



BID ADDENDUM NO. 2

OCTOBER 8, 2026

DERUYTER CENTRAL SCHOOL DISTRICT **2024 CAPITAL IMPROVEMENT PROJECT**

MAIN BUILDING N.Y.S.E.D. No. 25-03-01-04-0-001-024
MAIN BUILDING N.Y.S.E.D. No. 25-03-01-04-0-001-021 (SSBA)
ANNEX BUILDING N.Y.S.E.D. No. 25-03-01-04-007-007

TO: ALL BIDDERS AND DOCUMENT HOLDERS

ISSUED BY:

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All bidders submitting proposals for the above project shall take note of the following Clarifications, Changes, Additions, and Deletions to the drawings and specifications that become part of the contract.

Receipt of this Addendum shall be acknowledged on the Form of Proposal.

This Addendum consists of thirty-nine (39) pages of 8 ½" x 11" text and seven (7) attached 30" x 42" drawings.

CLARIFICATION

2-C-1 BID EXTENSION

1. QUESTION: Can bid period be extended?

- A. **ANSWER:** Requests for an extension of the bid submission deadline have been received and considered. The original advertised bid date and time shall remain unchanged. Sealed bids will be received until 3:30 PM local time on 10/15/26 at the DeRuyter CSD District Office.

2-C-2 MECHANICAL CLARIFICATIONS

1. **QUESTION:** MD100 calls for demo "RX" of (2) UV's however I do not see a replacement called for in the schedule. Please clarify if this is a typo or if the units are to be removed.
- A. **ANSWER:** These are existing units.
2. **QUESTION:** UV-8 in M101 is not in the schedule but calls for a room thermostat install. However, I do not see a room thermostat assigned to the new FCU. Is the UV-8 thermostat meant for the new FCU, or can you please clarify?

- A. **ANSWER:** It is meant for the new FCU.
3. **QUESTION:** In the previous bid for this project in addendum 4, it was determined that AHU-1 will have all field installed controls. That is the case here as well, correct? I'm slightly confused because the equipment schedule on M500 says it has a factory packaged controller.
- A. **ANSWER:** Yes, AHU will be controlled via the BMS with field installed controls. See AD-2 for revised MB M500.
4. **QUESTION:** How will the DX cooling for the UVs and FCUs be controlled? The SOO shows a DO for condensing unit start/stop control. However, Daikin equipment typically requires interface. Please provide clarification on control of the DX cooling for these units.
- A. **ANSWER:** We will provide BACnet adaptors and BMS will control the units and provide the space sensors. See **REVISED** MB M500.
5. **QUESTION:** There is a packaged control system for glycol system feed on the unit schedule. Sometimes pump run and a low-level contact will be picked up for monitoring. Will this be monitored at all?
- A. **ANSWER:** Yes, please provide BMS connection for status and alarm. See **REVISED** MB M500.
6. **QUESTION:** UV schedule on M500 calls for "space sensor for communication to BMS". I believe the intention of the previous bid was for the UVs to have field installed controls. Will that be the case here as well?
- A. **ANSWER:** UV will be controlled via BMS. See **REVISED** M500.
7. **QUESTION:** On drawing M-102, note 6, it calls for powering of the AADs, but I don't see it next to any dampers on the drawings. I see the same note 6 on E103, so I assume 120v power would be run to the damper actuators for EFs 1-3 by the E contract? The same applies to the SRV AADs?
- A. **ANSWER:** Yes, 120v AADs
8. **QUESTION:** I would think the EF SOO on M701 does not apply to EF-6 since this is controlled via a hood switch, correct? I would recommend running monitoring of EF-6 however.
- A. **ANSWER:** Concur, tie into ED-6 for status and alarm. ED-6 to be enabled via switch on existing hood.
9. **QUESTION:** Per schedule on MB M500 it indicates UV-11 as alternate MC-2. Drawing MB M102 does not indicate this. Please Clarify
- A. **ANSWER:** See text below UV-11 equipment tag, stating (ALTERNATE MC-2)
10. **QUESTION:** What is the scope of work on the Fin Tube Radiator in Rooms 212, 214. We are unclear what we are doing with it. Please Clarify.
- A. **ANSWER:** Fin tube is being removed and not replaced. Existing UVs will take over as primary source of heat for spaces.
11. **QUESTION:** What happens at the 60x42 louver after removals of existing Air Handling unit and ductwork. Please Clarify.
- A. **ANSWER:** See Detail C2/A201 for infilling of existing louver.
12. **QUESTION:** Is demolition work on Drawing MB MD102 in room faculty 104A part of MC-3 Alternate.
- A. **ANSWER:** I believe the question is miswritten. If alternate is not accepted the demo work to accommodate the alternate is not required. We would not remove the existing units and leave the space with no heating and cooling.
13. **QUESTION:** What is piping to Air handling unit – 1. Drawing MC M400 indicates 2" 6HWSTR + Drawing MB-M202 indicates 1 ½" 6HWSTR. Please clarify what size it is
- A. **ANSWER:** Piping shall be 2" to AHU-1. We will re-issue M-202 under AD-2 to address

2-C-3 K-13 ACOUSTIC APPLICATION

1. **QUESTION:** Is the K-13 application within Choral 101 and Band 102 limited to the underside of the gyp ceiling or the entire ceiling?
 - A. **ANSWER:** K-13 spray is to be applied to the underside of the gyp ceiling. (1" thickness in Band 102, with 2" thickness in Choral 101 both colored black.)

2-C-4 ROOFING CLARIFICATIONS

1. **QUESTION:** What manufacturer(s) hold the warranty for the roof at the main building? Specifically, in the areas getting new reinforcement to support the HVAC adds.
 - A. **ANSWER:** Carlisle, warranty #'s are as follows. #1095423 & #1095800. Expiration 11/2031.

2-C-5 TILE, WALL ASSEMBLY AND FLOORING CLARIFICATIONS

1. **QUESTION:** What is the course of action if 12"x12" wall tile cannot be salvaged?
 - A. **ANSWER:** A 12"x12" accent tile / replacement tile will be selected by Architect. District attic stock of tile is very low.
2. **QUESTION:** Confirm the following assumptions about wall assemblies:
 - A. Gaa1 - Ga1 assembly with 5/8" GWB to be on both sides, not just one side.
 - B. Gb3 - Gbb3 assembly with double layer of GWB types on one side only.
 - C. Gaa2 - Ga2 assembly with 5/8" GWB to be on both sides, not just one side.
 1. **ANSWER:** Yes, all three confirmed. Refer to A002 – Partition Schedule for key.
3. **QUESTION:** There is no specification for Resilient stair tread & landing tile that is in the base bid. Please provide.
 - A. **ANSWER:** Refer to 09 6500 - Resilient Flooring, Base and Accessories.

2-C-6 DISPLAY CASES

1. **QUESTION:** I would like clarification at the 3 display case areas that call out fixed veneer wood panels by Casework Contractor. (B4/A430 and C1/A431)
 - A. Please advise if the panels are to be PLAM or wood veneer.
 1. **ANSWER:** Panels are to be PLAM-01. DELETE reference to Casework Contractor, General Contractor shall provide. Class A Backer Material is required by code due to installation within corridor. Hold base of panel up 6" AFF to accommodate rubber base installation.
 - B. If wood veneer, what is the species of wood.
 1. **ANSWER:** See answer above.
 - C. How are they to be attached to the wall and are there any reveals?
 1. **ANSWER:** Provide 3/4" Monarch Snap Panel System (Linear) or equal with aluminum edge trim all sides and 3/8" aluminum panel reveals.
 - D. If there are reveals, are they to be aluminum reveals or just painted?
 1. **ANSWER:** Clear Anodized Aluminum, 3/8" reveals, typical.

2-C-7 STUDENT ISLAND

1. **QUESTION:** Is there an elevation for the student island in Room 212?
 - A. **ANSWER:** See **REVISED** A105 – ENLARGED PLANS – SCIENCE which includes elevations, as requested.

DRAWINGS

2-D-1 DRAWING A104 – ENLARGED PLANS – MUSIC

1. **REPLACE** sheet in its entirety.

2-D-2 DRAWING A105 – ENLARGED PLANS – SCIENCE

1. **REPLACE** sheet in its entirety.

2-D-3 DRAWING A130 – ROOF PLAN

1. **QUESTION:** I figured the piping penetrations & supports are included in our scope (GC), but there are no details showing whether the pipes and supports run along the roof or not; reference drawing MB M203. Can you clarify.
 - A. **ANSWER:** All penetrations through the roof shall be by the GC to maintain roof warranty. (Warranty Information above) All piping / hangers should be by Mechanical for their respective scope. All piping / hangers should be by Plumbing for their respective scope. See **REVISED** MB A130 – ROOF PLAN for clarity.
2. **QUESTION:** Please confirm that detail C5/MB A130 isn't referenced to be done. I cannot find any call out for that detail.
 - A. **ANSWER:** **REPLACE** sheet MB A130 – ROOF PLAN in its entirety. References have been added.

2-D-4 DRAWING A432 – INTERIOR ELEVATIONS – MUSIC

1. **REPLACE** sheet in its entirety.

2-D-5 DRAWING A601 – DOOR SCHEDULE

1. **QUESTION:** Glass Type M-1 at Frames Type F2 will not meet STC 47. Please Advise.
 - A. **ANSWER:** Install (2) layers of MG-1 glazing at sidelight, to meet STC 47 requirement.
2. **QUESTION:** Door 102B-1 & 102B-2 Show Frame Type F2 with Sidelight.
 - A. **ANSWER:** 102B-1 & 102B-2 have been **REVISED** to Type F1. See **REVISED** A601 – DOOR SCHEDULE.
3. **QUESTION:** Drawing MB A-104 Floor Plan B1 & Elevation C5 & C6 both do not show sidelights. Do these doors have sidelights?
 - A. **ANSWER:** 102B-1 & 102B-2 have been **REVISED** to Type F1 on A601 – DOOR SCHEDULE.
4. **QUESTION:** Door 209-1 Comments call for sidelight glass replacement. Plan C4 on MB A-105 & Elevation B4 on MB A-430 both do not show a sidelight. Does Door 209-1 have a sidelight?
 - A. **ANSWER:** Door 209-1 is no longer in scope, see **REVISED** A601 – DOOR SCHEDULE.
5. **QUESTION:** Will you be providing a specification for the aluminum frame at door 103B-1?
 - A. **ANSWER:** Assuming request for information on opening '103B-1' is a mistype and intention is for clarity on opening 102B-1 originally listed as AL. 102B-1 is intended to be a HM frame not AL. See **REVISED** A601 – DOOR SCHEDULE.

2-D-6 DRAWING M202 – MECHANICAL PIPING PLAN – SCIENCE ROOMS

1. **REPLACE** sheet in its entirety, per various clarifications above.

2-D-7 DRAWING M500 – MECHANICAL SCHEDULES AND DETAILS

1. **REPLACE** sheet in its entirety, per various clarifications above.

2-D-8 DRAWING MB E501 – ELECTRICAL SCHEDULES

1. **ADD** fixture type LA to LUMINAIRE SCHEDULE on sheet MB E501. Fixture LA to have the following characteristics:
 - A. DESCRIPTION: 2X2 LED TROFFER
 - B. FIXTURE BASIS OF DESIGN: COOPER METALUX 22CZ2-24-UNV-L835-CD-1-U
 - C. LENS/DIFFUSER: FROSTED ACRYLIC
 - D. VOLTAGE: 120V
 - E. LAMPS: 18.5W LED 3500K, 2400L
 - F. BALLAST BASIS OF DESIGN: 0-10V DIMMING DRIVER
 - G. MOUNTING: RECESSED CEILING
 - H. DIMMING: VARIES
2. **ADD** fixture type K to LUMINAIRE SCHEDULE on sheet MB E501. Fixture K to have the following characteristics:
 - A. DESCRIPTION: 6' LED LINEAR SUSPENDED DOWNLIGHT
 - B. FIXTURE BASIS OF DESIGN: COOPER CORELITE J3-CL-30L835-1D-UNV-STD-WAA-W-AC48-T1-6
 - C. LENS/DIFFUSER: FROSTED ACRYLIC
 - D. VOLTAGE: 120V
 - E. LAMPS: 4.9W/FT LED 3500K, 773 L/FT
 - F. BALLAST BASIS OF DESIGN: 0-10V DIMMING DRIVER
 - G. MOUNTING: SUSPENDED
 - H. DIMMING: YES
 - I. REMARKS:4

SPECIFICATIONS

2-S-1 SPECIFICATION 08 3313 – COILING COUNTER DOORS

1. **QUESTION:** Counter/Sill: Section 08 3313 specifies an integral stainless-steel countertop/sill, while D1/MB A900 shows a separately constructed SSM-01 countertop. Please clarify the required condition.
 - A. **ANSWER:** Coordinate the shutter sill condition with the countertop shown on D1/MB A900. **DELETE** the reference to an integral countertop/sill from Paragraph 2.01.B and **DELETE** Paragraph 2.01.B.9.
2. **QUESTION:** Operator: Section 08 3313 specifies an AlarmGard tube motor, while D1/MB A900 depicts a bracket mounted AlarmGard motor. Please clarify the required operator configuration.
 - A. **ANSWER:** Provide the AlarmGard tube motor as specified.
3. **QUESTION:** Curtain and Guides: Section 08 3313 contains requirements for both galvanized and stainless-steel construction. Please confirm the required curtain and guide material and finish.
 - A. **ANSWER:** Provide a Type 304 stainless-steel curtain and guides with No. 4 finish as indicated.
4. **QUESTION:** Sensing Edge: Section 08 3313 references a safety edge but does not clearly require one. Please clarify whether a sensing edge is required.
 - A. **ANSWER:** Provide a monitored sensing edge to permit powered closing upon fire alarm activation. Coordinate with E series drawings for additional fire alarm integration requirements.

5. **QUESTION:** Locking: Section 08 3313 specifies a latchset lock cylinder operable from both sides. Given the ballistic transaction window and motor-operated shutter, please clarify whether a lock is required and, if so, the required lock arrangement and motor interlock.

A. **ANSWER:** Omit the mechanical locking requirement.

6. **QUESTION:** Operating Controls: Please identify the required controls for normal operation, such as key switch or OPEN/CLOSE/STOP station, whether controls are to be surface or flush mounted.

A. **ANSWER:** OPEN/CLOSE/STOP station is preferred. Locate control station within new furred wall assembly, therefore allowing a flush mounted installation.

2-S-2 SPECIFICATION 22 1005 – PLUMBING PIPING

1. **REPLACE** section in its entirety.

2-S-3 SPECIFICATION 23 0900 – BUILDING AUTOMATION SYSTEM

1. **QUESTION:** In spec 230900, sections 1.1.E, 2.1, and 2.5, there are references to Siemens controls and state contract purchase. In the previous fall of 2026 bid, it was determined that this is an extension of the district's existing Tridium Niagara Honeywell system. That is still the case here, correct?

A. **ANSWER:** See attached **REVISED** specification section.

END OF ADDENDUM No. 2

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sanitary waste piping, above grade.
- B. Chemical-resistant sanitary waste piping.
- C. Domestic water piping, above grade.
- D. Natural gas piping, above grade.
- E. Pipe hangers and supports.
- F. Ball valves.

1.2 RELATED REQUIREMENTS

- A. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.
- B. Section 22 0529 - Hangers and Supports for Plumbing Piping and Equipment.
- C. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- D. Section 22 0719 - Plumbing Piping Insulation.
- E. Section 33 0110.58 - Disinfection of Water Utility Piping Systems.

1.3 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.
- D. ASME B31.1 - Power Piping; 2020.
- E. ASME B31.9 - Building Services Piping; 2020.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.
- G. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.
- H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.
- I. ASTM B32 - Standard Specification for Solder Metal; 2020.
- J. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.
- K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

- L. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
- M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.
- N. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.
- O. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications; 2000 (Reapproved 2015).
- P. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.
- Q. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.
- R. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020.
- S. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2016.
- T. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- U. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014 (Reapproved 2021).
- V. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings; 2016.
- W. AWWA C651 - Disinfecting Water Mains; 2014, with Addendum (2020).
- X. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2012.
- Y. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2012.
- Z. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.
- AA. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018 (Amendment 2019).
- BB. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .
- CC. NSF 61 - Drinking Water System Components - Health Effects; 2020.
- DD. NSF 372 - Drinking Water System Components - Lead Content; 2024.
- EE. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS**2.1 GENERAL REQUIREMENTS**

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.2 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
- B. PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679.
 - 1. Fittings: PVC.
 - 2. Joints: Push-on, using ASTM F477 elastomeric gaskets.

2.3 SANITARY SEWER PIPING AND VENT PIPING, ABOVE GRADE WHEN PENETRATING FIRE BARRIER.

- A. Cast Iron Pipe: ASTM A74, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.
- B. PVC Pipe: ASTM D2665. (NOTE: when installed in plenum space wrap PVC piping with Thermal Ceramics PlenumWrap+)
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.4 CHEMICAL-RESISTANT SANITARY WASTE PIPING

- A. Glass Pipe: ASTM C1053.
 - 1. Fittings: ASTM C1053.
 - 2. Joints: Stainless steel compression couplings with tetra-fluoroethylene seal ring.
- B. PP Pipe: Polypropylene, flame retardant.
 - 1. Fittings: Polypropylene.

2. Joints: Electrical resistance fusion.

2.5 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 2. Joints: ASTM B32, alloy Sn95 solder.
 3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

2.6 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 2. Joints: Threaded or welded to ASME B31.1.

