Adjust initial temperature set points.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.07 DEMONSTRATION

- A. Provide a qualified instructor (or instructors) with five years minimum field experience with the installation and programming of similar control systems. Orient training to the specific systems installed. Coordinate training times with the Owner. Training shall take place at the job site.
- B. Demonstration and training for equipment controls shall be by that vendor, or a qualified instructor. For example, boiler control training will need to be provided by the Viessmann rep.
- C. Provide basic control system fundamentals training.
 - 1. This project's list of control system components
 - 2. This project's sequences of control

END OF SECTION

SECTION 22 63 13

MEDICAL AIR SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 23 Section: "Common Work Results"
 - 2. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section includes medical gas and vacuum piping and components.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Simulated Medical oxygen operating at 50 to 55 psig.
 - 1. Note: there is no oxygen in this project, compressed air will be used as a surrogate.
- B. Simulated Medical air operating at 50 to 55 psig.
 - 1. Note: There is no medical grade air in this project, but house compressed air will be used as a surrogate.

- C. Compliance with NFPA 99 is not required. This facility will never have human patients.

2.02 PIPES, TUBES, AND FITTINGS

- A. Comply with ASME B31.1 for laboratory air piping operating at more than 150 psig.
- B. Copper Medical Gas Tube: ASTM B819, Type L, seamless, drawn temper.
- C. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type.
- D. Copper Unions: ASME B16.22 or MSS SP-123, wrought-copper or cast-copper alloy.
- E. Copper Pressure-Seal Fittings: Wrought-copper fitting with EPDM O-ring seal in each end.
- F. Flexible Pipe Connectors: Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: 200 psig minimum.
 - 2. End Connections: Plain-end copper tube.
- G. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys.

2.03 VALVES

- A. Ball Valves:
 - 1. Standard: MSS SP-110.
 - 2. Description: Three-piece body, brass, or bronze.
 - 3. Pressure Rating: 300 psig minimum.
 - 4. Ball: Full-port, chrome-plated brass.
 - 5. Seats: PTFE or TFE.
 - 6. Handle: Lever type with locking device.
 - 7. Stem: Blowout proof with PTFE or TFE seal.
 - 8. Ends: manufacturer-installed ASTM B819, copper-tube extensions with pressure gauge on one copper-tube extension.
- B. Check Valves:
 - 1. Description: In-line pattern, bronze.
 - 2. Pressure Rating: 300 psig minimum.
 - 3. Operation: Spring loaded.
 - 4. Ends: Manufacturer-installed ASTM B819, copper-tube extensions.
- C. Pressure Regulators:
 - 1. Spring-loaded, diaphragm-operated, relieving type.
 - 2. Manual pressure-setting adjustment.
 - 3. Rated for 250-psig minimum inlet pressure.
 - 4. Capable of controlling delivered gas pressure within 0.5 psig for each 10-psig inlet pressure.

2.04 MEDICAL GAS OUTLETS

- A. Connect to the patient room headwall modular service assembly as shown on the architectural plans. Coordinate with Section 117001 "Medical Equipment".
- B. General Requirements for Gas-Service, Suction, & Outlet Connections:**
- 1. Suitable for specific gas pressure and suction service listed.**
 - 2. Include roughing-in assemblies, finishing assemblies, and cover plates.**
 - 3. Recessed-type units made for concealed piping unless otherwise indicated.**
- C. Roughing-in Assembly:**
- 1. Steel outlet box for recessed mounting and concealed piping.**
 - 2. Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed.**
 - 3. Double seals that will prevent gas leakage.**
 - 4. ASTM B819, NPS 3/8 copper outlet tube brazed to valve with service marking and tube-end dust cap.**
- D. Finishing Assembly:**
- 1. Brass housing with primary check valve.**
 - 2. Double seals that will prevent gas leakage.**
 - 3. Cover plate with gas-service label.**
- E. Provide with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.**
- F. Coordinate connection type with Owner.**

2.05 AIR COMPRESSOR EQUIPMENT

- A. Provide a new air filter for air compressor, sized to meet the existing compressor's manufacturer's installation requirements and recommendations.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPING

- A. General Location and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of gas piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Provide piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Provide piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

- C. Provide piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- E. Provide piping adjacent to equipment and specialties to allow service and maintenance.
- F. Provide nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.
- G. Provide piping to permit valve servicing.
- H. Provide piping free of sags and bends.
- I. Provide fittings for changes in direction and for branch connections.
- J. Provide service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
- K. Connect gas piping to gas sources and to gas outlets and equipment requiring gas service.
- L. Provide unions in copper tubing adjacent to each valve and at final connection to each specialty and piece of equipment.

3.02 INSTALLATION OF VALVES

- A. Provide shutoff valve at each connection to equipment and specialties.
- B. Provide check valves to maintain correct direction of gas flow from gas supplies.
- C. Provide pressure regulators on gas piping where reduced pressure is required.

3.03 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
- C. Brazed Joints: Join copper tube and fittings in accordance with CDA's "Copper Tube Handbook," Ch. "Braze Joints."
- D. Soldered Joints: Apply ASTM B813, water-flushable flux to tube end. Join copper tube and fittings in accordance with ASTM B828.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for hangers, supports, and anchor devices specified in Section 230500.

- B. Vertical Piping: MSS Type 8 or Type 42, clamps.
- C. Individual, Straight, Horizontal Piping Runs: MSS Type 1, adjustable, steel, clevis hangers.
- D. Provide hangers for copper tubing with maximum horizontal spacing and minimum rod diameters to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping within 12 inches of each fitting and coupling.
- F. Support vertical runs of copper tubing to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.05 INSTALLATION OF COMPRESSED-AIR EQUIPMENT

- A. Equipment Mounting: Provide on cast-in-place concrete equipment base. Comply with requirements for equipment bases and foundations specified in Section 230500. Install equipment anchored to substrate.
- B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components.
- C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.
- D. Install equipment to allow right of way for piping installed at required slope.
- E. Connect wiring and ground equipment in accordance with Division 26. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

3.06 IDENTIFICATION

- A. Provide identifying labels and devices, comply with requirements in Section 230500.

3.07 PROTECTION

- A. Protect tubing from damage.
- B. Retain sealing plugs in tubing, fittings, and specialties until installation.

3.08 STARTUP SERVICE – COMPRESSED-AIR

- A. Perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Check for lubricating oil in lubricated-type equipment.
 - 3. Check belt drives for proper tension.
 - 4. Verify that air compressor inlet filters and piping are clear.

5. Check for equipment vibration-control supports and flexible pipe connectors and verify that equipment is properly attached to substrate.
 6. Check safety valves for correct settings. Ensure that settings are higher than air compressor discharge pressure, but not higher than rating of system components.
 7. Drain receiver tanks.
 8. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 9. Test and adjust controls and safeties.
- B. Prepare written report documenting testing procedures and results.
- C. Adjust equipment to function smoothly and lubricate as recommended by manufacturer.
- D. Adjust control set points.

3.09 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust and operate the compressed air unit.

