



**Crabtree, Rohrbaugh & Associates - Architects**

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Pennsylvania • Maryland • Virginia • West Virginia

**ADDENDUM NO. 2**

**March 26, 2025**

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School District of Haverford Township | Coopertown Elementary School Renovations & Additions  
CRA Project No. 3758

TO: All Perspective Bidders and Other Recipients of Contract Drawings and Specifications

This Addendum is hereby made a part of the Contract Document, which will be the basis of the Contract. The Addendum is issued to modify and/or correct the original Contract Documents dated March 10, 2025. Attach this Addendum to your Contract Documents. Receipt of this Addendum must be acknowledged on the Proposal Form. Failure to do so may subject the bidder to disqualification.

GENERAL

1. Each Bid must be submitted on the form provided by the Architect/Engineer, and must be accompanied by a bid bond, certified check, or cashier's check equal to ten percent of the total price submitted inclusive of add alternates. The Owner also reserves the right to reject any or all Bids for any reason whatsoever.
2. The last day which Contractors can ask questions in writing will be five days prior to receipt of bids. Questions will be answered by Addendum only.
3. All bidders are hereby notified that they are responsible for reviewing all parts of this addendum for conditions and requirements that may apply to their individual contracts. All Plan Holders shall review their Bidding Documents against the Table of Contents and List of Drawings to ensure that all Specifications Sections and Drawings are in your possession.
4. The Existing Condition Drawings for Coopertown Elementary School are being issued to bidders as informational only information and is not considered part of the contract bidding documents.
5. See attached Prebid Sign-In Sheet

## SPECIFICATIONS

### SPECIFICATIONS – VOLUME 1

#### SECTION 000010 – ADVERTISEMENT FOR BIDS

REVISE Paragraph 1: **NOTE THE FOLLOWING CHANGE:**

# (BID OPENING HAS BEEN EXTENDED 3 Days).

Notice is hereby given that sealed bids for construction of Additions and Renovations to Coopertown Elementary School, 800 Coopertown Road, Bryn Mawr, Pennsylvania 19010 will be received at the Administrative Offices of the School District of Haverford Township, 50 East Eagle Road until **11:00 A.M., prevailing time, on Friday, April 11, 2025**. Bids must be submitted to the attention of Antony Testa, Business Manager. Bids shall be submitted in sealed envelopes bearing the name of the Bidder and shall be clearly marked "Additions and Renovations to Coopertown Elementary School". Bids will be publicly opened and read aloud immediately after the scheduled closing time for receipt of Bids. Bids received after the above-referenced date and time shall be returned to the Bidder unopened.

### SPECIFICATIONS - VOLUME 2

#### SECTION 074223 – METAL WALL PANELS

1. **REMOVE** entire specification.

#### SECTION 087100 – DOOR HARDWARE

##### 3.2 INSTALLATION

1. **ADD** All hardware for both wood and hollow metal doors to be pre-installed by hardware supplier prior to shipping to jobsite

##### **ADD** HARDWARE SET NO. MISC-02

For use on Door #(s):

MISC 02

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
EA	ALL HARDWARE TO BE	PRE-INSTALLED BY HARDWARE SUPPLIER PER PART 3.02 EXECUTION		

Hardware sets: 03A, 03B, 03C, 03D, 03E, 03F, 03G, 03H, 03J, 03K, 03L, 03M, 03N, 03P, 03Q, 03R, 03S, 03T, 03U, 03V, 03W, 03X, 03Y, 06A

1. **DELETE:** hardware set line item "1 EA PIM PIM400-485RSI (FURNISHED BY SECURITY VENDOR)"
2. **REPLACE** with: "1 EA PIM (SPECIFIED UNDER SECTION 281000)"

#### SECTION 122413 - ROLLER WINDOW SHADES

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

#### SECTION 220410 – PLUMBING PIPING & SPECIALTIES

1. **ADD** paragraph 2.39 to read as follows:
  - 2.39 SOLID INTERCEPTOR (SI-1)
    - A. Furnish and install a ZURN: Z1183 Large capacity acid resistant stainless steel, solids interceptor, for on floor or semi-recessed installation cores with screen attached to gasketed, removable, latched lid, and removable stainless steel sediment basket.

#### SECTION 230100 – MECHANICAL GENERAL EQUIPMENT

1. **ADD** to paragraph 2.21. Roof Curbs
2. Curb height shall be at least 12" higher than the top of roof insulation.

#### SECTION 230510 – HVAC PIPING

1. **ADD** to paragraph 2.4.A. Manufacturers:
  - a. Nibco.

#### SECTION 230835 – HVAC EQUIPMENT

1. **REPLACE** specification section in its entirety.
2. **CLARIFIED** paragraph titles, descriptions, manufacturers and controls.
3. **REVISE** paragraph 2.4.E. replace electric heaters with hot water coil.
4. **ADD** paragraphs 2.4 G and H.
5. **REVISE** paragraph 2.5 A, C.1., E, H, and J.
6. **ADD** paragraphs 2.5 K and L.
7. **ADD** Paragraph 2.7 B and C.
8. **ADD** 2.8. FAN COIL UNITS.

#### SECTION 230855 – AIR HANDLING UNITS

1. **REPLACE** specification section in its entirety.
2. **CLARIFIED** paragraph titles, descriptions, manufacturers and controls.

#### SECTION 230900 – ATC Systems

1. **REPLACE** specification section in its entirety.
2. **CLARIFIED** new unit DDC controls in sequences of control.
3. **ADD** paragraph 1.2. O.
4. **ADD** to paragraph 2.1. A.

#### SECTION 260620 – SCHEDULES FOR ELECTRICAL DISTRIBUTION EQUIPMENT

1. Switchboard MDS circuit 15: **CHANGE** Amps to 70.
2. Panel LA2 circuit 40: **CHANGE** Amps to 15 and **CHANGE** description to (E) CUH.

3. Panel LB2 circuit 2,4,6: **CHANGE** Amps to 70.
4. Panel LB2 circuit 24,26,28: **CHANGE** description to Spare.
5. Panel LB2 circuit 34: **CHANGE** description to Motorized Shades B121.
6. Panel LC2 circuits 20,22,24,26,28,30,32,34,36,38, and 41: **CHANGE** Amps to 15.
7. Panel LD1 circuit 38,40,42: **CHANGE** Amps to 50.
8. Panel LD2 circuit 33: **CHANGE** description to Motorized Shades D120, D121.
9. Panel LE1 circuit 12: **CHANGE** description to Motorized Shades E122, E123.
10. Panel LA1 circuit 71: **CHANGE** description to Condensate Pumps A110,111,114.
11. Panel LK1 circuit 28: **CHANGE** description to Spare.
12. Panel OLA2 circuit 13: **CHANGE** description to Condensate Pumps A117,120.
13. Panel OLB1 circuit 25: **CHANGE** description to Condensate Pump B118.
14. Panel OLB1 circuit 27: **CHANGE** description to Condensate Pump B134.
15. Panel LC1 circuit 55: **CHANGE** description to Condensate Pumps C113,129
16. Panel LC2 circuit 29: **CHANGE** description to Condensate Pumps C101,103
17. Panel LD1 circuit 27: **CHANGE** description to Condensate Pumps D101,102,106.
18. Panel OLD1 circuit 13: **CHANGE** description to Condensate Pump D103.
19. Panel OLE1 circuit 9: **CHANGE** description to Condensate Pump E109.

#### SECTION 2831100 – EXPANSION OF THE EXISTING FIRE ALARM SYSTEM

1. Paragraph 2.8.B.2: **ADD** paragraph to read as follows: “Sprinkler System”
2. Paragraph 2.8.B.3: **ADD** paragraph to read as follows: “Kitchen Hood Systems Monitoring”
3. Paragraph 2.8.C.3: **ADD** paragraph to read as follows: “Smoke Door Holder Control”
4. Paragraph 2.8.C.4: **ADD** paragraph to read as follows: “Security, Access-Controlled Doors and Gates”
5. Paragraph 2.8.C.5: **ADD** paragraph to read as follows: “Sound System Equipment”
6. Paragraph 2.14: **ADD** paragraph to read as follows:
  - 2.16 KNOX BOX
    - a. Provide a flush mounted Knox Box at location where required by local AJH, fire marshal, fire chief, etc. and meeting their key requirements. No alarm tamper alert. Housing finished in dark bronze, aluminum or black (Architect’s choice during shop drawing review).
    - b. Acceptable Manufacturer: Knoxbox Model Knoxbox® 3200

#### SECTION 285000 – BUILDING TWO-WAY EMERGENCY RESPONDER COMMUNICATION ENHANCEMENT SYSTEM

1. Paragraph 2.2.D.2: **ADD** the following sentence to this paragraph to read as follows: “Reference the latest Police/Law Enforcement, Emergency Medical Services (EMS) and Fire Department frequency lists for Delaware County, Pennsylvania and the Haverford School District.”

#### SPECIFICATIONS – VOLUME 3

#### SECTION 329210 – SODDING

1. **ADD** entire specification.



## **DRAWINGS**

### CIVIL DRAWINGS

#### **DRAWING C-107 – LANDSCAPE PLAN**

1. **ADD** Alternative for areas of site laydown to be restored with sod.

### ARCHITECTURAL DRAWINGS

#### **DRAWING CC.1 – CODE COMPLIANCE FIRST FLOOR PLAN**

1. **ADD** fire extinguisher in Kiln room.

#### **DRAWING A1.7 – OVERALL ROOF PLAN**

1. **REMOVE** overflow drain.
2. **REVISE** existing roof drain to new roof drain in existing location.

### STRUCTURAL DRAWINGS

#### **DRAWING S7.1 – FIRST FLOOR LINTEL PLAN - OAKMONT BUILDING**

1. 1/D1.3 FIRST FLOOR DEMOLITION PLAN – UNITS A & B
  - a. **DELETE** lintel required on left side of corridor per attached revised drawing.
  - b. **ADD** 2 lintels on right side of corridor per attached revised drawing.
  - c. **REVISE** W16x50 lintel to have 3/8" plate welded to the bottom of the lintel per the attached revised drawing.
  - d. **ADD** temporary shoring note on each side of added lintels per attached revised drawing.

### MECHANICAL DRAWINGS

#### **DRAWING M1.3 – FIRST FLOOR UNIT C HVAC DEMOLITION**

1. **REPLACE** drawing in its entirety. Corrected the title block date and description to Addendum #1.

#### **DRAWING M2.4 – FIRST FLOOR UNIT D HVAC**

1. **REPLACE** drawing in its entirety.
2. **REPLACE** relocated existing ductwork with new ductwork in room D101, D102, and D106.
3. **ADD** and revise key notes.

#### **DRAWING M2.5 – FIRST FLOOR UNIT E HVAC**

1. **REPLACE** drawing in its entirety.
2. **REPLACE** relocated existing ductwork with new ductwork in room E108.
3. **ADD** and revise key notes.

#### **DRAWING M3.2 –FIRST FLOOR UNIT B HVAC PIPING**

1. **REPLACE** drawing in its entirety.
2. **ADD** pipe to (E)FCU-19 and pipe sizes.

#### **DRAWING M4.1 –ENLARGED MECHANICAL ROOM PLANS**

1. **REPLACE** drawing in its entirety.
2. **ADD** and revise key notes.
3. **PLACED** key notes on plans.

4. **REVISED** exterior pipe notes.

#### DRAWING M5.1 – HVAC SCHEDULES

1. **REPLACE** drawing in its entirety.
2. **DELETE** “UNIT VENTILATOR” schedule. No new unit ventilators.

#### DRAWING M6.1 – HVAC DETAILS

1. **REPLACE** drawing in its entirety.
2. **ADD** and revise details.

#### DRAWING M6.3 – HVAC DETAILS

1. **REPLACE** drawing in its entirety.
2. **ADD** and revise details.

#### PLUMBING DRAWINGS

##### DRAWING P1.1 - FIRST FLOOR UNIT A PLUMBING DEMOLITION

1. **REPLACE** with the attached.

##### DRAWING P1.2 - FIRST FLOOR UNIT B PLUMBING DEMOLITION

1. **REPLACE** with the attached.

##### DRAWING P1.3 - FIRST FLOOR UNIT C PLUMBING DEMOLITION

1. **ADD** Drawing note 1 next to WH.

##### DRAWING P1.4 - FIRST FLOOR UNIT D & E PLUMBING DEMOLITION

1. **REPLACE** with the attached.

##### DRAWING P1.5 - ROOF PLAN PLUMBING DEMOLITION

1. **REPLACE** with the attached.

##### DRAWING P2.1 - FIRST FLOOR UNIT A DOMESTIC WATER PIPING

1. **REPLACE** with the attached.

##### DRAWING P2.2 - FIRST FLOOR UNIT B DOMESTIC WATER PIPING

1. **REPLACE** with the attached.

##### DRAWING P2.5 - FIRST FLOOR UNIT E DOMESTIC WATER PIPING

1. **REPLACE** with the attached.

##### DRAWING P3.1 - FIRST FLOOR UNIT A SANITARY WASTE & VENT PIPING

1. **REPLACE** with the attached.

##### DRAWING P3.2 - FIRST FLOOR UNIT B SANITARY WASTE & VENT PIPING

1. **REPLACE** with the attached.

##### DRAWING P3.4 - FIRST FLOOR UNIT D SANITARY WASTE & VENT PIPING

1. **REVISE** sanitary pipe size coming from lavatories in Toilet D-115 from 2” to 3”

DRAWING P3.5 - FIRST FLOOR UNIT E SANITARY WASTE & VENT PIPING

1. **REPLACE** with the attached.

DRAWING P3.6 - ROOF PLUMBING

1. **REPLACE** with the attached.

DRAWING P4.1 - ENLARGED PLANS

1. **REPLACE** with the attached.

DRAWING P4.2 - ENLARGED PLANS

1. **REPLACE** with the attached.

DRAWING P4.3 - ENLARGED PLANS

1. **REPLACE** with the attached.

DRAWING P5.1 - DETAILS

1. **REPLACE** with the attached.

ELECTRICAL DRAWINGS

DRAWING E1.2 – ENLARGED DEMO PLAN

1. **REPLACE** Drawing with the attached.

DRAWING E2.1 – FIRST FLOOR UNIT A LIGHTING

1. **REPLACE** Drawing with the attached.

DRAWING E3.1 – FIRST FLOOR UNIT A POWER

1. **REPLACE** Drawing with the attached.

DRAWING E3.2 – FIRST FLOOR UNIT B POWER

1. **REPLACE** Drawing with the attached.

DRAWING E3.3 – FIRST FLOOR UNIT C POWER

1. **REPLACE** Drawing with the attached.

DRAWING E3.4 – FIRST FLOOR UNIT D POWER

1. **REPLACE** Drawing with the attached.

DRAWING E3.5 – FIRST FLOOR UNIT E POWER

1. **REPLACE** Drawing with the attached.

DRAWING E3.6 – ROOF ELECTRICAL

1. **REPLACE** Drawing with the attached.

DRAWING E4.1– PARTIAL PLANS

1. **REPLACE** Drawing with the attached.

DRAWING E4.2 – ENLARGED PLANS

1. **REPLACE** Drawing with the attached.

DRAWING E5.1 – FIRST FLOOR FIRE ALARM AND CELLULAR EXTENSION

1. **REPLACE** Drawing with the attached.

DRAWING E9.2 – ELECTRICAL DETAILS

1. **REPLACE** Drawing with the attached.

DRAWING E9.7 – ELECTRICAL DETAILS

1. **ADD** the attached drawing.

DRAWING E9.8 – ELECTRICAL DETAILS

1. **ADD** the attached drawing.

End Of Addendum No. 2

## Attachments

### Specifications:

SECTION 122413	ROLLER WINDOW SHADES
SECTION 230835	HVAC EQUIPMENT
SECTION 230855	AIR HANDLING UNITS
SECTION 230900	ATC SYSTEMS
SECTION 329210	SODDING

### Drawings:

DRAWING C-107	LANDSCAPE PLAN
DRAWING CC.1	CODE COMPLIANCE FIRST FLOOR PLAN
DRAWING A1.7	OVERALL ROOF PLAN
DRAWING S7.1	FIRST FLOOR LINTEL PLAN - OAKMONT BUILDING
DRAWING M1.3	FIRST FLOOR UNIT C HVAC DEMOLITION
DRAWING M2.4	FIRST FLOOR UNIT D HVAC
DRAWING M2.5	FIRST FLOOR UNIT E HVAC
DRAWING M3.2	FIRST FLOOR UNIT B HVAC PIPING
DRAWING M4.1	ENLARGED MECHANICAL ROOM PLANS
DRAWING M5.1	HVAC SCHEDULES
DRAWING M6.1	HVAC DETAILS
DRAWING M6.3	HVAC DETAILS
DRAWING P1.1	FIRST FLOOR UNIT A PLUMBING DEMOLITION
DRAWING P1.2	FIRST FLOOR UNIT B PLUMBING DEMOLITION
DRAWING P1.4	FIRST FLOOR UNIT D & E PLUMBING DEMOLITION
DRAWING P1.5	ROOF PLAN PLUMBING DEMOLITION
DRAWING P2.1	FIRST FLOOR UNIT A DOMESTIC WATER PIPING
DRAWING P2.2	FIRST FLOOR UNIT B DOMESTIC WATER PIPING
DRAWING P2.5	FIRST FLOOR UNIT E DOMESTIC WATER PIPING
DRAWING P3.1	FIRST FLOOR UNIT A SANITARY WASTE & VENT PIPING
DRAWING P3.2	FIRST FLOOR UNIT B SANITARY WASTE & VENT PIPING
DRAWING P3.5	FIRST FLOOR UNIT E SANITARY WASTE & VENT PIPING
DRAWING P3.6	ROOF PLUMBING
DRAWING P4.1	ENLARGED PLANS
DRAWING P4.2	ENLARGED PLANS
DRAWING P4.3	ENLARGED PLANS
DRAWING P5.1	DETAILS
DRAWING E1.2	ENLARGED DEMO PLAN
DRAWING E2.1	FIRST FLOOR UNIT A LIGHTING
DRAWING E3.1	FIRST FLOOR UNIT A POWER
DRAWING E3.2	FIRST FLOOR UNIT B POWER
DRAWING E3.3	FIRST FLOOR UNIT C POWER

DRAWING E3.4	FIRST FLOOR UNIT D POWER
DRAWING E3.5	FIRST FLOOR UNIT E POWER
DRAWING E3.6	ROOF ELECTRICAL
DRAWING E4.1	PARTIAL PLANS
DRAWING E4.2	ENLARGED PLANS
DRAWING E5.1	FIRST FLOOR FIRE ALARM AND CELLULAR EXTENSION
DRAWING E9.2	ELECTRICAL DETAILS
DRAWING E9.7	ELECTRICAL DETAILS
DRAWING E9.8	ELECTRICAL DETAILS

## SECTION 122413 - ROLLER WINDOW SHADES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Manually operated roller shades with single rollers.
  - 2. Manually operated roller shades with double rollers.
  - 3. Motor-operated roller shades with single rollers.
  - 4. Motor-operated roller shades with double rollers.