2.7 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 4. Vertical Pipe Support: Steel riser clamp.
- B. Plumbing Piping - Drain, Waste, and Vent:
 1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm, DN): Malleable iron, adjustable swivel, split ring.
 2. Hangers for Pipe Sizes 2 inch (50 mm, DN) and Over: Carbon steel, adjustable, clevis.
 3. Wall Support for Pipe Sizes to 3 inch (80 mm, DN): Cast iron hook.
 4. Wall Support for Pipe Sizes 4 inch (100 mm, DN) and Over: Welded steel bracket and wrought steel clamp.
- C. Plumbing Piping - Water:
 1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm, DN): Malleable iron, adjustable swivel, split ring.
 2. Hangers for Cold Pipe Sizes 2 inch (50 mm, DN) and Over: Carbon steel, adjustable, clevis.
 3. Hangers for Hot Pipe Sizes 2 to 4 inch (50 to 100 mm, DN): Carbon steel, adjustable, clevis.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
 1. Concrete Wedge Expansion Anchors: Comply with ICC-ES AC193.
 2. Masonry Wedge Expansion Anchors: Comply with ICC-ES AC01.

3. Concrete Screw Type Anchors: Comply with ICC-ES AC193.
4. Masonry Screw Type Anchors: Comply with ICC-ES AC106.

2.8 BALL VALVES

- A. Manufacturers:
 1. Conbraco Industries, Inc: www.apollovalves.com.
 2. Grinnell Products, a Tyco Business: www.grinnell.com.
 3. Shurjoint Piping Products, Inc., a Tyco Business: www.shurjoint.com.
 4. Nibco, Inc: www.nibco.com.
 5. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder or threaded ends with union.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 0516.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- J. Install bell and spigot pipe with bell end upstream.
- K. Install valves with stems upright or horizontal, not inverted. See Section 22 0523.

- L. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- M. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- N. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 8. Provide copper plated hangers and supports for copper piping.
 - 9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - 10. Support cast iron drainage piping at every joint.
- O. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.3 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.4 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/4 inch per foot (1:50) slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.5 FIELD TESTS AND INSPECTIONS

- A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.
- B. Domestic Water Systems:
 - 1. Perform hydrostatic testing for leakage prior to system disinfection.

2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
3. General:
 - a. Fill the system with water and raise static head to 10 psi (345 kPa) above service pressure. Minimum static head of 50 to 150 psi (345 to 1,034 kPa). As an exception, certain codes allow a maximum static pressure of 80 psi (551.6 kPa).
- C. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed, and clean.
- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.7 SCHEDULES

- A. Pipe Hanger Spacing:
 1. Metal Piping:
 - a. Pipe Size: 1/2 inch (15 mm, DN) to 1-1/4 inch (32 mm, DN):
 - 1 Maximum Hanger Spacing: 6.5 ft (2 m).
 - 2 Hanger Rod Diameter: 3/8 inches (9 mm).
 - b. Pipe Size: 1-1/2 inch (40 mm, DN) to 2 inch (50 mm, DN):
 - 1 Maximum Hanger Spacing: 10 ft (3 m).
 - 2 Hanger Rod Diameter: 3/8 inch (9 mm).
 - c. Pipe Size: 2-1/2 inch (65 mm, DN) to 3 inch (80 mm, DN):
 - 1 Maximum Hanger Spacing: 10 ft (3 m).
 - 2 Hanger Rod Diameter: 1/2 inch (13 mm).
 2. Plastic Piping:
 - a. All Sizes:

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- 1 Maximum hanger spacing: 4 ft.
 - 2 Hanger Rod Diameter: 3/8 inch (9 mm).

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes control equipment and installation for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-furnished controls.
- B. The control system shall be extension of the existing Niagara System and all controllers and software shall match existing or be the latest version of existing.
- C. Deruyter Central School District's existing Building Management System is Niagara. The project is designed and based upon the extension of this system as installed by C&S operations inc..
- D. All control systems in each building shall seamlessly integrate with the existing system without the use of integrator panels, routers, or any other hardware or software. The control system manufacturer shall guarantee that all new controls operate with the existing Niagara systems.

1.2 WORK INCLUDED

- A. The BAS Contractor shall provide a complete and operational system that will perform the sequences of operation as described herein.
- B. Furnish a complete distributed direct digital control system in accordance with this specification section. This includes all system controllers, logic controllers, and all input/output devices. Items of work included are as follows:
 - 1. Provide a submittal that meets the requirements below for approval.
 - 2. Coordinate installation schedule with the mechanical contractor and general contractor.
 - 3. Provide installation of all panels and devices unless otherwise stated.
 - 4. Provide power for panels and control devices unless otherwise stated.
 - 5. Provide all low voltage control wiring for the DDC system.
 - 6. Provide engineering and technician labor to program and commission software for each system and operator interface. Submit commissioning reports for approval.
 - 7. Provide testing, demonstration and training as specified below.
- C. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation, or identification number and sequence of operation all bearing the name of the manufacturer.

1.3 SUBMITTALS

- A. Provide submittals for fast track items that need to be approved and released to meet the schedule of the project. Provide submittals for the following items separately upon request:
 - 1. Valve schedule and product data

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2. Damper schedule and product data
 3. Mounting and wiring diagrams for factory-installed control components
 4. Thermostat locations
- B. Provide a complete submittal with all controls system information for approval before construction starts. Include the following:
1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 2. Wiring Diagrams: Power, signal, and control wiring. Detail the wiring of the control devices and the panels. Show point-to-point wiring from field devices to the control panel. Show point-to-point wiring of hardwired interlocks. Show a ladder diagram or schematic of wiring internal to the panels, including numbered terminals. Clearly designate wiring that is done at a factory, at a panel shop or in the field.
 3. Details of control panel faces, including sizes, controls, instruments, and labeling.
 4. Schedule of dampers and actuators including size, leakage, and flow characteristics. If dampers are furnished by other, submit a damper actuator schedule coordinating actuator sizes with the damper schedule.
 5. Schedule of valves including leakage and flow characteristics.
 6. Written description of the Sequence of Operations.
 7. Network riser diagram showing wiring types, network protocols, locations of floor penetrations and number of control panels. Label control panels with network addresses and BACnet device instance numbers. Show all routers, switches, hubs and repeaters.
 8. Point list for each system controller including both inputs and outputs (I/O), point numbers, controlled device associated with each I/O point, and location of I/O device.
 9. Starter and variable frequency drive wiring details of all automatically controlled motors.
 10. Product Data: Include manufacturer's technical literature for each control device indicated, labeled with setting or adjustable range of control. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated. Submit a write-up of the application software that will be used on the operator workstation including revision level, functionality and software applications required to meet the specifications.
 11. Submit BACnet Protocol Implementation Conformance Statements (PICS) for all direct digital controllers, software and other system components that will communicate on the BAS utilizing BACnet.
- C. Submit blank field check-out and commissioning test reports, customized for each panel or system, which will be filled out by the technician during start-up.
- D. Variance letter: Submit a letter detailing each item in the submission that varies from the contract specification or sequence of operation in any way.
- E. After the BAS system is approved for construction, submit sample operator workstation graphics for typical systems for approval. Print and submit the graphics that the operator will use to view the systems, change setpoints, modify parameters and issue manual commands. Programming shall not commence until typical graphics are approved.
- F. Operation and Maintenance Data: In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
1. Product data with installation details, maintenance instructions and lists of spare parts for each type of control device.
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2. Keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Inspection period, cleaning methods, cleaning materials recommended and calibration tolerances.
4. Calibration records and list of set points.

1.4 PROJECT RECORD DOCUMENTS

A. Project Record Documents:

1. Project Record Drawings. As-built versions of the submittal shop drawings provided as AutoCAD compatible files in electronic format.
2. Operation and Maintenance (O & M) Manual.
 - a. As-built versions of the submittal product data.
 - b. Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.
 - c. Operator's Manual with procedures for operating control systems, logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
 - d. Programming manual or set of manuals with description of programming language and of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
 - e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
 - f. Documentation of all programs created using custom programming language, including setpoints, tuning parameters, and object database.
 - g. Graphic files, programs, and database on electronic media.
 - h. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware, including computer equipment and sensors.
 - i. Complete original original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
 - j. Licenses, guarantees, and warranty documents for equipment and systems.

B. Provide maintenance manual to serve as training and reference manual for all aspects of day-to-day maintenance and major system repairs. As a minimum include the following:

1. Complete as-built installation drawings for each building system.
2. Overall system electrical power supply schematic indicating source of electrical power for each system component. Indicate all battery backup provisions.
3. Drawings showing installation details and locations of equipment.
4. Parts list with manufacturer's catalog numbers.

1.5 QUALITY ASSURANCE**A. Codes**

1. Perform all wiring in accordance with Division 26, NEC, local codes and Owner's requirements.

B. Qualifications

1. Installing contractor shall be in the business of installing and servicing DDC controls for mechanical systems, temperature and ventilation control, environmental controls as their primary business.
2. Installer Qualifications: An experienced installer who is the authorized representative of the automatic control system manufacturer for both installation and maintenance of controls required for this Project.
3. Engineering, drafting, programming, and graphics generation shall be performed by the local branch engineers and technicians directly employed by the Building Automation System Contractor.
4. Supervision, checkout and commissioning of the system shall be by the local branch engineers and technicians directly employed by the Building Automation System Contractor. They shall perform commissioning and complete testing of the BAS system.

- C. All portions of the system must be designed, furnished, installed, commissioned and serviced by manufacturer approved, factory trained employees.

- D. The system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability for any existing control system component including but not limited to building controllers, advanced application controllers, application specific, personal operator workstations and portable operator's terminals, to be connected and directly communicate with any new BAS system equipment without bridges, routers or protocol converters.

1.6 COORDINATION

- A. Coordinate IP drops, network connections, user interfaces, firewall, etc with Owner's IT representative.

- B. Coordinate location of thermostats, humidistats, panels, and other exposed control components with plans and room details before installation.

- C. Coordinate equipment with Division 28 "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

- D. Coordinate power for control units and operator workstation with electrical contractor.

- E. Coordinate equipment with provider of starters and drives to achieve compatibility with motor starter control coils and VFD control wiring.

- F. Coordinate scheduling with the mechanical contractor and general contractor. Submit a schedule for approval based upon the installation schedule of the mechanical equipment.

- G. Coordinate installation of taps, valves, airflow stations, etc. with the mechanical contractor.

H. Products Furnished but Not Installed Under This Section

1. Hydronic and Refrigerant Piping accessories:
 - a. Control Valves
 - b. Temperature Sensor Wells and Sockets

- c. Pressure Sensor Wells and Sockets
- d. Flow Switches
- e. Flow Meters
- f. Differential Pressure Transmitters
- g. Sheet metal accessories
 - 1 Dampers
 - 2 Airflow Stations
 - 3 Terminal Unit Controls
- I. Products Installed but Not Furnished Under This Section
 - 1. Refrigeration Equipment:
 - a. Refrigerant Leak Detection System
 - b. Proof of flow pressure switches
 - c. Rooftop Air Handling Equipment:
 - 1 Thermostats
 - 2 Duct Static Pressure Sensors
- J. Products Integrated To but Not Furnished or Installed Under This Section

1.7 WARRANTY

- A. Provide warranty per Division 20 Section "General Mechanical Requirements" and as supplemented in this section.
- B. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of 12 months from completion of system demonstration.
- C. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours.
- D. During normal building occupied hours, failure of items that are critical for system operation shall be provided within 4 hours of notification from the Owner's Representative.
- E. This warranty shall apply equally to both hardware and software.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. The Building Automation System (BAS) contractor shall furnish and install a networked system of HVAC controls. The contractor shall incorporate direct digital control (DDC) for central plant equipment, building ventilation equipment, supplemental heating and cooling equipment, and terminal units.

- B. The control system for this project shall be an extension of the Owner's existing Niagara Building Automation System and all controllers and software shall match existing or be latest version of existing.
- C. Provide networking to new DDC equipment using industry accepted communication standards. System shall utilize BACnet communication according to ANSI/ASHRAE standard 135-2010 for interoperability with smart equipment, for the main IP communication trunk to the BAS Server and for peer-to-peer communication between DDC panels and devices. The system shall not be limited to only standard protocols, but shall also be able to integrate to a wide variety of third-party devices and applications via drivers and gateways.
- D. Provide standalone controls where called for on the drawings or sequences.

2.2 BUILDING AUTOMATION SYSTEM NETWORK

- A. The Building Level Controllers shall be able to support subnetwork protocols that may be needed depending on the type of equipment or application. Subnetworks shall be limited to :
 - 1. BACnet MS/TP
- B. BACnet MSTP Setup rules
 - 1. Addressing for the MSTP devices shall start at 00 and continue sequentially for the number of devices on the subnetwork.
 - 2. No gaps shall be allowed in the addresses.
 - 3. Set the MaxMaster property to the highest address of the connected device.
 - 4. MaxMaster property shall be adjusted when devices are added to the subnetwork.
- C. Provide all communication media, connectors, repeaters, bridges, switches, and routers necessary for the internetwork.
- D. Controllers and software shall be BTL listed at the time of installation.
- E. The system shall meet peer-to-peer communication services such that the values in any one BACnet Building Controller or BACnet Advanced Application Controller can be read or changed from all other controllers without the need for intermediary devices. The software shall provide transparent transfer of all data, control programs, schedules, trends, and alarms from any one controller through the internetwork to any other controller, regardless of subnetwork routers.
- F. Systems that use variations of BACnet using Point-to-Point (PTP) between controllers, gateways, bridges or networks that are not peer-to-peer are not allowed.
- G. Remote Communications: Provide a TCP/IP compatible communication port for connection to the Owner's network for remote communications. Provide coordination with the Owner for addressing and router configuration on both ends of the remote network.
- H. The system shall be installed with a 10% spare capacity on each subnetwork for the addition of future controllers.

2.3 BUILDING AUTOMATION SYSTEM SERVER HARDWARE

- A. BAS Server application and database are existing.

2.4 BACNET BUILDING CONTROLLERS

- A. Provide all necessary hardware for a complete operating system as required. The Building Controller shall be able to operate as a standalone panel and shall not be dependent upon any higher level computer or another controller for operation.
 - 1. The Building Level Controller shall support transmitting and receiving segmented messages.

2. The Building Level Controller shall have the capability to be the BACnet/IP Broadcast Management Device (BBMD) and support foreign devices.
 3. The Building Level Controller shall have the capability to act as a BACnet router between MS/TP subnetworks and BACnet/IP.
- B. This level of controller shall be used for the following types of systems:
1. Chiller plant systems
 2. Heating plant systems
 3. Cooling Towers
 4. Pumping systems
 5. VAV air handlers
 6. Air handlers over 15,000 cfm
 7. Systems with over 24 input/output points
 8. Rooftop systems
- C. Computing power and memory minimum:
1. A 32-bit, stand-alone, multi-tasking, multi-user, real-time 100MHz digital control microprocessor module.
 2. Inputs shall be 16-bit minimum analog-to-digital resolution
 3. Outputs shall be 10-bit minimum digital-to-analog resolution
 4. Memory module (24 Megabyte, minimum) to accommodate all Primary Control Panel software requirements, including but not limited to, its own operating system and databases (see Controllers Software section), including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, operator I/O, dial-up communications.
 5. Real time clock and battery
 6. Data collection/ Data Trend module sized for 10,000 data samples.
 7. Flash Memory Firmware: Each Building Level Control Panel shall support firmware upgrades without the need to replace hardware.
- D. Onboard or Modular hardware and connections:
1. Primary Network communication module, if needed for primary network communications.
 2. Secondary Network communication module, if needed for secondary network communications.
 3. RJ45 port 10/100Mbaud
 4. RS485 ports for subnetworks and point expansion
 5. Man to Machine Interface port (MMI)
 6. USB Port
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E. Input and Output Points Hardware

1. Input/output point modules as required including spare capacity.
2. Input/output point modules shall have removable terminal blocks.
3. Monitoring of the status of all hand-off-auto switches.
4. Monitoring of all industry standard types of analog and digital inputs and outputs, without the addition of equipment to the primary control panel.
5. Local status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Each primary control panel shall perform diagnostics on all inputs and outputs and a failure of any input or output shall be indicated both locally and at the operator workstation.
6. Graduated intensity LEDs or analog indication of value for each analog output.

F. Code compliance

1. Approvals and standards: UL916; CE; FCC
2. Provide UL864-UUKL where called for in the sequences of operations.

G. Accessories:

1. Appropriate NEMA rated metal enclosure.
2. Power supplies as required for all associated modules, sensors, actuators, etc.

H. Each Building Level Control Panel shall continuously perform self-diagnostics on all hardware modules and network communications. The System Level Control Panel shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication with any system.**I. Panel setup, point definitions and sequencing diagrams shall be backed up on EEPROM memory.****J. Power loss. In the event of the loss of power, there shall be an orderly shutdown of all Building Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 30 days.****K. Building Level control panels shall provide at least two serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. Primary control panels shall allow temporary use of portable devices without interrupting the normal communications, operation of permanently connected modems, printers or terminals.****L. Building Level Controllers shall have the capability to serve as a gateway between Modbus subnetworks and BACnet objects. Provide software, drives and programming.****M. Spare Capacity: Provide enough inputs and outputs to handle the equipment shown to be "future" on drawings and 10% more of each point type. Provide all hardware modules, software modules, processors, power supplies, communication controllers, etc. required to ensure adding a point to the spare point location only requires the addition of the appropriate sensor/actuator and field wiring/tubing.****N. Environment.**

1. Controller hardware shall be suitable for the anticipated ambient conditions.

2. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).
3. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).
4. Controller hardware shall be optionally suitable for rooftop environments.