END OF SECTION

DEMO - LEGEND	
Key Value	Keynote Text
001	EXISTING 8" CMU PARTITION TO BE REMOVED. REFER TO CONSTRUCTION PLANS FOR EXTENTS
002	EXISTING DOOR TO BE REMOVED
003	EXISTING FLOORING TO BE REMOVED
004	EXISTING EXTERIOR WINDOW FINISHED TO BE PRESERVED TYP. REFER TO FINISH PLAN
005	EXISTING ACT CEILING TO BE REMOVED. REFER TO CONSTRUCTION PLANS FOR EXTENTS
006	EXISTING LIGHTING / CEILING MOUNTED EQUIPMENT TO BE REMOVED. REFER TO RCP FOR EXTENTS
007	EXISTING GLAZING TO BE REMOVED / REPLACED. REFER TO DOOR SCH.
008	EXISTING GUARDRAILS / HANDRAILS TO BE REMOVED / REPLACED
009	NEW DOOR LOCATION. REFER TO CONSTRUCTION PLAN
014	CONC FLOOR TRENCHING FOR (N) PLUMBING. REFER TO PLUMBING DWGS
016	EXISTING STUD/GYPSUM PARTITION TO BE REMOVED. REFER TO CONSTRUCTION PLANS FOR EXTENTS
017	EXISTING 8" CMU PARTITION TO BE REMOVED. REFER TO CONSTRUCTION PLANS FOR EXTENTS
019	WALL FINISH AT EXISTING COLUMNS TO BE REMOVED TO ALLOW FOR NEW FIRE PROTECTION TO BE APPLIED (REFER TO A0.2A). GC TO REINSTALL FINISH TO MATCH IN KIND US ON CONSTRUCTION DWGS.

DEMOLITION LEGEND:

S1 DEMOLITION NOTE

— EXISTING CONSTRUCTION TO REMAIN

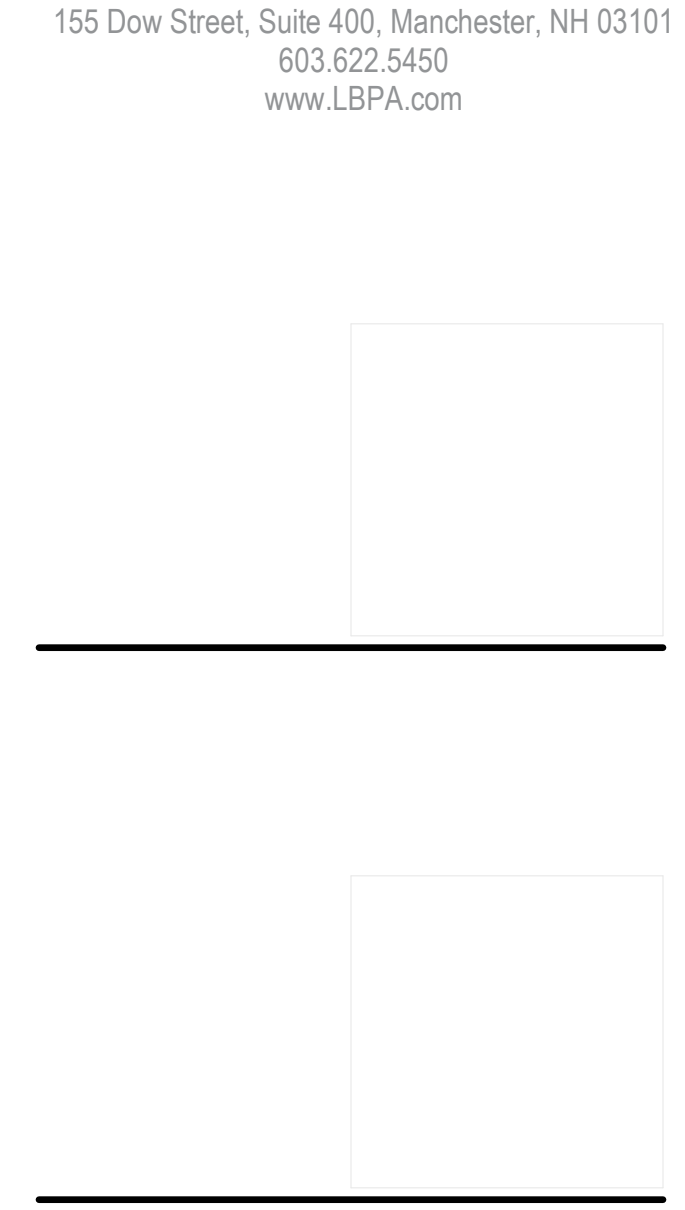
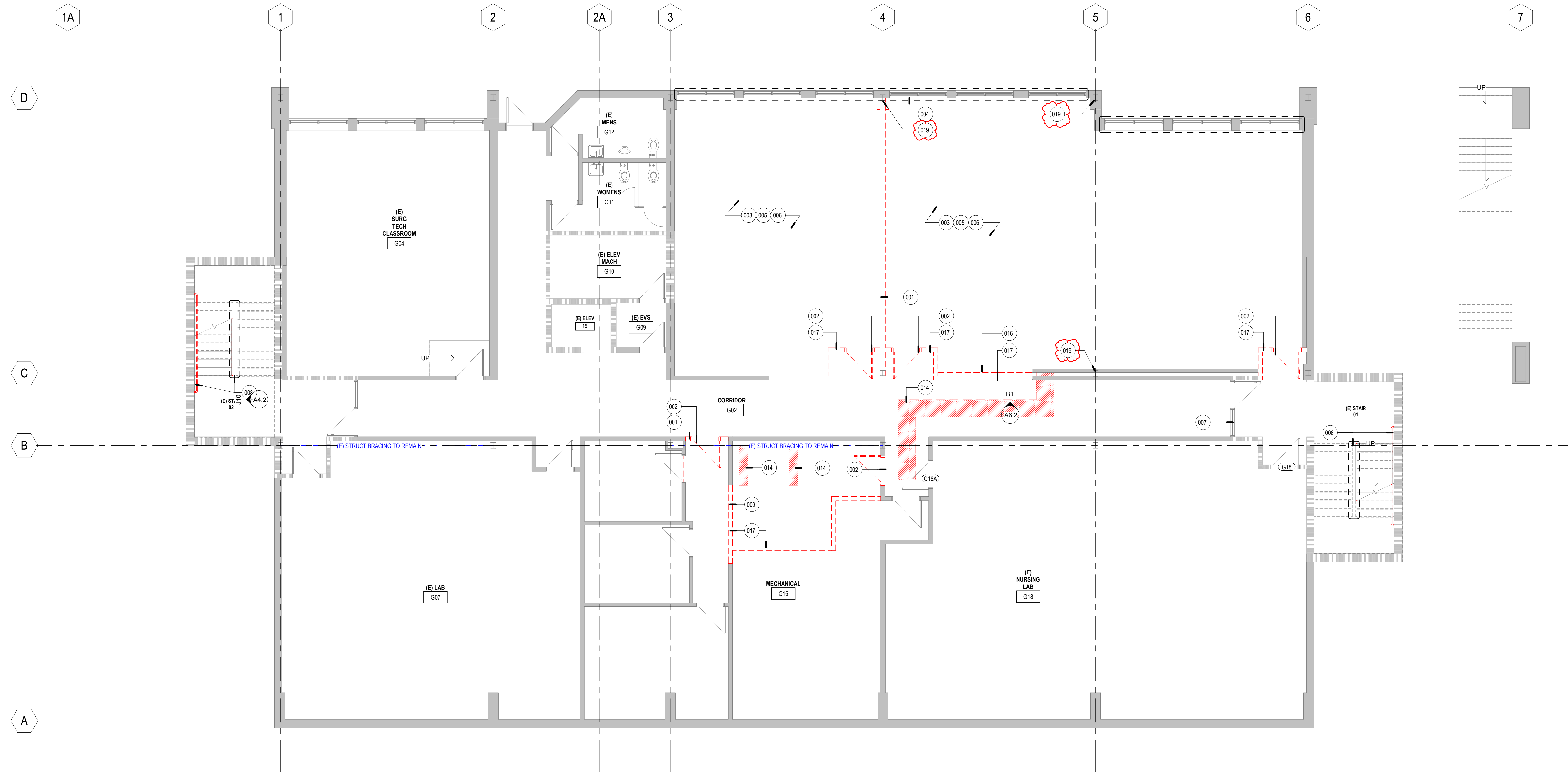
- - - - EXISTING CONSTRUCTION TO BE REMOVED