- B. Related Requirements:

- 1. Division 6 Section "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
  - 2. Division 7 Section "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.
  - 3. Division 26 Section "Electrical" for electrical supply, conduit, and wiring for motorized window shades.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

- 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

- C. Samples for Initial Selection: For each type and color of shadeband material.

- 1. Include Samples of accessories involving color selection.

- D. Roller-Shade Schedule: Use same designations indicated on Drawings.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material, signed by product manufacturer.
- C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Basic of Design:



- a. Draper Inc., Manual Flexshade.
  - b. Draper Inc., Motorized Flexshade.
- 2. Approved Manufacturers:
  - a. Jacksons Window Shoppe.
  - b. Hunter Douglas Contract.
  - c. Levelor Commercial.
  - d. MechoShade Systems, Inc.
  - e. SWF Contract.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

## 2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated. Manufacturer's standard which must comply with ANSI/WCMA A100.1, American National Standard for Safety of Corded Window Covering Products.
  - 1. Bead Chains: Stainless steel.
    - a. Loop Length: Full length of roller shade.
    - b. Limit Stops: Provide upper and lower ball stops.
    - c. Chain-Retainer Type: Chain tensioner, jamb mounted.
  - B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
    - 1. Roller Drive-End Location: Right side of inside face of shade.
    - 2. Direction of Shadeband Roll: Regular, from back of roller.
    - 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
  - C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
  - D. Shadebands:
    - 1. Shadeband Material: Light-filtering Series.
    - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
      - a. Type: Enclosed in sealed pocket of shadeband material
      - b. Color and Finish: As selected by Architect from manufacturer's full range of colors.
  - E. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped
    - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.
  2. Endcap Covers: To cover exposed endcaps.
  3. Back Covers for Roller Shades at Interior Windows: Provide and install back cover for all interior shades.
  4. Installation Accessories Color and Finish: As selected from manufacturer's full range.
- F. Location: Shades to be applied to exterior applications as indicated on the Drawings; refer to reflected ceiling plans.

## 2.3 MANUALLY OPERATED SHADES WITH DOUBLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated. Manufacturer's standard which must comply with ANSI/WCMA A100.1, American National Standard for Safety of Corded Window Covering Products.
1. Bead Chains: Stainless steel.
    - a. Loop Length: Full length of roller shade.
    - b. Limit Stops: Provide upper and lower ball stops.
    - c. Chain-Retainer Type: Chain tensioner, jamb mounted.
  - B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
    1. Double-Roller Mounting Configuration: Offset, outside roller over and inside roller under.
    2. Inside Roller:
      - a. Drive-End Location: Right side of interior face of shade
      - b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
    3. Outside Roller:
      - a. Drive-End Location: Left side of interior face of shade.
      - b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
    4. Shadeband-to-Roller Attachment: Manufacturer's standard method.
  - C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.

D. Inside Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
  - a. Type: Enclosed in sealed pocket of shadeband material.
  - b. Color and Finish: As selected by Architect from manufacturer's full range of colors.

E. Outside Shadebands:

1. Shadeband Material: Light-blocking fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
  - a. Type: Enclosed in sealed pocket of shadeband material.
  - b. Color and Finish: As selected by Architect from manufacturer's full range of colors.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
  - a. Shape: L-shaped
  - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.
2. Back Covers: Aluminum extrusion that conceals back and top of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
  - a. Shape: L-shaped
  - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 8 inches.
  - c. Depth: Manufacturer's standard depth required to conceal roller and shadeband when shade is fully open, but not less than 6 inches.
3. Endcap Covers: To cover exposed endcaps.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

G. Location: Shades to be applied to exterior applications as indicated on the Drawings; refer to reflected ceiling plans.

## 2.4 MOTORIZED SHADES WITH SINGLE ROLLERS

- A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. ~~Include line wiring from motor controls to motors.~~ **Include line-wiring from building motor with low voltage wiring to controls and motor locations.**

**(ADDENDUM 3)** Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
    - a. Electrical Characteristics: 110-V ac.
    - b. **Low Voltage Control: CAT 6. (ADDENDUM 3)**
  - ~~3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote control activation of shades:
    - a. Individual/Group Control Station: Momentary contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for individual and group control.
    - b. Color: As selected by Architect from manufacturer's full range. **(ADDENDUM 3)**~~
  4. Operating Features:
    - a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shades for service.
1. Roller Drive-End Location: Right side of inside face of shade
  2. Direction of Shadeband Roll: Regular, from back of roller.
  3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.
- D. Shadebands:
1. Shadeband Material: Light-filtering Series.
  2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    - a. Type: Enclosed in sealed pocket of shadeband material
    - b. Color and Finish: As selected by Architect from manufacturer's full range of colors.
- E. Installation Accessories:
1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped.

- b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches.
  - 2. Back Covers: Aluminum extrusion that conceals back and top of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped
    - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 4 inches.
    - c. Depth: Manufacturer's standard depth required to conceal roller and shadeband when shade is fully open, but not less than 4 inches.
  - 3. Endcap Covers: To cover exposed endcaps.
  - 4. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as are drawn-down.
  - 5. Installation Accessories Color and Finish: As selected from manufacturer's full range.
- F. Location: Shades to be applied to exterior applications as indicated on the Drawings; refer to reflected ceiling plans.

## 2.5 MOTOR-OPERATED, DOUBLE-ROLLER SHADES

- A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. ~~Include line wiring from motor controls to motors.~~ **Include line-wiring from building motor with low voltage wiring to controls and motor locations. (ADDENDUM 3)** Coordinate operator wiring requirements and electrical characteristics with building electrical system.
  - 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
    - a. Electrical Characteristics: 110-V ac.
    - b. **Low Voltage Control: CAT 6. (ADDENDUM 3)**
  - ~~3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote control activation of shades:~~
    - ~~a. Individual/Group Control Station: Momentary contact, three position, rocker-style, wall-switch-operated control station with open, close, and center off functions for individual and group control.~~
    - ~~b. Color: As selected by Architect from manufacturer's full range. (ADDENDUM 3)~~
  - 4. Operating Features:

- a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shades for service.
  - 1. Double-Roller Mounting Configuration: Offset, outside shade over and inside shade under.
  - 2. Inside Roller:
    - a. Drive-End Location: Right side of interior face of shade.
    - b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
  - 3. Outside Roller:
    - a. Drive-End Location: Right side of interior face of shade.
    - b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
  - 4. Shadeband-to-Roller Attachment: Adhesive strip.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.
- D. Inside Shadebands:
  - 1. Shadeband Material: Light-filtering fabric.
  - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    - a. Type: Enclosed in sealed pocket of shadeband material.
    - b. Color and Finish: As selected by Architect from manufacturer's full range.
- E. Outside Shadebands:
  - 1. Shadeband Material: Light-blocking fabric.
  - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    - a. Type: Enclosed in sealed pocket of shadeband material.
    - b. Color and Finish: As selected by Architect from manufacturer's full range.
- F. Installation Accessories:
  - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped.
    - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches.

2. Back Covers: Aluminum extrusion that conceals back and top of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped
    - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 8 inches.
  3. Endcap Covers: To cover exposed endcaps.
  4. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as are drawn-down.
  5. Installation Accessories Color and Finish: As selected from manufacturer's full range.
- F. Location: Shades to be applied to exterior applications as indicated on the Drawings; refer to reflected ceiling plans.

## 2.6 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701 Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
  1. Source: Mermet, T- Screen
  2. Type: PVC Coated Fiberglass.
  3. Weight: 13.3 oz per yard.
  4. Openness Factor: 1 percent.
  5. Color: As selected by Architect from manufacturer's full range.
- C. Blackout Fabric: Woven fabric, stain and fade resistant.
  1. Source: Indiana Coated Fabrics (ICF), Apagon Style III
  2. Type: Fiberglass textile with PVC film bonded to both sides.
  3. Weight: 12.8 oz per square yard
  4. Color: As selected by Architect from manufacturer's full range. Provide a minimum of (8) color selections.
  5. Location: Refer to drawings.

## 2.7 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F.
  1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch plus or minus 1/8 inch.

- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
  - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4 provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
  - 1. Hardware shall be mounted to jamb or head of window opening. Mounting to the frame is NOT approved.

### 3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

### 3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413



## SECTION 230835 - HVAC EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Cabinet **Unit** Heaters
- B. Unit Heaters
- C. Single Duct VAV Boxes
- D. Fan Powered VAV Boxes
- E. Ductless Air-conditioning Units
- F. Electric **Unit** Heaters
- G. Fan Coil Units (Addendum #2)**

#### 1.2 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code

#### 1.3 SUBMITTALS

- A. Submit shop drawings in accordance with provisions of Section 230010.

#### 1.4 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 70 code for internal wiring of factory wired equipment.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS:

- A. CABINET UNIT HEATERS, CONVECTORS, UNIT HEATERS
  - 1. Airtherm
  - 2. Sigma
  - 3. Sterling
  - 4. Modine
  - 5. Rittling
  - 6. **Johnson Controls**
  - 7. **Trane (Addendum #2)**

## 2.2 CABINET HEATERS (CUH)

- A. Cabinet unit heaters Modine Model CW.
- B. Furnish and install where indicated on the drawings, horizontal recessed style cabinet heaters of the capacity indicated on the schedule. Units shall include galvanized steel chassis, water coil, fanboard, fanwheel, housing, motor, filter and insulation.
- C. Horizontal Recessed Models – Unit shall have 18-gauge steel, removable, 4 side overlap bottom panel adjustable 3/8" with full length, piano-type hinge at back and camlocks at front.
- D. All cabinet parts shall be cleaned, bonderized, phosphatized and coated with baked-on primer ready for field painting. Unit painting by Architect. Access doors and front panel shall be tamper-proof.
- E. Hot water heating coils shall be 5/8" OD copper finned tube construction factory tested to 300 PSIG. Units shall be provided with shut-off valves on both supply and return connections. All control valves, valving and piping shall be concealed inside unit.
- F. Provide on-off switch to disconnect power to unit for servicing.
- G. ***Unit shall be controlled as described in the specification section 230900 ATC Systems. (Addendum #2)***

## 2.3 UNIT HEATERS (UH)

- A. Horizontal heater unit Modine Model HC.
- B. Casing shall be 2-piece with "picture frame" front formed into wrap-around sides, top and bottom. Horizontal louvers with louver keepers shall be standard. Unit shall have 18-ga back panel with deep-draw fan orifice for extreme rigidity and cast brass coil supply and return pipe tap connectors bolted to back corners. Casings shall be phosphatized to prevent corrosion and painted with green baked enamel.
- C. Fan shall be high efficiency fan with aluminum blades, factory balanced and sturdy for standard or spark-proof applications.
- D. Hot water headerless coils are single tube, single serpentine. Fins are aluminum Sigma-Flo, mechanically bonded to seamless copper tubing. All coils shall be 1-row deep in airflow direction and shall be tested at 300 psig air under water. Standard coils shall have .031 copper tubing suitable for use on hot water up to 200 psi or 325°F.
- E. Totally enclosed, 115/60/1 Class "B" insulated, shaded pole and PSC motor shall be standard. Motor shall be sleeve bearing. Motors shall have built-in overload protection. Motors shall be able to be oiled.
- F. Unit shall be controlled as described in the ***specification section 230900 ATC Systems. (Addendum #2)***

## 2.4 **SINGLE DUCT VAV BOX (V-) (Addendum #2)**

- A. Acceptable Manufacturers: These Specifications set forth the minimum requirements for single duct VAV terminal units. If they comply with these specifications, single duct VAV terminal units manufactured by one of the following manufacturers will be acceptable:
1. JCI
  2. Trane
  3. Nailor Industries
  4. Price
- B. Construction:
1. Terminals shall be constructed of not less than 22-ga galvanized steel with a minimum G90 zinc coating, able to withstand a 125-hour salt spray test per ASTM B-117. Stainless steel casings, or galvanized steel casings may be used as an alternative. The terminal casing shall be mechanically assembled (spot-welded casings are not acceptable).
  2. Casing shall be internally lined with 1/2" thick, 4 pound per cubic foot skin, dual density fiberglass insulation, rated for a maximum air velocity of 3600 f.p.m. In addition to using adhesive complying with NFPA 90A, the insulation shall incorporate a secondary mechanical fastener attached to the unit casing wall (clench nail). Adhesive as the only method of fastening the insulation to the casing is not acceptable. Maximum thermal conductivity shall be 0.24. Insulation must meet all requirements of ASTM Standards C1071, (fibrous glass duct lining insulation) G21, (Resistance of synthetic polymers to fungi) UL 181, (materials for the fabrication of air duct and air connector systems) and NFPA 90A, (Installation of air conditioning and ventilating systems). Raw insulation edges on the discharge of the unit must be covered with metal liner to eliminate flaking of insulation during field duct connections. Simple "buttering" of raw edges with an approved sealant is not acceptable
  3. All appurtenances including control enclosures and electric heating coils shall not extend beyond the top and bottom of the unit casing. At an inlet velocity of 2000 f.p.m., the static pressure drop across the basic terminal or basic terminal with a sound attenuator shall not exceed .08" W.G. for all unit sizes.
- C. Primary Air Valve: The primary air valve shall consist of a minimum 22-ga cylindrical body that includes embossment rings for rigidity. The damper blade shall be connected to a solid shaft by means of an integral molded sleeve which does not require screw or bolt fasteners. The shaft shall be manufactured of a low thermal conducting composite material and include a molded damper position indicator visible from the exterior of the unit. The damper shall pivot in nylon bearings. The damper actuator shall be mounted on the exterior of the terminal for ease of service. The valve assembly shall include internal mechanical stops for both full open and closed positions. The damper blade seal shall be secured without use of adhesives. The air valve leakage shall not exceed 1% of maximum inlet rated airflow at 3" W.G. inlet pressure.
- D. Primary Airflow Sensor: Differential pressure airflow sensor shall traverse the duct using the equal cross-sectional area or log-linear traverse method along two perpendicular diameters. Single axis sensor shall not be acceptable for duct diameters 6" or larger. A minimum of 12 total pressure sensing points shall be utilized. The total pressure inputs shall be averaged using a pressure chamber located at the center of the sensor. A sensor that delivers the differential pressure signal from one end of the sensor is not acceptable. The sensor shall output an amplified differential

pressure signal that is at least 2.5 times the equivalent velocity pressure signal obtained from a conventional pitot tube. The sensor shall develop a differential pressure of 0.03" w.g. at an air velocity of < 450 FPM. Documentation shall be submitted which substantiates this requirement. Brass balancing taps and airflow calibration charts shall be provided for field airflow measurements.

**E. Hot Water Coil:**

1. ***Single duct terminal shall include an integral hot water coil where indicated on the plans. The coil shall be manufactured by the terminal unit manufacturer and shall have a minimum 22-gauge galvanized sheet metal casing with a minimum G90 zinc coating. Stainless steel casings, or galvanized steel casings may be used as an alternative. Coil to be constructed of pure aluminum fins with full fin collars to assure accurate fin spacing and maximum tube contact. Fins shall be spaced with a minimum of 10 per inch and mechanically fixed to seamless copper tubes for maximum heat transfer. Each coil shall be tested at a minimum of 450 PSIG underwater. (Addendum #2)***

- F. Foil Faced Insulation: Insulation shall be covered with scrim backed foil facing. All insulation edges shall be covered with foil or metal nosing. Insulation shall meet ASTM C1136 as a low permeance vapor retarding material and ASTM C665 for thermal and acoustic properties of insulation.

**G. Controls:**

1. ***Single duct terminals shall include electronic field mounted, terminal strip controls.***
2. ***Unit shall be controlled as described in the specification section 230900 ATC Systems. (Addendum #2)***

**H. Options and Accessories:**

1. ***Access Plate in terminal casing***
2. ***Hanger brackets***
3. ***Control Enclosure (Addendum #2)***

**2.5 FAN POWERED VAV BOX (FV-)**

- A. Acceptable Manufacturers: These Specifications set forth the minimum requirements for ***Low Profile Series Flow Constant Volume Fan Powered Terminals***. If they comply with these specifications, ***Series Flow Constant Volume Fan Powered Terminals*** manufactured by one of the following manufacturers will be acceptable: ***(Addendum #2)***

1. JCI
2. Trane
3. Nailor Industries
4. Price

**B. General:**

1. Furnish and install Series Flow Constant Volume Fan Powered Terminals of the sizes and capacities scheduled. Units shall be ETL listed. Terminals with electric heat shall be listed as an assembly. Separate listings for the terminal and electric heater are not acceptable. Terminals shall include a single point electrical connection. Terminal units shall be AHRI certified and bear the AHRI 880 seal.