2.5 BACNET ADVANCED APPLICATION CONTROLLERS (DXR)

- A. Each Advanced Application Controller shall operate as a stand-alone controller capable of performing its user selectable control routines independently of any other controller in the system. Each Advanced Application Controller shall provide standard applications and programmability to provide both reliability and flexibility. Each advanced application controller shall be a microprocessor-based, multi-tasking, digital control processor.
- B. Configurable control applications. Each Advanced Application Controller model must have a set of pre-loaded, selectable and field-adjustable control applications appropriate for the secondary HVAC equipment that the controller model is intended to control. Specific applications must be configurable to meet the user's control strategy requirements, allowing for additional system flexibility.
- C. Programmability: Advanced Application Controllers shall be programmable. Program language shall be graphical.
- D. The Advanced Application Controller shall include all point inputs and outputs necessary to perform the specified HVAC control sequences. The controller shall accept input and provide output signals that comply with industry standards. Controllers only utilizing proprietary control output signals shall not be acceptable. Controllers shall provide outputs utilized either for two-state, modulating floating, or proportional control, allowing for additional system flexibility.
 1. Analog inputs shall be software configurable to accept sensors using 0-10v (such as RH or CO2 sensors), NTC3k, NTC10k, NTC100k, Ni1000, PT1K 385, PT1K 375, and resistance sensors of 10000, 2500 O, 10K O, and 100k O. 24vDC or 24vAC power to drive active sensors shall be an option available from the controller.
 2. Differential Pressure sensor (on selected controllers) 0-500 Pa (0-2.0 in. w.c.)
 3. Digital input
 4. Analog Outputs shall support 0-10v HVAC control signals.
 5. Digital outputs shall be AC 24V high-side switching triacs, able to switch loads of 250 mA / 6 VA per output.
 6. Every installed Advanced Application Controller shall be prepared for the addition of occupancy, CO2 and humidity sensors
 7. Additional sensors and output modules for occupancy, lighting and shade control within the same space as the HVAC control shall be connected as needed via a sub-network connection on each Advanced Application Controller
- E. Advanced Application Controller communication
 1. Communication over floor level network shall be BACnet over MS/TP or BACnet IP over Ethernet.
 2. A maximum of 96 controllers may be configured on individual BACnet MS/TP networks.
 3. Each controller that uses BACnet IP shall provide at least two Ethernet ports allowing the controllers to be wired in a daisy-chain configuration of up to at least 20 controllers per chain, utilizing standard Ethernet cables of up to 300ft in length between each controller.

- F. The Advanced Application Controller shall have the BTL listing and meet the BACnet device profile of an Advanced Application Controller (B-AAC) as specified in ANSI/ASHRAE 135-2012.
- G. Each Advanced Application Controller shall, at a minimum, be provided with:
 - 1. Appropriate NEMA rated enclosure
 - 2. Power supplies as required for all associated modules, sensors, actuators, etc.
 - 3. Each controller measuring air volume shall include a differential pressure transducer
 - 4. Approvals and standards: UL916 PAZX; UL864 UUKL; CUL; FCC
 - 5. Plenum rated per UL94-5VB flammability rating, UL1995
- H. Each Advanced Application Controller shall continuously perform self-diagnostics on all hardware and secondary network communications. The Advanced Application Controller shall provide both local and remote annunciation of any detected component failures or repeated failure to establish communication to the system.
- I. Power Supply. The Advanced Application controller shall be powered from a 24 VAC, 50/60 Hz source and shall function normally under an operating range of -15% / +20%.
- J. All controller configuration settings and programs shall be stored in non-volatile memory. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration.
- K. Environment. The controllers shall function normally under ambient conditions of 23 to 122°F (-5 to 50°C) and 5% to 95% RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the circuit board assembly.

2.6 CONTROL PANELS

- A. Controllers in mechanical rooms shall be mounted in NEMA 1 enclosures.
- B. Controllers in areas where moisture is a concern shall be mounted in NEMA 12 enclosures.
- C. Controllers installed outdoors shall be mounted in NEMA 4X enclosures. Provide heaters where freezing temperatures are normally experienced.
- D. Mount on walls at an approved location or provide a free standing rack.
- E. Panels shall be constructed of 16 gauge, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with ANSI 61 gray polyester-powder painted finish, UL listed. Provide common keying for all panels.
- F. Provide power supplies for control voltage power.
- G. Dedicate 1 power supply to the DDC controller. Other devices shall be on a separate power supply, unless the power for the control device is derived from the controller terminations.
- H. Power supplies for controllers shall be a transformer with a fuse or circuit breaker. Power supplies for other devices can be plain transformers.
- I. All power supplies for 24V low voltage wiring shall be class 2 rated and less than 100VA. If low voltage devices require more amps, then provide multiple power supplies. If a single device requires more amps, then provide a dedicated power supply in a separate enclosure and run a separate, non-class 2 conduit to the device.
- J. Surge transient protection shall be incorporated in design of system to protect electrical components in all DDC Controllers and operator's workstations.

- K. All devices in a panel shall be permanently mounted, including network switches, modems, media converters, etc.
- L. Provide a pocket to hold documentation.

2.7 SENSORS

A. General

1. Provide mounting hardware for all devices, including actuator linkages, wells, installation kits for insertion devices, wall boxes and fudge plates, brackets, etc.
2. If a special tool is required to mount a device, provide that tool.

B. Terminal Unit Space Thermostats

1. Each controller performing space temperature control shall be provided with a matching room temperature sensor.
 - a. Plain Space Temperature Sensors – Wired: Where called for in the sequences or on the drawings, provide sensors with plain covers.
 - b. The sensing element for the space temperature sensor shall be thermistor type providing the following.
 - 1 Element Accuracy: + /- 1.0°F
 - 2 Operating Range: 55 to 95°F
 - 3 Set Point Adjustment Range: 55 to 95°F
 - 4 Calibration Adjustments: None required
 - 5 Installation: Up to 100 ft. from controller
 - 6 Auxiliary Communications Port: as required
 - 7 Local LCD Temperature Display: as required
 - 8 Setpoint Adjustment Dial as required
 - 9 Occupancy Override Switch as required
 - 10 Auxiliary Communication Port. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. RS-232 communications port shall allow the operator to query and modify operating parameters of the local room terminal unit from the portable operator's terminal.
 - c. Digital Display temperature sensor specifications – Wired:
 - 1 As called for in the sequences of operations or on the drawings, provide temperature sensors with digital displays.
 - 2 The sensing element for the space temperature sensor must be IC-based and provide the following.
 - (a) Digitally communicating with the Application Specific Controller.
 - (b) Mountable to and fully covering a 2 x 4 electrical junction box without the need for an adapter wall plate.

- (c) IC Element Accuracy: +/- 0.9°F
 - (d) Operating Range: 55 to 95°F
 - (e) Setpoint Adjustment Range: User limiting, selectable range between 55 and 95°F
 - (f) Display of temperature setpoint with numerical temperature values
 - (g) Display of temperature setpoint graphically, with a visual Hotter/Colder setpoint indication
 - (h) Calibration: Single point, field adjustable at the space sensor to +/- 5°F
 - (i) Installation: Up to 100 ft. from controller
 - (j) Auxiliary Communications Port: included
 - (k) Local OLED Temperature Display: included
 - (l) Display of Temperature to one decimal place
 - (m) Temperature Setpoint Adjustment: included
 - (n) Occupancy Override Function: included
- 3 Auxiliary Communication Port. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. RS-232 communications port shall allow the operator to query and modify operating parameters of the local room terminal unit from the portable operator's terminal.
- d. Provide the following options as they are called for in the sequences or on the drawings:
- 1 Setpoint Adjustment. The setpoint adjustment function shall allow for modification of the temperature by the building operators. Setpoint adjustment may be locked out, overridden, or limited as to time or temperature through software by an authorized operator at any central workstation, Building Controller, room sensor two-line display, or via the portable operator's terminal.
 - 2 Override Switch. An override button shall initiate override of the night setback mode to normal (day) operation when activated by the occupant and enabled by building operators. The override shall be limited to two (2) hours (adjustable.) The override function may be locked out, overridden, or limited through software by an authorized operator at the operator interface, Building Controller, room sensor two-line display or via the portable operator's terminal.
 - 3 Space Combination Temperature and Humidity Sensors. Each controller performing space temperature control shall be provided with a matching room temperature sensor, which also includes the ability to measure humidity for either monitoring or control purposes. The combination temperature and humidity sensors shall have the same appearance as the space temperature sensors. Humidity elements shall measure relative humidity with a +/- 2% accuracy over the range of 10 to 90% relative humidity. Humidity element shall be an IC (integrated circuit) sensing element. Humidity sensing elements shall be removable and field replaceable if needed.

C. Temperature Sensors

- 1. All temperature sensors shall meet the following specifications:
 - a. Accuracy: Plus or minus 0.2 percent at calibration point.

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- b. Wire: Twisted, shielded-pair cable.
 - c. Vibration and corrosion resistant
 - d. Space temperature sensors shall meet the following specifications:
 - 1 10k ohm type 2 thermistors
 - e. Insertion Elements in Ducts shall meet the following specifications:
 - 1 Single point 10k ohm thermistor
 - 2 Use where not affected by temperature stratification
 - 3 The sensor shall reach more that 1/3 the distance from the duct wall
 - 4 Junction box for wire splices
 - f. Averaging Elements in Ducts shall meet the following specifications:
 - 1 72 inches (183 cm) long
 - 2 Flexible
 - 3 Use where prone to temperature stratification, in front of coils, or where ducts are larger than 9 sq. ft.
 - 4 Junction box for wire splices
 - g. Insertion Elements for Liquids shall meet the following specifications:
 - 1 Platinum RTD with 4-20mA transmitter
 - 2 Threaded mounting with matching well
 - 3 Brass well with minimum insertion length of 2-1/2 inches for pipes up to 4" diameter
 - 4 Brass well with insertion length of 6 inches for pipes up to 10" diameter
 - 5 Junction box for wire splices
 - h. Outside-Air Sensors Platinum RTD with 4-20mA transmitter:
 - 1 Watertight enclosure, shielded from direct sunlight
 - 2 Circulation fan
 - 3 Watertight conduit fitting
- D. Where called for in the sequences of operations, provide the following feature on space sensors and thermostats:
- 1. Security Sensors: Stainless-steel cover plate with insulated back and security screws
 - 2. Space sensors with setpoint adjust: Plain white plastic cover with slide potentiometer to signal a setpoint adjustment to the DDC
 - 3. Space Sensors with LCD display:
 - a. Operator buttons for adjusting setpoints, setting fans speeds and overriding unit to on/off
-

- b. Graphical LCD icons for signaling heating/cooling mode, fans speed, schedule mode, actual temperature and current setpoint
- E. Humidity Sensors shall meet the following specifications:
 - 1. Bulk polymer sensor element
 - 2. Accuracy: 2 percent full range with linear output
 - 3. Room Sensors: With locking cover matching room thermostats, span of 0 to 100 percent relative humidity
 - 4. Duct and Outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity
- F. Air Static Pressure Transmitter shall meet the following specifications:
 - 1. Non-directional sensor with suitable range for expected input, and temperature compensated.
 - 2. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
 - 3. Output: 4 to 20 mA.
 - 4. Building Static-Pressure Range: 0 to 0.25 inches wg.
 - 5. Duct Static-Pressure Range: 0 to 5 inches wg.
- G. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.
- H. Equipment operation sensors as follows:
 - 1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 inches wg.
 - 2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 60 psig.
 - 3. Status Inputs for direct drive electric motors: Current-sensing relay with current transformers, adjustable and sized for 175 percent of rated motor current.
 - 4. Status inputs for belt drive electric motors: Current sensing transmitter with linear 4-20mA output
- I. Electronic Valve/Damper Position indication: Visual scale indicating percent of travel and 0 to 10 V dc, feedback signal.
- J. Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless-steel or bronze paddle. For chilled-water applications, provide vapor proof type.
- K. Air Differential Pressure Switches: Diaphragm type air differential pressure switches with die cast aluminum housing, adjustable setpoint, minimum 5 amp switch rating at 120VAC, SPDT switches, and the switch pressure range shall be suited for the application. Provide Dwyer or equal. These switches shall be utilized for filter status.
- L. Leak detectors: Provide spot leak detectors that can be secured to the floor or secured to a drain pan. The detection shall used a microchip controlled energized probes. The detector shall operate on 24V or less. Provide a way to adjust the height of the leak probes. The SPDT contacts shall be inside a watertight enclosure.

2.8 AUTOMATIC CONTROL VALVES

- A. General:

1. All automatic control valves shall be fully proportioning, unless specified otherwise. The valves shall be quiet in operation and fail-safe in either normally open or normally closed position in the event of control air failure. All valves shall be capable of operating at varying rates of speed to correspond to the exact dictates of the controllers and variable load requirements. The valves shall be capable of operating in sequence with other valves and/or dampers when required by the sequence of operation. All control valves shall be sized by the control vendor and shall be guaranteed to accommodate the flow rates as scheduled. All control valves shall be suitable for the pressure conditions and shall close against the differential pressures involved. Body pressure rating and connection type construction shall conform to fitting and valve schedules. Control valve operators shall be sized to close against a differential pressure equal to the design pump heads plus 10 percent.
 2. Cold water, hot water and steam valves, throttling type, and bypass valves shall have equal percentage flow characteristics.
 3. Unless otherwise specified, control valves 2 inches and smaller shall have cast iron or bronze bodies with screwed NPT connections.
 4. Valves between 2-1/2 inch and 4 inch shall have cast iron bodies with flanged connections.
 5. All automatic control valves installed exposed to the elements shall be provided with electric actuators with operating characteristics and accessories as described in herein. Coordinate with electrical contractor for power availability and point of connection.
 6. All automatic control valves controlled by the BAS shall be furnished by the controls contractor unless noted otherwise in these documents.
 7. All automatic control valves shall be installed by the mechanical trade.
 8. The controls contractor shall provide wiring as follows:
 - a. All line voltage power for electric valve actuators shall be wired by the controls contractor from the nearest available power panel. Coordinate with electrical trade.
 - b. All wiring between the central control system (ATC/BMS) and the valve actuator shall be wired by the controls contractor.
 - c. All wiring between the valve actuator and their associated thermostats, pressure switches, control devices, etc. shall be wired by the controls contractor.
 - d. All wiring shall comply with code requirements. Segregate high and low voltage wiring & circuits and segregate the FAS and controls (BMS) terminals.
- B. Threaded Valves, line size 1/2" to 2"
1. Controlled Media Specific Items
 - a. The control valve shall be suitable for chilled water to a minimum of 35°F (2°C) and hot water to a maximum temperature of 250°F (121°C). 3-way 1-1/2 inch and 2 inch valves shall be suitable for chilled water to a minimum of 35°F (2°C) and hot water to a maximum temperature of 230°F (110°C).
 - b. The control valve shall be suitable for up to 50% ethylene or propylene glycol solutions, chilled glycol/water solutions to a minimum of 35°F (2°C) and hot glycol/water solutions to a maximum temperature of 250°F (121°C). 3-way 1-1/2 inch and 2 inch valves shall be suitable for up to 50% ethylene or propylene glycol solutions, chilled glycol/water solutions to a minimum of 35°F (2°C) and hot glycol/water solutions to a maximum temperature of 230°F (110°C).
 - c. General Construction Materials/Applicable Standards

- 1 Control valve bodies shall be constructed of forged brass according to ASTM B283 (C37700, CuZn39Pb2 or equivalent), and shall meet requirements of ANSI 250 and 600WOG pressure classes.
- 2 Inlets and outlets shall be clearly marked on the valve bodies.
- 3 Valve ball shall consist of nickel-plated brass, chrome-plated brass or stainless steel.
- 4 End connections shall be NPT internally threaded according to ANSI B1.20.1.
- 5 The control valve flow rate (Cv) shall meet the requirements of ANSI/ISA S75.02.
- 6 The control valve shall have an equal percentage flow characteristic, according to ANSI/ISA S75.11. A single glass filled PTFE V port insert shall provide both the ball seal and shall establish the flow coefficient of the valve. The V port insert shall be retained by the valve body itself, not requiring additional retaining components. Flow coefficient adapters requiring a retainer clip, or installed after final assembly of the valve or as inserts in the ball shall not be allowed.
- 7 2-way valves and the A-AB path on 3-way valves shall meet the requirements of ANSI Class IV (0.01% of rated Cv) seat leakage, or better, according to ANSI/FCI 70.2, at the specified close-off pressure. Bypass path (B-AB) on 3-way valves shall meet the requirements of ANSI Class III (0.1% of rated Cv) seat leakage, or better, according to ANSI/FCI 70.2.
- 8 Chilled and Hot water valve shall have a blow-out proof stem with two EPDM (peroxide cured) O-rings. External stem retainers will not be allowed.
- 9 Valve stem shall be made of brass or stainless steel.
- 10 Valve shall have the ability to be manually operated in the event of a power failure.

C. Actuators - Electric

1. The valves shall be provided with an actuator by the same manufacturer, factory installed.
2. All actuators shall have visual position indication.
3. No external programming device shall be required.
4. Actuator shall be electric motor driving, microprocessor signal controlled.
5. Modulating valves shall be positive positioning, responding to a 0-10VDC, 2-10VDC or 4-20mA signal. Floating modulating signals are acceptable for modulation on terminal units and radiation units. There shall be a visual valve position indicator.
6. Power: All actuators shall be 24VAC power and less than 100VA draw. Power shall be via Class 2 wiring. Actuators requiring more than 100VA shall have a dedicated conduit for power wiring, not mixed with the signal wiring.
7. Fail Safe: Valves actuators shall position the valve in a fail-safe position when the power supply is disrupted or the signal goes to 0. Fail-safe according to the following guidelines unless otherwise stated in the sequence of operations
 - a. Power fail safe shall be via spring loaded mechanical means
 - b. Any AHU hot water exposed to ventilation air shall fail open
 - c. AHU Chilled water coils exposed to ventilation air in possible freezing conditions shall be fail open
 - d. AHU Chilled water coils that are drained in winter months or are in climate zones without freezing conditions shall be fail-in-place

- e. Terminal unit valves shall fail-in-place
 - f. Fail in Safe valves on primary equipment such as chilled water systems, hot water systems and condenser water systems shall have a means to manually open the valve when power is not available, such as a hand wheel or a geared crank with a clutch.
 - g. The actuator shall be designed with a current limiting motor protection. A release button (clutch) or handle on the actuator shall be provided to allow for manual override (except when actuator is spring return type).
 - h. Actuator shall provide minimum torque required for proper valve close-off. The close-off differential pressure rating of the valve shall exceed the highest possible head pressure available at the pump plus 10%, and still be rated for a Class IV leakage.
 - i. The actuator shall have the capability of adding auxiliary switches or feedback potentiometer if specified.
 - j. All automatic control valves installed in locations exposed to the elements shall be provided with weather resistant housings and heaters for climates that reach below freezing.
 - k. Actuators shall be UL and CSA listed.
- D. Hot Water / Condenser Water / Control Valves
- 1. Single-seated.
 - 2. Fully proportioning with modulating plug or V-port inner valves.
 - 3. Body pressure rating and connection type construction shall conform to fitting and valve schedules. The ANSI rating of the valve shall match the ANSI rating of the piping in which the valve is installed. Minimum ANSI rating shall be ANSI 125.
 - 4. Stainless steel stems and trim.
 - 5. Spring loaded Teflon packing
 - 6. Quiet in operation.
 - 7. Fail-safe in either normally open or normally closed position in the event of power failure.
 - 8. Capable of operating in sequence with other valves and/or dampers when required by the sequence of operation.
 - 9. Capable of operating at varying rates of speed to correspond to the exact dictates of the controller and variable load requirements.