NOTE: ALL NUMBERS OMITTED ARE NOT IN USE

DEMOLITION NOTES:

GENERAL NOTES:

1. THE DEMOLITION PLANS AND ELEVATIONS ILLUSTRATE THE CONCEPT OF THE ARCHITECTURAL DEMOLITION. THEY ARE NOT INTENDED TO BE A COMPLETE REPRESENTATION OF ALL DEMOLITION WORK REQUIRED. ALL DRAWINGS AND SPECIFICATIONS ARE TO BE CONSIDERED WHEN DETERMINING THE SCOPE OF DEMOLITION FOR THE PROJECT. IT IS THE INTENT OF THE DRAWINGS AND SPECIFICATIONS TO REQUIRE DEMOLITION OF ALL BUILDING ELEMENTS AS NECESSARY FOR THE INSTALLATION OF WORK REQUIRED BY THE SCOPE OF THIS PROJECT.
2. DASHED LINES GENERALLY REPRESENT ITEMS TO BE REMOVED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY EXACT LIMITS AND DETAILS OF REQUIRED DEMOLITION AND COORDINATE WITH PLANS AND DETAILS.
3. REMOVE PARTITIONS TO STRUCTURE ABOVE, UNLESS OTHERWISE INDICATED BY CONSTRUCTION DETAILS.
4. REMOVE MASONRY FOR NEW OPENINGS AS REQUIRED FOR THE INSTALLATION OF NEW LINTELS.
5. REMOVE DOORS, FRAMES AND HARDWARE INCLUDING SIDELIGHTS, TRANSOMS AND THRESHOLDS WHERE DOORS ARE SHOWN DASHED, UNLESS OTHERWISE INDICATED.
6. REMOVE PORTIONS OF ALL SUSPENDED CEILING FOR THE INSTALLATION OF NEW WORK TO BE DONE ABOVE CEILING, UNLESS OTHERWISE INDICATED. SAVE USABLE COMPONENTS FOR REINSTALLATION WHERE CEILING ARE NOT BEING REPLACED.
7. REMOVE ALL CHALK, MARKER AND TACK BOARDS, SHELVING AND OTHER EQUIPMENT ON WALLS TO BE REMOVED OR FURRED.
8. REMOVE CONCRETE SLABS AND FILLS AS REQUIRED FOR INSTALLATION OF NEW MECHANICAL, ELECTRICAL AND PLUMBING SERVICES. SEE MECHANICAL, ELECTRICAL AND PLUMBING DRAWINGS.
9. ANY/ALL PENETRATIONS, OPENINGS, IMPERFECTIONS OR OTHER DAMAGE RESULTING FROM THE REMOVAL OF COMPONENTS AND STRUCTURES AS INDICATED OR REQUIRED TO COMPLETE THE SCOPE OF WORK SHALL BE PATCHED/REPAIRED IN KIND UNLESS SPECIFICALLY NOTED OTHERWISE. REFER TO THE PROJECT MANUAL FOR RELEVANT MATERIAL SECTIONS INCLUDING STANDARDS AND RELATED REQUIREMENTS.
10. COORDINATE MODIFICATION, REMOVAL, AND REINSTALLATION OF EXISTING ACT AND ASSOCIATED HARDWARE / CEILING FIXTURES WITH SPRINKLER DWGS.



SMCC

**HEALTH SCIENCE
CENTER**

BGS NUM: 3809

79 Ford Road, South Portland, Maine,
04106

NO.	DESCRIPTION	DATE
2	ADDENDUM 01	06/03/2026
3	ADDENDUM 02	06/10/2026

FOR ADDITIONAL INFORMATION, REFER TO PROJECT MANUAL.

CONTENT:
GROUND FLOOR PLAN - DEMO

DRAWN BY: MOL

PROJECT NO: 25-062-00

DATE: 05/08/2026

REVISED:

SCALE: As indicated

AD1.0

Project Phase
CONSTRUCTION DOCUMENTS

COPYRIGHT © 2026 BY LAVALLEE BRENSINGER PLLC.
ALL RIGHTS RESERVED.
NO REPRODUCTION WITHOUT PERMISSION.

DEMO - LEGEND	
Key Value	Keynote Text
002	EXISTING DOOR TO BE REMOVED
003	EXISTING FLOORING TO BE REMOVED
005	EXISTING ACT CEILING TO BE REMOVED. REFER TO CONSTRUCTION PLANS FOR EXTENTS
008	EXISTING GUARDRAILS / HANDRAILS TO BE REMOVED / REPLACED
010	EXISTING WINDOW TO BE REMOVED
012	EXISTING HEADWALLS TO BE REMOVED / SALVAGED / REINSTALLED IN NEW SIM LAB. REFER TO CONSTRUCTION DWGS
013	NEW OPENING IN EXISTING FLOOR FOR NEW DUCTWORK SHAFT
016	EXISTING STUDY/GYPSUM PARTITION TO BE REMOVED. REFER TO CONSTRUCTION PLANS FOR EXTENTS
018	EXISTING CASEWORK TO BE REMOVED. ADJACENT SURFACES TO BE PATCHED AND REPAIRED
019	WALL FINISH AT EXISTING COLUMNS TO BE REMOVED TO ALLOW FOR NEW FIRE PROTECTION TO BE APPLIED (REFER TO A02A, GC TO REINSTALL FINISH TO MATCH IN KIND LION ON CONSTRUCTION DWGS)

DEMOLITION LEGEND:

- (S1) DEMOLITION NOTE
 - EXISTING CONSTRUCTION TO REMAIN
 - - - - EXISTING CONSTRUCTION TO BE REMOVED
- NOTE: ALL NUMBERS OMITTED ARE NOT IN USE