2. The entire unit shall be designed and built as a single unit. Field-assembled components or built-up terminals employing components from multiple manufacturers are not acceptable.
- C. Construction:
1. ***Terminals shall be constructed of not less than 20-gauge galvanized steel, able to withstand a 125-hour salt spray test per ASTM B-117. Casing shall be internally lined with 1/2" thick fiberglass insulation, rated for a maximum air velocity of 5000 f.p.m. Maximum thermal conductivity shall be .24 (BTU • in) / (hr • ft<sup>2</sup> • °F). Insulation must meet all requirements of ASTM C1071 (including C665), UL 181 for erosion, and carry a 25/50 rating for flame spread/smoke developed per ASTM E-84, UL 723 and NFPA 90A. (Addendum #2)***
  2. Casing shall be internally lined with 1/2" thick, 4 pound per cubic foot skin, dual density fiberglass insulation, rated for a maximum air velocity of 3600 f.p.m. In addition to using adhesive complying with NFPA 90A, the insulation shall incorporate a secondary mechanical fastener attached to the unit casing wall (clench nail). Adhesive as the only method of fastening the insulation to the casing is not acceptable. Maximum thermal conductivity shall be 0.24. Insulation must meet all requirements of ASTM Standards C1071, (fibrous glass duct lining insulation), G21, (Resistance of synthetic polymers to fungi), UL 181, (materials for the fabrication of air duct and air connector systems) and NFPA 90A, (Installation of air conditioning and ventilating systems). Raw insulation edges on the discharge of the unit must be covered with metal liner to eliminate flaking of insulation during field duct connections. Simple "buttering" of raw edges with an approved sealant is not acceptable.
  3. Casing shall have full bottom access to gain access to the primary air valve and fan assembly. The opening shall be sufficiently large to allow complete removal of the fan if necessary. The casing shall be constructed in a manner to provide a single rectangular discharge collar. Multiple discharge openings are not acceptable. All appurtenances including control enclosures and electric heating coils shall not extend beyond the top or bottom of the unit casing.
- D. Sound: The terminal manufacturer shall provide AHRI certified sound power data for radiated and discharge sound. The sound levels shall not exceed the octave band sound power levels indicated on the schedule. If the sound data does not meet scheduled criteria, the contractor shall be responsible for the provision and installation of any additional equipment or material necessary to achieve the scheduled sound performance.
- E. Primary Air Valve: ***Rectangular shaped primary air valves shall consist of minimum 18-gauge galvanized steel.*** The primary air valve shall consist of a minimum 22-ga cylindrical body that includes embossment rings for rigidity. The damper blade shall be connected to a solid shaft by means of an integral molded sleeve which does not require screw or bolt fasteners. The shaft shall be manufactured of a low thermal conducting composite material and include a molded damper position indicator visible from the exterior of the unit. The damper shall pivot in nylon bearings. The damper actuator shall be mounted on the exterior of the terminal for ease of service. The valve assembly shall include internal mechanical stops for both full open and closed positions. The damper blade seal shall be secured without use of adhesives. The air valve leakage shall not exceed 1% of maximum inlet rated airflow at 3" W.G. inlet pressure. ***Rectangular valve leakage shall not exceed 2% of maximum inlet rated airflow at 3" W.G. inlet pressure. (Addendum #2)***

- F. Primary Airflow Sensor: Differential pressure airflow sensor shall traverse the duct using the equal cross-sectional area or log-linear traverse method along two perpendicular diameters. Single axis sensor shall not be acceptable for duct diameters 6" or larger. A minimum of 12 total pressure sensing points shall be utilized. The total pressure inputs shall be averaged using a pressure chamber located at the center of the sensor. A sensor that delivers the differential pressure signal from one end of the sensor is not acceptable. The sensor shall output an amplified differential pressure signal that is at least 2.5 times the equivalent velocity pressure signal obtained from a conventional pitot tube. The sensor shall develop a differential pressure of 0.03" w.g. at an air velocity of < 450 FPM. Documentation shall be submitted which substantiates this requirement. Brass balancing taps and airflow calibration charts shall be provided for field airflow measurements.
- G. Fan Assembly:
1. The unit fan shall utilize a forward curved, dynamically balanced, galvanized wheel with a direct drive motor. The motor shall be permanent split capacitor type with three separate horsepower taps. Single speed motors with electronic speed controllers are not acceptable.
  2. The fan motor shall be un-pluggable from the electrical leads at the motor case for simplified removal (open frame motors only). The motor shall utilize permanently lubricated sleeve type bearings, include thermal overload protection and be suitable for use with electronic and/or mechanical fan speed controllers. The motor shall be mounted to the fan housing using torsion isolation mounts properly isolated to minimize vibration transfer.
  3. The terminal shall utilize an electronic (SCR) fan speed controller for aid in balancing the fan capacity. The speed controller shall have a turn down stop to prevent possibility of harming motor bearings.
- H. **Hot Water Coil:**
1. ***Terminal shall include an integral hot water coil where indicated on the plans. The coil shall be manufactured by the terminal unit manufacturer and shall have a minimum 22 gauge galvanized sheet metal casing. Stainless steel casings, or galvanized steel casings may be used as an alternative. Coil to be constructed of pure aluminum fins with full fin collars to assure accurate fin spacing and maximum tube contact. Fins shall be spaced with a minimum of 10 per inch and mechanically fixed to seamless copper tubes for maximum heat transfer.***
  2. ***Each coil shall be hydrostatically tested at 450 PSIG under water and rated for a maximum 300 PSIG working pressure at 200°F. Coils shall incorporate a built in, flush mounted access plate, allowing top and bottom access to coil. (Addendum #2)***
- I. Foil Faced Insulation: Insulation shall be covered with scrim backed foil facing. All insulation edges shall be covered with foil or metal nosing. Insulation shall meet ASTM C1136 for low permeance vapor retarders and ASTM C665 for biological growth in mineral-fiber blanket thermal insulation.
- J. **Fan Assembly:**
1. ***The unit fan shall utilize a forward curved, dynamically balanced, galvanized wheel with a direct drive motor.***
  2. ***Fan motor shall be ECM. Motor shall be brushless DC controlled by an integral controller / inverter that operates the wound stator and senses rotor position to electronically***

*commutate the stator. Motor shall be permanent magnet type with near-zero rotor losses designed for synchronous rotation. The motor shall utilize permanently lubricated ball bearings. Motor shall maintain minimum 70% efficiency over the entire operating range. Motor speed control shall be accomplished through a PWM (pulse width modulation) controller specifically designed for compatibility with the ECM. The speed controller shall have terminals for field verification of fan capacity utilizing a digital volt meter. A calibration graph shall be supplied indicating Fan CFM verses DC Volts. The fan motor shall be unpluggable from the electrical leads at the motor case for simplified removal (open frame motors only). The motor shall utilize permanently lubricated sleeve type bearings, include thermal overload protection and be suitable for use with electronic and/or mechanical fan speed controllers. The motor shall be mounted to the fan housing using torsion isolation mounts properly isolated to minimize vibration transfer.*

3. *The terminal shall utilize an electronic (SCR) fan speed controller for aid in balancing the fan capacity. The speed controller shall have a turn down stop to prevent possibility of harming motor bearings.*

**K. Controls:**

1. *Fan-Powered terminals shall include electronic field mounted, terminal strip controls.*
2. *Unit shall be controlled as described in the specification section 230900 ATC Systems.*

**L. Options and Accessories:**

1. *Hanger brackets*
2. *Control Enclosure*
3. *50 VA Transformer (Addendum #2)*

2.6 DUCTLESS SPLIT SYSTEM UNITS (AC/CU)

**A. Manufacturer:**

1. Mitsubishi (Basis of Design)
2. Acceptable Substitutes:
  - a. LG
  - b. Hitachi

- B.** Furnish and install Mini-Split system air conditioning units as noted on the plans, ductless splits, concealed, or ceiling cassette type as noted.

- C.** Indoor units shall be ceiling or wall hung (as shown on plans) and shall include thermostat and condensate pump.

- D.** Outdoor units shall include all standard equipment and controls. Furnish with 5-year warranty for all components.

- E.** Unit shall include low ambient control operation down to 0°F.

- F.** Electrical Contractor wires to the indoor unit and the Mechanical Contractor wires from the indoor unit to the outdoor unit.

- G. Controls: Unit shall be controlled as described in the specification section 230900 ATC Systems. (Addendum #2)**

## 2.7 ELECTRIC **UNIT** HEATERS (*Addendum #2*)

- A. Manufacturer:
  - 1. Qmark (Basis of Design)
  - 2. Berko
  - 3. Equal
- B. *Unit mounts either horizontally or vertically. Heavy gauge die-formed steel housing. Two-toned, smartly styled with stainless steel louvers. Advanced pull-through air flow design draws air across heating element for more even air distribution and cooler element operation. Branch circuit fusing (when required). Completely enclosed fan motor. 1- or 3-phase wiring on 5 through 10 KW 208/240V and 15 KW 208V units (field interchangeable). Aluminum-finned, copper clad steel sheath heating element has longer useful life, because of cooler sheath temperature and faster heat dissipation. 24V control transformer standard on most models, providing a safer and more accurate means of temperature control. 24V control. Automatic reset linear thermal cut-out, capillary type, provides protection over entire length of element areas. Fan delay feature eliminates cold drafts. Element heats up before fan cuts in, then fan continues to distribute heat after element shuts off. Ruggedly built, yet lighter weight for easier installation. No piping flutes, valves, or traps. Individually adjustable discharge louvers to control air flow. Meets all UL, NEC, and OSHA requirements. Power Disconnect Switch. Remote Summer Fan Switch with Relay (24V Coil-Single Pole Normally Open).*
- C. Controls
  - 1. *Unit shall be controlled as described in the specification section 230900 ATC Systems. (Addendum #2)*

## 2.8 **FAN COIL UNITS (FCU)**

- A. *Manufacturers: Classroom fan coil unit manufacturer shall be provided to match the existing classroom fan coil unit manufacturer.*
  - 1. *Johnson Controls*
- B. *General: Units shall be completely factory assembled, tested and shipped as one piece. All units shall be capable of meeting or exceeding the scheduled capacities for cooling, heating and air delivery. All unit dimensions for each model and size shall be considered maximums. Units shall be ETL listed in compliance with UL/ANSI Standard 1995, and be certified as complying with the latest edition of ARI Standard 440.*
- C. *Construction: All unit chassis shall be fabricated of heavy gauge galvanized steel panels able to meet 125 hour salt spray test per ASTM B-117. All exterior panels shall be insulated with 1/2" thick fiberglass insulation with a maximum k value of .24 (BTU • in) / (hr • ft<sup>2</sup> • °F) and rated for a maximum air velocity of 5000 f.p.m. Insulation must meet all requirements of ASTM C1071 (including C665), UL 181 for erosion, and carry a 25/50 rating for flame spread/smoke developed per ASTM E-84, UL 723 and NFPA 90A.*
- D. *Provide standard fiberglass insulation. Insulation shall conform to UL 181 for erosion and NFPA 90A for fire, smoke and melting, and comply with a 25/50 Flame Spread and Smoke Developed Index per ASTM E-84 or UL 723. Additionally, insulation shall comply with Antimicrobial*



*Performance Rating of 0, no observed growth, per ASTM G-21. Polyethylene insulation is not acceptable. All concealed units shall have a minimum 1 1/4" duct collar on the discharge. Plenum units shall have a minimum 1" duct collar on the return. Mixing units shall have top and rear inlet damper location.*

- E. Sound: Manufacturer shall provide AHRI 260 sound power data at any specified airflow and static pressure.*
- F. Fan Assembly: Unit fan shall be a dynamically balanced, forward curved; DWDI centrifugal type constructed of galvanized steel for corrosion resistance. Motors shall be high efficiency, permanently lubricated sleeve bearing, permanent split-capacitor type with UL and CSA listed automatic reset thermal overload protection and three separate horsepower taps. Single speed motors are not acceptable.*
- G. The fan assembly shall be easily removable for servicing the motor and blower at, or away from the unit. The entire fan assembly shall be able to come out of the unit by removing four nuts per fan and unplugging the motor(s). Plenum unit fan assemblies shall be easily serviced through the filter opening or through the bottom panel.*
- H. Provide Electronically Commutated (EC) Motor capable of operation with low voltage 3 speed thermostat. Motor shall come factory programmed and configured for 3 speed operation.*
- I. Motor shall be capable of accepting a 2-10 VDC output from BAS.*
- J. Coils: All coils shall be ARI 410 certified and tagged with an ARI 410 label. All cooling and heating coils shall optimize rows, circuit count, and fin density to meet the specified capacity. Coils shall have seamless copper tubes and shall be mechanically expanded to provide an efficient, permanent bond between the tube and fin. Fins shall have high efficiency aluminum surface optimized for heat transfer, air pressure drop and carryover. All coils shall be hydrostatically tested at 450 PSIG air pressure under water and rated for a maximum of 450 PSIG working pressure at 200°F. Direct expansion cooling coils shall include a fixed orifice distributor. All evaporator coils shall be factory sealed and charged with a minimum 5 PSIG nitrogen or refrigerated dry air. Steam coils shall be standard steam type suitable for temperatures above 35°F and 15 PSIG maximum working pressure. All coils shall be provided with a manual air vent fitting to allow for coil venting. Heating coils shall be furnished in the reheat. Provide a condensate overflow switch in the primary drain pan for condensate overflow.*
- K. Drain Pans: Primary condensate drain pans shall be single wall; heavy gauge galvanized steel for corrosion resistance and extend under the entire cooling coil. Drain pans shall be of one-piece construction and be positively sloped for condensate removal. Drain pan shall be removable without the use of tools. The drain pan shall be externally insulated with fire retardant, closed cell foam insulation. The insulation shall carry no more than a 25/50 Flame Spread and Smoke Developed Rating per ASTM E-84 and UL 723 and an Antimicrobial Performance Rating of 0, no observed growth, per ASTM G-21.*
- L. Filters: All plenum and exposed units shall be furnished with a minimum 1" nominal glass fiber throwaway filter. Filters shall be tight fitting to prevent air bypass. Plenum and exposed unit filters shall be easily removable from the bottom of the unit without the need for tools. Provide unit with 2" pleated filters rated at MERV 8 based on ASHRAE 52.2 – 1999.*

**M. Electrical: Units shall be furnished with single point power connection and fused, or circuit breaker disconnect. Provide an electrical junction box with terminal strip for motor and other electrical terminations. The factory mounted terminal wiring strip consists of a multiple position screw terminal block to facilitate wiring terminations for the electric control valves and thermostats. Unit shall be furnished with disconnect switch. The disconnect switch shall be operable from the outside of the cabinet to reduce hazards during field service and commissioning.**

**N. Controls:**

- 1. Unit shall be supplied with a terminal strip for connection of the Metasys controller. Controller provided by Johnson Metasys factory direct controls.**
- 2. Unit shall be controlled as described in the specification section 230900 ATC Systems**

**(Addendum #2)**

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Locate baseboard radiation on outside walls and run cover continuously wall-to-wall unless otherwise indicated. Center elements under windows. Install end caps where units butt against walls.
- C. Install convectors and cabinet heaters as indicated. Coordinate to assure correct recess size for recessed convectors.
- D. Protect units with protective covers during balance of construction.

#### **3.2 CLEANING**

- A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.
- C. Install new filters.
- D. Fan motor shall be totally enclosed and permanently lubricated for long life and low maintenance.
- E. Heater shall contain automatic reset thermal overload protector to disconnect power in event of overheating due to accidental blockage.
- F. Heater shall contain built-in fan delay switch to energize fan motor only after elements are heated to prevent discharge of unheated air. When heat shuts off, switch shall de-energize fan motor only after residual heat has been dissipated.

- G. Heater shall contain built-in double-pole disconnect switch for added safety during maintenance.
- H. Electric wall heater shall be wall or recessed model as indicated.
- I. Unit shall be furnished with self-contained tamper-resistant thermostat with tamper-proof front cover.

END OF SECTION 230835

## SECTION 230855 - AIR HANDLING UNITS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Air Handling Units
- B. Rooftop Units (**Addendum #2**)

#### 1.2 REFERENCES

- A. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils
- B. ARI 430 - Central-Station Air-Handling Units
- C. ARI 435 - Application of Central-Station Air-Handling Units
- D. NFPA 70 - National Electrical Code
- E. SMACNA - HVAC Duct Construction Standards - Metal and Flexible

#### 1.3 SUBMITTALS

- A. Submit in accordance with provisions of Section 230010.
- B. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Unit shall be shipped with doors bolted shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.
- B. Installation, Operation, and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location should be followed.
- C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the installation, Operation, and Maintenance Manual.

#### 1.5 SIZING REQUIREMENTS

- A. Manufacturers listed as accepted substitutes are required to verify if their units will fit in the available space with adequate clearances. Unit dimensions shall be equal to, or less than the basis of design units.

## 1.6 PRODUCTS

### 1.7 AIR HANDLING UNIT (*RTU-3*) (*Addendum #2*)

- A. Manufacturers
  - 1. JCI/York
  - 2. Addison
  - 3. Greenheck Fan Corporation
  - 4. Aeon
  - 5. **Trane (*Addendum #2*)**
- B. Configuration
  - 1. Filter section
  - 2. **Heating Coils (*Pre-heat*)**
  - 3. **Cooling Coil**
  - 4. **Heating Coils (*Reheat coil section*) (*Addendum #2*)**
  - 5. Fan section
- C. General
  - 1. Factory assembled air-handling unit that is modular in design and construction. Unit may consist of a fan and coil section with factory-installed chilled water or direct expansion coil, preheat or reheat coil, heating coil section, filter section, combination filter/mixing box (flat or V-bank arrangement), or access section(s) as indicated on the equipment schedules.
- D. Unit Cabinet
  - 1. Unit panels shall be constructed of 20-gauge G40 galvanized steel and shall be capable of withstanding 125-hour salt spray test per ASTM Standard 117. All casing panels shall be removable for easy access to the unit. All panels shall be gasketed to ensure a tight seal.
  - 2. Double wall unit panels (includes corner posts, mullions and access doors) shall be 1-in. nominal thickness using 1.5-lbs/ft<sup>3</sup> fiberglass insulation between galvanized steel panels.
  - 3. Insulation shall be secured to casing with water based adhesive, and weld pins where necessary, corresponding to 25/50-flame spread/smoke developed.
  - 4. Condensate drain pans shall be sloped to prevent standing water and shall be constructed of 18-gauge G40 galvanized steel or stainless steel; they shall have a galvanized steel or stainless steel male pipe threaded drain connection.
- E. Fan Section
  - 1. Fan sections shall be constructed of G40 steel and shall have a formed channel base for integral mounting of fan, motor, and casing panels. Fan housing, wheel, shaft, and bearings shall be rigidly secured to the base unit.
  - 2. Fan decks shall be internally spring isolated (one-inch deflection) with the fan outlet connection to be made using canvas duct.
  - 3. Each unit shall have one fan wheel and housing only.
  - 4. Fan wheels shall be designed for continuous operation at the maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected to operate at least 25% below the first critical speed and shall be statically and dynamically balanced as an assembly.
  - 5. Fan shafts shall be solid steel, turned, ground and polished.