2.9 ELECTRONIC ACTUATOR SPECIFICATION

A. ELECTRONIC VALVE ACTUATORS

- 1. Actuator shall be fully modulating, floating (tri-state), two position, and/or spring return as indicated in the control sequences. Specified fail safe actuators shall require mechanical spring return.
- 2. Modulating valves shall be positive positioning, responding to a 2-10VDC or 4-20mA signal. There shall be a visual valve position indicator.
- 3. The actuator shall have the capability of adding auxiliary switches or feedback potentiometer if specified.
- 4. Actuator shall provide minimum torque required for proper valve close-off. The actuator shall be designed with a current limiting motor protection. A release button (clutch) or handle on the actuator shall be provided to allow for manual override (except when actuator is spring return type).

5. Actuators shall be UL listed.

B. ELECTRONIC DAMPER ACTUATORS

1. Actuator shall be direct coupled (over the shaft), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator-to-shaft clamp shall use a "V" bolt and "V" shaped, toothed cradle to attach to the damper shaft for maximum holding strength. Single bolt or set screw type fasteners are not acceptable.
2. Actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. End switches to deactivate the actuator at the end of rotation or magnetic clutch are not acceptable.
3. For power-failure/safety applications, a mechanical, spring return mechanism shall be used.
4. Actuators with spring return mechanisms shall be capable of either clockwise or counterclockwise spring return operation by simply changing the mounting orientation.
5. Proportional actuators shall accept a 2-10VDC, 4-20mA signal, or be of the 2 point floating type and provide a 2-10VDC actuator position feedback signal.
6. All actuators shall have an external manual gear release (clutch) or manual crank to aid in installation and for allowing manual positioning when the actuator is not powered.
7. All actuators shall have an external direction of rotation switch to aid in installation and to allow proper control response.
8. Actuators shall be provided with a factory-mounted 3-foot electrical cable and conduit fitting to provide easy hook-up to an electrical junction box.
9. Actuators shall be listed under Underwriters Laboratories Standard 873 and Canadian Standards Association. They must be manufactured under ISO 9001.

PART 3 EXECUTION

3.1 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.
- 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 and the plans and the 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.

3.2 INSTALLATION

- A. Provide all relays, switches, and all other auxiliaries, accessories and connections necessary to make a complete operable system in accordance with the sequences specified. All field wiring shall be by this contractor.
- B. Install controls so that adjustments and calibrations can be readily made. Controls are to be installed by the control equipment manufacturer.
- C. Mount surface-mounted control devices on brackets to clear the final finished surface on insulation.

- D. Install equipment level and plumb.
- E. Install control valves horizontally with the power unit up.
- F. Unless otherwise noted, install wall mounted thermostats and humidistat 60" above the floor measured to the center line of the instrument, or as otherwise directed by the Architect.
- G. Install averaging elements in ducts and plenums in horizontal crossing or zigzag pattern.
- H. Install outdoor sensors in perforated tube and sunshield.
- I. Install damper motors on outside of duct in protected areas, not in locations exposed to outdoor temperatures.
- J. Install labels and nameplates on each control panel listing the name of the panel referenced in the graphics and a list of equipment numbers served by that panel.
- K. Furnish hydronic instrument wells, valves, and other accessories to the mechanical contractor for installation.
- L. Furnish automatic dampers to mechanical contractor for installation.

3.3 ELECTRICAL WIRING SCOPE

- A. This contractor shall be responsible for power that is not shown on the electrical drawings, to controls furnished by this contractor. If power circuits are shown on the electrical drawings, this contractor shall continue the power run to the control device. If power circuits are not shown, this contractor shall coordinate with the electrical contractor to provide breakers at distribution panels for power to controls. This contractor is then responsible for power from the distribution panel.
 - 1. Coordinate panel locations. If enclosures for panels are shown on the electrical drawings, furnish the enclosures according to the electrician's installation schedule.
- B. This contractor shall not be responsible for power to control panels and control devices that are furnished by others, unless it is part of the control interlock wiring.
- C. Refer to Coordination section for what devices this contractor is responsible to mount and which are turned over to others to mount.
- D. This contractor shall be responsible for wiring of any control device that is furnished as part of this section of specification.
- E. Interlock wiring shall be run in separate conduits from BAS associated wiring.
- F. Provide network wiring for equipment that is called to be integrated to the BAS.

3.4 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. All low voltage control wiring shall be class 2. Control wiring that is not class 2 shall be run in separate conduits from class 2 wiring.
- B. Floor level network wiring between terminal units can be combined with thermostat and other low voltage wiring in the same conduit. All other network wiring shall be in dedicated conduits.
- C. Install raceways, boxes, and cabinets according to Division 26 Section "Raceways and Boxes."
- D. Install building wire and cable according to Division 26 Section "Conductors and Cables."
- E. Installation shall meet the following requirements:
 - 1. Conceal cable and conduit, except in mechanical rooms and areas where other conduit and piping are exposed.

2. Install exposed cable in raceway or conduit.
 3. Install concealed cable using plenum rated cable.
 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 7. All wiring in lab areas shall be in conduit.
 8. All unsupported risers shall be rigid steel conduit. Supported risers shall be EMT.
- F. Rigid conduit shall be steel, hot dip galvanized, threaded with couplings, ¾ inch minimum size, manufactured in accordance with ANSI C-80-1. Electrical metallic tubing (EMT) with compression fittings or intermediate metallic conduit (IMC) may be used as conduit or raceway where permitted by the NEC.
- G. Concealed control conduit and wiring shall be provided in all spaces except in the Mechanical Equipment Rooms and in unfinished spaces. Install in parallel banks with all changes in directions made at 90 degree angles.
- H. Install conduit adjacent to machine to allow service and maintenance.
- I. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- J. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.
- K. Ground equipment.

3.5 COMMUNICATION WIRING

- A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- B. Do not install communication wiring in raceway and enclosures containing Class 1 wiring.
- C. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- D. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
- E. Cable bundling:
1. RS485 cabling run open air in accessible areas can be bundled with other class 2 low voltage cabling.
 2. RS485 cabling run between terminal units in conduits above ceilings or under floors or in inaccessible areas can be bundled with other class 2 low voltage cabling.
 3. RS485 cabling run between floors shall be in a communication only conduit.
 4. RS485 conduit run long distances between utility rooms or between buildings shall be in a communication only conduit.
 5. Ethernet cabling shall be in a communication only conduit.

6. Ethernet and RS485 can be run together.
7. Fiber optics can be run with Ethernet and RS485 cabling as long as the conduit is bent to fiber optic standards and junction boxes are sized for fiber optic use.

F. RS485 Cabling

1. RS485 cabling shall be used for BACnet MS/TP networks.
2. RS485 shall use low capacitance, 20-24 gauge, twisted shielded pair.
3. The shields shall be tied together at each device.
4. The shield shall be grounded at one end only and capped at the other end.
5. Provide end of line (EOL) termination devices at each end of the RS485 network or subnetwork run, to match the impedance of the cable, 100 to 120ohm.

G. Ethernet Cabling

1. Ethernet shall not be run with any Class 1 or low voltage Class 2 wiring.
2. CAT6, unshielded twisted pair (UTP) cable shall be used for BAS Ethernet.
3. Solid wire shall be used for long runs, between mechanical rooms and between floors. Stranded cable can be used for patch cables and between panels in the same mechanical room up to 50 feet away.
4. When the BAS Ethernet connects to an Owner's network switch, document the port number on the BAS As-builts.

H. Fiber-Optic Cabling

1. 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.
 2. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.
 3. All terminations shall to be made into a patch panel, designed for such use. Free air terminations with patch panels are prohibited.
- I. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to the manufacturer's instructions.
- J. All runs of communication wiring shall be unspliced length when that length is commercially available.
- K. All communication wiring shall be labeled to indicate origination and destination data.
- L. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.6 IDENTIFICATION

- A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the DDC system.
1. Labels shall use white lettering (12-point type or larger) on a red background.

-
2. Warning labels shall read as follows: C A U T I O N This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.
- B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.
1. Labels shall use white lettering (12-point type or larger) on a red background.
 2. Warning labels shall read as follows: C A U T I O N This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.
- C. Control Equipment and Device labeling:
1. Labels and tags shall match the unique identifiers shown on the as-built drawings.
 2. All Enclosures shall be labeled to match the as-built drawing by either control panel name or the names of the DDC controllers inside.
 3. All sensors and actuators not in occupied areas shall be tagged.
 4. Airflow measurement arrays shall be tagged to show flow rate range for signal output range, duct size, and pitot tube AFMS flow coefficient.
 5. Duct static pressure taps shall be tagged at the location of the pressure tap.
 6. Each device inside enclosures shall be tagged.
 7. Terminal equipment need only have a tag for the unique terminal number, not for each device. Match the unique number on:
 - a. First, the design drawings, or
 - b. Second, the control as-builts, or
 - c. Third, the DDC addressing scheme
 - d. Tags on the terminal units shall be displayed on the Operator Workstation Graphics.
- D. Tags shall be mechanically printed on permanent adhesivebacked labeling strips, 12 point height minimum.
- E. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.
- F. Identification of Wires
1. Tag each wire with a common identifier on each end of the wire, such as in the control panel and at the device termination.
 2. Tag each network wire with a common identifier on each end.
 3. Tag each 120V power source with the panel and breaker number it is fed by.
- G. Identification of Conduits:
1. Identify the low voltage conduit runs as BAS conduit, power feeds not included.
 2. Identify each electric box, junction box, utility box and wiring tray with a blue paint mark or blue permanent adhesive sticker.
-

3. For conduit runs that run more than 8 ft between junction boxes in 1 room, place a blue identifier at least every 8 feet.
4. Place a blue identifier on each side of where a conduit passed through a wall or other inaccessible path.
5. Identify all BAS communication conduits the same as above.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
 3. Calibration test controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
- B. Replace damaged or malfunctioning controls and equipment.
 1. Start, test, and adjust control systems.
 2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
 3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

3.8 SYSTEM CHECKOUT AND STARTUP

- A. Inspect each termination in the MER control panels and devices to make sure all wires are connected according to the wiring diagrams and all termination are tight.
- B. After the controls devices and panels are installed and power is available to the controls, perform a static checkout of all the points, including the following:
 1. Inspect the setup and reading on each temperature sensor against a thermometer to verify its accuracy.
 2. Inspect the setup and reading on each humidity sensor against a hygrometer to verify its accuracy.
 3. Inspect the reading on each CO2 sensor using a calibration kit to verify the sensor range accuracy matches the DDC setup.
 4. Inspect the reading of each status switch to verify the DDC reads the open and close correctly.
 5. Command each relay to open and close to verify its operation.
 6. Command each 2-position damper actuator to open and close to verify operation.
 7. Command each 2-position valve to open and close to verify operation.
 8. Ramp each modulating actuator to 0%, 25%, 50%, 75% and 100% to verify its operation.
 9. Ramp each modulating output signal, such as a VFD speed, to verify its operation.
 10. Test each safety device with a real life simulation, for instance check low temperature detectors with ice water, water detectors with water, etc.

- C. Document that each point was verified and operating correctly. Correct each failed point before proceeding to the dynamic startup.
- D. Verify that each DDC controller communicates on its respective network correctly.
- E. After all of the points are verified, and power is available to the mechanical system, coordinate a startup of each system with the mechanical contractor. Include the following tests:
 - 1. Start systems from DDC.
 - 2. Verify that each setpoint can be met by the system.
 - 3. Change setpoints and verify system response.
 - 4. Change sensor readings to verify system response.
 - 5. Test safety shutdowns.
 - 6. Verify time delays.
 - 7. Verify mode changes.
 - 8. Adjust filter switches and current switches for proper reactions.
 - 9. Adjust proportional bands and integration times to stabilize control loops.
- F. Perform all program changes and debugging of the system for a fully operational system.
- G. Verify that all graphics at the operator workstations correspond to the systems as installed. Verify that the points on the screens appear and react properly. Verify that all adjustable setpoints and manual commands operate from the operator workstations.
- H. After the sequence of operation is verified, setup the trends that are listed in the sequence of operations for logging and archiving for the commissioning procedure.

3.9 SYSTEM COMMISSIONING, DEMONSTRATION AND TURNOVER

- A. The BAS Contractor shall prepare and submit for approval a complete acceptance test procedure including submittal data relevant to point index, functions, sequence, inter-locks, and associated parameters, and other pertinent information for the operating system. Prior to acceptance of the BAS by the Owner and Engineer, the BAS contractor shall completely test the BAS using the approved test procedure.
- B. After the BAS contractor has completed the tests and certified the BAS is 100% complete, the Engineer shall be requested, in writing, to approve the satisfactory operation of the system, sub-systems and accessories. The BAS contractor shall submit Maintenance and Operating manuals at this time for approval. An acceptance test in the presence of the Engineer and Owner's representative shall be performed. The Owner will then shake down the system for a fixed period of time (30 days).
- C. The BAS contractor shall fix punch list items within 30 days of acceptance.
- D. When the system performance is deemed satisfactory in whole or in part by these observers, the system parts will be accepted for beneficial use and placed under warranty.

3.10 TRAINING

- A. During System commissioning and at such time as acceptable performance of the Building Automation System hardware and software has been established, the BAS contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction during normal working hours shall be performed by a competent building automation contractor representative familiar with the Building Automation System's software, hardware and accessories.

- B. At a time mutually agreed upon, during System commissioning as stated above, the BAS contractor shall give 8 hours of onsite training on the operation of all BAS equipment. Describe its intended use with respect to the programmed functions specified. Operator orientation of the automation system shall include, but not be limited to:
1. Explanation of drawings and operator's maintenance manuals.
 2. Walk-through of the job to locate all control components.
 3. Operator workstation and peripherals.
 4. DDC Controller and ASC operation/sequence.
 5. Operator control functions including scheduling, alarming, and trending.
 6. Explanation of adjustment, calibration and replacement procedures.
- C. Additional 8-hours of training shall be given after the 30 day shakedown period.
- D. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If the Owner requires such training, it will be contracted at a later date. Provide description of available local and factory customer training. Provide costs associated with performing training at an off-site classroom facility and detail what is included in the manufacturer's standard pricing such as transportation, meals, etc.

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THE LINE SHOWN ABOVE IS EXACTLY AS DRAWING. IT IS NOT A CONSTRUCTION LINE. IT IS A CONSTRUCTION LINE.