DEMOLITION NOTES:

- GENERAL NOTES:**
1. THE DEMOLITION PLANS AND ELEVATIONS ILLUSTRATE THE CONCEPT OF THE ARCHITECTURAL DEMOLITION. THEY ARE NOT INTENDED TO BE A COMPLETE REPRESENTATION OF ALL DEMOLITION WORK REQUIRED. ALL DRAWINGS AND SPECIFICATIONS ARE TO BE CONSIDERED WHEN DETERMINING THE SCOPE OF DEMOLITION FOR THE PROJECT. IT IS THE INTENT OF THE DRAWINGS AND SPECIFICATIONS TO REQUIRE DEMOLITION OF ALL BUILDING ELEMENTS AS NECESSARY FOR THE INSTALLATION OF WORK REQUIRED BY THE SCOPE OF THIS PROJECT.
 2. DASHED LINES GENERALLY REPRESENT ITEMS TO BE REMOVED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY EXACT LIMITS AND DETAILS OF REQUIRED DEMOLITION AND COORDINATE WITH PLANS AND DETAILS.
 3. REMOVE PARTITIONS TO STRUCTURE ABOVE, UNLESS OTHERWISE INDICATED BY CONSTRUCTION DETAILS.
 4. REMOVE MASONRY FOR NEW OPENINGS AS REQUIRED FOR THE INSTALLATION OF NEW LINTELS.
 5. REMOVE DOORS, FRAMES AND HARDWARE INCLUDING SIDELIGHTS, TRANSOMS AND THRESHOLDS WHERE DOORS ARE SHOWN DASHED, UNLESS OTHERWISE INDICATED.
 6. REMOVE PORTIONS OF ALL SUSPENDED CEILING FOR THE INSTALLATION OF NEW WORK TO BE DONE ABOVE CEILING, UNLESS OTHERWISE INDICATED. SAVE USABLE COMPONENTS FOR REINSTALLATION WHERE CEILING ARE NOT BEING REPLACED.
 7. REMOVE ALL CHALK, MARKER AND TACK BOARDS, SHELVING AND OTHER EQUIPMENT ON WALLS TO BE REMOVED OR FURRED.
 8. REMOVE CONCRETE SLABS AND FILLS AS REQUIRED FOR INSTALLATION OF NEW MECHANICAL, ELECTRICAL AND PLUMBING SERVICES. SEE MECHANICAL, ELECTRICAL AND PLUMBING DRAWINGS.
 9. ANY WALL PENETRATIONS, OPENINGS, IMPERFECTIONS OR OTHER DAMAGE RESULTING FROM THE REMOVAL OF COMPONENTS AND STRUCTURES AS INDICATED OR REQUIRED TO COMPLETE THE SCOPE OF WORK SHALL BE PATCHED/REPAIRED IN KIND UNLESS SPECIFICALLY NOTED OTHERWISE. REFER TO THE PROJECT MANUAL FOR RELEVANT MATERIAL SECTIONS INCLUDING STANDARDS AND RELATED REQUIREMENTS.
 10. COORDINATE MODIFICATION, REMOVAL, AND REINSTALLATION OF EXISTING ACT AND ASSOCIATED HARDWARE / CEILING FIXTURES WITH SPRINKLER DWGS.



SMCC

**HEALTH SCIENCE
CENTER**

BGS NUM: 3809

79 Ford Road, South Portland, Maine,
04106

NO.	DESCRIPTION	DATE
2	ADDENDUM 01	06/03/2026
3	ADDENDUM 02	06/10/2026

FOR ADDITIONAL INFORMATION REFER TO PROJECT MANUAL

CONTENT:
FIRST FLOOR PLAN - DEMO

DRAWN BY: MOL

PROJECT NO: 25-062-00

DATE: 05/08/2026

REVISED:

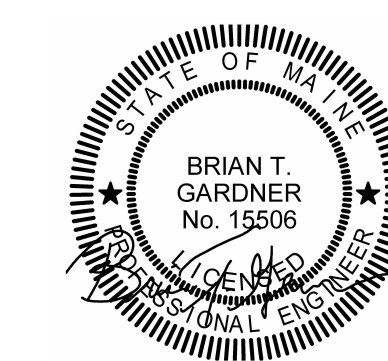
SCALE: As indicated

AD1.1

Project Phase
CONSTRUCTION DOCUMENTS

COPYRIGHT © 2026 BY LAVALLEE BRENSINGER PLLC.
ALL RIGHTS RESERVED.
NO REPRODUCTION WITHOUT PERMISSION.

6/10/2026 3:12:13 PM Autodesk Docs/25-062-00/SMCC/HS Ctr Remo25-062-00_SMOCC_V05.rvt



SMCC

**HEALTH SCIENCE
CENTER**

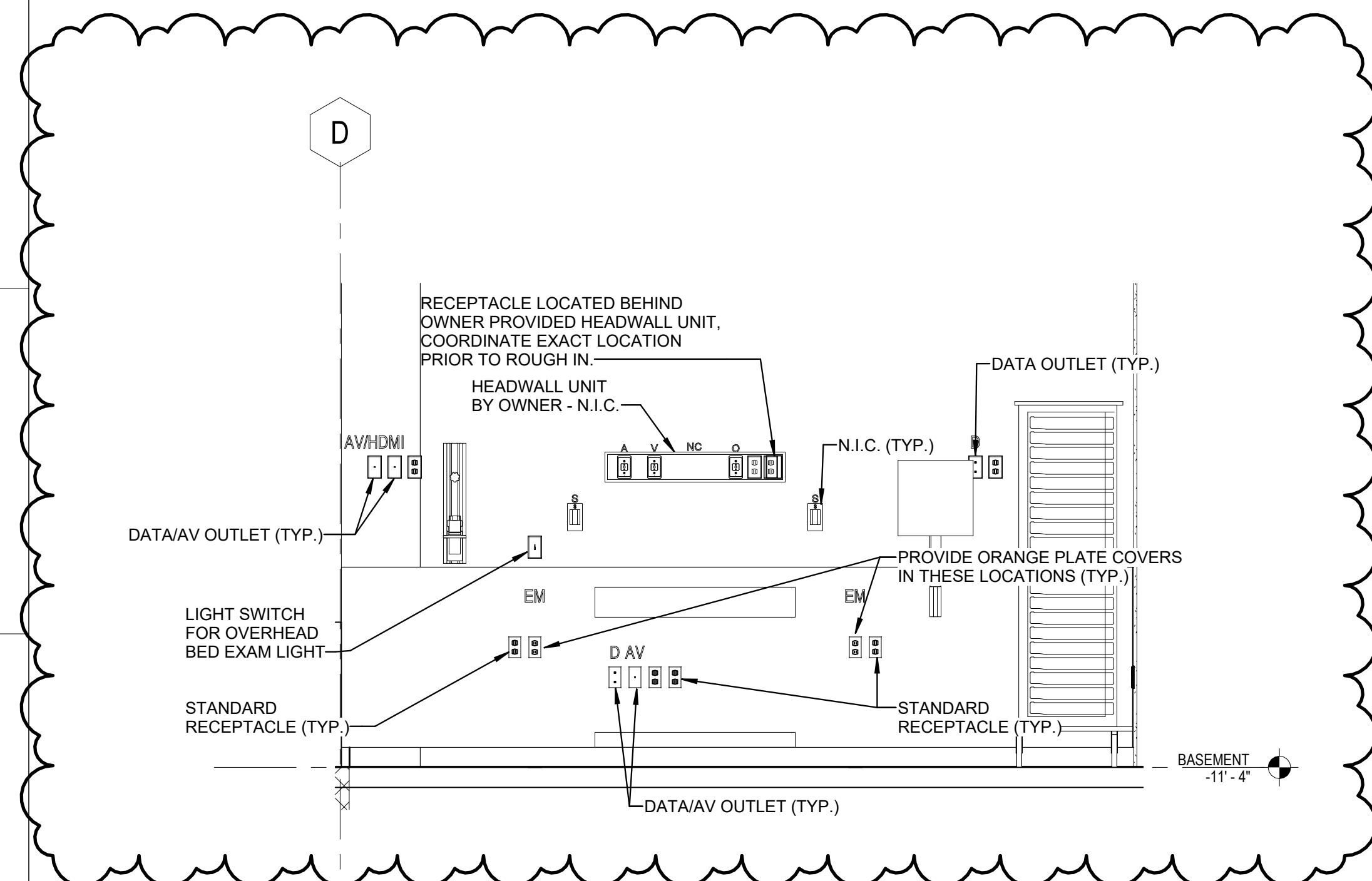
2 Ford Road, South Portland, Maine,
04106