6. Fan bearings shall be self-aligning, non-regreasable (permanent) ball bearing type selected for an average life (L50) of 100,000 hours at design operation conditions, per ANSI Code B3.15.
  7. Fan motor shall be mounted within the fan section casing. Motor shall be NEMA Design B with sizes and electrical characteristics as shown on the equipment schedule.
  8. Fan drive shall be designed for a minimum of 1.15 service factor and shall be factory mounted and aligned. Belt drive package shall be variable-pitch type (constant volume) or fixed-pitch type (variable volume).
- F. Coil Sections
1. All coils shall have aluminum plate fins mechanically bonded to 1/2-in. OD seamless copper tubes by mechanical expansion. Coils shall be factory leak tested at 450-psig air pressure under water in an illuminated test tank. Copper tubes shall be either 0.016" or 0.025" copper tube wall thickness. Coils shall have G40 galvanized steel or stainless-steel casings with copper headers and sweat connections.
  2. Chilled water coils shall have a working pressure of 450-psig at 200°F. No turbulence-promoting devices will be permitted inside the tubes. Headers shall have vent connections.
  3. Hot water coils shall have a working pressure of 450-psig at 200°F. No turbulence-promoting devices will be permitted inside the tubes. Headers shall have vent connections.
- G. Filter Sections
1. Each filter section shall be designed and constructed to house the specific type of filter specified on the equipment schedule.
- H. Access Stations
1. Access sections shall be installed where indicated on the drawings and shall be as specified on the equipment schedule.
  2. Access sections shall have removable access panels.
- I. Special Features: The following shall be included:
1. Fan Section:
    - a. Variable frequency drives.
    - b. Motor starters – contactor with overload for three phase and contactor for single phase.
    - c. High-efficiency motors (inverter-duty).
    - d. Totally enclosed fan cooled (TEFC) motors (inverter-duty).
    - e. Class II forward curved fans with regreasable pillow block bearings.
    - f. Provide with factory mounted non-fused disconnect.
  2. Coil Section:
    - a. Chilled water coil with copper plate fins and/or stainless steel casing.
    - b. Hot water coil with copper plate fins and/or stainless steel casing.
  3. Access Doors: Hinged (lift-off type) doors with quick-action latches (handles) on both sides of the section for access to both the fan and filter from either side of the unit.
  4. Base Rail: Unit mounted base rail shall be a minimum of 4" in height and constructed of galvanized steel, structurally capable of supporting unit on floor or by ceiling suspension.
- J. Unit Controls
1. ***Terminal Strip controls for field supplied and installed controls.***

2. ***Where unit mounted controls are required they shall be protocol in accordance with Johnson Metasys factory direct controls per specification section 230900. Contractor and Manufacturer are required to coordinate with control contractor.***

***K. Curb: Refer to Specification Section 230100. (Addendum #2)***

**1.8 PACKAGED ROOF TOP HEATING COOLING UNIT (RTU-1, RTU-2, RTU-4) (Addendum #2)**

**A. Manufacturers:**

1. Johnson Controls
2. ***Trane***
3. ***Lennox***
4. ***Greenheck Fan Corporation***
5. ***Aaon (Addendum #2)***

**B. Configurations: Hot Water Heating; DX Cooling**

**C. General:** Unit shall be factory assembled, piped, internally wired and fully charged with refrigerant. Unit shall be designed to operate at outdoor ambient temperatures as high as 115 degrees F. Cooling and heating capacities shall be rated in accordance with ARI standards. Unit design shall be certified by the CSA specifically for outdoor applications using propane or natural gas. Unit shall be designed for outdoor rooftop level installation.

**D. Casings:** Unit casing shall be Double Wall, heavy gauge galvanized steel with exterior surfaces painted. Unit casing shall be capable of withstanding 750- hour salt spray exposure per ASTM B117 (scribed specimen). All panels shall be heavy gauge steel, gasketed, and insulated. Fiberglass insulation with thermal conductivity of 0.23 or better, adhered with water-based adhesive shall be installed. Removable, hinged access or service panels shall be provided for access.

**E. Refrigeration System:** Refrigeration controls shall include condenser fan, evaporator fan, and compressor contactors, and 24-volt transformer. Each circuit shall have a separate set of refrigerant controls. Safety controls shall be an internal, motor overload device. Refrigerant shall be R-454B. ***Provide unit with leak detection controls. (Addendum #2)***

1. Compressors: Unit shall use fully hermetic scroll compressors for each independent refrigeration circuit.
  - a. Motors shall be cooled by refrigerant gas passing through motor windings.
  - b. Two stage 6-ton models shall use fully hermetic, 2-stage compressors.
  - c. Compressors shall be internally protected from high discharge temperature conditions.
  - d. Compressors shall be factory mounted on rubber grommets.
  - e. Crankcase heaters shall be installed in the factory as needed on tandem compressor sets.
2. Evaporator Coils, Aluminum Fin- Copper Tube: Standard evaporator coils shall have aluminum plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
  - a. Microchannel condenser coils shall be leak tested to 150 psig, pressure tested by supplier to 600 psig, and burst qualified to CSA C22.2 No. 60335-2-40.
  - b. Assembled unit shall be pressure tested to 450 psig.

3. Drain Pan: Shall be a multidirectional internally sloped condensate drain pan made of a non-corrosive material. Shall comply with ASHRAE Standard 62. Shall use a 1" NPT female drain connection through the side of the drain pan. Connection shall be made per manufacturer's recommendations.
  4. Hot Water Heating Coils: Standard condenser coils shall have all aluminum microchannel design consisting of aluminum multiport flat tube design and aluminum fin. Coils shall be a furnace brazed design and contain epoxy lined shrink wrap on all aluminum to copper connections.
    - a. Shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig.
    - b. Assembled unit shall be pressure tested to 400 psig.
- F. Heating Systems: Hot Water heating section shall be a completely assembled, wired and piped, hot water heating system within the unit.**
- G. Fans**
1. Supply Air Fan: Shall be standard belt drive assembly with an adjustable pitch motor pulley.
    - a. Shall use sealed, permanently lubricated ball-bearing type.
    - b. Blower fan shall be double-inlet type with forward-curved blades.
    - c. Shall be constructed from steel with corrosion resistant finish and dynamically balanced.
    - d. 6.5 ton models and above shall have a Variable Frequency Drive (VFD) installed inside the unit cabinet, mounted, wired, and tested.
    - e. VFD shall have controller for VAV Operation
  2. Condenser Fans: Shall be direct driven propeller-type fan. Shall have aluminum blades riveted to corrosion-resistant steel spider brackets and be dynamically balanced.
- H. Filters: 2" pleated MERV 13 filters, in quantity and size to fit unit filter rack.**
- I. Electrical Connections:**
1. Single Point Power Connection
- J. Accessories**
1. Disconnect Switch, Factory Installed: Unit Mounted, Non-Fused Disconnect Switch:
    - a. Switch shall be factory installed, internally mounted.
    - b. National Electric Code (NEC) and UL approved non-fused switch shall provide unit power shutoff.
    - c. Shall be accessible from outside the unit
    - d. Shall provide local shutdown and lockout capability
  2. Downflow Economizer, Factory Installed: Enthalpy controlled 100% economizer shall automatically use outdoor air for free cooling when outdoor air temperature and humidity are at acceptable levels.
    - a. Barometric relief shall be provided
- K. Controls:**
1. Terminal Strip controls for field supplied and installed controls.



2. ***Where unit mounted controls are required they shall be protocol in accordance with Johnson Metasys factory direct controls per specification section 230900. Contractor and Manufacturer are required to coordinate with control contractor. (Addendum #2)***
  - L. Warranty: Provide standard one-year complete unit parts warranty and 2-5 years compressor parts warranty.
  - M. Curb: Refer to Specification Section 230100.
- 1.9 PACKAGED ROOF TOP AIR CONDITIONING UNITS (*RTU-5, RTU-6*) (*Addendum #2*)
- A. Manufacturers
    1. Addison
    2. Greenheck Fan Corporation
    3. Aeon
    4. ***Trane (Addendum #2)***
  - B. Configuration: ***Energy Wheel, Chilled-Water Cooling Coil, Hot-Water Re-Heat Coil.***
  - C. General
    1. The unit shall be a packaged factory assembled ***air handler cooling / heating / dehumidification unit per plans and specifications. Capacity, efficiency and air delivery shall not be less than scheduled. Unit shall be provided with factory installed features listed below. Performance shall be rated per AHRI Standard 210 for units rated less than 65,000 BTUH and ARI Standard 360 for units rated over 65,000 BTUH. Unit shall be designed to conform to appropriate UL Standards by ETL, a nationally recognized testing laboratory. The unit shall be completely factory assembled, tested, piped, wired and shipped in one section. The equipment specified under this section shall be a standard product of the manufacturer and shall be fully depicted in current catalog data.***
  - D. Unit Cabinet
    1. ***Base and Cabinet: The unit shall be double wall construction with minimum 24-gauge G-90 galvanized steel outer sheet metal. Gasketed access doors shall be minimum 20-gauge steel with 2" 7# density closed cell polyisocyanurate foam core insulation and a 24-gauge galvanized steel liner. Standard outer panels will be insulated with 2" 7# density closed cell polyisocyanurate foam core insulation with a 24-gauge galvanized steel interior liner. Service access doors shall also be mounted with stainless steel hinges and equipped with 1/4 turn cam operated adjustable compression type latches. The underside of the base panel shall be insulated with 3/8" closed cell foam insulation. Each roof section shall be sloped for proper drainage. All openings through the base pan of the unit shall have upturned flanges of at least 1/2" in height. The design of the cabinet shall allow access to the electrical control panel without impairing unit operation. Cabinet shall be designed for vertical supply and return air or horizontal supply and vertical return air. Horizontal return through a roof curb shall be acceptable. The unit shall be equipped with a factory installed weatherproof, outside-air intake hood with bird screen. Outside air damper and economizer options shall be provided.***
    2. ***Paint Finish: Constructed of hot dipped galvanized G-90 steel that is chemically treated with zinc phosphate, coated with 0.2 to 0.3 MIL polyurethane primer then finished with 0.7 to 0.8 MIL polyester top coating.***

E. Fans

1. Indoor Supply, Exhaust Fans:

- a. *The supply fan(s) shall be a (SWBI) (SWAF) direct-drive assembly and shall be mounted on a rigid frame. The blower shall be mounted on the motor shaft.*
- b. *The motor(s) shall be a high efficiency open drip proof nominal 1800 or 3600 RPM. For 1.0 horsepower and larger and it is externally protected (manual reset). Motors shall be furnished with sealed ball bearings. A factory-mounted Variable Frequency Drive shall be furnished for each motor.*
- c. *VAV Control-Supply Duct DPT.*

F. **Evaporator Coil**

1. *Evaporator coil shall have a 6 row Chilled Water Coil. Evaporator coil shall be enhanced surface aluminum fins, formed on multiple rows of seamless rifled copper tubing, arranged in staggered tube configuration with galvanized steel header plates. These tubes are mechanically expanded, firmly bonding the tube to the shoulder of each fin. Dual circuit units shall have face-split coils for optimal dehumidification at part-load operation.*
2. *IAQ Condensate Drain Pan: The condensate drain pan shall be double sloped to comply with ASHRAE Standard 62-1089R and shall be fabricated from heavy gauge stainless steel. The bottom of the condensate drain pan shall be insulated with closed cell neoprene insulation. The drain pan shall be furnished with an MPT drain fitting positioned at the exterior of the cabinet. The weight of the coil and refrigerant components shall not compress the insulation thus reducing its insulation value.*

G. **Hot Water Heating**

1. *Unit shall have a minimum 4-row hot water coil, 1/2" diameter copper tube and .016" tube wall thickness with aluminum fin construction, 8 fins per inch and .006" fin thickness, with air vents. Coil is installed downstream of the supply blower. Coil connection stubs will be located inside the unit cabinet. Hydronic control valves shall be field furnished.*

H. **Energy Conservation Wheel**

1. *Wheel Media: The ECW or enthalpy wheel shall be constructed of corrugated synthetic fibrous media, with a desiccant intimately bound and uniformly and permanently dispersed throughout the matrix structure of the media. Rotors with desiccants coated, bonded, or synthesized onto the media are not acceptable due to delaminating or erosion of the desiccant material. Media shall be synthetic to provide corrosion resistance and resistance against attack from laboratory chemicals present in pharmaceutical, hospitals, and other harsh environments. Coated aluminum is not acceptable. Rotor shall be constructed of alternating layers of flat and corrugated media. Wheel layers should be uniform in construction forming uniform aperture sizes for air flow. Wheel construction shall be fluted or formed honeycomb geometry so as to eliminate internal wheel bypass. Ribbon type wheels or wheel layers that can be separated are unacceptable due to the possibility of channeling and performance degradation. The minimum acceptable performance shall be as specified in the drawings/ submittal. The wheel shall slide out the side of the unit cabinet for easy service.*
2. *Desiccant Material: The desiccant material shall be a molecular sieve, and specifically a 4-angstrom or smaller molecular sieve to minimize cross contamination.*

3. **Wheel Media Support System:** The wheel frames shall consist of evenly spaced steel spokes, galvanized steel outer band and rigid center hub.
  4. **Wheel Seals:** The wheel seals shall be full contact nylon brush seals or equivalent
  5. **Wheel Cassette:** Cassettes shall be fabricated of heavy duty reinforced galvanized steel. Cassettes shall have a built-in adjustable purge section minimizing cross contamination of supply air. Bearings shall be inboard, zero maintenance, permanently sealed roller bearings, or alternatively, external flanged bearings. Drive systems shall consist of fractional horsepower A.C. drive motors with multilink drive belts.
  6. **Certification:** The wheel shall be ARI certified and must bear the ARI certification stamp. Private independent testing performed "in accordance with" various standards is not a substitute for ARI certification and shall not be accepted. The wheel shall be listed or recognized by UL or equivalent.
  7. **ECW Options:** Factory mounted VFD temperature actuated defrost control for the ECW.
- I. **Filter Section**
1. **Standard filter section** shall have 2 in. filter racks of 20 gage G-90 construction. 2-in. thick **MERV-8 pleated media filters** as standard.
- J. **Controls**
1. Terminal Strip controls for field supplied and installed controls.
  2. **Where unit mounted controls are required they shall be protocol in accordance with Johnson Metasys factory direct controls per specification section 230900. Contractor and Manufacturer are required to coordinate with control contractor.**
- K. **Electrical**
1. **The unit shall be designed for electrical power entry through the curb. The starter/control panel shall include a programmable logic controller and a complete modular, integrated motor control system mounted on din rails. All safety and operating controls shall be factory mounted. The system shall also include all relays, fan contactors, compressor contactors, and power distribution. The 24-volt control circuit shall include a transformer and low voltage terminal strip for interface with a control system.**
  2. **A factory mounted and wired non-fused disconnect.**
- L. **Ventilation**
1. **The unit shall be equipped with a factory installed motorized two position Outside Air Damper (used for 100%Outside Air) with a weatherproof air intake hood and bird screen.**
  2. **The unit shall be equipped with a factory installed fully modulating enthalpy economizer with a weatherproof, full-size, outside-air intake hood and bird screen. The economizer shall consist of actuator operated outside and return air dampers. The dampers shall be constructed with 14 gauge galvanized steel frames and 16 gauge galvanized steel formed blades. The blades shall have parallel action. Each blade shall have vinyl edge seals and aluminum end seals for a maximum leakage rate of 6.25 cfm/sq. ft. Shafts shall be square, plated steel stubs in oil-impregnated bronze sleeves. Linkage shall be plated steel arms with stainless steel pivots and galvanized steel angles, located external to the damper blades. Stops shall be 16 gauge steel angles. A direct connected actuator shall be connected to extended shafts. Plastic gears are not acceptable. A gravity relief damper and discharge hood are also included**

**M. Curb: Refer to Specification Section 230100. (Addendum #2)**

**1.10 MAKE-UP AIR UNIT (MAU-1), PACKAGED ROOFTOP VENTILATORS - HEATING/COOLING**

**A. Manufacturers**

1. JCI/York
2. Addison
3. Greenheck Fan Corporation
4. Aeon
5. **Trane (Addendum #2)**

- B. Description:** Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, downturn outdoor air intake with 2" aluminum mesh filter assembly, hot gas reheat coil, indirect gas-fired furnace, packaged DX system, phase and brownout protection, motorized dampers, curb assembly, filter assembly intake air, supply air blower assembly, and an electrical control center. All specified components and internal accessories factory installed are tested and prepared for single-point high voltage connection except with electric post heat and exhaust fan only power which have dual point power

**C. Cabinet**

1. **Materials:** Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
  - a. Unit's exterior shall be supplied from the manufacturer using G60 galvaneal steel with proprietary pre-painted material in the following finish color; Concrete Gray-RAL 7023. This has been subjected to a salt spray test per ASTM-B117 and evaluated using ASTM-D714 and ASTM-D610 showing no observable signs of rust or blistering until reaching 2,500 hours. Uncoated galvanized steel exterior is not acceptable.
  - b. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.
2. **Cabinet Insulation:** Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
  - a. **Materials:** Rigid urethane injected foam. Foam board not acceptable.
    - 1) Thickness: 2 inch (50.8 mm)
    - 2) Thermal Resistance R13
    - 3) Thermally broken
    - 4) Meets UL94HF-1 flame requirements.
    - 5) Location and application: Full coverage of entire cabinet exterior to include walls, roof of unit, unit base, and doors.
  - b. **Materials:** Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
    - 1) Thickness: 2 inch (50.8 mm)
    - 2) Thermal Resistance R8
    - 3) Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
    - 4) Location and application: Divider panels between outdoor air and return air/exhaust air streams.
3. **Roof Insulation:** 2 inch (50.8 mm) fiberglass located above the 1 inch (25.4 mm) foam panel.