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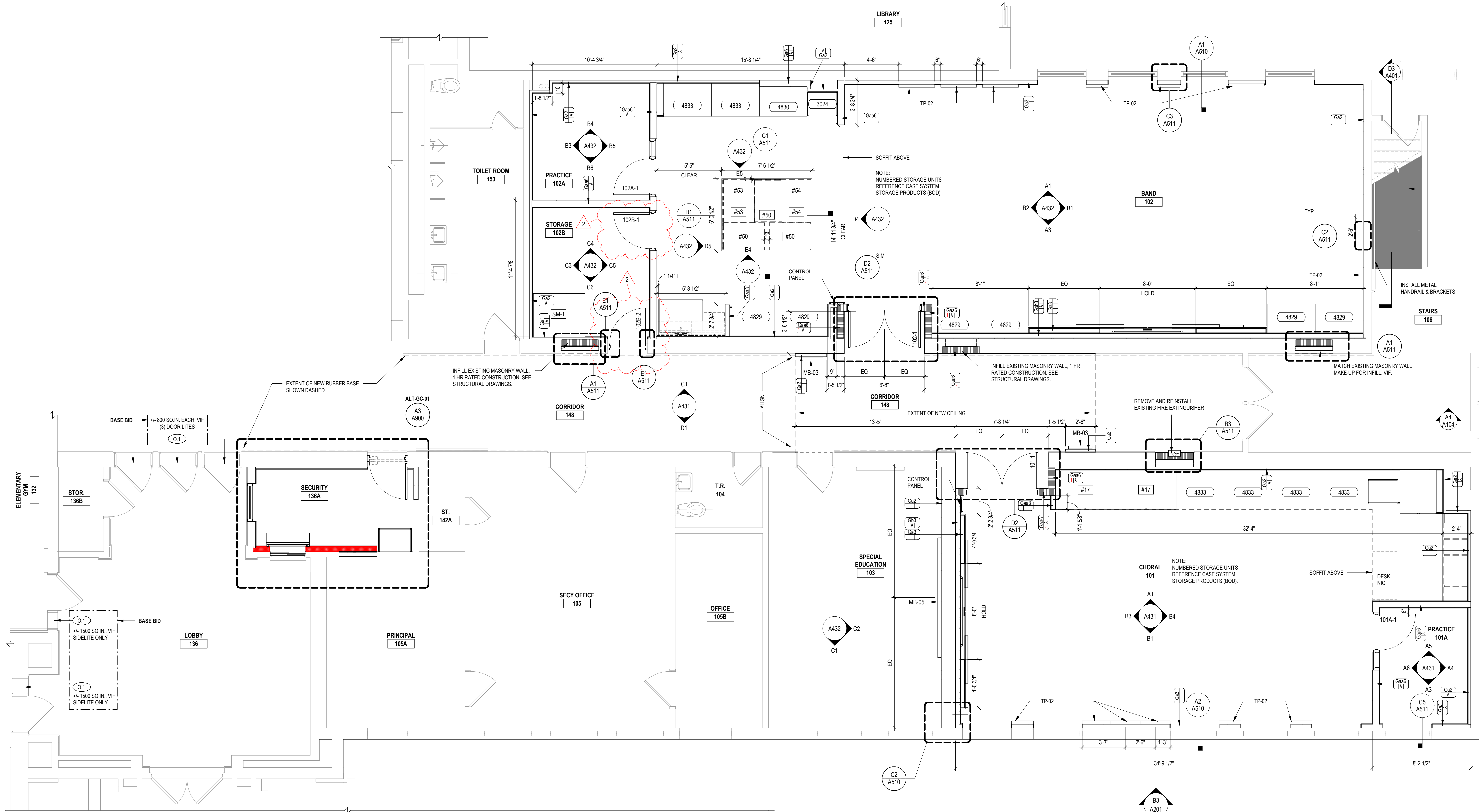
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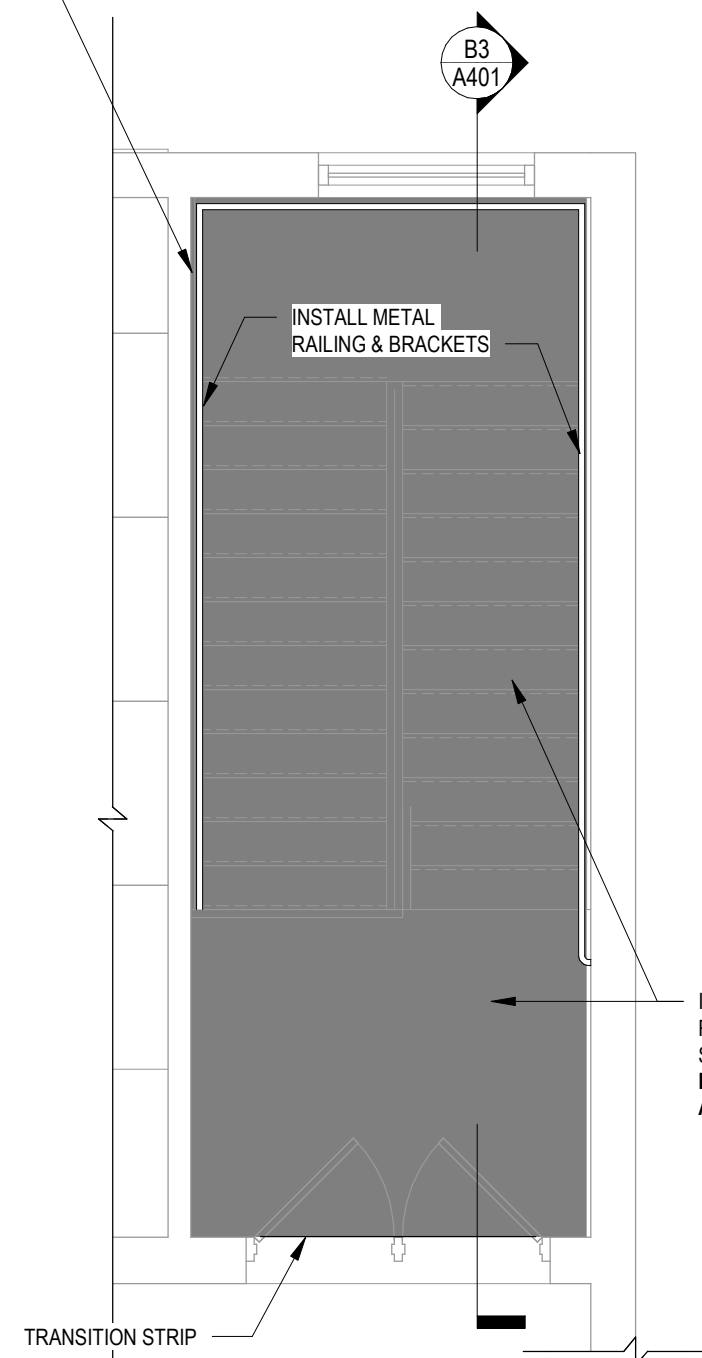
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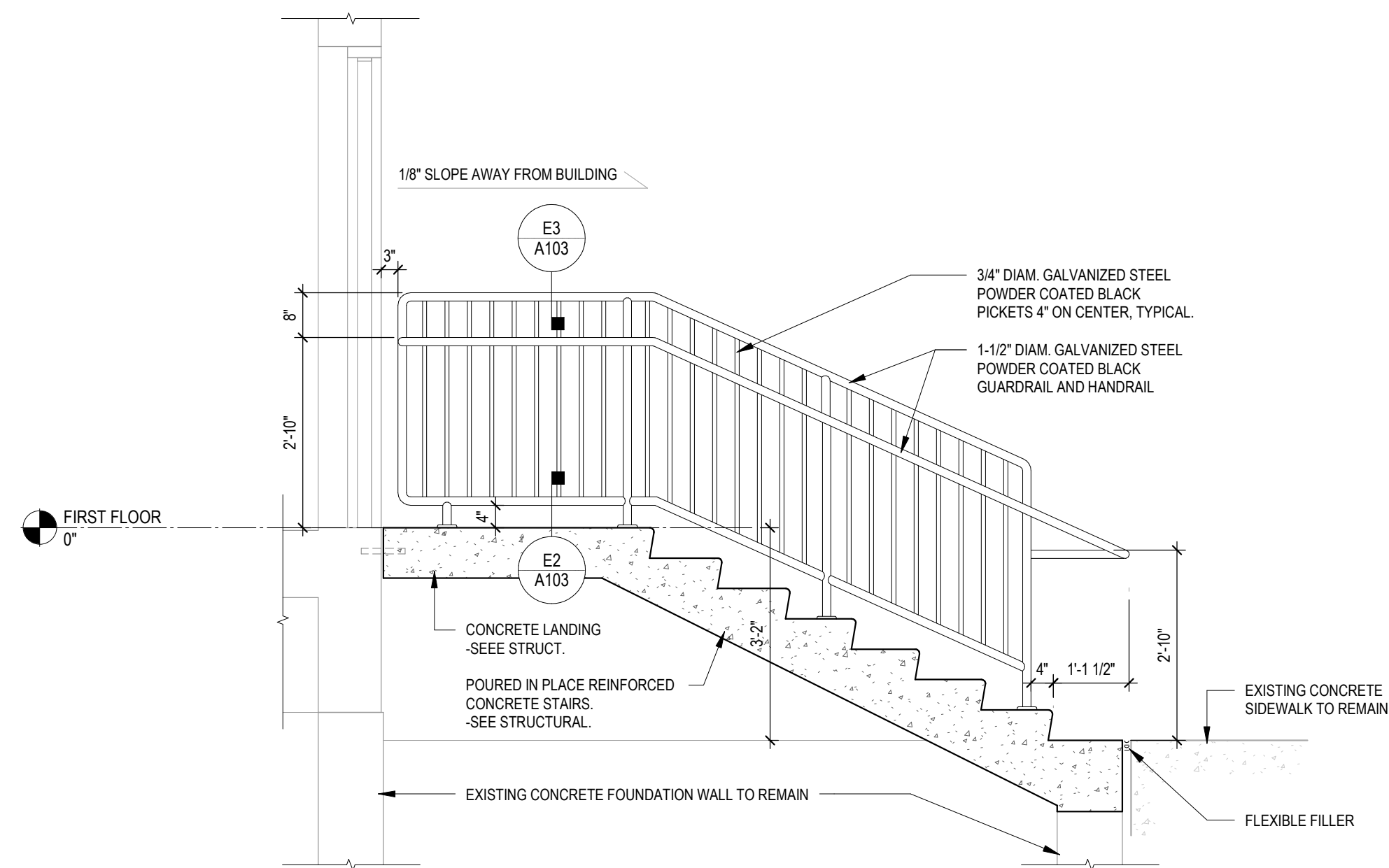


B1 ENLARGED PLAN - FIRST FLOOR - MUSIC SUITE AND LOBBY
1/4" = 1'-0"

PREP & PAINT METAL FRAME IN FULL COLOR TO MATCH NEW HM DOOR FRAMES. REMOVE, PROTECT AND REINSTALL GRILLES AS NECESSARY.



A3 ENLARGED PLAN - SECOND FLOOR - STAIRCASE 147
1/4" = 1'-0"



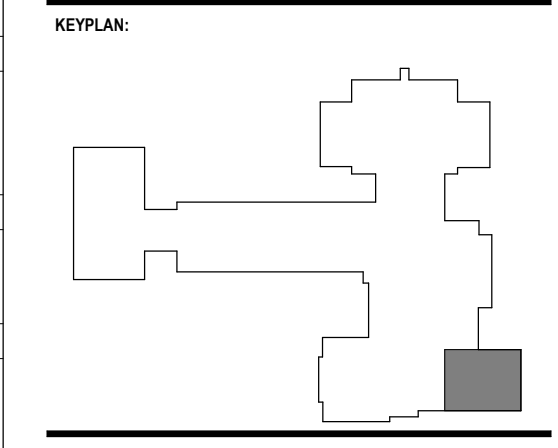
A4 SECTION - NORTH ENTRANCE EXTERIOR STAIRS
1/2" = 1'-0"

KEYED NOTES	
KEY VALUE	KEYNOTE TEXT
O 1	EXISTING GLAZING TO BE HARDENED WITH BREACH RESISTANT FILM. PREP AND CLEAN AS REQUIRED TO INSTALL. APPROXIMATE QUANTITIES ARE INDICATED. TO BE VERIFIED IN FIELD.

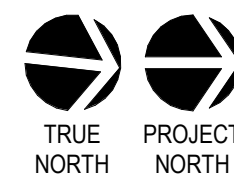
KEYED NOTES	
KEY VALUE	KEYNOTE TEXT
O 1	EXISTING GLAZING TO BE HARDENED WITH BREACH RESISTANT FILM. PREP AND CLEAN AS REQUIRED TO INSTALL. APPROXIMATE QUANTITIES ARE INDICATED. TO BE VERIFIED IN FIELD.

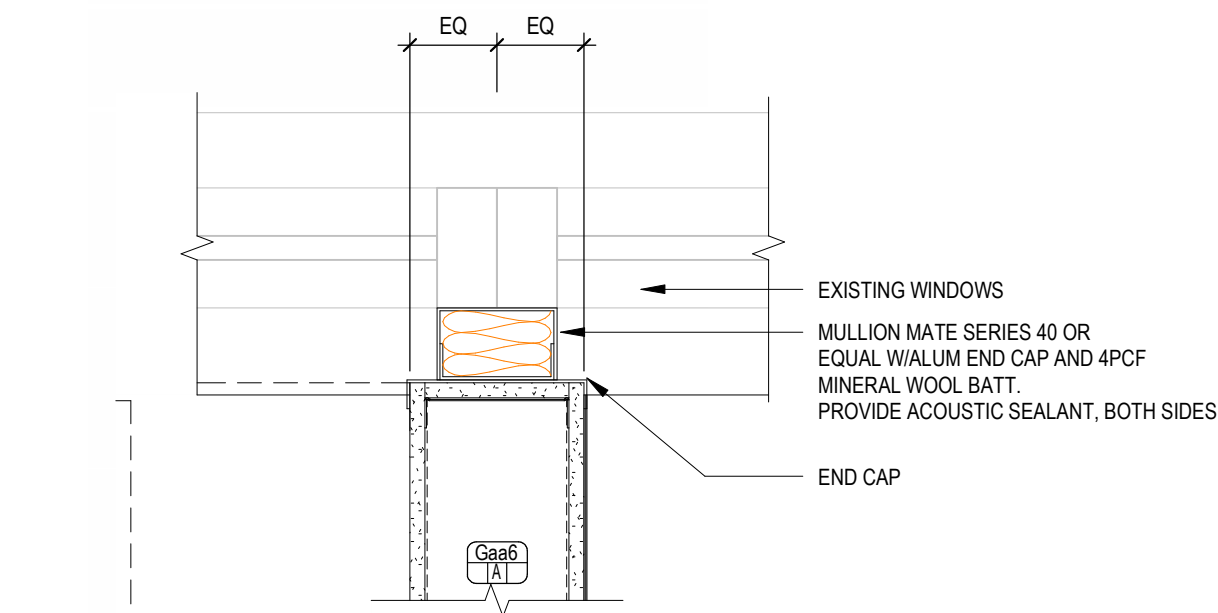
GENERAL DRAWINGS NOTES

A	GENERAL NOTES APPLY TO THE INTENDED WORK INCLUDED IN THE CONTRACT DOCUMENTS.
B	EXISTING CONDITIONS AND PERTINENT UTILITIES INDICATED ARE BASED ON FIELD OBSERVATIONS, SURVEYS, AND DOCUMENTATION OF PRIOR CONSTRUCTION, AS AVAILABLE. EXISTING DIMENSIONS INDICATED ARE APPROXIMATE AND SUBJECT TO CONTRACTOR'S VERIFICATION.
C	EXISTING CONDITIONS MAY VARY FROM THOSE INDICATED. NOTIFY THE ARCHITECT IN WRITING OF DISCREPANCIES BETWEEN EXISTING CONDITIONS AND THE CONTRACT DOCUMENTS BEFORE PROCEEDING WITH THE WORK.
D	SHOULD CONFLICTS EXIST WITHIN THE CONSTRUCTION DOCUMENTS, VERIFY INTENT WITH ARCHITECT PRIOR TO BIDDING. CLARIFICATIONS ISSUED AFTER BIDDING SHALL NOT BE BASIS FOR ADDITIONAL COMPENSATION.
E	WHERE SPECIFIC NOTES CONFLICT WITH GENERAL NOTES, THE SPECIFIC NOTES SHALL GOVERN.
F	WHERE NEWLY EXPOSED SURFACES ARE TO REMAIN EXPOSED IN THE COMPLETED WORK, CONTRACTORS SHALL PATCH SURFACES WITH IN-KIND MATERIAL TO LIKE-NEW CONDITION, SUBJECT TO ARCHITECT'S APPROVAL.
G	ITEMS INDICATED FOR REINSTALLATION SHALL INCLUDE TRIM, ACCESSORIES, MOUNTING HARDWARE, ETC., AS WELL AS IN-KIND PATCHING OF ADJACENT CONSTRUCTION DISTURBED DURING REMOVAL.
H	WHEN DURING THE COURSE OF THE WORK, EXISTING CONSTRUCTION INDICATED TO REMAIN IS DAMAGED, THE CONTRACTOR SHALL REPAIR OR REPLACE WITH IN-KIND MATERIAL TO LIKE-NEW CONDITION, AT NO EXPENSE TO THE OWNER, AND SUBJECT TO ARCHITECT'S APPROVAL.
I	CONTRACTORS SHALL BE RESPONSIBLE FOR CUTTING, PATCHING, AND TRIMMING REQUIRED TO INTEGRATE WORK WITH ADJACENT NEW WORK OR EXISTING CONDITIONS IN KEEPING WITH THE INTENDED INSTALLATION DETAILS, AND ASSOCIATED FUNCTIONAL REQUIREMENTS. SUCH AS OPERATIONAL CLEARANCES OR MAINTENANCE ACCESS FOR EQUIPMENT. VERIFY WITH ARCHITECT SUCH CONDITIONS AND PROPOSED ACCOMMODATIONS PRIOR TO INSTALLATION.
J	IN THE ABSENCE OF DIMENSIONS LAYOUT OF ITEMS SHALL BE CENTERED IN A SPACE, EVENLY SPACED, ALIGNED WITH ADJACENT CONSTRUCTION, OR OTHERWISE SET TO LOGICAL POINTS. WHERE ITEMS ARE INDICATED IN AN UNUSUAL OR ASYMMETRICAL MANNER VERIFY INTENT WITH ARCHITECT BEFORE PROCEEDING WITH WORK.
K	WHERE ADJACENT SURFACES APPEAR FLUSH TO ONE ANOTHER IT IS INTENDED THAT THE FACE OF THE FINISHES ARE ALIGNED UNLESS OTHERWISE INDICATED.
L	REMEDIATION OF UNSATISFACTORY WORK DUE TO FAILURE TO FOLLOW THESE AND OTHER GENERAL NOTES SHALL BE SUBJECT TO ARCHITECT'S APPROVAL, AND AT NO ADDITIONAL COST TO THE OWNER.