NO.	DESCRIPTION	DATE
1	ADDENDUM 01	06-03-26
2	ADDENDUM 02	06-10-25

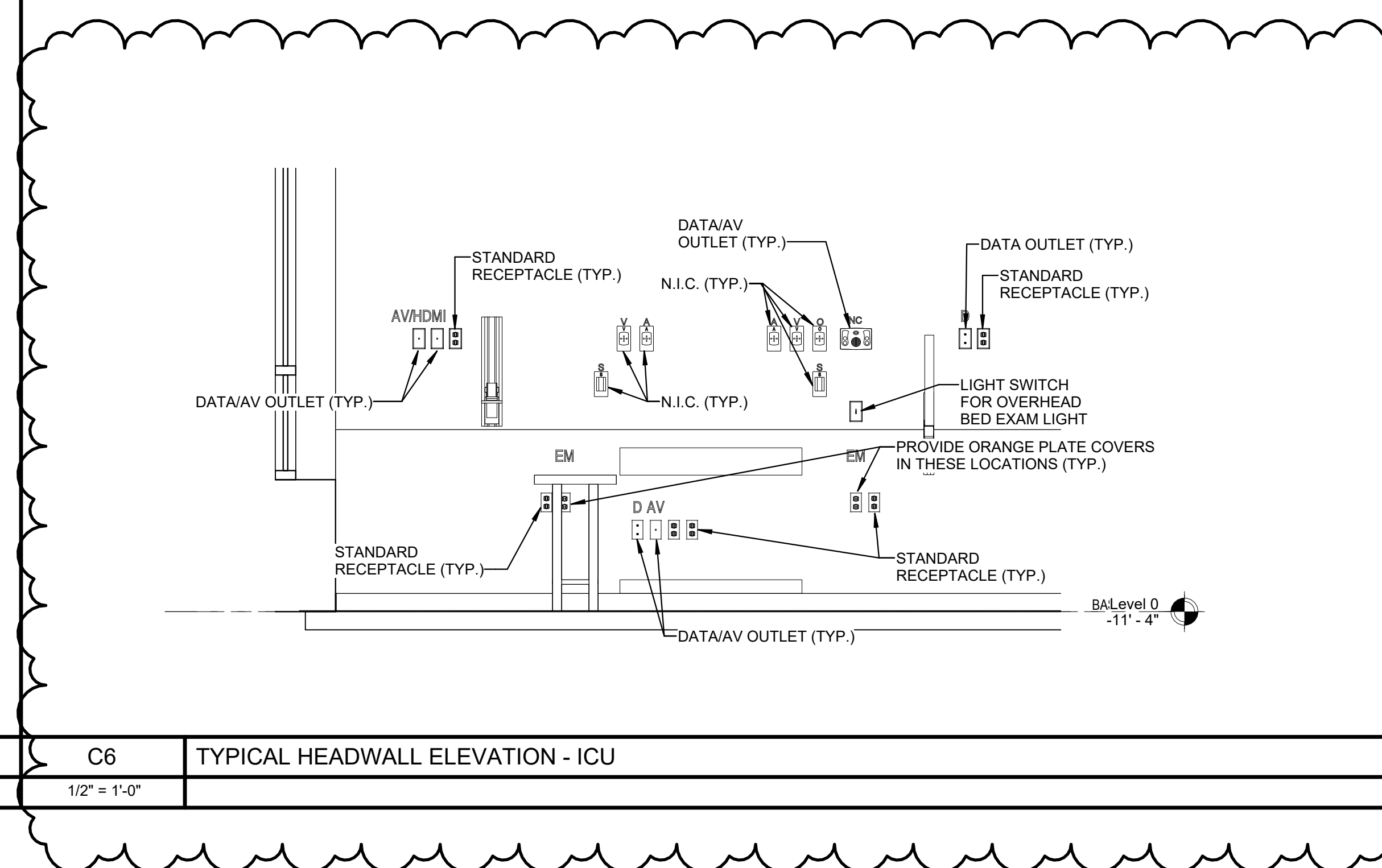
CONTENT: ELECTRICAL PLAN - GROUND FLOOR	
DRAWN BY:	PMC
PROJECT NO:	25-062-00
DATE:	02/13/2026
REVISED:	
SCALE:	As indicated