4. Access panels / doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of 18 gauge galvanized G90 steel or painted galvanized steel.
5. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and direct-drive fans. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motors shall be capable of continuous speed modulation and controlled by a VFD.
6. Evaporator Coil: Evaporator coil shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be a single circuit design. constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame.
7. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections. RTU shall be equipped with a Unit Disconnect Switch.
8. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.
9. P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices.
10. Reheat coil shall be an all-aluminum micro channel design with factory installed modulating hot gas reheat valve.
11. Indirect gas furnace
  - a. Shall be ETL Certified as a component of the unit.
  - b. Shall have an integral combustion gas blower.
  - c. Shall be ETL Certified for installation downstream of a cooling coil.
  - d. Shall have fault sensors to provide fault conditions to optional digital controller or building controls.
  - e. Shall have 4-pass tubular heat exchangers, constructed of type 409 stainless steel. Heat exchanger tubes shall be installed on the vest plate by means of swaged assembly, welded connections are not acceptable. Heat exchanger tubes shall be supported by a minimum of two fabricated assemblies that support the tubes and also permit expansion and contraction of the tubes.
  - f. Heat exchanger shall have a 25 year extended warranty.
  - g. Furnace control shall be 4:1 Modulating.
  - h. Shall be encased in a weather-tight metal housing with intake air vents. Large, metal lift-off door shall provide easy access to the enclosed vest plate, control circuitry, gas train, burner assembly and exhaust blower.
  - i. Shall have solid state controls permitting stand-alone operation or control by building controllers.
12. Packaged DX System: Unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. Condenser coils shall be all-aluminum micro channel design appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the unit's exterior. Lead condenser fan(s) will have an electronically commutated (EC) motor that will modulate to maintain a head pressure set point.] Motors shall be UL Recognized and CSA Certified. The lead refrigerant

compressor shall be inverter hermetic scroll-type. Additional compressor shall be single stage hermetic scroll-type paired in tandem with lead inverter compressor. Compressors shall be equipped with liquid line filter drier, electronic expansion valves (EEV) or thermostatic expansion valves (TXV) on non-inverter compressor circuits, manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports, leak detection sensors and safety devices. Compressed refrigerant system shall be fully charged with R-454B refrigerant. Compressors shall be mounted within an insulated access compartment and on a raised cabinet shelf to reduce sound and vibration. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.

13. Condenser Fans: Fan blades must be constructed of aluminum or a composite material and have a geometry designed and documented to reduce sound and energy when compared to a traditional rectangular blade fan. Traditional rectangular blade fans are not allowed due to increased noise generated and increase power utilized. Condenser fan motors shall be three phase, external rotor, type 56 frame, open air over and shaft up. Each condenser fan motor shall have a vented frame, rated for continuous duty and be equipped with an automatic reset thermal protector. Lead condenser fan(s) will have an electronically commutated (EC) motor that will modulate to maintain a head pressure set point. Motors shall be UL Recognized and CSA Certified. Single condenser fan running at max RPM and design static pressure shall not exceed an A-weighted sound power level of 75 db at free inlet/outlet test conditions.
14. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:
  - a. Global alarm condition (active when there is at least one alarm)
  - b. Supply Air Proving alarm
  - c. Compressor Trip alarm
  - d. Compressor Locked Out alarm
  - e. Supply Air Temperature Low Limit alarm
    - 1) Sensor #1 Out of Range (outside air temperature)
    - 2) Sensor #2 Out of Range (supply air temperature)
    - 3) Sensor #3 Out of Range (cold coil leaving air temperature)
15. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.
16. Motorized dampers / Intake Air, Motorized dampers of low leakage type shall be factory installed.
17. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly. The curb shall be the height of 18 in.
18. Bipolar Ionization: Needlepoint bipolar ionizer is factory mounted and provides air disinfection. The ionizer is on when there is power to the unit disconnect.

D. Blower

1. Blower section construction, Supply Air: direct drive motor and blower shall be assembled on a 14 gauge galvanized steel platform and shall be equipped with 1.125 inch thick neoprene vibration isolation devices.
2. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.
3. Fan: Direct drive, airfoil plenum fan with aluminum wheel statically and dynamically balanced. Prop or belt-drive fan not acceptable due to low static capabilities.
4. Blades: Welded aluminum blades only.
5. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

E. Motors

1. General: Blower motors greater than 1/2 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPart minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure.
2. Motors shall be 60 cycle, 3 phase 208 volts.

F. Controls

1. ***Terminal Strip controls for field supplied and installed controls.***
2. ***Where unit mounted controls are required they shall be protocol in accordance with Johnson Metasys factory direct controls per specification section 230900. Contractor and Manufacturer are required to coordinate with control contractor. (Addendum #2)***

G. Filters

1. Unit shall have permanent 2 inch aluminum filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the supply air stream. MERV 13 disposable pleated filters shall be provided in the supply final air stream.

H. ***Curb: Refer to Specification Section 230100. (Addendum #2)***

1.11 EXECUTION

1.12 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in conformance with ARI 435.
- C. Install assembled units on vibration isolators.
- D. Install assembled units on curb rail vibration isolators.

#### 1.13 EXAMINATION AND COORDINATION

- A. General: Install energy recovery units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Connections: Install piping and ductwork to allow service and maintenance.
- C. Cleaning:
  - 1. After completing system installation and testing, inspect exposed finishes. Clean and remove burrs and construction debris, repair damaged finishes.
  - 2. Vacuum equipment interior to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, and coils.
- D. Field Quality Control and Testing: Operational Test: Upon completion of inspection, testing, and start-up, test system for proper operation and system capacity. Repair malfunctions and/or replace components. Re-test equipment until proper operation is achieved.
- E. Start-Up: Provide services of a factory trained representative to start-up equipment. Contractor shall assist and cooperate with factory representative as required. Coordinate start-up with TAB & ATC Contractors. Start-up equipment in accordance with manufacturer's instructions. Refer to Section 230990, "Testing, Adjusting, and Balancing" for additional start-up procedures.
  - 1. Ensure filters are installed prior to initial start-up; do not start-up or operate equipment without filters in place. Filters shall remain in place through the duration of construction
  - 2. Provide and install new filters upon turnover to Owner.
  - 3. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- F. Training: Provide services of manufacturer's service representative to instruct Owner's personnel in operation and maintenance of rooftop air handling units. Training to include start-up and shut-down, servicing, and preventative maintenance schedules and procedures, and troubleshooting procedures, and procedures for obtaining replacement parts and technical assistance. Review operating and maintenance data contained in the Operating and Maintenance Manuals specified in Division One. Schedule 4 hours of training with Owner, schedule at least 7-days prior notice.
- G. Demonstration: After completion of inspections, installation, and testing, Contractor shall perform the following demonstration inspections and tests in the presence of the Engineer and Owner.
  - 1. Verification of proper installation
  - 2. System functional and safety tests
  - 3. System operational tests

#### 1.14 END OF SECTION 230855



## SECTION 230900 - ATC SYSTEMS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Johnson Controls HVAC Control Equipment & Wiring
- B. Johnson Controls Metasys Building Management System
- C. Software including Graphics Package
- D. Building Systems Interface
- E. Sequence of Operation

#### 1.2 SCOPE OF WORK

- A. The system shall extend the existing campus Branch Metasys BMS to implement a single Graphical User Interface (GUI) as the single-seat solution for HVAC Control and electrical systems monitoring and control as specified herein. Please contact Mike Turriziani for Branch Metasys scope of work, [Mike.turriziani@jci.com](mailto:Mike.turriziani@jci.com).
- B. Provide occupied/unoccupied/warm-up zone control for zones as follows. Provide with four (4) Optimizer Zones.
  - 1. Cafeteria
  - 2. Kitchen
  - 3. Gymnasium
  - 4. Lobby and Public Toilets, Corridors, Etc.
  - 5. Admin. Office, Health Office, Guidance Office
  - 6. Media Center/ Library
  - 7. Classrooms Area A
  - 8. Classrooms Area B
  - 9. Classrooms Area C
  - 10. Classrooms Area D
  - 11. Classrooms Area E
- C. Furnish and install a complete electronic DDC system of automatic control for controlling all new HVAC equipment throughout the building.
- D. Interface the Lighting Control System as described in Section 23 09 60 for control of the specified lighting zones.
- E. Provide interface to electric meter (furnished and installed by the Electrical Contractor).

- F. Provide interface to the existing campus wide Metasys System for monitoring of PJM and local distribution company(s) current and forecasted loads; and for implementing automated curtailment strategies.
- G. DDC System shall control Day/Night/Auto time schedule and optimizer control for all zones.
- H. Through the HVAC Control System, provide the necessary points and associated sensors, relays, valves, wiring, programming, etc. to accomplish to Sequence of Operations as specified herein.
- I. New DDC Control Panel shall be connected, by means of Ethernet connection to a personal computer (provided by the Contractor) located as directed by the Owner.
- J. Provide full graphics package as part of software.
- K. Power Monitoring:
  - 1. Provide an interface to the KWH and KW demand signals from a digital multimeter provided on the main electric service by the Electrical Contractor.
  - 2. Provide electrical data (kWh and kW) to the Johnson Controls Metasys Server
  - 3. Provide real time graphic displays of power usage including current usage, year-to-date usage, maximum usage, and minimum usage for each category of use.
  - 4. Provide real time and forecasted PJM Grid load.
  - 5. Provide real time and forecasted load for the PPL and Met Ed utilities.
  - 6. Energy usage data shall be accurate to 1% and will be used for LEED validation of the building design.
  - 7. The BAS shall provide all electrical power data to the Owner via a graphic interface and reports.
- L. Generator Monitoring:
  - 1. The BAS system shall display 16 pre-warning and alarm conditions for the standby electric generator.
  - 2. Interface to the generator will be by way of a Modbus connection between the generator control and the BAS.
- M. UPS Power System: Provide UPS power units for the BAS panel to keep systems powered constantly during switchover from normal to emergency power.
- N. The "Scope of Work" to be performed under this Contract shall be used as a guide only and will not be considered as the limit of this contract. Any additional items which are not specifically called for, but which are required by the specification shall be furnished and installed by the contractor without additional cost to the School District.
- O. ***Control Contractor shall refer to equipment specifications for equipment controls. They are responsible for coordinating additional controls and controllers as required to make the equipment interface and to provide the specified sequences of control. (Addendum #2)***

### 1.3 QUALIFICATIONS

- A. The Automatic Control System shall be installed complete by competent, trained mechanics regularly employed by the manufacturer of the automatic control equipment. Control manufacturer shall have an established (minimum of 20 years) branch office staffed with installation and service mechanics; factory trained engineers and technicians fully capable of rendering training, instruction, and engineering assistance; as well as providing routine and emergency service on all system components.

### 1.4 PRODUCTS NOT FURNISHED UNDER THIS SECTION

- A. Smoke detectors will be furnished and installed by Electrical Contractor who will provide an auxiliary contact for connection by ATC Contractor.

### 1.5 SUBMITTALS

- A. Submit in accordance with provisions of Section 23 00 10.
- B. Shop Drawings:
  - 1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
  - 2. List of connected data points, including connected control unit and input device.
  - 3. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
  - 4. System configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
  - 5. Descriptive data and sequence of operation of operating, user, and application software.
  - 6. Minimum requirements for Owner supplied hardware.
- C. Product Data: Provide data for each system component and software module including catalog sheets, specifications, wiring, damper and valve schedule, flow diagram of system.

### 1.6 PROTECTION OF SOFTWARE RIGHTS

- A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:
  - 1. Limiting use of software to equipment provided under these specifications.
  - 2. Limiting copying.
  - 3. Preserving confidentiality.
  - 4. Prohibiting transfer to a third party.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. The System shall be an extension of the district's existing Metasys BMS as furnished and installed by Johnson Controls, Inc. **Factory direct Johnson Controls only. Johnson franchise controls are not permitted. Controls contract is as follows: (Addendum #2)**
  - 1. Johnson Controls Inc. – Contact: Mike Turriziani, (610) 247-6062, [mike.turriziani@jci.com](mailto:mike.turriziani@jci.com)

### 2.2 GENERAL

- A. The Building Automation System shall include but not be limited to the following components.
  - 1. The Operator Interface shall consist of hardware and software that allows full user monitoring and adjustment of system parameters.
  - 2. System Application Controllers shall manage the Energy and Building Management capabilities of the automation system as well as facilitate remote communications and central monitoring.
  - 3. Application Specific Controllers shall provide distributed, pre-engineered control, specific to the mechanical equipment specified.
  - 4. Custom Application Controllers with distributed custom programming capability shall provide control for nonstandard control sequences.
  - 5. The Data Communications capability shall allow data to be shared between the various controllers in the architecture.
  - 6. The system software shall include system software for global application functions, application software for distributed controllers, and operator interface software.
  - 7. End devices such as sensors, actuators, dampers, valves, and relays.
- B. The failure of any single component shall not interrupt the control strategies of other operational devices. System expansion shall be through the addition of end devices, controllers, and other devices described in this specification.
- C. All system components are to be designed and built to be fault tolerant.
  - 1. Provide satisfactory operation without damage at 110% above and 85% below rated voltage and at +3 hertz variation in line frequency.
  - 2. Provide static, transient, and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interference. Bus connected devices shall be a.c. coupled or equivalent so that any single device failure will not disrupt or halt bus communication.

### 2.3 ACCEPTABLE MANUFACTURERS

- A. Type and manufacturers: Fully integrated Building Management System (BMS) incorporating Type and manufacturers: Fully integrated Building Management System (BMS) incorporating Network Central Processors (NCP), Energy Management Monitoring and Control. All control components shall be standard products of the manufacturer.
- B. The system shall be provided and installed by Johnson Controls, Inc.

## 2.4 SPECIFICATION NOMENCLATURE

- |    |         |   |
|----|---------|---|
| A. | ASC     | Application Specific Controller                 |
| B. | BC      | Building Controller                             |
| C. | CAC     | Custom Application Controller                   |
| D. | CSMA/CD | Carrier Sense Multiple Access/ Collision Detect |
| E. | FMCS    | Facility Management Control System              |
| F. | FTT     | Free Topology Transceivers                      |
| G. | GP      | Graphical Programmer                            |
| H. | GUI     | Graphical User Interface                        |
| I. | ISO     | International Standards Organization            |
| J. | LAN     | Local Area Network                              |
| K. | LCD     | Liquid Crystal Display                          |
| L. | UTP     | Unshielded Twisted Pair                         |
| M. | WAN     | Wide Area Network                               |

## 2.5 MATERIALS

- A. All products used in this project installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of [2] years. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner's Representative in writing. Spare parts shall be available for at least 5 years after completion of this contract.

## 2.6 COMMUNICATION

- A. Control system provided for this project shall consist of a peer-to-peer networked, stand-alone, distributed system. The FMCS (Facility Management Control System) requires the incorporation of BACnet Technologies using specific conformance to the latest BACnet guidelines in all unitary, terminal units and other DDC devices.
- B. BACnet communications protocol shall be used on the Primary Control communication network between FMCS controllers and other BACnet devices to assure interoperability between all devices within the network.
- C. The FMCS shall support the direct integration of standard and non-standard communicating systems. At a minimum, the FMCS shall deliver connectivity at the BACnet, IP, and GUI levels

through standard offerings. The FMCS shall offer as a standard available solution, a minimum of 300 individual communicating interfaces to 3<sup>rd</sup> party products.

- D. The FMCS shall provide compliance with the ANSI/ASHRAE standard 135-1995 for interoperability.
- E. The FMCS shall provide a high-speed Enterprise Network Interface that shall plug directly into the BC (Building Controllers) which supports one of the following types of communication standards between BCs:
  - 1. Ethernet:
    - a. The Network Interface shall employ Carrier Sense Multiple Access/Collision Detect (CSMA/CD) contention type protocol, which adheres to the industry standard format IEEE 802.3. The content of messages shall be the manufacturer's standard. The Network Interface shall be fully Internet Protocol (IP) compliant allowing connection to currently installed IEEE 802.3 compliant Ethernet Networks.
    - b. The Network Interface shall directly support connectivity to a variety of cabling types. As a minimum provide the following connectivity: 10Base2 (ThinNet RG-58 A/U Coaxial cabling with BNC connectors), 10Base T (Twisted-Pair RJ-45 terminated UTP cabling).
  - 2. BACnet:
    - a. The ability to support bi-directional access to remote BCs shall be supported by a single point of connection. The ability to monitor and edit system data shall be provided via the BC remote communication connection. Connection via the GUI, the GP as well as a standard VT-100 terminal interface shall be provided. Support for solicited as well as unsolicited communications is a requirement.
    - b. Enterprise Level Communication Network (ELCN) shall consist of high-speed BACnet/IP Local Area Network (LAN) and/or Wide Area Network (WAN) to host Operators Workstations (B-OWS), Building Controllers (B-BC), Building Level Communication Networks (BLCN) and Web-Enabled remote connectivity
    - c. Building Level Communication Network (BLCN) shall consist of a BACnet internetwork to host field level DDC Controllers.
    - d. B-BC's shall automatically route BACnet communications to all configured available BACnet networks.
    - e. B-OWS and B-BC's shall be fully IT-compatible devices that communicate directly on a TCP/IP Local Area Network (LAN).
      - 1) LAN shall be 10/100Mbps TCP/IP with the following minimum requirements:
        - a) Cable: 10 base-T, UTP-8-wire, category 5e or greater
        - b) Minimum throughput: 10Mbps with the ability to increase to 100Mbps
      - 2) Enterprise Level Communication Network (ELCN) shall provide communication between BBC's, B-OWS, remote B-OWS and Web Server using a B/IP LAN backbone.
      - 3) B-BC's shall connect directly to the LAN and communicate using B/IP without a TCP/IP Gateway or network server
      - 4) Owner shall be responsible for providing TCP/IP networking scheme, addressing, &c. It shall be the responsibility of the BAS Contractor to coordinate implementation of the BAS on the Owner's LAN without disruption.
    - f. BAS Manufacturer must natively support the following BACnet data links as defined in the ANSI/ASHRAE Standard 135-2008, BACnet:

- 1) Point-to-Point (PTP)
  - 2) Master Slave/Token Passing (MS/TP)
  - 3) Ethernet (ISO 8802-3)
  - 4) BACnet IP (B/IP)
- g. Field sensors and control devices shall connect to peer-to-peer, fully programmable B-BC, B-AAC & B-ASC as required to achieve the point monitoring and Sequence of Control as specified herein. All devices are to be monitored by a B-OWS. Final control devices are to be electronic.
  - h. There shall be no power wiring, in excess of 30 Vac rms voltage, run in conduit with communications trunk wiring. In cases where power or signal wiring is run in conduit with trunk wiring, all communications trunk wiring and power wiring shall be run using separate twisted pairs, 22-ga, (Cat 4).
  - i. The FMCS shall support the direct integration of standard and non-standard communicating systems. At a minimum, the FMCS shall deliver connectivity at the BACnet, Lon, IP, and GUI levels through standard offerings. The FMCS shall offer as a standard available solution, a minimum of 300 individual communicating interfaces to 3<sup>rd</sup> party products. The FMCS shall provide a standard available kit for development of additional interfaces by others, in addition to the FMCS manufacturer.
  - j. The FMCS shall provide compliance with the ANSI/ASHRAE Standard 135-1995 for interoperability.