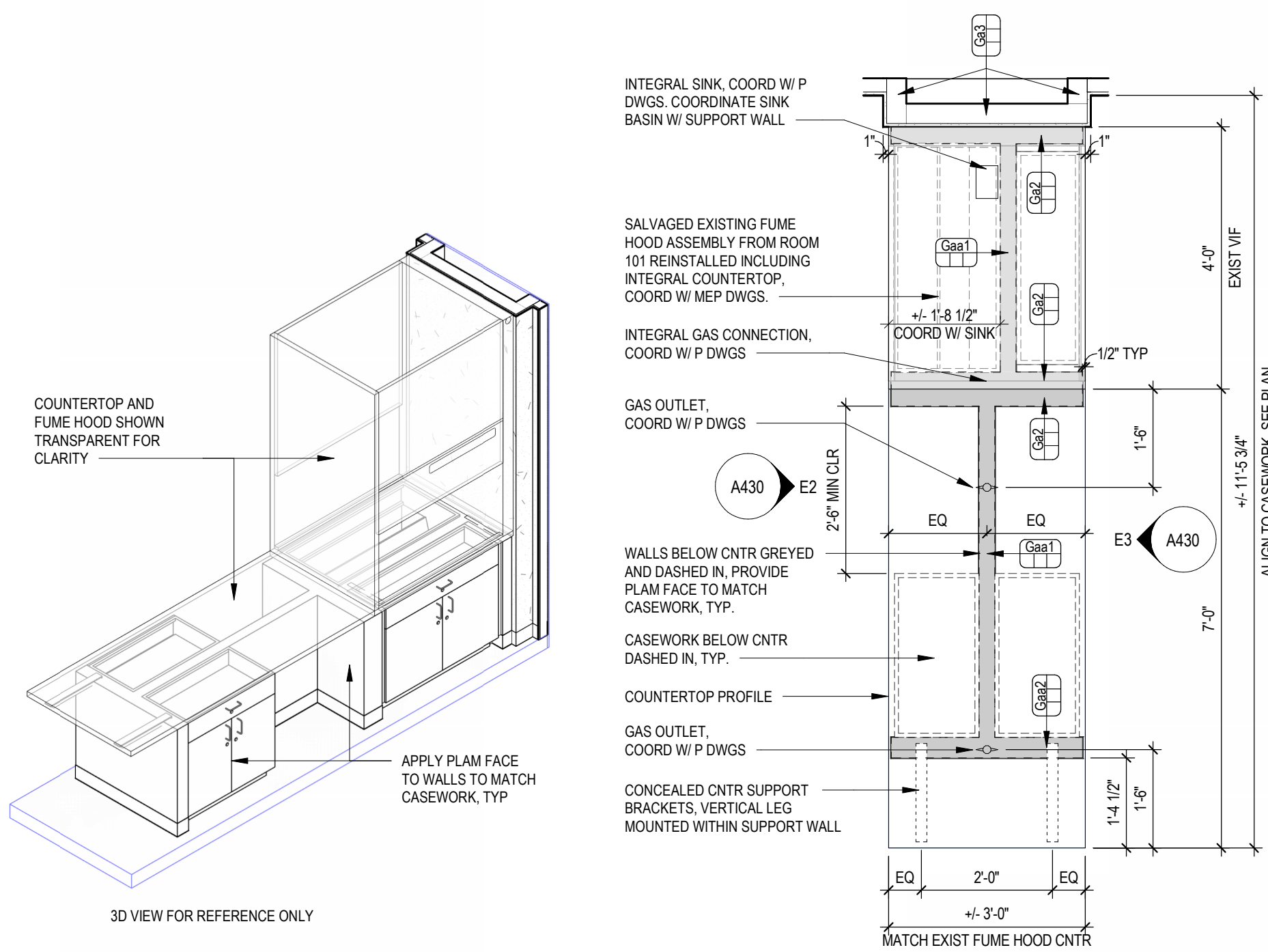


REV. NO.	REV. DATE	REV. DESCRIPTION
2	01/09/2025	ACCORDUM #2

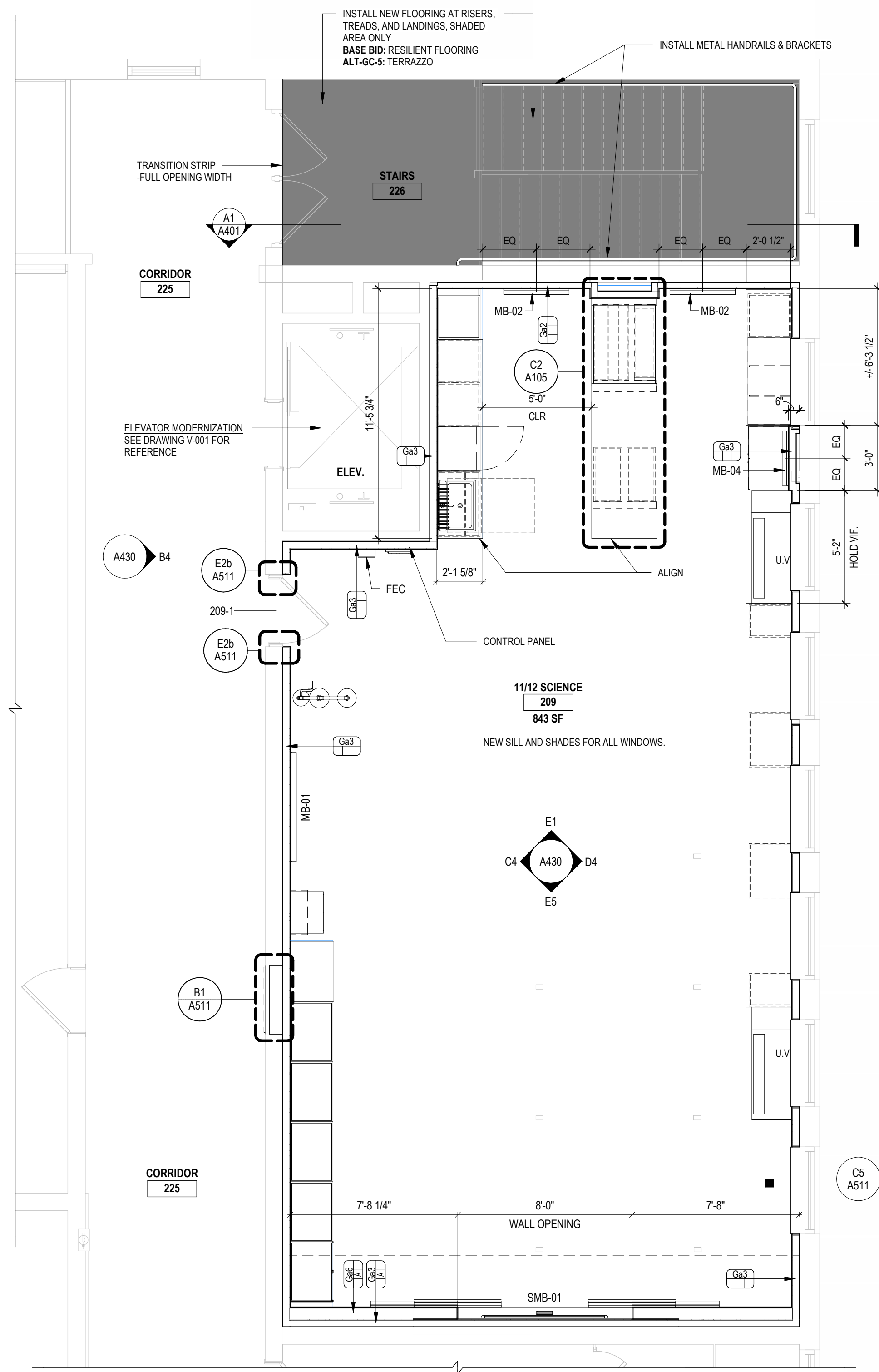




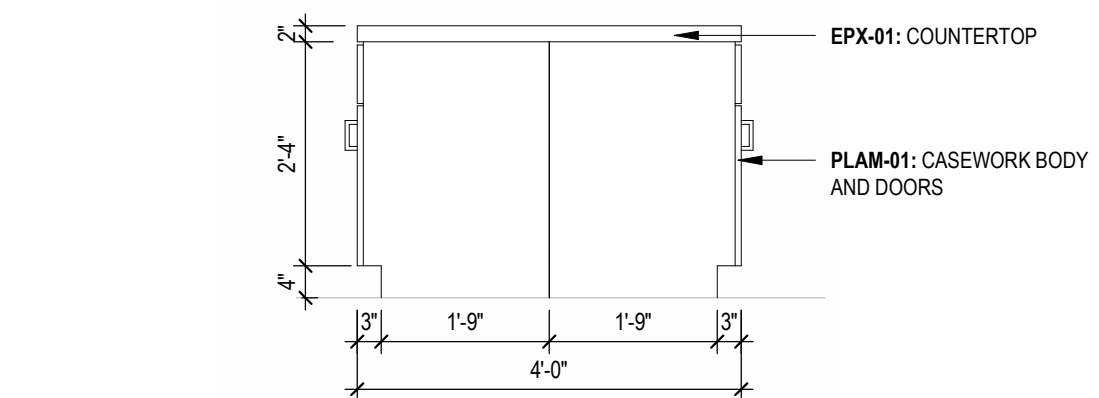
D2 DETAIL - SCIENCE ROOM 214 MULLION / WALL CONNECTION
1 1/2" = 1'-0"



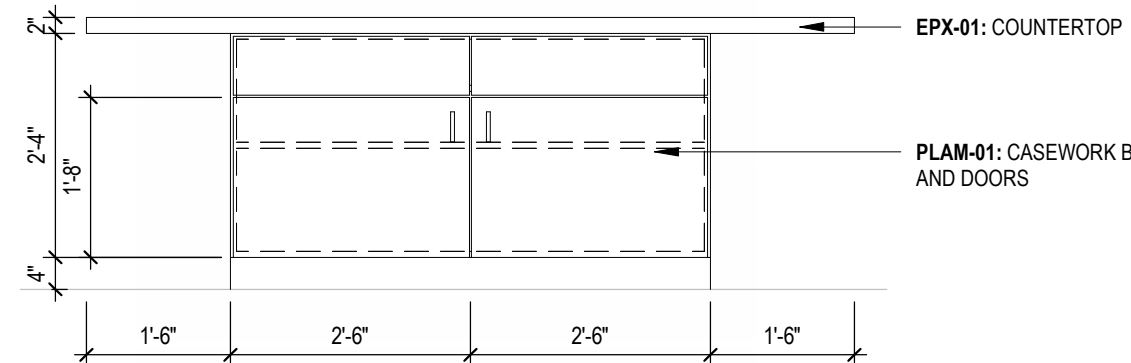
C2 ENLARGED PLAN - SCIENCE ROOM 209 DEMO TABLE
1/2" = 1'-0"



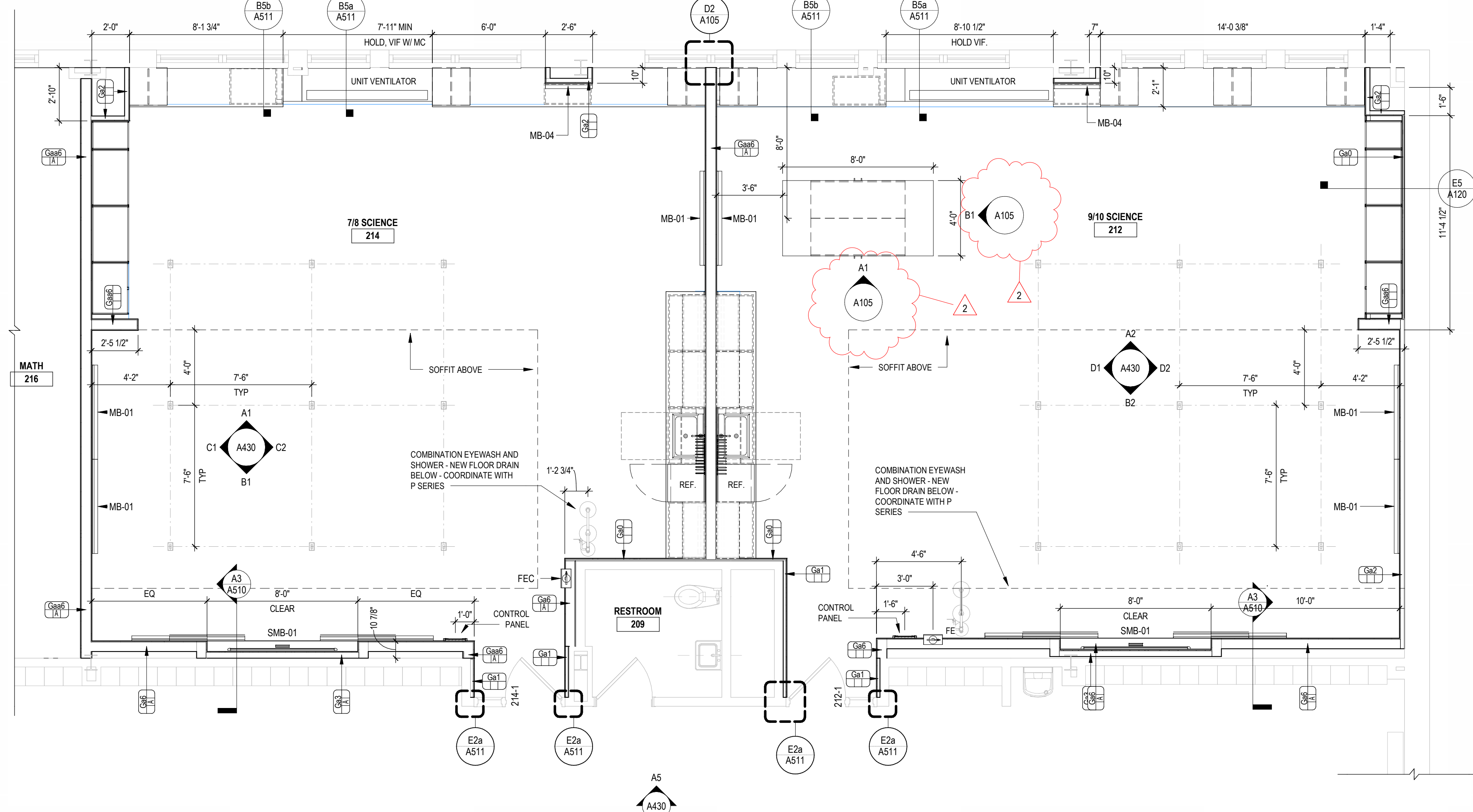
C4 ENLARGED PLAN - SECOND FLOOR - SCIENCE ROOM 209
1/4" = 1'-0"



B1 ELEVATION - DEMONSTRATION TABLE SCIENCE ROOM 212 SHORT SIDE
1/2" = 1'-0"



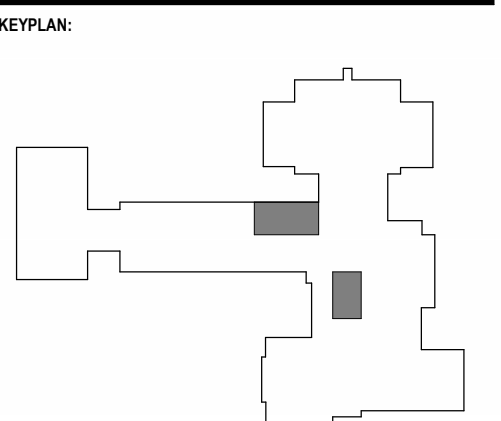
A1 ELEVATION - DEMONSTRATION TABLE SCIENCE ROOM 212 LONG SIDE
1/2" = 1'-0"



A2 ENLARGED PLANS - SECOND FLOOR - SCIENCE ROOMS 212, 214
1/4" = 1'-0"

GENERAL DRAWINGS NOTES

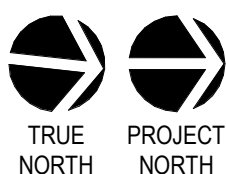
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- EXISTING CONDITIONS AND PERTINENT UTILITIES INDICATED ARE BASED ON FIELD OBSERVATIONS, SURVEYS, AND DOCUMENTATION OF PRIOR CONSTRUCTION, AS AVAILABLE. EXISTING DIMENSIONS INDICATED ARE APPROXIMATE AND SUBJECT TO CONTRACTOR'S VERIFICATION.
- EXISTING CONDITIONS MAY VARY FROM THOSE INDICATED. NOTIFY THE ARCHITECT IN WRITING OF DISCREPANCIES BETWEEN EXISTING CONDITIONS AND THE CONTRACT DOCUMENTS BEFORE PROCEEDING WITH THE WORK.
- SHOULD CONFLICTS EXIST WITHIN THE CONSTRUCTION DOCUMENTS, VERIFY INTENT WITH ARCHITECT PRIOR TO BIDDING. CLARIFICATIONS ISSUED AFTER BIDDING SHALL NOT BE BASIS FOR ADDITIONAL COMPENSATION.
- WHERE SPECIFIC NOTES CONFLICT WITH GENERAL NOTES, THE SPECIFIC NOTES SHALL GOVERN.
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- ITEMS INDICATED FOR REINSTALLATION SHALL INCLUDE TRIM, ACCESSORIES, MOUNTING HARDWARE, ETC., AS WELL AS IN-KIND PATCHING OF ADJACENT CONSTRUCTION DISTURBED DURING REMOVAL.
- WHEN DURING THE COURSE OF THE WORK, EXISTING CONSTRUCTION INDICATED TO REMAIN IS DAMAGED, THE CONTRACTOR SHALL REPAIR OR REPLACE WITH IN-KIND MATERIAL TO LIKE-NEW CONDITION, AT NO EXPENSE TO THE OWNER, AND SUBJECT TO ARCHITECT'S APPROVAL.
- CONTRACTORS SHALL BE RESPONSIBLE FOR CUTTING, PATCHING, AND TRIMMING REQUIRED TO INTEGRATE WORK WITH ADJACENT NEW WORK OR EXISTING CONDITIONS IN KEEPING WITH THE INTENDED INSTALLATION, DETAILS, AND ASSOCIATED FUNCTIONAL REQUIREMENTS, SUCH AS OPERATIONAL CLEARANCES OR MAINTENANCE ACCESS FOR EQUIPMENT. VERIFY WITH ARCHITECT SUCH CONDITIONS AND PROPOSED ACCOMMODATIONS PRIOR TO INSTALLATION.
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- WHERE ADJACENT SURFACES APPEAR FLUSH TO ONE ANOTHER IT IS INTENDED THAT THE FACE OF THE FINISHES ARE ALIGNED UNLESS OTHERWISE INDICATED.
- REMEDICATION OF UNSATISFACTORY WORK DUE TO FAILURE TO FOLLOW THESE AND OTHER GENERAL NOTES SHALL BE SUBJECT TO ARCHITECT'S APPROVAL, AND AT NO ADDITIONAL COST TO THE OWNER.