EP1.0

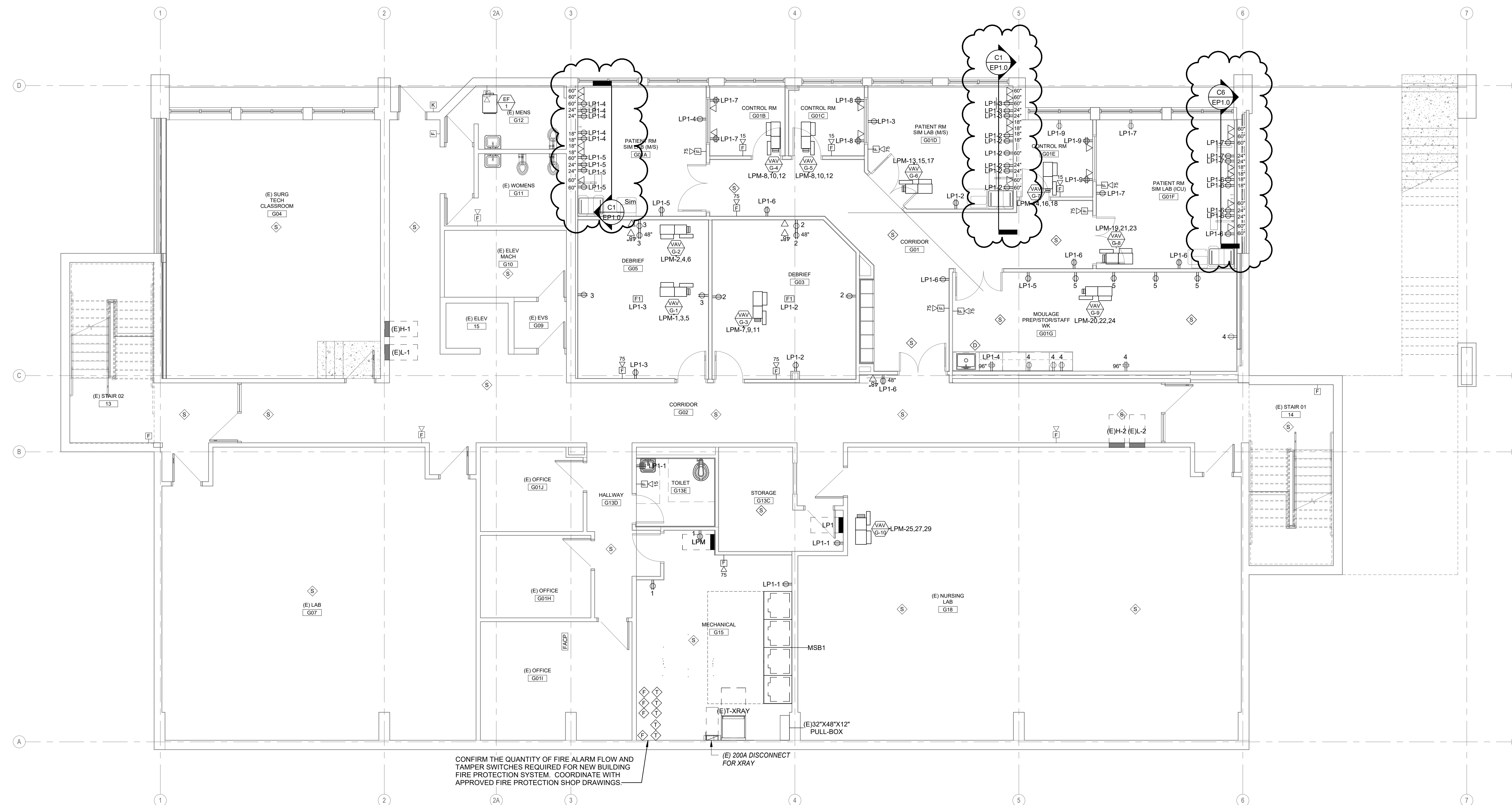
Project Phase
CONSTRUCTION DOCUMENTS 5-08-2026
COPYRIGHT © 2025 BY LAVALLEEBRENSINGER
PROFESSIONAL ASSOCIATION. ALL RIGHTS RESERVED.
NO REPRODUCTION WITHOUT PERMISSION.



C1 TYPICAL HEADWALL ELEVATION - MED/SURG
1/2" = 1'-0"



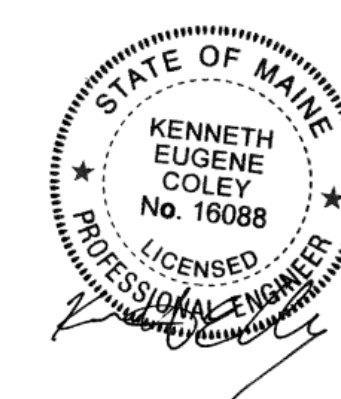
C6 TYPICAL HEADWALL ELEVATION - ICU
1/2" = 1'-0"



CONFIRM THE QUANTITY OF FIRE ALARM FLOW AND TAMPER SWITCHES REQUIRED FOR NEW BUILDING FIRE PROTECTION SYSTEM. COORDINATE WITH APPROVED FIRE PROTECTION SHOP DRAWINGS.

(E) 200A DISCONNECT FOR XRAY

J1 ELECTRICAL PLAN - GROUND FLOOR
3/16" = 1'-0"