## 2.7 OPERATING INTERFACE (GRAPHICAL USER INTERFACE)

### A. System Software (GUI):

1. Operating System. FMCS shall operate under Windows environment.
2. System Graphics: The operator workstation software shall be graphically oriented. The system shall allow display of multiple graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while online. An operator with the proper password level shall be able to add, delete, or change dynamic points on a graphic. Dynamic points shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the point.
3. Custom Graphics: Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in industry standard formats such as AI, TGA, PCX, JPEG, and BMP. The graphics generation package also shall provide the capability of capturing or converting graphics from other programs such as Designer, AutoCAD or Visio.
4. Graphics Library: Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, and variable air volume terminals. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.

5. Graphic Tools: Graphic applications shall support Active X controls and use them in any application window. Active X controls shall be used to handle control events, call control methods, and set and get control properties from quick scripts
- B. System Applications: The operator workstation shall provide operator interface and off-line storage of system information. Provide the following applications at each workstation:
1. System Database Save and Restore: The workstation shall store on the hard disk a copy of the current database of each building controller. This database shall be updated whenever a change is made in any system panel. In the event of a database loss in a building management panel, the workstation shall be able to restore the database for that panel.
  2. Manual Database Save and Restore: A system operator with the proper password clearance shall be able to save the database from any system panel. The operator also shall be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
  3. System Configuration: The workstation software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password protection.
  4. On-Line Help: Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.
  5. Security: Each operator shall be required to log on to the system with a username and password in order to view, edit, add, or delete data. System access level shall be selectable up to 9999 levels, for each operator. The system administrator shall have the ability to set passwords and access levels for all other operators. Each operator password shall be able to restrict the functions accessible to viewing and/or changing each system application, editor, and object. Each operator shall automatically be logged off the system if no keyboard or mouse activity is detected. This adjustable auto logoff time shall be set per operator password. All system security data shall be stored in an encrypted format.
  6. System Diagnostics: The system shall automatically monitor the operation of all associated workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
  7. Alarm Processing: Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure multiple alarm limits, alarm limit differentials, states, alarm deviation dead bands and reactions for each object in the system.
  8. Binary Alarms: Each binary object shall be set to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.
  9. Analog Alarms: Each analog object shall have both high/low warning and alarm limits. Limits shall be capable of a fixed or floating setting. Alarming must be able to be automatically and manually disabled.
  10. Alarm Reactions: The operator shall be able to determine (by object) what if any actions are to be taken during an alarm. Actions shall include logging, printing, starting programs, displaying messages, dialing out to remote stations, paging, providing audible annunciation, or displaying specific system graphics. Each of these actions shall be configurable by workstation and time of day. An object in alarm that has not been acknowledged within an operator-specified time period shall be moved to a higher level of priority. The actions for that level will then be followed.



11. Trend Logs: The operator shall be able to define a custom trend log for any data point/object in the system. This definition shall include interval, start time, and stop time. Trend data shall be sampled and stored on the Building Controller panel and be archivable on the hard disk and be retrievable for use in spreadsheets and standard database programs.
12. Historical Trends: The operator shall be able to define a custom historical trend chart for up to eight pens (any data point/object in the system). Historical trend shall be updated when they are instructed to do so, either through the execution of a quick Script or an action by the operator. The operator shall have complete flexibility in designing the interface for the trend. Operator shall be able to create buttons to zoom in and out between the scooters or to data, such as the maximum to minimum value. Average and standard deviation shall be displayed for a complete chart or for the area between scooters. Historical trends shall also be scrolled by any amount of time. Custom scales shall be created and linked to the data fields to display the minimum and maximum engineering units.
13. Alarm and Event Log: The operator shall be able to view all system alarms and change of states from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be archived to the hard disk on the workstation.
14. Object and Property Status and Control: Provide a method for the operator to view, and edit if applicable, the status of any object and property in the system. The status shall be available by menu, on graphics, or through custom programs.
15. Clock Synchronization: The real-time clocks in all building control panels and workstations shall be synchronized on command of an operator. The system also shall be able to automatically synchronize all system clocks daily from any operator-designated device in the system. The system shall automatically adjust for daylight savings and standard time, if applicable.
16. Reports and Logs: Provide a reporting package that allows the operator to select, modify, or create reports. Each report shall be definable as to data content, format, interval, and date. Report data shall be archivable on the hard disk for historical reporting. Provide the ability for the operator to obtain real-time logs of all objects by type or status (e.g., alarm, lockout, normal). Reports and logs shall be stored on the Administration Building PC hard disk in a format that is readily accessible by other standard software applications, including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer and shall be set to be printed either on operator command or at a specific time each day.
17. Standard Reports: The following standard system reports shall be provided for this project. Provide ability for the owner to readily customize these reports for this project for all applicable monitored devices and points specified.
  - a. All Point: All system (or sub-system) points and their current value.
  - b. Alarm Summary: All current alarms (except those in alarm lockout).
  - c. Disabled Points: All points that are disabled.
  - d. Alarm Lockout points: All points in alarm lockout (whether manual or automatic).
  - e. Alarm Lockout points in alarm: All points in alarm lockout that are currently in alarm.
  - f. Logs:
    - 1) Alarm History
    - 2) System Messages
    - 3) System Events
    - 4) Trends

18. Custom Reports: Provide the capability for the operator to easily define any system data into a daily, weekly, monthly, or annual report. These reports shall be time and date stamped and shall contain a report title and the name of the facility.
19. Workstation Applications Editors: The PC workstation shall support editing of all system applications. Provide editors for each application at the PC workstation. The applications shall be downloaded and executed at the controller panels.
20. Controller: Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and set points for all controllers.
21. Scheduling: An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and month. This shall consist of a monthly calendar for each schedule. Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a schedule. The start and stop times for each object shall be adjustable from this master schedule. Schedules shall be easy to copy to other objects and/or dates.
22. Custom Application Programming: Provide the tools to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The system shall be fully operable while custom routines are edited, compiled, and downloaded. The programming language shall have the following features:
  - a. The programming language shall be graphically based using function blocks. Function blocks shall directly provide the functions listed below, and system shall allow user to create custom or compound function blocks. Alternatively, the language can be English language oriented, based on the syntax of BASIC, FORTRAN, C, or PASCAL, and allow for free-form programming (i.e., not column-oriented or "fill in the blanks").
  - b. A full-screen character editor/programming environment shall be provided. The editor shall be cursor/mouse-driven and allow the user to insert, add, modify, and delete custom programming code. It also shall incorporate word processing features such as cut/paste and find/replace.
  - c. The programming language shall allow independently executing program modules to be developed. Each module shall be able to independently enable and disable other modules.
  - d. The editor/programming environment shall have a debugging/simulation capability that allows the user to step through the program and observe any intermediate values and or results. The debugger also shall provide error messages for syntax and execution errors.
  - e. The programming language shall support conditional statements (IF/THEN/ELSE/ELSE-IF) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
  - f. The programming language shall support floating point arithmetic using the following operators: +, -, /, x, square root, and x-to-the-y-power. The following mathematical functions also shall be provided: natural log, log, trigonometric functions (sine, cosine, etc.), absolute value, and minimum/maximum value from a list of values.
  - g. The programming language shall have predefined variables that represent time of day, day of the week, month of the year, and the date. Other predefined variables shall provide elapsed time in seconds, minutes, hours, and days. These elapsed time

variables shall be able to be reset by the language so that interval-timing functions can be stopped and started within a program. Values from all the above variables shall be readable by the language so that they can be used in a program for such purposes as IF/THEN comparisons, calculations, etc.

- h. The language shall be able to read the values of the variables and use them in programming statement logic, comparisons, and calculations.
- i. The programming language shall have predefined variables representing the status and results of the System Software, and shall be able to enable, disable, and change the set points of the System Software described below.

## 2.8 SYSTEM APPLICATION SOFTWARE

- A. Furnish the following applications software for building and energy management. All software applications shall reside and operate in the system controllers. Editing of applications shall occur at the operator workstation.
- B. System Security:
  - 1. User access shall be secured using individual security passwords and usernames.
  - 2. Passwords associated with access level shall restrict the user to the objects, applications, and system functions as assigned by the system manager/ administrator.
  - 3. User Log On/ Log Off attempts shall be recorded.
  - 4. The system shall protect itself from unauthorized use by automatically logging off after a time delay following no activity. The delay time shall be user definable.
  - 5. Audit trails shall be created that tie each user to all alarms and events during the time they are logged on to the system.
- C. Scheduling: Provide the capability to schedule each object or group of objects in the system. Each schedule shall consist of the following:
  - 1. Weekly Schedule: Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop, optimal start, optimal stop, and night economizer. Each schedule may consist of up to [10] events. When a group of objects are scheduled together, provide the capability to adjust the start and stop times for each member.
  - 2. Exception Schedules: Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by the standard schedule for that day of the week.
  - 3. Holiday Schedules: Provide the capability for the operator to define up to [99] special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.
- D. System Coordination: Provide a standard application for the proper coordination of equipment. This application shall provide the operator with a method of grouping together equipment based on function and location. This group may then be used for scheduling and other applications.
- E. Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions.

An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display graphics.

- F. Remote Communication: The system shall have the ability to phone modem dial out or web access notify in the event of an alarm. Receivers shall include ASCII devices, pagers, fax machines, cell phones or computer stations.
- G. Maintenance Management: The system shall monitor equipment status and generate maintenance messages based upon user-designated run-time, starts, and/or calendar date limits.
- H. Sequencing: Provide application software to properly sequence the start and stop of chillers, boilers, and pumps to minimize energy usage in the facility.
- I. PID Control: A self-tuning PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-wind-up shall be supplied. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, set point, and PID gains shall be user-selectable.
- J. Staggered Start: This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts, shall be user-selectable.
- K. Energy Calculations: Provide software to allow instantaneous power (e.g., kW) or flow rates (e.g., L/s [GPM]) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window kW demand value.
- L. Anti-Short Cycling: All binary output points shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.
- M. On/Off Control with Differential: Provide an algorithm that allows a binary output to be cycled based on a controlled variable and set point. The algorithm shall be direct-acting or reverse-acting and incorporate an adjustable differential.
- N. Automatic Alarm Lockout:
  - 1. This package will enable alarms generated by analog or digital inputs, or calculated points, to be locked out when equipment they are associated with is not operating for any reason. Either ON or OFF status condition may be designated as the auto alarm lockout status.
  - 2. Enabled analog and digital inputs shall continue to be scanned, and the current values shall appear on all relevant logs together with an identification of all inputs having the auto-lockout feature.
  - 3. Provide the means for an override of auto-lockout on operator-specified inputs, whether or not the associated system is operational.
  - 4. Upon startup of a system the auto-lockout feature for points on that system shall be automatically removed from that system after an operator-adjustable period of time. The reverse also shall act automatically on the shutdown of the system.
  - 5. Provide a summary log available on demand, on a point/system/building/ total basis.
  - 6. Authorized operators shall be able to add and delete points having the auto-lockout feature and to change the lockout time delay following the startup of systems.

7. The actions of the automatic alarm lockout program shall not cancel existing point alarm conditions.
- O. Calculated Point:
1. Provide a package that will create an on-line pseudo-point as a result of a series of calculations.
  2. The calculations may use operator-entered constants, values of other points in the system, or values of other calculated points as variables in the equations.
  3. Provide the means for the calculated points to be used in loops for control purposes.
  4. Provide the means for points to be created on-line by an authorized operator and formatted into the system for summary purposes (e.g., power factor or equipment efficiencies).
  5. Provide the means for totalization of values as part of this package (e.g., energy consumption or flows).
  6. The frequency of the calculation is to be operator-assignable. The default will be the program cycle time.
  7. Provide the means for alarming calculated points, as any other point.
  8. Provide a package to calculate the following psychometric properties of air, when the values of any two are known, corrected for location altitude:
    - a. Dry bulb temperature
    - b. Wet bulb temperature
    - c. Dew point temperature
    - d. Relative humidity
    - e. Enthalpy
- P. Run-Time Totalization:
1. Provide monitoring and totalization of the run-times for all digital status inputs.
  2. Totalization shall be selectable on a per-point basis, for either open or closed condition of the status input.
  3. A high run-time alarm shall be assigned, if required.
  4. Run-times can be reset by an operator having the necessary access level. The date on which the value was reset shall be logged.
  5. Run-times shall be totalized up to 9999 hours before resetting to zero. Automatic resetting to zero shall generate a suitable message.
  6. The maximum scan frequency for run-time will be 6 minutes.
- Q. Optimum START/STOP:
1. Optimum START/STOP programs shall be applied to the central plant equipment and for each air handling unit.
  2. This package shall continuously monitor all of the space temperature transducers served by a respective air handling unit and the outside air temperature for each system specified to be under optimized START/STOP control. The control algorithm shall start the system at the latest possible moment in order to warm up the space to the required temperature (or to cool the space down to the required temperature) prior to scheduled occupancy. When multiple space sensors are associated with a unit, the space temperature sensor that has the largest deviation from set point (heating or cooling) shall be used to determine the optimal START/STOP times for that AHU. When an appropriate number of air handling

units are operating in the occupied mode, the central heating/cooling equipment shall be started to maintain building conditions.

3. This package shall shut the system down for a maximum of one hour (operator-adjustable) early if the space temperature and outside air temperature indicate that the building flywheel effect will maintain the space temperature within acceptable limits until the scheduled unoccupied period.
4. The initial setup of this package shall be based on empirical, or theoretical, calculations based on the building's construction, orientation, and mass. The package shall be structured such that job-site tuning may be done by simple keyboard entry of one multiplier to the empirical formula, or it shall be adaptive.

## 2.9 BUILDING CONTROLLERS

- A. General: Provide an adequate number of Metasys Building Controllers to achieve monitoring and control of all data points specified in the I/O summary and all necessary devices to satisfy the sequence of operation for all mechanical systems shown on the plans. Each of these controllers shall meet the following requirements.
  1. The Building Automation System shall be composed of one or more independent, standalone, microprocessor-based Building Controllers to manage the global strategies described in the System Software section.
  2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.
  3. Data shall be shared between networked Building Controllers.
  4. The operating system of the Building Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
  5. Controllers that perform scheduling shall have a battery backed real-time clock.
  6. The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
    - a. Assume a predetermined failure mode.
    - b. Generate an alarm notification.
- B. Communication:
  1. See Section 2.6 F2
  2. The controller shall provide a minimum of two service communication ports for the connection of serial devices such as the GP (graphical programmer), GUI (Graphical User Interface), modems, printers etc. Connection of a service device, to a service port, shall not cause the controller to lose communication with its peers or other networked device controllers. The controllers shall be able to route alarms, trends, and reports to any serial device connected to the network.
  3. The controllers shall be capable of dialing out to a minimum of 10 remote locations for annunciation of alarms. These alarms shall include the time, date, and alarm condition, in addition to a user defined detailed action message.
- C. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
  1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at -40°C to 60°C [-40°F to 140°F].

2. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 55°C [32°F to 122°F].
- D. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field- removable, modular terminal strips or to a termination card connected by a ribbon cable.
- E. Memory. The Building Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m [3 ft].

## 2.10 CUSTOM APPLICATION CONTROLLERS

- A. General: Provide an adequate number of Metasys System Custom Application Controllers to achieve the performance specified above. CAC's shall be provided for Air Handling Units, Boiler Plant, Chiller Plant and other applications as shown on drawings and shall have published Bacnet application source code, device resource files and external interface definitions. Each of these controllers shall meet the following requirements.
  1. The Custom Application Controller shall have sufficient memory to support its operating system, database, and programming requirements.
  2. Data shall be shared between networked Custom Application Controllers.
  3. The operating system of the Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
  4. Controllers that perform scheduling shall have a battery backed real-time clock.
  5. The Custom Application Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
    - a. Assume a predetermined failure mode.
    - b. Generate an alarm notification.
- B. Communication:
  1. See Section 2.6 F2
  2. The controller shall provide a minimum of one service communication port for the connection of serial devices such as the GP (graphical programmer). Connection of a service device to a service port, shall not cause the controller to lose communication with its peers or other networked device controllers.
- C. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
  1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at -40°C to 60°C [-40°F to 140°F] and 5 to 95% RH, non-condensing.
  2. Controllers used in conditioned ambient space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 55°C [32°F to 122°F] and 5 to 95% RH, non-condensing.

- D. Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips C or to a termination card connected by a ribbon cable.
- E. Memory: The Custom Application Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- F. Immunity to power and noise: Controller shall be able to operate at 90 to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m [3 ft].