JOB NO. 23062		
REV. NO.	REV. DATE	REV. DESCRIPTION
1	01/09/2025	ACCELOM R2

PROJECT STATUS:	BID
DATE ISSUED:	09/17/2026

ENLARGED PLANS - SCIENCE



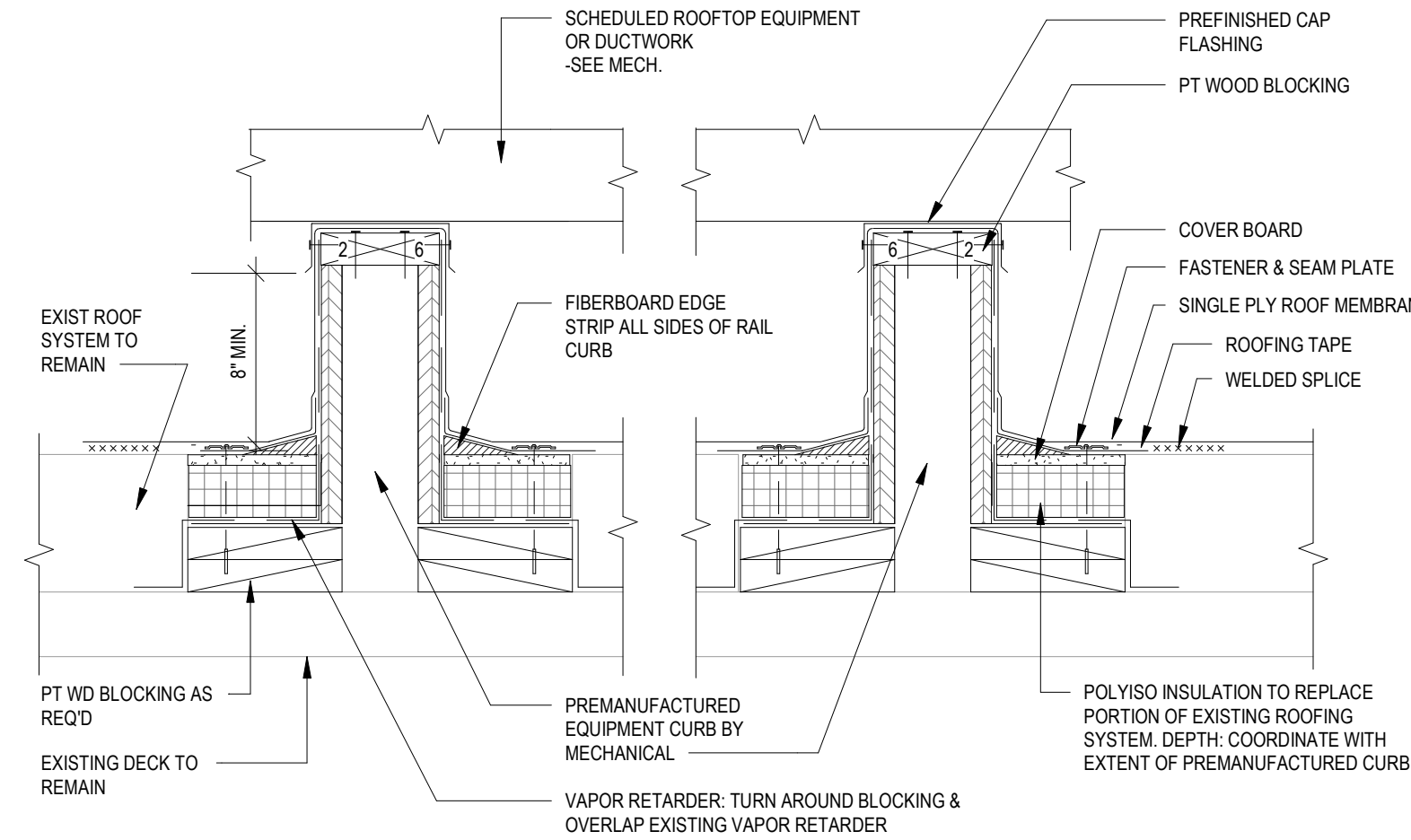
THESE DOCUMENTS WERE PREPARED UNDER THE DIRECT SUPERVISION OF A LICENSED PROFESSIONAL ARCHITECT. THE DOCUMENTS AND ALL THE DETAILS, SPECIFICATIONS, AND NOTES ARE THE PROPERTY OF ASHLEY MCGRAW ARCHITECTS, P.C. IT IS A VIOLATION OF THE PROFESSIONAL SEAL OF A LICENSED ARCHITECT OR ENGINEER TO REPRODUCE OR TRANSMIT THESE DOCUMENTS IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF ASHLEY MCGRAW ARCHITECTS, P.C.

THE LINE SHOWN ABOVE IS EXACTLY AS SHOWN IN THE ORIGINAL DRAWING. IT IS NOT TO BE INTERPRETED AS A MEASUREMENT.

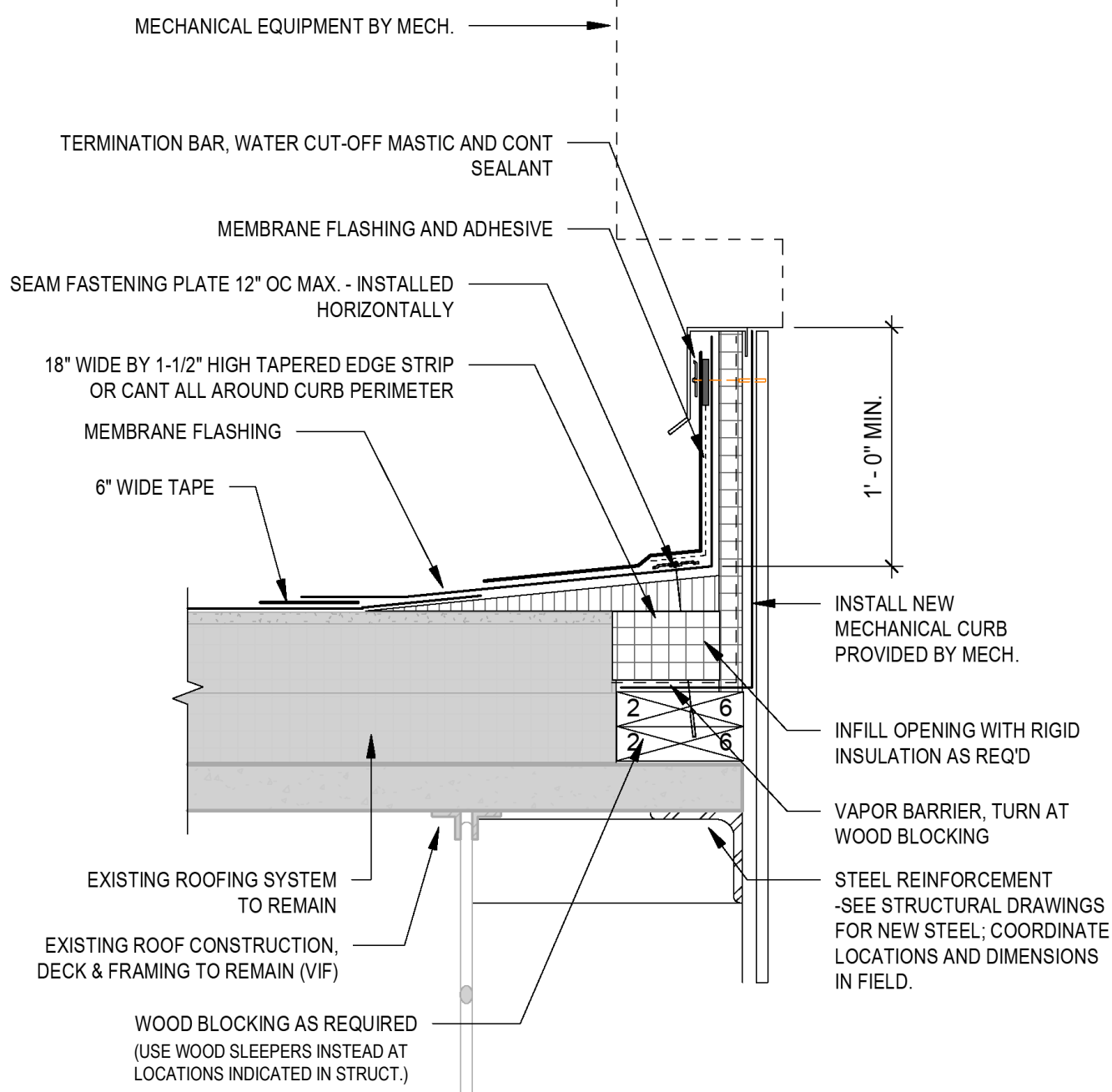
THE DIMENSIONS ABOVE ARE GIVEN IN FEET AND INCHES. DIMENSIONS IN PARENTHESIS ARE GIVEN IN METERS. DIMENSIONS IN PARENTHESIS ARE GIVEN IN METERS.

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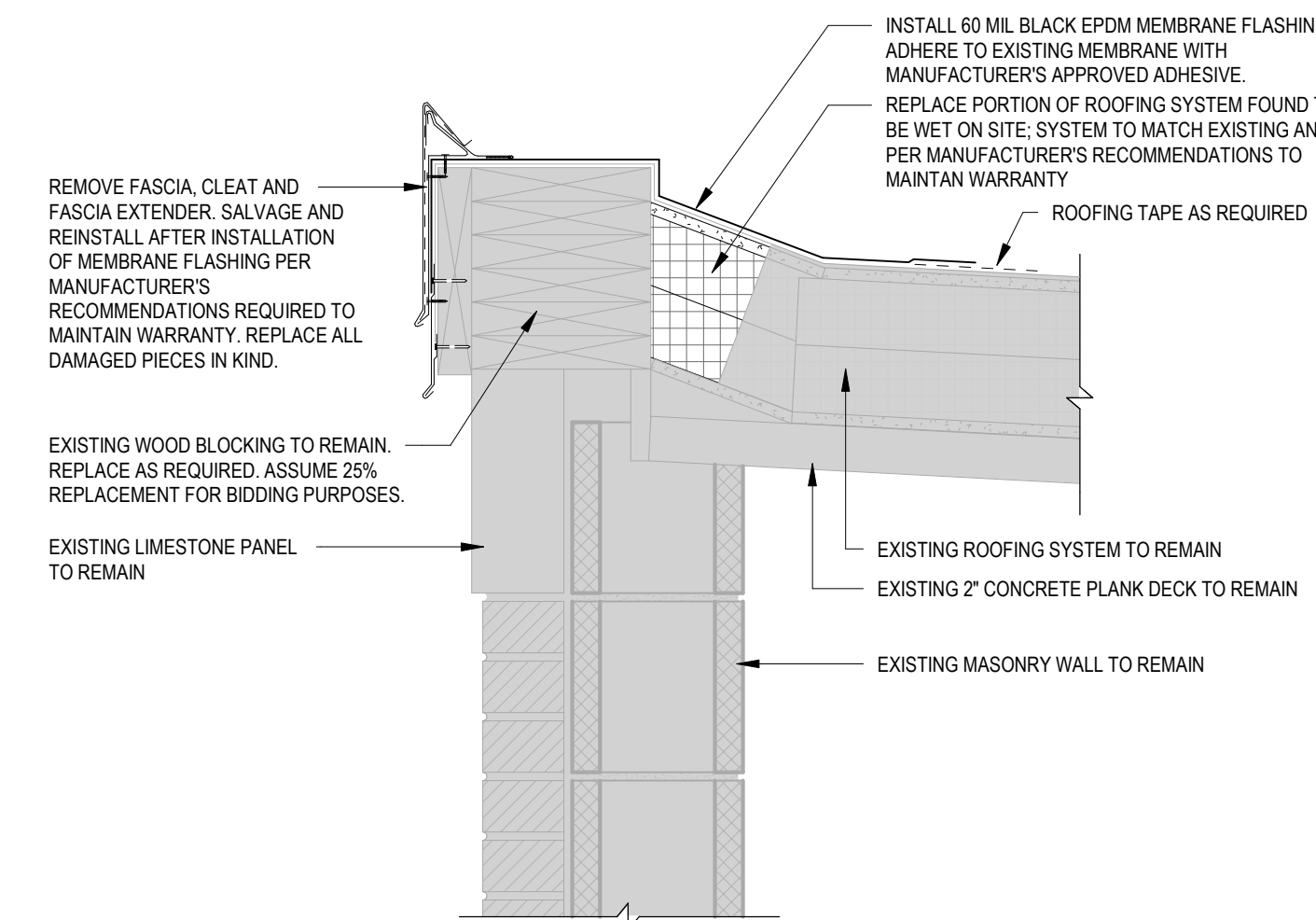
Asst:Doc:Deruyter CSD Capital Project2025:Deruyter ABG Central R25.rvt



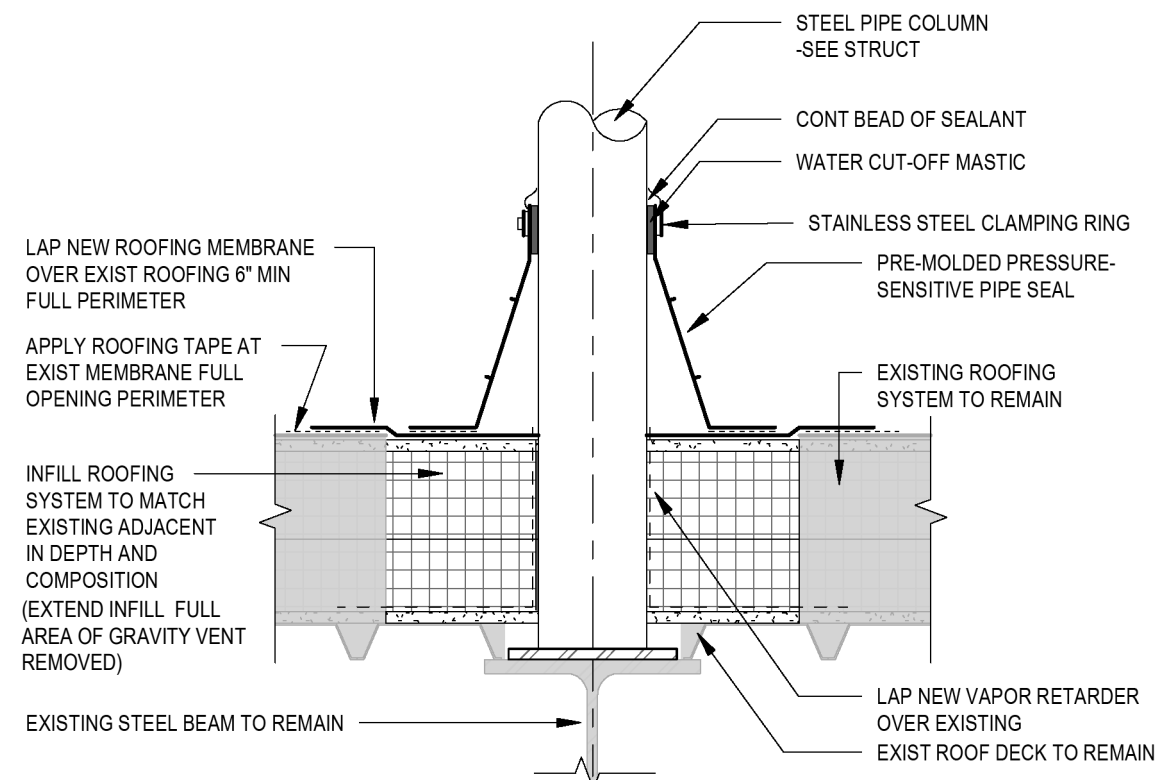
E4 DETAIL - MECHANICAL EQUIPMENT RAIL (TYP)
1 1/2" = 1'-0"



D5 SECTION DETAIL - MECH CURB @ EXISTING ROOFING
1 1/2" = 1'-0"



C5 SECTION DETAIL - ROOF EDGE LEAK MITIGATION
1 1/2" = 1'-0"



B5 SECTION DETAIL - STEEL DUNNAGE COLUMN @ EXISTING ROOFING
1 1/2" = 1'-0"

KEYED NOTES

KEY VALUE	KEYNOTE TEXT
R.1	INSTALL ROOF FLASHING AS REQUIRED TO MITIGATE LEAKS. SHADED AREA. REPLACE WE/DAMAGED ELEMENTS OF ROOFING SYSTEM. REMOVE, SALVAGE REINSTALL ROOF EDGE/FASCIA PER DETAIL E5/A130.
R.2	CUT AND REMOVE PORTION OF ROOFING SYSTEM AND ROOF DECK, AS REQUIRED TO INSTALL ROOF CURB AND DUCT/PIPE PENETRATION. COORDINATE EXTENT WITH MECH. INSTALL PERIMETER STRUCTURAL REINFORCEMENT AROUND NEW OPENING (COORDINATE WITH STRUCT). INSTALL MECHANICAL CURB PROVIDED BY MECHANICAL AND FLASH ALL AROUND PER DETAIL D5/A130. COORDINATE ALL DIMENSIONS AND LOCATION IN FIELD WITH MECHANICAL & STRUCTURAL.
R.3	INSTALL STEEL PIPE COLUMN AT EXISTING STEEL BEAM AND ATTACH PER STRUCTURAL GC TO CORE DRILL ROOFING SYSTEM AND DECK AS REQUIRED, AND FLASH PER DETAIL E5/A130. COORDINATE ALL LOCATIONS AND DIMENSIONS IN FIELD AND PER STRUCT & MECH.
R.4	APPROXIMATE LOCATION OF EXISTING GRAVITY VENT TO BE REMOVED BY OTHER PRIME CONTRACTOR(S). VERIFY LOCATION AND EXTENT IN FIELD. REMOVE CURBS AND RELATED FLASHING. INFILL RESULTING OPENING WITH ROOFING SYSTEM SIMILAR IN DEPTH AND KIND TO EXISTING ADJACENT AND AS REQUIRED TO MAINTAIN EXISTING WARRANTIES (COORDINATE WITH ROOFING SYSTEM MANUFACTURER). SEE STRUCTURAL DRAWINGS FOR ANY REINFORCEMENT AND DECK INFILL AS REQUIRED FOR NEW ROOF SYSTEM INFILL.
R.5	APPROXIMATE LOCATION OF EXISTING EXHAUST FAN TO BE REMOVED BY OTHER PRIME CONTRACTOR(S). VERIFY LOCATION AND EXTENT IN FIELD. REMOVE CURBS AND RELATED FLASHING. INFILL RESULTING OPENING WITH ROOFING SYSTEM SIMILAR IN DEPTH AND KIND TO EXISTING ADJACENT AND AS REQUIRED TO MAINTAIN EXISTING WARRANTIES (COORDINATE WITH ROOFING SYSTEM MANUFACTURER). SEE STRUCTURAL DRAWINGS FOR ANY REINFORCEMENT AND DECK INFILL AS REQUIRED FOR NEW ROOF SYSTEM INFILL.