SMCC

**HEALTH SCIENCE
CENTER**

2 Ford Road, South Portland, Maine,
04106

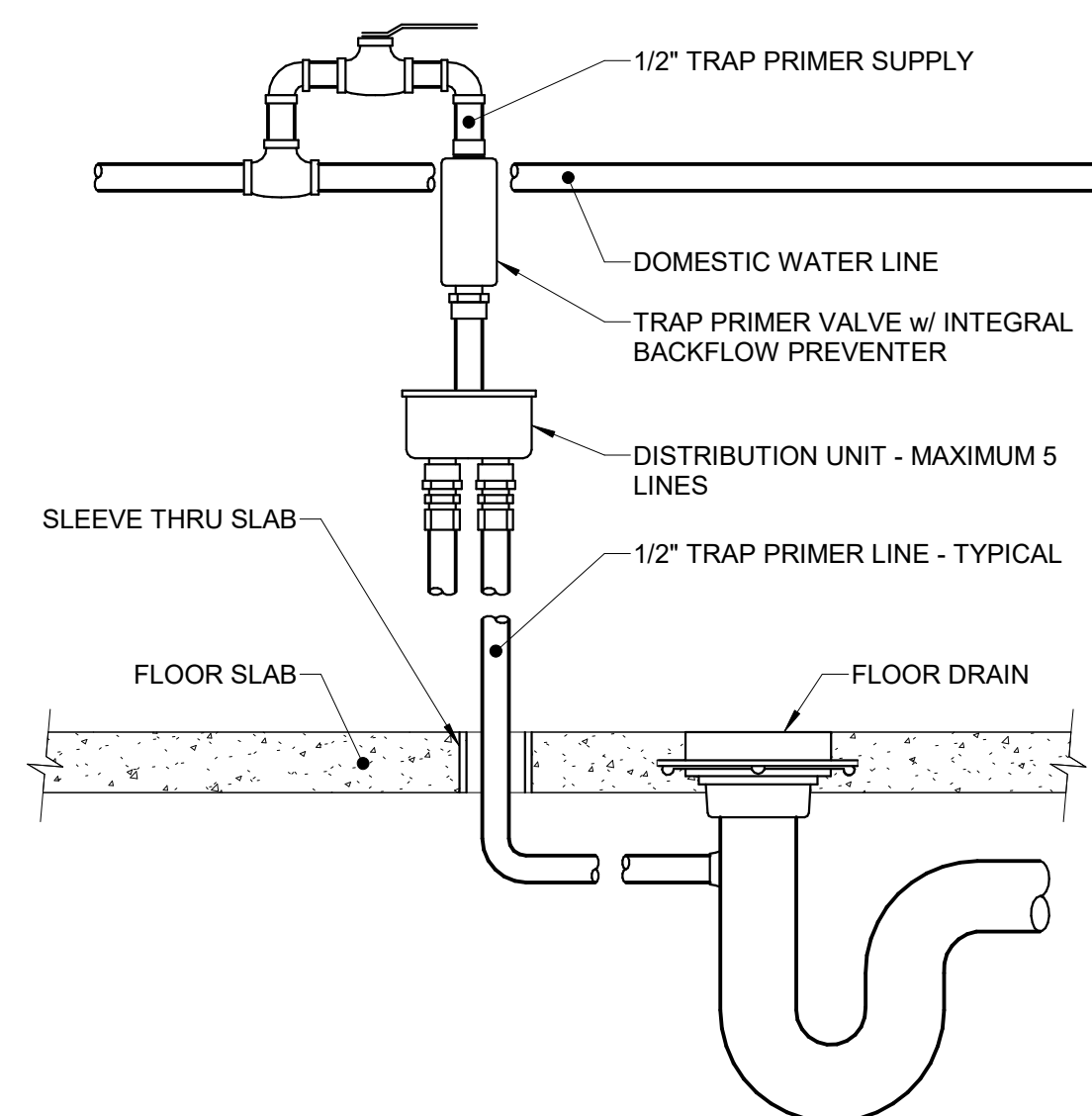
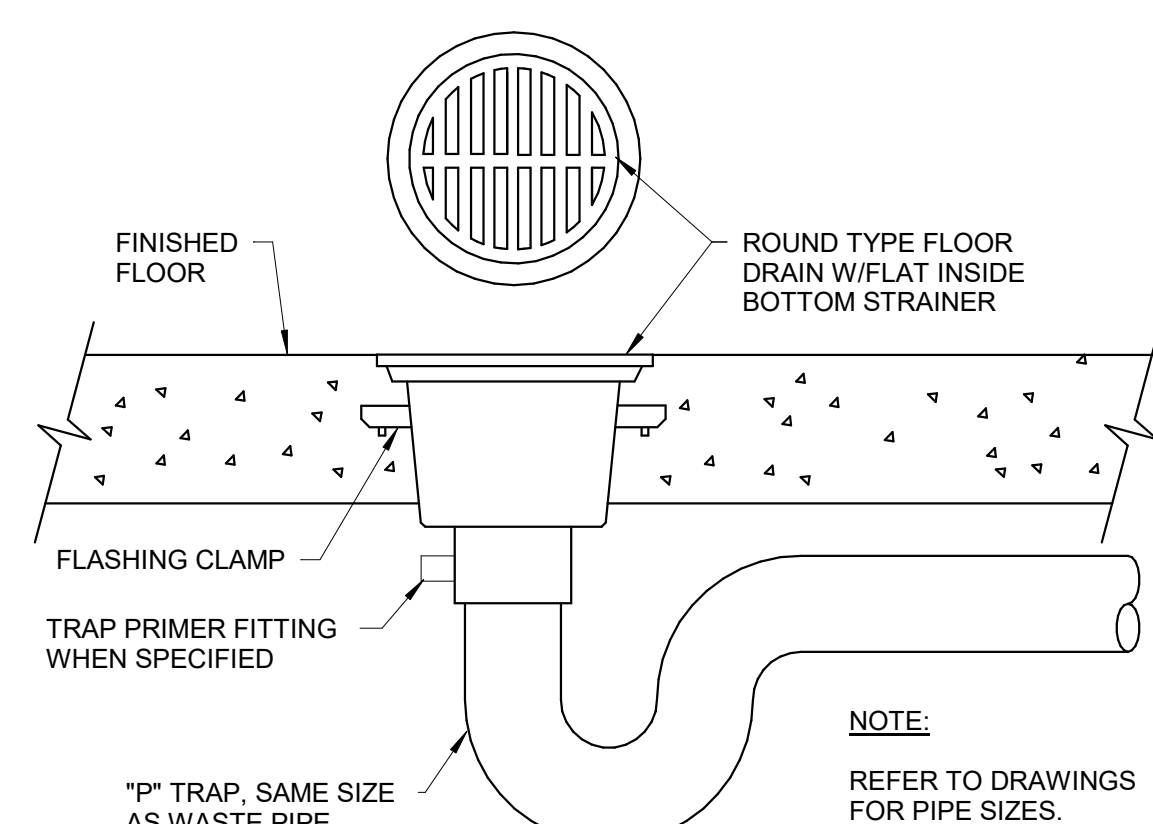
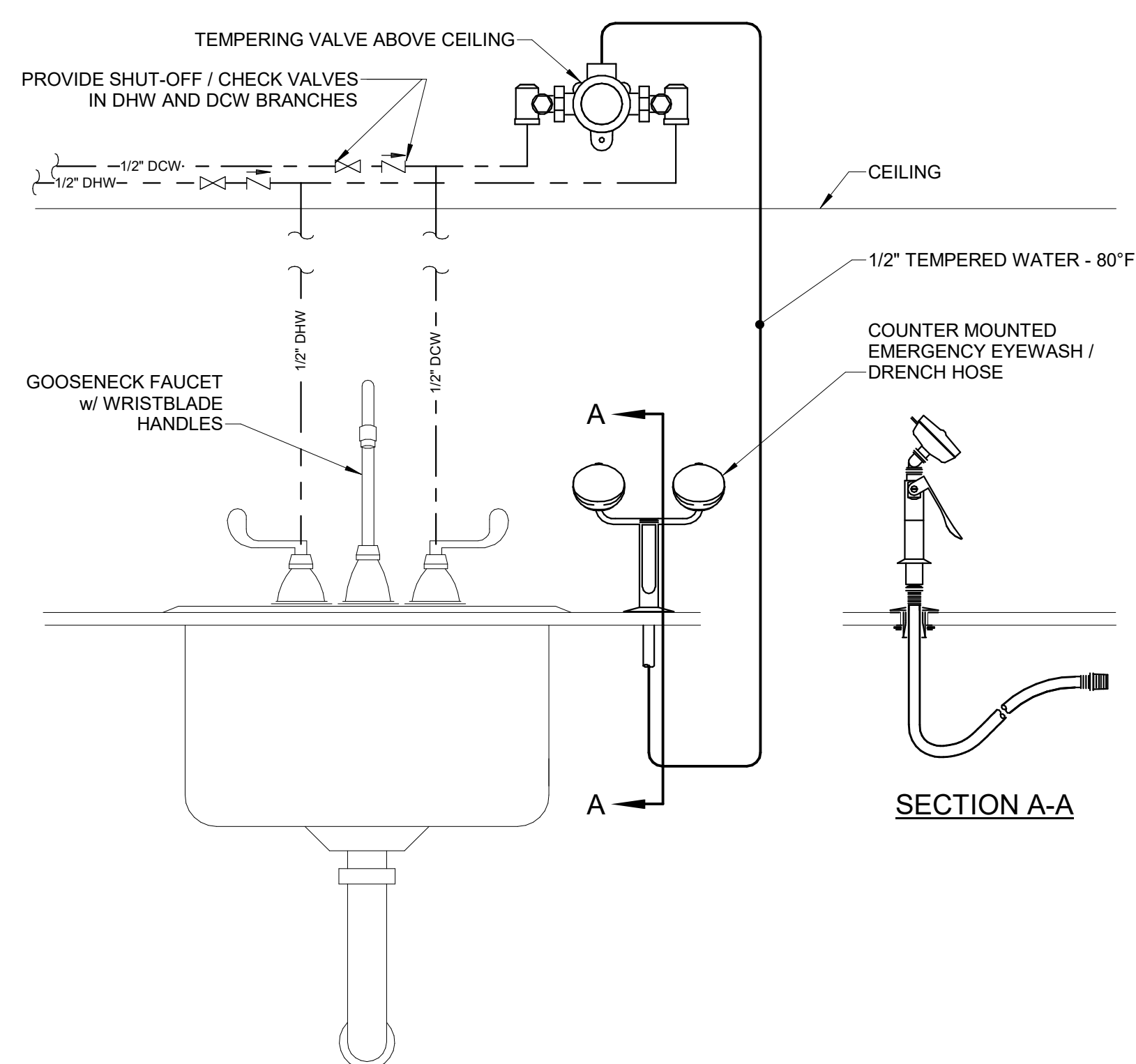
NO.	DESCRIPTION	DATE
2	ADDENDUM 02	06-10-25