## 2.11 APPLICATION SPECIFIC CONTROLLERS (ASC)

- A. General: Controls shall be microprocessor based Interoperable BACnet Controllers (ASC), bearing the applicable BACnet interoperability logo on each product delivered. These controllers shall be Metasys CGM/CGE line. ASCs shall be provided for VAV Terminal Boxes and other applications as shown on the drawings and shall contain the appropriate BACnet profile. ASCs shall be based on the Echelon Neuron 3150 microprocessor working from software program memory which is physically located in the ASC. The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals.
  - 1. To simplify controls and mechanical service troubleshooting, the ASC shall be mounted directly in the control compartment of the unitary system. The ASC shall be provided with a sheet metal or polymeric enclosure that is constructed of material allowing for the direct mounting within the primary air stream, as defined by UL94-5V. The direct mounting shall allow all controls maintenance and troubleshooting to be made while at the unitary equipment.
  - 2. A Secondary Control Network may be used at the supplier's option for the ASC and intelligent actuators and sensors. ASC shall reside directly on a peer to peer network utilizing BACnet conformance level 3 configurations. Physical media configuration shall be provided to support the protocol utilized.
  - 3. The ASCs shall be fully supported and communicate with any and all GUI(s) on the bus.
- B. ASC Sensor: The ASC Sensor shall connect directly to the ASC and shall not utilize any of the I/O points of the controller. These shall be Metasys NS Sensors. The ASC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The ASC Sensor shall provide a communications jack for connection to the BACnet communication trunk to which the ASC controller is connected. The ASC Sensor, the connected controller, and all other devices on the BACnet bus shall be accessible by the Graphical Programming tool.
  - 1. The ASC Sensor shall be supplied in the following variations:
    - a. Tamper-resistant (no display)
    - b. Tamper-resistant with tenant override
    - c. Basic user functions (LCD display and setpoint adjustment and tenant override)
    - d. Full user functions (LCD display and network-variable access and tenant override)
    - e. ASHRAE 95 compliance (LCD display and sub-base functionality)
    - f. The ASC Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering. The ASC Sensor shall allow for the customization of the color on the esthetic covering as a standard offering. User interface with the ASC Sensor shall be provided as a



configurable function by the FMCS and shall offer password protection for access to network variable editing. Multiple network variables shall be accessible and editable by the ASC Sensor. Icons shall be utilized to represent sensor and controller function status, affording independence from a single language for use interface.

- C. ASC Functionality: The ASC shall provide a 40 to 140°F ambient operating temperature and 5 to 95% RH, non-condensing humidity range. The ASC shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of any of the ASC electronics. ASC devices that require the electronics to be present at the time of wiring, will require an additional controller to be provided for every 10 devices on the drawings, to allow for the pre-configuration and storing for service purposes.
1. All input/output signals shall be directly hardwired to the ASC. For all non-VAV terminal applications, a minimum of 2 input points of the ASC shall employ a universal configuration that allows for flexibility in application ranging from dry contact, resistive, to voltage/current sourced inputs. If universal points are not available, a minimum of 2 input points (each) of the dry contact, resistive and analog voltage/current types must be provided on every controller. The outputs of the ASC shall be of the relay and universal analog form. All digital outputs shall be relay type. ASC devices utilizing non-relay outputs shall provide an interface relay for all points. All analog outputs shall be programmable for their start points and span to accommodate the control devices. Configuration of all I/O points shall be accomplished without physical hardware jumpers, switches, or settings. Troubleshooting of input/output signals shall be easily executed with the Graphical Programming tool (GP) or a volt-ohm meter (VOM). All I/O points shall be utilized by the local ASC or shall be available as I/O points for other controllers throughout the network.
  2. All ASCs shall be fully application programmable and shall at all times maintain their Bacnet certification. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the ASC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
  3. The ASC shall be provided with the ability to interface with the Graphical Programming tool. The interface port shall be provided at the wall sensor or within the ASC equipment, as specified on the plans. The interface port shall allow the GP to have full functionality as described in GP section of this specification. Through the connected controller all ASC and CAC devices on the communication bus shall be accessible by the Graphical Programming tool.
- D. ASC B VAV Controller Functionality: Controls shall be microprocessor-based Pressure Independent Variable Air Volume Digital Controllers, as shown in the drawings. The VAV ASC shall be a single integrated package consisting of a microprocessor, power supply, damper actuator, differential pressure transducer, field terminations, and application software. An alternate model shall be offered that allows for direct connectivity to an external actuator for those applications that employ a non-butterfly style damper configuration. All input/output signals shall be directly hardwired to the VAV ASC controller. The internal actuator shall employ a manual override that allows for powered or non-powered adjustment of the damper position. In all cases, the controller shall automatically resume proper operation following the return of power to, or control by the ASC. Programming, configuring and/or troubleshooting of input/output signals shall be easily executed through the ASC sensor or GP tool connected at the wall sensor location.

1. The VAV ASC control algorithms shall be designed to limit the frequency of damper repositioning, to assure a minimum 10-year life from all components. The VAV ASC shall provide internal differential pressure transducer for pressure in dependent applications with an accuracy of 5%. Flows through transducers requiring filter maintenance are not acceptable. The VAV ASC shall provide zone control accuracy equal to or better than  $\pm 1^{\circ}\text{F}$ . Systems providing control accuracy's greater than  $\pm 1^{\circ}\text{F}$  are not acceptable. With the submittal package, contractor shall provide performance data that verifies control accuracy of the VAV ASC.
2. All input/output signals shall be directly hardwired to the VAV ASC. A minimum of one input point of the VAV ASC shall employ a universal configuration that allows for flexibility in application ranging from dry contact, resistive, to voltage/current sourced inputs. If a universal point is not available, a minimum of one input point (each) of the dry contact, resistive and analog voltage/current types must be provided on every controller. The outputs of the ASC shall be of the relay and universal analog form. All digital outputs shall be relay type. ASC devices utilizing non-relay outputs shall provide an interface relay for all points. All analog outputs shall be programmable for their start points and span to accommodate the control devices. Configuration of all I/O points shall be accomplished without physical hardware jumpers, switches, or settings. Troubleshooting of input/output signals shall be easily executed with the Graphical Programming tool or a volt-ohm meter (VOM). All I/O points shall be utilized by the local ASC or shall be available as I/O points for other controllers throughout the network.
3. The FMCS contractor shall provide VAV ASC to the VAV box manufacturer, for factory mounting. The VAV terminal unit supplier shall include in its price all costs for mounting of VAV ASC controller, connection of actuator to damper shaft, wiring of device power, wiring of VAV ASC to fan (fan powered terminal) and wiring to electric reheat coils or reheat valve actuator as specified on drawing.
4. The VAV terminal manufacturer shall provide a multi-point, averaging, differential pressure sensor mounted on the inlet to each VAV box. The VAV terminal unit manufacturer shall supply a line to low voltage transformer, of sufficient capacity, to power the VAV ASC plus all reheat valves and/or contactors and fan circuits associated with the VAV terminal and actuator assemblies. The FMCS contractor shall provide all reheat control valves to the mechanical contractor for mounting and piping. The FMCS contractor shall provide and install all wiring between the valve and VAV ASC controller and between the room sensor and the VAV ASC controller.

## 2.12 INPUT/OUTPUT INTERFACE

- A. Hardwired inputs and outputs may tie into the system through Building, Custom, or Application Specific Controllers.
- B. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no damage to the controller. Inputs and outputs shall be arranged on interchangeable modules or circuit boards to allow the replacement of a damaged module or board without replacing the entire controller.

- C. Binary inputs shall allow the monitoring of ON/OFF signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense “dry contact” closure without external power (other than that provided by the controller) being applied.
- D. Pulse accumulation input points. This type of point shall conform to all the requirements of binary input points and accept up to 10 pulses per second for pulse accumulation.
- E. Analog inputs shall allow the monitoring of low-voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with and field-configurable to commonly available sensing devices. To prevent thermal loading, RTDs and thermistors shall be scanned rather than have continuous power applied.
- F. Inputs shall be electrically isolated from their associated field points.
- G. Readings of any analog input point shall be repeatable within 0.1% of range; drift of readings shall be less than 0.2% of range per year. (see accuracy table)
- H. Binary outputs shall provide for ON/OFF operation, or a pulsed low-voltage signal for pulse width modulation control. Outputs shall be selectable for either normally open or normally closed operation.
- I. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10 VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.
- J. System Point Capacity: The system size shall be expandable to at least [2] times the number of input/output points required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

## 2.13 POWER SUPPLIES AND LINE FILTERING

- A. Control transformers shall be UL and CSA Listed. Furnish Class 2 current-limiting type or furnish over-current protection in both primary and secondary circuits for Class 2 service per NEC requirements.
  - 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0-% line and load combined with 100 microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand a 150% current overload for at least 3 seconds without trip-out or failure.
    - a. Unit shall operate between 0°C and 50°C [32°F and 120°F]. EM/RF shall meet FCC Class B.
    - b. Line voltage units shall be UL Recognized and CSA or ETL Approved.
    - c. Acceptable manufacturers: Schneider Electric Building Systems transformers ASP8301 through ASP8311 or approved equal.

B. Power Line Filtering:

1. Provide transient voltage and surge suppression for all workstations and controllers either internally or as an external component. Surge protection shall have the following at a minimum:
  - a. Dielectric strength of 1,000 volts minimum
  - b. Response time of 10 nanoseconds or less
  - c. Transverse mode noise attenuation of 65 dB or greater
  - d. Common mode noise attenuation of 150 dB or better at 40 Hz to 100 Hz.

2.14 INPUT/OUTPUT SENSORS

A. Temperature:

1. Resistance temperature detectors with resistance tolerance of  $\pm 0.1\%$  at  $21^{\circ}\text{C}$ , interchangeability less than  $\pm 0.2\%$  C, time constant of 13 seconds maximum for fluids and 200 seconds maximum for air.
2. Measuring current maximum 5 MA with maximum self-heat of  $0.017^{\circ}\text{C}/\text{MW}$  in fluids and  $0.008^{\circ}\text{C}/\text{MW}$  in fluids and  $0.008^{\circ}\text{C}/\text{MW}$  in air.
3. Provide 3 lead wires and shield for input bridge circuit.
4. Use insertion elements in ducts not affected by temperature stratification or smaller than one square meter. Use averaging elements where larger or prone to stratification sensor length 2.5 m or 5 m as required.
5. Insertion elements for liquids shall be with brass socket with minimum insertion length of 2-1/2" (60 mm).
6. Supply room sensors with locking cover.
7. Provide outside air sensors with watertight inlet fitting, shielded from direct rays of sun.
8. Provide thermostats or sensors and CO<sub>2</sub> sensors in public areas such as toilets, corridors, vestibules, stairs, gymnasiums, locker rooms, etc with guards. Provide wire guards in gymnasium areas and lockable covers in public spaces.
9. All temperature sensors shall have LCD displays.
10. Room sensors shall allow for warmer/cooler adjustment and override capabilities at the sensor programmed to a specific adjustment bandwidth and time duration. Adjustment bandwidth shall be programmable through the Building Automation System. Sensor shall include a timed override that can be disabled through the Building Automation System. The override shall provide an adjustable time override to bring unit from unoccupied mode to occupied mode but not enable ventilation mode unless commanded to by CO<sub>2</sub> or if more than 50% of VAV units are in override.

B. Humidity Sensors:

1. Elements: Accurate within 5% full range with linear output.
2. Room Sensors: With locking cover matching temperature sensors used, span of 10 to 60% relative humidity.
3. Duct and Outside Air Sensors: With element guard and mounting plate, range of 0-100% relative humidity.

C. Equipment Operation Sensors:

1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0-5" wg.
2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.

3. Status Inputs where Differential Pressure Sensing is Impractical: Current sensitive relay with current transformers, adjustable and set to 175% of rated motor current.

## 2.15 AUXILIARY CONTROL DEVICES

### A. Dampers:

1. Dampers shall be low leakage or high velocity low leakage as specified in the sequence of operations. All proportional dampers shall be opposed blade type. Two position dampers may be opposed or parallel blade type.
2. Damper frames and blades shall be galvanized steel and a minimum of 16-ga. Blade width shall not exceed 8". Dampers and seals shall be suitable for temperature ranges of -50 to 250°F.
3. Standard Low Leakage Dampers: Standard low leakage dampers shall be provided to conserve energy. Dampers shall be equipped with neoprene edge seals and compressible metal jamb seal. Leakage shall not exceed 10 CFM/Sq. Ft. at 4" W.G. differential.
4. High Velocity Low Leakage Dampers: Where specifically called out in the specification, low leakage dampers shall be furnished. Field replaceable edge and end seals will be installed along the top, bottom and side of the frame and each blade. Seals and bearings shall be suitable for temperature ranges from -40 to 200°F. Leakage shall not exceed 6 CFM/Sq. Ft. at 4" W.G. Differential.

- ### B. Damper Operators:
- Damper operators shall be electronic, spring return, low voltage (24VAC) and shall be properly sized so as to stroke the damper smoothly and efficiently throughout its range. Actuator response shall be linear in response to sensed load.

### C. Control Valves:

1. Valve bodies shall be 2-way normally open or closed, or 3-way mixing as specified. Valve bodies 2" and smaller shall be bronze, screwed type and shall be rated at 250 PSIG. Valve bodies 2-1/2" and larger shall be iron, flanged and rated at 125 PSIG except where otherwise noted.
2. Valves shall have stainless steel stems and allow for servicing including packing, stem, and disk replacement.

### D. Valve Actuators:

1. Valve actuators shall be electronic, spring return, low voltage (24 VAC) and properly selected for the valve body and service.
2. Actuators shall be fully proportioning and be spring return for normally open or normally closed operation as called out in the sequence of operations.

### E. Low Limit Thermostats:

1. Safety low limit thermostats shall be vapor pressure type with a 20' minimum element. Element shall respond to the lowest temperature sensed by any 1' section.
2. Low limit shall be manual reset only.

### F. Safety and Status Switches:

1. Freezestats for each piece of the equipment being protected shall have manual reset and shall shut down the supply fan and alarm the DDC when 1' of its 20' element senses a

temperature below its set point. Freezestats shall be of sufficient length to effectively protect the coils entire surface.

2. Differential air pressure switches shall be utilized at each air handling unit for proof of airflow and for filter status - switch shall be diaphragm operated. Field adjustable set point with 0.05" to 12.0" water column range provide sensing tube and tip and install to provide accurate airflow sensing.

- G. Line Voltage Thermostat shall have a repetitive accuracy of +1% of the operating ranges shown. Switch actuation shall be adjustable over the operating temperature range. The switch shall have a snap action form C contact rated for the application.
- H. Control Relays: Control relay contacts shall be rated for the application, with a minimum of 2 sets, 5-amp rating of Form C contacts enclosed in a dustproof enclosure. Relays shall be rated for a minimum life of one million operations. Operating time shall be 30 milliseconds or less, with release time of 10 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage.
- I. High Limit Thermostats: High limit thermostats shall be manual reset type set at 120°F.

## 2.16 WIRING

- A. All electrical work performed in the installation of the BAS/ATC system as described in this specification shall be per the National Electrical Code (NEC) and per applicable state and local codes. Where exposed, wiring shall be installed in conduit which shall be run parallel to building lines properly supported and sized at a maximum of 40% fill. In no cases shall field installed conduit smaller than 1/2" trade size be allowed. Where conductors are concealed, cable rated for use in return air plenums shall be used.
- B. For connection between DDC panels, utilize RG62U coaxial cable. For connection from DDC panels to Local Controllers, utilize 3-conductor 18-ga RS 485.
- C. Power for DDC panels shall be connected to nearest Normal/Emergency Electric Panel. Provide transformers as required.

## 2.17 CONTROLLERS

- A. All controllers shall be electronic except where specifically noted to be electric limit thermostats.
- B. All controllers, except room thermostats and unit low-limit thermostats and electric limit thermostats, shall be panel mounted and shall be of the dual input receiver-controller type utilizing transmitters mounted at the location where the temperature is sensed. Transmitters sensing duct temperatures shall be equipped with 8' averaging elements and transmitters sensing water temperature shall be equipped with stainless-steel or brass separable sockets. All transmitters shall be capable of being re-calibrated in the field, if necessary. For each temperature transmitter, furnish and install one dial type temperature indicator in the local control cabinet and, where specified, in the central control cabinet.

## 2.18 MISCELLANEOUS INSTALLATION

- A. Installation of control dampers specified under this section will be by the HVAC Contractor.
- B. Control valves and wells for immersion elements shall be furnished by the ATC Contractor and installed by the HVAC Contractor.
- C. Interface of the Lighting Control System shall be in conjunction with the Lighting Control provider. The Lighting Control System provider shall provide on-site technical support for all interface requirements with the Lighting Control System.
- D. Installation of the Electric Meter shall be by the Electrical Contractor.
- E. The system shall not be affected by transient current or radio frequency and this system shall not affect the operation of other electrical or communication equipment within building complex.
- F. Use stainless steel flanges to support element in ducts. In liquids, use separable wells.

## 2.19 CONTROL PANEL(S)

- A. Provide local panel(s) of unitized cabinet type for each system under automatic control including each air handling unit, chillers, cooling tower(s), water boilers, steam boilers and pumps. Mount relays, switches and controllers with control point adjustment in cabinet and temperature indicators, pilot lights, push buttons, clocks and switches flush on cabinet panel face.
- B. Fabricate panels from 12-ga furniture steel with baked enamel finish and hinged key lock door.
- C. Mount panels adjacent to associated equipment on vibration free walls or free-standing steel angle supports. One cabinet may accommodate more than one system in same room. Provide engraved plastic name plates for instruments and controls inside cabinet and on cabinet face.
- D. All wiring in the panel shall be Type THW insulated conductors, color-coded and extended to numbered terminals in the panel. Complete wiring diagrams indicating terminal connections inside the panel shall be placed in the panel. Each switch and control in the panel shall be labeled. Each switch and thermometer on the face shall be labeled with Bakelite nameplates.

## 2.20 AIRFLOW MEASURING STATIONS

- A. Furnish and install Airflow Measurement Stations on all supply air, outdoor air and exhaust air systems for Rooftop Units (RTAC).
- B. Measurement Stations shall be Ebtron Gold Series systems or equal with required interface and shall monitor and control fans and dampers via the ATC System.

## 2.21 LOW TEMPERATURE DETECTION THERMOSTATS

- A. Low temperature detection thermostats with manual resets shall be provided where indicated. The sensing elements shall be not less than 20' long and shall be installed to sense all representative temperatures across the entire duct or unit cross section.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install electrical work in accordance with NEC. Electrical material and installation shall be in accordance with appropriate requirements of Division 16.
- C. Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.
- D. Provide service engineer to instruct Owners representative in operation of system.
- E. Provide basic operator training on data display, alarm and status descriptions, requesting data, execution of commands, request of logs and graphics design. Include a minimum of 24 hours dedicated instruction time and 10 hours programming time.