A1 ROOF PLAN - OVERALL
1/16" = 1'-0"

2

E4

1 1/2" = 1'-0"

D5

1 1/2" = 1'-0"

C5

1 1/2" = 1'-0"

B5

1 1/2" = 1'-0"

2

R.2

12'-0"

(MIN)

DUNNAGE ABOVE

SEE STRUCT

R.3

R.4

R.5

ALT-GC-2

RTU ABOVE

SEE MECH

D5

A130

R.2

D5

A130

R.2

E4

A130

R.2

E4

A130

R.2

D5

A130

R.2

E4

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A130

1. LIGHT FIXTURES, AIR TERMINALS, GRILLES, ELECTRICAL FIXTURES, OUTLETS, DATA RECEPTACLES, AUDIO/VIDEO CONNECTIONS AND MEDICAL GAS FIXTURES SHOWN ARE FOR ARCHITECTURAL COORDINATION AND DIMENSIONAL CONTROL ONLY. REF: MECHANICAL, ELECTRICAL, AND PLUMBING DRAWINGS AND SPECIFICATIONS.
2. NOT ALL FIXTURES MAY BE SHOWN ON ARCHITECTURAL ELEVATIONS

THESE DOCUMENTS WERE PREPARED UNDER THE DIRECT SUPERVISION OF A LICENSED PROFESSIONAL ENGINEER. THE DOCUMENTS AND ALL THE RESULTS OF THE ENGINEERING WORK HEREON ARE THE PROPERTY OF JADE STONE ENGINEERING, INC. NO PART OF THESE DOCUMENTS MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT THE WRITTEN PERMISSION OF JADE STONE ENGINEERING, INC. CONSULTANT'S SEAL AND SIGNATURE ARE REQUIRED FOR THESE DOCUMENTS TO BE VALID. ANY VIOLATION OF THESE RULES WILL BE REPORTED TO THE APPROPRIATE AUTHORITIES.

THE LINE SHOWN ABOVE IS EXISTING DRAINAGE. ALL NEW DRAINAGE SHALL BE AS SHOWN.

THE SYMBOLS ABOVE ARE COLOR WITH BLACK AND WHITE LETTERS. IF PRINTED CORRECTLY.

10/7/2025 10:06:05 AM

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THE LINE SHOWN ABOVE IS EXACTLY AS SHOWN IN THE ORIGINAL DRAWING. ANY CHANGES TO THE ORIGINAL DRAWING SHALL BE INDICATED BY A RED LINE AND A NOTE. THE CONSULTANT SHALL BE RESPONSIBLE FOR THE DESIGN AND CONSTRUCTION OF THE PROJECT.

10/30/2025 4:16:49 PM

C

B

A

Address: Docs\Deruyter CSD Capital Project\23062-Deruyter-MEP-Ceme-425.rvt

AIR INLET AND OUTLET SCHEDULE

TYPE	DESCRIPTION	SERVICE	FACE SIZE (NECK SIZE)	# OF SLOTS	SLOT WIDTH (IN)	MOUNTING TYPE	BASIS OF DESIGN MANUFACTURER AND MODEL	REMARKS
E1	GRILLE	EXHAUST	SEE PLANS	-	-	LAY-IN	PRICE B1 SERIES	①
E2	GRILLE	EXHAUST	SEE PLANS	-	-	SURFACE MOUNT	PRICE S30 SERIES	①
S1	GRILLE	SUPPLY	SEE PLANS	-	-	CEILING	PRICE SCD	①
S2	LINEAR SLOT	SUPPLY	SEE PLANS	3	1-1/2	CEILING	PRICE SDS	①
R1	GRILLE	RETURN	SEE PLANS	-	-	CEILING	PRICE B1 SERIES	①
① PROVIDE W/ VOLUME DAMPER.								
② PROVIDE WITH MANUFACTURER'S SDB DUCT PLENUM AND ADJUSTABLE AIR PATTERN CONTROLLERS.								

LOUVER SCHEDULE

UNIT TAG	WIDTH	HEIGHT	CFM	FREE AREA (SQ FT)	FACE VELOCITY (FPM)	BIRD SCREEN	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL NUMBER	REMARKS
LV-1	32	24	1500	2.49	604	Y	GREENHECK	ESD-435	①
LV-2	32	24	1500	2.49	604	Y	GREENHECK	ESD-435	①
① PROVIDE WITH AUTOMATIC AIR DAMPER.									

AIR SEPARATOR SCHEDULE

UNIT TAG	LOCATION	SERVICE	TYPE	MAX GPM	WPD FT-H ₂ O	CONN. SIZE (IN)	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL NUMBER
AS-1	TBD	AHU-1	COALESCING	62	0.4	2	BELL&GOSSETT	CRSN-2N

STATIONARY ROOF VENTILATOR SCHEDULE

UNIT TAG	LOCATION	SERVICE	CFM	THROAT DIMENSIONS	THROAT VELOCITY (FT./MIN.)	FREE AREA (SQ. FT.)	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL NUMBER	REMARKS
IH-1	ROOF	FCU-2	2000	22"X24"	545	3.67	GREENHECK	FGI	①
RH-1	ROOF	BAND	2000	22"X22"	595	3.36	GREENHECK	FGR	①
① WITH FACTORY PROVIDED AAD									

EXPANSION TANK SCHEDULE

UNIT TAG	SERVICE	TYPE	ACCEPTANCE VOLUME (GAL)	TANK VOLUME (GAL)	DIAMETER (IN)	LENGTH (IN)	FILL PRESSURE (PSI)	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL NUMBER
EXT-1	GLYCOL LOOP	BLADDER	8.8	11	10	25	60	BELL&GOSSETT	D20

PUMP SCHEDULE

UNIT TAG	LOCATION	SERVICE	SYSTEM FLUID	GPM (GPH)	HEAD FT. WG.	RPM	ELECTRICAL		BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL NUMBER	REMARKS
							HP	VOLTS PHASE			
P-1	BOILER RM	HYDRONIC LOOP	100% H2O	120	52	3256	3	208 3	B&G	E-1510X (1.5AD)	①
P-2	BOILER RM	HYDRONIC LOOP	100% H2O	120	52	3256	3	208 3	B&G	E-1510X (1.5AD)	①
BP-1	BOILER RM	B-1	100% H2O	100	20	2385	3	460 3	B&G	ECO-CIRC 45-375	②
BP-2	BOILER RM	B-2	100% H2O	100	20	2385	3	460 3	B&G	ECO-CIRC 45-375	②
GP-3	BOILER RM	B-3	100% H2O	100	20	2385	3	460 3	B&G	ECO-CIRC 45-375	②
GP-1	TBD	AHU-1	40% PG	30	50	2896	2	208 3	B&G	E-90E	①
GP-2	TBD	AHU-1	40% PG	30	50	2896	2	208 3	B&G	E-90E	①
① PROVIDE WITH INTEGRAL VFD AND CONNECTION TO BMS. INTERLOCK WITH BOILER PUMP START/STOP CONTACT, AND RIGHT ANGLE SUCTION DIFFUSER.											
② PROVIDE WITH INTEGRAL VFD, CONNECTION TO BMS, INTERLOCK WITH BOILER PUMP START/STOP CONTACT, AND RIGHT ANGLE SUCTION DIFFUSER.											

BOILER SCHEDULE

UNIT TAG	LOCATION	SYSTEM FLUID	NATURAL GAS		OUTPUT MBH	BOILER HP	% EFF	RELIEF VALVE (PSI)	ELECTRICAL		FLUE OUTLET CONNECTION	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL NUMBER	REMARKS
			INPUT (MBH)	RATE (CFH)					VOLTS/ PH	MCA				
B-1	BOILER RM	100% H2O	2000	1961	1874	56	93.7	50	120/1	25	8	ATH	KN-20	①
B-2	BOILER RM	100% H2O	2000	1961	1874	56	93.7	50	120/1	25	8	ATH	KN-20	①
B-3	BOILER RM	100% H2O	2000	1961	1874	56	93.7	50	120/1	25	8	ATH	KN-20	①
① PROVIDE WITH CONDENSATE ACID NEUTRALIZER, OUTSIDE AIR RESET, BACNET COMMUNICATION, MANUFACTURER'S EXHAUST FLUE ADAPTOR, BAROMETRIC DAMPER, AND MAGNETIC BAG FILTER.														

EXHAUST FAN SCHEDULE

UNIT TAG	SERVICE	ARRANGEMENT	DRIVE	CFM	SP (IN WG)	FAN RPM	MAX. SONES	ROOF OPENING SIZE	ELECTRICAL			BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL NUMBER	REMARKS		
									HP (W)	VOLTS	PHASE					
EF-1	SCIENCE 7/9	ROOF	DIRECT	1100	0.6	1268	10	12X12	1/4	120	1	GREENHECK	CUE-120-VG	①		
EF-2	SCIENCE 8/10	ROOF	DIRECT	1100	0.6	1268	10	12X12	1/4	120	1	GREENHECK	CUE-120-VG	①		
EF-3	SCIENCE 11/12	ROOF	DIRECT	1100	0.6	1268	10	12X12	1/4	120	1	GREENHECK	CUE-120-VG	②	①	
EF-4	NOT USED															
EF-6	(E)FUME HOOD	ROOF	DIRECT	900	0.8	1629	10	12X12	1/2	120	1	GREENHECK	FJ-8	③	①	
①	PROVIDE WITH MANUFACTURER'S DISCONNECT SWITCH AND VARIGREEN CONTROLLER.															
②	EXHAUST FAN SHALL BE ENABLED DURING OCCUPIED HOURS. INTERLOCK EXHAUST FAN WITH ASSOCIATED FUME HOOD TO DISABLE FAN WHILE FUME HOOD IS ENABLED.															
③	PROVIDE WITH SWITCH TO BE MOUNTED ON FUME HOOD FOR ENABLE/DISABLE OF EXHAUST FAN.															

AIR HANDLING UNIT SCHEDULE

UNIT TAG	LOCATION	SERVICE	SA CFM (HEAT)	OA CFM (MIN)	ELECTRICAL CIRCUIT #1 (SF)				ELECTRICAL CIRCUIT #2 (RECEPTACLE)		SUPPLY FAN					RELIEF FAN					HEATING COIL - 40%PG						ENERGY RECOVERY WHEEL				BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL NUMBER	REMARKS	
					VOLTS/PH	MCA	FLA	MROPD	VOLTS/PH	HP	# OF FANS	MOTOR HP (EACH)	FAN RPM	TSP	ESP	# OF FANS	MOTOR HP (EACH)	FAN RPM	TSP	ESP	MBH	EAT (°F)	LAT (LAT°)	EWI (°F)	LWT (°F)	WPD (FT HD)	GPM	CFM (OA/EA)	HEATING OA (°F)	HEATING RA (°F) (DB/WB)				HEATING LAT (°F) (DB/WB)
AHU-1	ROOF	1ST & 2ND FLOOR	4600	3200	208/3	315	27.1	45	120/1	-	1	5	1267	2.9	1.0	1	4.3	2441	-	1.0	416	49	95	170	140	3.7	30	3200/3200	-10	70/62.5	50.7	DAIKIN	DAHATSA	①
① PROVIDE W/ SUPPLY FAN VFD, RELIEF FAN VFD, VIBRATION ISOLATORS, FIELD POWERED 115V GFI SINGLE POINT POWER, SOUND BLANKET INSULATION & MANUFACTURER'S DISCONNECT SWITCH. PROVIDE CONNECTION INTO BMS. PROVIDE ROOF CURB WITH SIDE INLET/OUTLET TO BE MOUNTED TO STEEL DUNNAGE.																																		

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(HW/DX) UNIT VENTILATOR SCHEDULE

UNIT TAG	LOCATION	ARRANGEMENT	SUPPLY (CFM)	OA CFM (MIN)	ESP (IN WG)	DX COOLING COIL						HEATING COIL - WATER						FAN COIL ELECTRIC						BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL NUMBER	REMARKS	ALTERNATE NO.		
						TOTAL TONS	SENSIBLE TONS	EDB (°F)	EWB (°F)	LDB (°F)	LWB (°F)	MBH	ROWS	EAT (°F)	LAT (°F)	EWI (°F)	LWT (°F)	WPD (FT HD)	GPM	VOLTS	PHASE	HP (W)	FLA					MCA	MOP
UV-6	144 SPECIAL EDUCATION	THRU WALL	498	145	0	-	-	-	-	-	-	30.8	1	46.0	103.0	180.0	149.2	0.61	2.0	208	1	1/3	3.0	3.8	15	DAIKIN	UAV5H07	①	MC-3
UV-7																													
UV-8																													
UV-9	229 11/12 SCIENCE	THRU WALL	748	225	0	1.8	1.2	80.0	67.0	62.0	58.3	42.0	1	46.0	97.7	180.0	152.0	1.38	3.0	208	1	1/3	3.0	3.8	15	DAIKIN	UAV5KH07	①	BASE BID
UV-10	229 11/12 SCIENCE	THRU WALL	750	225	0	1.8	1.2	80.0	67.0	62.0	58.3	42.0	1	46.0	97.7	180.0	152.0	1.38	3.0	208	1	1/3	3.0	3.8	15	DAIKIN	UAV5KH07	①	BASE BID
UV-11	239 11TH/12TH GRADE MATH	THRU WALL	999	250	0	2.6	1.8	80.0	67.0	62.0	57.1	60.7	1	46.0	102.0	180	149.6	2.51	4.0	208	1	1/3	3.0	3.8	15	DAIKIN	UAV5KH10	①	MC-2
①	PROVIDE W/ VARIABLE SPEED MOTOR, MOUNTING BRACKETS, CONDENSATE PUMP AND SPACE SENSOR FOR COMMUNICATION TO BMS. PROVIDE WITH BACNET ADAPTOR FOR CONTROL VIA BMS.																												
②	PROVIDE WITH MANUFACTURER'S WALL TO WALL METAL CASEWORK ON EITHER SIDE OF UNIT VENTILATOR.																												

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DUCTLESS SPLIT SYSTEM SCHEDULE

INDOOR UNIT												OUTDOOR UNIT														
UNIT TAG	LOCATION	ARRANGEMENT	NOMINAL SUPPLY CFM	OA CFM	COOLING COIL TOTAL COOLING (MBH)	HEATING LOAD	HEATING CAPACITY @ 67°F (MBH)	VOLTS	PHASE	MCA	REMARKS	UNIT TAG	LOCATION	COOLING (BTU/H)	HEATING (BTU/H)	BASE REFRIGERANT CHARGE (LB.)	ELECTRICAL #2				BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL NUMBER INDOOR UNIT	BASIS OF DESIGN MODEL NUMBER OUTDOOR UNIT	REMARKS	ALTERNATE NO.	
																		VOLTS	PHASE	#2	MCA					
AC-27	241 TECH STUDIES	CEILING MOUNT	1059	0	30	25	34	208	1	0.1	①		ACCU-17	EXTERIOR	30	34	7.5	208	1	35	34.6	DAIKIN	FC430AAVJU	RZA30AAVJU	②	MC-2
AC-30	238 OFFICE	WALL MOUNT	441	0	8	6.1	11	208	1	0.3	①		ACCU-17A	EXTERIOR	9	9.4	1.65	208	1	15	9.3	DAIKIN	FTXC09AXVJU	RXC09AXVJU	②	MC-2
AC-28	244 11TH/12TH GRADE ENGLISH	CEILING MOUNT	1253	0	36	35.6	40	208	1	1.6	①		ACCU-18	EXTERIOR	36	40	7.5	208	1	35	34.6	DAIKIN	FC436AAVJU	RZA36AAVJU	②	MC-2
AC-29	245 11TH/12TH GRADE S. STUDIES	CEILING MOUNT	1253	0	36	33.1	40	208	1	1.6	①		ACCU-19	EXTERIOR	36	40	7.5	208	1	35	34.6	DAIKIN	FC436AAVJU	RZA36AAVJU	②	MC-2
AC-31	227 6-12TH GRADE ART	CEILING MOUNT	1253	0	48	38.6	54	208	1	1.6	①		ACCU-26	EXTERIOR	48	54	7.5	208	1	35	34.6	DAIKIN	FC448AAVJU	RZA48AAVJU	②	MC-2
AC-32	144 SPECIAL EDUCATION	CEILING MOUNT	547	0	18	14.3	20	208	1	0.4	①		ACCU-25	EXTERIOR	36	40	7.5	208	1	35	34.6	DAIKIN	FC418AAVJU	RZA18AAVJU	②	MC-3
② PROVIDE WITH MANUFACTURER'S REFINET KITS. MOUNT AIR COOLED CONDENSING UNIT ON 18" HIGH PATE EQUIPMENT RACK ROOLS. DISCONNECT SWITCHES PROVIDED BY DIVISION 56. PROVIDE WITH BACNET ADAPTOR FOR CONTROL VIA BMS.																										