FOR ADDITIONAL INFORMATION, REFER TO PROJECT MANUAL.	
CONTENT:	PLUMBING PLAN - GROUND LEVEL
DRAWN BY:	SCL
PROJECT NO:	25-062-00
DATE:	02/13/2026
REVISED:	
SCALE:	As indicated

PL1.1

Project Phase
CONSTRUCTION DOCUMENTS 5-08-2026
COPYRIGHT © 2025 BY LAVALLEE-BRENSINGER
PROFESSIONAL ASSOCIATION. ALL RIGHTS RESERVED.
NO REPRODUCTION WITHOUT PERMISSION.

PLUMBING FIXTURE SCHEDULE						
TAG	DESCRIPTION	CW	HW	VENT	WASTE	NOTES
P-1	WATER CLOSET FLOOR MT.-FLUSH VALVE	1"	----	1-1/2"	3"	
P-2	LAVATORY WALL HUNG CHINA	1/2"	1/2"	1-1/2"	1-1/2"	
P-3	MOULAGE STAINLESS STEEL HAND WASH SINK, 19" X 18" X 5.5", WRIST BLADE...	1/2"	1/2"	1-1/2"	2"	
FD	FLOOR DRAIN	1/2"	----	1-1/2"	3"	WITH TRAP PRIMER
EW-1	EYEWASH DECK MOUNTED	----	----	----	----	WITH TV-1, 1/2" TW PIPING FROM TV-1
TV-1	TEMPERING VALVE	1/2"	1/2"	----	----	MOUNT BELOW SINK, 1/2" TW TO...
TP	TRAP PRIMER	1/2"	----	----	----	TRAP PRIMER TO FD

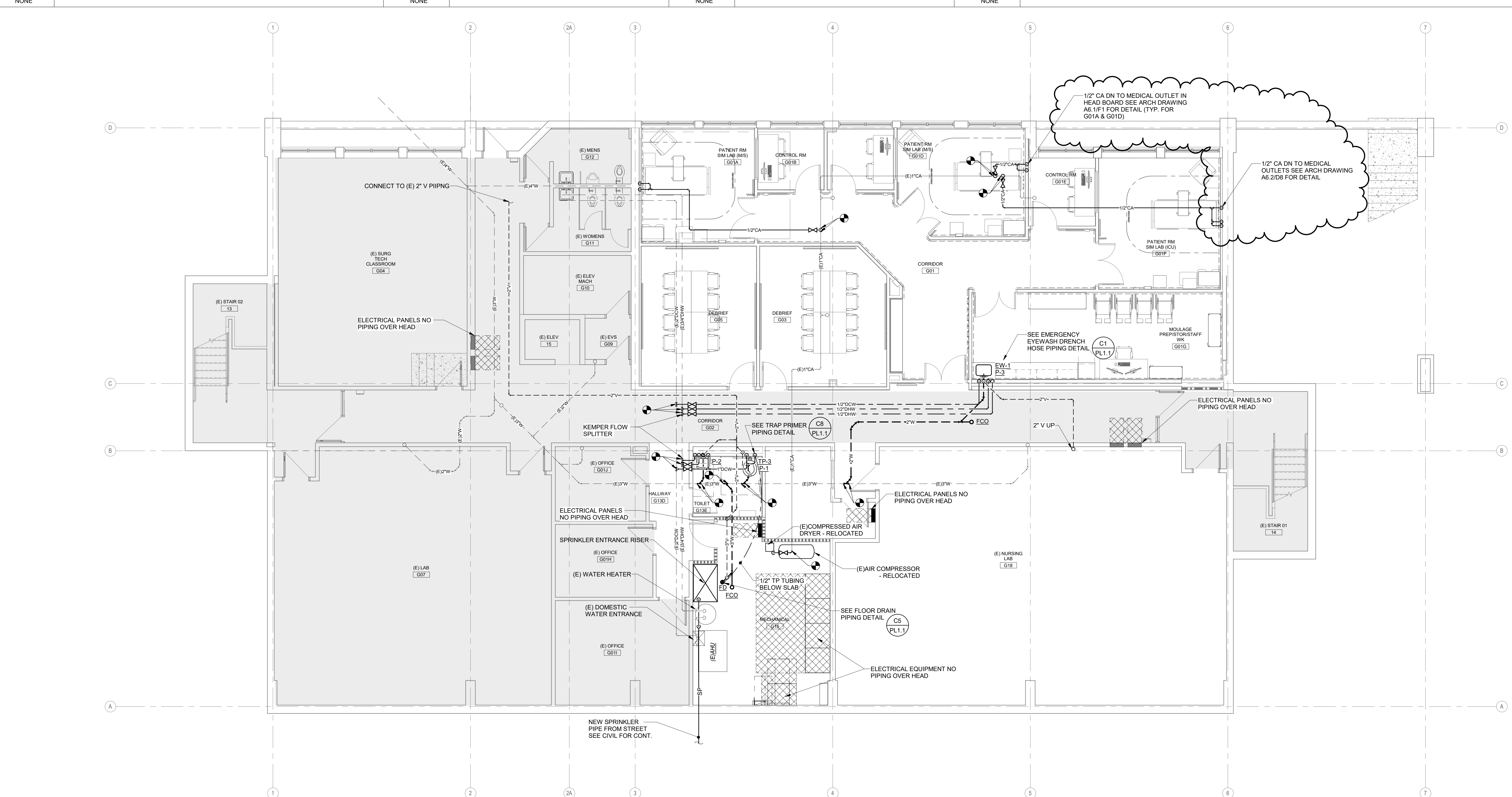


C1 EMERGENCY EYEWASH / DRENCH HOSE PIPING

C5 DETAIL - FLOOR SINK PIPING

C8 TRAP PRIMER PIPING - AUTOMATIC

C10 PLUMBING SCHEDULE



J1 PLUMBING PLAN - GROUND LEVEL