## PART 4 - SEQUENCE OF CONTROLS

### 4.1 CONTROL OF BOILERS

- A. The hot water system consists of two boilers, primary/boiler hot water pumps with VFD, and secondary hot water pumps with VFD. Loop differential pressure sensor and is set up as a variable secondary loop. Outside air temperature and humidity are monitored at the sensors OA-T and OA-H and are shared across the Metasys BAS Network.
- B. Boilers shall be controlled to maintain required supply water temperature. Temperature shall be adjustable.
- C. Boilers shall control primary pumps.
- D. Provide lead/lag control so that lag boilers are energized in stages upon fall of hot water boiler supply temperature in lead boiler (1) to 150°F (adjustable). Alternate operation of boilers will be through DDC system. Energize two (min) boilers below outside temperature of **45°F** (adjustable).
- E. Primary pump for each boiler shall run continuously when any boiler is enabled.
- F. Boilers shall utilize Smart Touch Control System for sequencing and control of hot water discharge temperature which shall be reset based on outside air temperature.



- G. Coordinate with **existing** Boiler Control Management System supplied. ***Provide additional controls for the interface. (Addendum #2)***
- H. Boilers and Pumps are to be enabled in dehumidification mode.

#### 4.2 CONTROL OF VARIABLE SPEED SECONDARY HOT WATER PUMPS (P-3, P-4)

- A. Provide the following to control variable speed pumping systems:
  1. Modulate Pumps speed to maintain differential pressure at setpoint
  2. Differential pressure transmitters at the ends of the pipe runs (see Drawings)
  3. Receiver/Controller
  4. All interconnecting wiring and programming.
  5. Interface DDC System with pump system drives.
- B. Speed of pumps shall be varied as required to maintain minimum required pressure at end of system. Points shall be monitored and adjustable through the DDC System.
- C. Provide through the DDC System:
  1. On/Off control of each pump
  2. Alarm for each pump
  3. Status of each pump
  4. Percentage speed of each pump
  5. System pressure

#### 4.3 CONTROL OF HOT WATER PUMPS AND HOT WATER SUPPLY TEMPERATURE

- A. Please note that Boiler manufacturer is providing associated control system to provide sequence listed below (refer to Section 230570). Integrate and coordinate with Boiler Manufacturer.
- B. The heating hot water pumps shall be controlled by the DDC System. The lead/lag sequence shall be as follows: The lead pump shall be energized and run continuously. A current transformer shall, through a panel mounted time delay relay, energize the lag pump, and initiate a pilot light alarm upon sensing a loss of flow at lead pump. A panel pilot light will remain lit until the problem has been corrected and then can be reset by pushbutton. The pumps shall automatically alternate weekly through optimal time sequence. Starters for pumps shall be Hand/Off/Auto. When starter is in Auto position, pump shall be controlled by DDC System.
- C. Hot Water Reset Control shall be as follows: The outdoor air master thermostat shall reset the control point of a submaster thermostat with its sensing element in the supply water piping. The panel mounted submaster receiver controller shall modulate a three-way mixing valve located in the hot water supply piping to maintain supply water temperature as listed below:

<u>Outside Air Temperature</u>	<u>Hot Water Supply Temperature</u>
20°	160°F
60°F and above	140°F

#### 4.4 CONTROL OF CHILLERS AND PRIMARY PUMPS

- A. The existing chilled water system consists of air cooled chiller, chilled water pumps with VFD. Loop differential pressure sensor and is set up as a variable primary loop. Outside air temperature and humidity are shared from the Hot Water System Control Panel of the Johnson Metasys BAS Network. ***Provide additional controls for the interface. (Addendum #2)***

#### 4.5 VAV BOXES – FAN POWERED

- A. ***Provide new unit DDC controller.*** Multiple VAV boxes controlled by single controller shall not be acceptable. Service technician shall be able to view, change and program all points associated with VAV box from portable service tool plugged into space sensor or a computer.
- B. During the occupied mode, fan shall be energized to run continuously. Primary air control damper shall modulate to maintain space temperature. On a call for heat, air control damper shall go to closed position and reheat coil valve shall modulate to maintain space temperature setpoint. Occupied heating setpoint shall be 70°F (adjustable) and occupied cooling setpoint shall be 74°F (adjustable).
- C. For dehumidification mode (occupied and unoccupied), on a rise in RH above 60% (adjustable), the VAV box inlet damper shall modulate open, VAV box fan shall be on and HW coil shall reheat air to maintain room temperature setpoint.

#### 4.6 VAV BOXES – NON-FAN POWERED

- A. ***Provide new unit DDC controller.*** Multiple VAV boxes controlled by single controller shall not be acceptable. Service technician shall be able to view, change and program all points associated with VAV box from portable service tool plugged into space sensor or at computer.
- B. During the occupied mode, primary air control damper shall modulate to maintain space temperature. On a call for heat, air control damper shall go to minimum heating position.
- C. For dehumidification mode (occupied and unoccupied), on a rise of RH above 60% (adjustable), the VAV box inlet damper shall open and the HW coil shall reheat air to maintain room setpoint.

#### 4.7 VAV ROOFTOP AIR HANDLING SYSTEMS

- A. General: The units shall be indexed to the occupied/unoccupied/warm-up modes from the DDC System. Duct smoke detectors mounted in return and discharge air ducts shall, upon sensing alarm conditions, shut down unit fans. A current sensing switch on supply fan shall alarm the DDC System whenever the fan fails. A differential pressure switch across units' filter bank shall display filter pressure drop and alarm the DDC System when filter pressure exceeds a high limit setpoint. On a rise in discharge static above 4" w.c. (adjustable) on leaving side of supply fan, high static limit shall de-energize supply fan and alarm DDC System.
- B. Occupied Mode: When the AH is in the occupied mode, the supply fan shall operate continuously, the variable-frequency drive shall modulate the capacity of the supply fan to maintain the duct static pressure setpoint (adjustable) as measured by a static pressure sensor located

approximately 1/3 down supply air duct. The discharge air temperature setpoint shall be reset based on the cooling requirements (if any) of any of the associated spaces served by this unit.

1. For fan-powered VAV boxes, fan shall operate continuously. Room sensor shall modulate VAV box inlet damper and hot water reheat coil to maintain setpoint.
  2. For non-fan-powered VAV boxes, room sensor shall modulate VAV box inlet damper and hot water coil to maintain setpoint.
- C. Unoccupied Mode: Fan powered VAV boxes shall be off with inlet dampers closed. Room sensor shall cycle VAV box fans and modulate hot water coil ATC valve to maintain unoccupied setpoint. AH fan shall operate to provide cooling whenever any space calls for dehumidification.
- D. For warm-up cycle, associated VAV boxes shall operate with hot water coils providing heating.
- E. Supply Fan Control: The supply fan will operate continuously whenever the AH is in the occupied mode. The supply fan shall be cycled whenever the AH is in the unoccupied mode and there is a call for cooling during the unoccupied cycle.
- F. Variable Frequency Drive Control: When the supply fan is on, the variable-frequency drive(s) will slowly ramp up (adjustable) and modulate to maintain the proper discharge duct static pressure setpoint and local building static pressure setpoint.
- G. ***Provide new unit DDC controller.***
- H. Points List:
1. Supply Duct Static Pressure (AI)
  2. Supply Leaving Air Temperature (AI)
  3. Return Air Temperature (AI)
  4. Chilled Water Control Valve Position (AO)
  5. Smoke Detector (Normal/Alarm) (BI)
  6. Dirty Filter (Normal/Alarm) (BI)
  7. Supply Fan (On/Off), Alarm (BO, BI)
  8. Local Building Static Pressure (AI)

#### 4.8 ROOFTOP AIR HANDLING SYSTEM WITH TOTAL ENERGY WHEEL

- A. General: The units shall be indexed to the occupied/unoccupied/warm-up positions from the DDC System. Freeze detection thermostat shall de-energize the unit fan, close outdoor air damper, open hot water valve (preheat coil) and annunciate alarm upon sensing a coil discharge temperature below its setting. Duct smoke detector mounted in return air and discharge air ducts shall, upon sensing alarm conditions, completely shut down the unit supply fan and exhaust fan, close outside air damper and open return air damper. A current sensing switch on supply fan and exhaust fan shall alarm the DDC System whenever the fan fails. A differential pressure switch across units' filter bank shall display filter pressure drop and alarm the DDC System when filter pressure exceeds a high limit setpoint.
- B. Warm-Up: The unit supply fan shall run continuously. The exhaust fan shall be off. The outdoor air damper shall remain closed, and the unit shall operate on full return air. The room thermostat shall modulate a 2-way ATC hot water valve to maintain room temperature. The outside air and

exhaust air bypass dampers shall be closed. The recirculation damper shall be open. The wheel shall be de-energized.

- C. Occupied: The unit supply fan and exhaust fan shall run continuously. The total energy wheel shall be energized with outdoor air and recirculation damper open. The hot water and chilled water ATC valves shall modulate as required to maintain room setpoint. If outdoor air enthalpy level is acceptable, total energy wheel shall be de-energized (economizer mode).
- D. Unoccupied: Outdoor air damper shall be closed, return air damper open. Exhaust fan and total energy wheel shall be de-energized. Hot water coil ATC valve shall be open. On a call for heat by room thermostat supply fan shall cycle to maintain unoccupied setpoint. The outside air and exhaust air bypass dampers shall be closed. The recirculation damper shall be open.
- E. Room humidistat shall, on a rise of space humidity above 60% (adjustable) modulate chilled water valve open and reheat coil hot water valve open (reheat) as required to maintain desired space temperature and humidity (both occupied and unoccupied cycles).
- F. Points List:
  - 1. Supply Leaving Air Temperature (AI)
  - 2. Discharge Air Temperature – Wheel outlet (AI)
  - 3. Entering Air Temperature – Wheel Inlet (AI)
  - 4. Heating Coil Control Valve Position (AO)
  - 5. Chilled Water Control Valve Position (AO)
  - 6. Reheat Coil Control Valve Position (AO)
  - 7. Return Air, Smoke Detector (Normal/Alarm) (BI)
  - 8. Freezestat (Normal/Alarm) (BI)
  - 9. Dirty Filter (Normal/Alarm) (BI)
  - 10. Supply and Exhaust Fan (On/Off), Alarm (BO, BI)
  - 11. Exhaust Wheel Motor (On/Off), Alarm (BO, BI)
  - 12. Outdoor Air Damper (2) (AO)
  - 13. Outdoor Air Bypass Damper (AO)
  - 14. Exhaust Bypass Damper (AO)
  - 15. Recirculation Damper (AO)
- G. Outside air damper shall be closed and wheel off. When carbon dioxide sensor reaches threshold limit, outside air damper shall modulate open as required and wheel energized. Economizer cycle shall override this control. Sensor shall be located in return air duct.
- H. ***Provide new unit DDC controller.***

#### 4.9 CONTROL OF HOT WATER UNIT HEATERS

- A. Single temperature electric space thermostat shall cycle the unit heater fan on and open 2-way electric hot water valve whenever hot water is circulating through the unit heater circuit as sensed by a strap-on aquastat.
- B. The thermostat shall be connected to DDC System.

#### 4.10 CONTROL OF HOT WATER CONVECTORS, CABINET HEATERS, WALL FIN

- A. A single temperature electric thermostat shall modulate the 2-way electric control valve to maintain desired room temperature. For cabinet heaters, fan shall be cycled on a call for heat by thermostat. Provide with thermostat tied to DDC System.
  - 1. Points:
    - a. Fan Status (on/off), Alarm (BO,BI)
    - b. Supply Leaving Air Temperature (AI)
    - c. Heating Coil Control Valve Position (AO)
- B. A common thermostat shall control the wall fin radiation in those spaces that have wall fin radiation installed.

#### 4.11 CONTROL OF EXHAUST FANS, MAKE-UP AIR FANS

- A. Control Type 1: These fans shall be tied into DDC time clock for that respective zone. Fan shall be energized only during the occupied cycle.
- B. Control Type 2: These fans shall be controlled by means of tie-in with wall light switch. Provide time delay (by EC) so that fan operates for 10 minutes (adjustable) after light switch is turned off.
- C. Control Type 3: This fan shall be tied into existing Dishwasher control panel or provided with a switch for manual operation.
- D. Control Type 4: This fan shall be tied into kitchen hood control panel provided by others.
- E. Control Type 5: These fans shall be controlled by a reverse acting thermostat.

#### 4.12 CONTROL OF KITCHEN MAKE-UP AIR UNIT

- A. The kitchen make-up air unit shall be interlocked with kitchen hood controls. Kitchen exhaust fans as controlled by the kitchen hood controls. The kitchen make-up air unit shall operate when kitchen hood exhaust fans operate.
- B. Unit shall be controlled by discharge air temperature sensor to maintain 75°F DAT (cooling – adj) and 70°F DAT (Heating – adj)
- C. OA damper shall open whenever unit is operating.
- D. Smoke detector shall shut down unit and annunciate an alarm when activated.
- E. The kitchen make-up air unit and exhaust fans shall be connected to the kitchen hood fire protection system. When the fire protection system is activated, the make-up air unit fan shall be shut down while exhaust fans shall continue to operate.
- F. The hood system shall signal the make-up air unit controller with the exhaust fan CFM ratio. The kitchen make-up air unit speed shall be controlled to deliver the correct make-up air based on that signal. Required fan speeds to be determined by the Test and Balance Contractor.

- G. Provide the following points and any additional points required to provide control sequence.
  - 1. Sa Fan On-Off and Status
  - 2. SA Fan Speed
  - 3. OA Damper Open-Close
  - 4. Gas Heating – 2 Stage
  - 5. DX Cooling – 2 Stage (1<sup>st</sup> Stage Modulating, 2<sup>nd</sup> Stage On-Off)
  - 6. DAT
  - 7. Smoke Detector
  - 8. Clogged Filter Switch
  - 9. Refer to Drawing QF1.10 for additional requirements.

H. ***Provide new unit DDC controller.***

#### 4.13 CONTROL OF DUCTLESS SPLIT SYSTEM UNITS (AC/CU)

- A. General: The units shall be controlled by wall mounted thermostat provided with the unit. Provide a room temperature sensor connected to the DDC System.

#### 4.14 DOMESTIC HOT WATER HEATERS

- A. Domestic hot water heaters are enabled based on need and system requirements. ATC Contractor shall monitor water heater status and alarms. Domestic hot water supply temperature is monitored at the temperature sensor.

#### 4.15 DOMESTIC THERMOSTATIC MIXING VALVE

- A. Domestic thermostatic mixing valve is enabled based on need and system requirements. ATC Contractor shall monitor water heater status and alarms. Domestic hot water supply temperature is monitored at the temperature sensor.

#### 4.16 CONTROL OF DOMESTIC HOT WATER RECIRCULATING PUMPS

- A. Pumps shall be controlled by a strap-on thermostat to maintain the desired hot water temperature in the return line. Pumps shall be tied into DDC schedule system and shall be energized during the occupied cycle and de-energized during the unoccupied cycle. This section applies to the domestic water recirculating pumps. In addition, ATC Contractor shall connect water temperature sensor from the domestic hot water heaters to the master controller on the lead water heater.

#### 4.17 SEQUENCE OF CONTROL FOR GENERATOR

- A. Emergency Generator & ATS: The BAS shall monitor the on/off status of the emergency generator and automatic transfer switches position.
- B. Provide the following sequence for the control of the generator (All by BAS). Upon loss of power the following shall occur:
  - 1. Step 1:

- a. Turn all equipment connected to the DDC System off.
  - b. Set P-3 & P-4 to OFF. Provide verification back from pump that unit is set to OFF.
- 2. Step 2:
  - a. Set P-3 & P-4 so only 1 pumps can run. Provide verification back.
  - b. Start one pump and ramp-up speed. Set maximum horsepower at 20 HP. Provide verification back.
  - c. Monitor building load 10 minutes after transfer.
- 3. After normal power has returned:
  - a. After 20 minutes, return DDC System back to original state.
- 4. Provide 5 hours additional programming hours for changes to generator sequence.

#### 4.18 POINTS LIST

- A. Refer to following points list.
- B. Refer to Section 230900-1.2 K and L for additional points.
- C. These lists are for information only. Provide total number of points required to provide specified control sequence.

#### 4.19 SEQUENCE OF OPERATION

- A. Through the DDC System, provide the following points and associated sensors, relays, wiring, programming, etc. for each school.
  - 1. Analog Input:
    - a. Temperature and humidity Sensor from each HVAC Zone
    - b. Chilled Water Supply & Return Loop Temperature
    - c. Hot Water Supply and Return Loop Temperature
    - d. Outside Air Temperature and humidity
    - e. 110° and 140° Domestic Water Supply Temperature
    - f. Freezer Temperature (2)
    - g. Refrigerator Temperature (1)
    - h. Bacnet connection to Boiler Control Panel
    - i. Bacnet connection to Chiller
  - 2. Binary Output
    - a. Chiller On/Off (1)
    - b. Boiler On/Off (2)
    - c. Hot Water Pump On/Off (2)
    - d. Chilled Water Pump On/Off (2)
    - e. All Outside Air Dampers Open/closed
    - f. Domestic Water Pump On/Off (2)
    - g. Emergency Generator On/Off
  - 3. Binary Input
    - a. Chiller Status – On/Off (1)
    - b. Boiler Burner Status – On/Off (2)
    - c. Chilled Water Pump Status – On/Off (2)
    - d. Hot Water Pump Status – On/Off (2)

- e. Boiler Alarm (2)
  - f. Chiller Alarm (1)
  - g. Domestic Water Pump Status (2)
  - h. Fire Alarm Trouble/Alarm
  - i. Switchgear Alarm
4. Programming Notes
- a. User shall be able to revise day/nighttime schedule for each zone from remote location through DDC Panel.
  - b. If DDC Panel fails, the following shall occur:
    - 1) All zones index to warm-up cycle
    - 2) Hot Water Pump index to ON position
    - 3) Chilled Water Pump indexes to OFF position
  - c. All DDC points shall be mapped back into the network for access by any workstation in the network.
  - d. Points from chiller and boiler panels shall be connected to network via BACNET **IP and MS\TP** and interface panels.
  - e. High limit shutdown can be done via software from discharge air sensor in lieu of hard wired device.
  - f. For sensing if chilled water is available for cooling, it is acceptable to utilize central sensors in lieu of an aquastat at each unit.

END OF SECTION 23 09 00



## SECTION 329210 - SODDING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Sodding.
- B. Related Requirements:
  - 1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

#### 1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer.

- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
  - 1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
  - 1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
  - 2. Personnel Certifications: Installer's personnel assigned to the Work shall have certification in one of the following categories from the National Association of Landscape Professionals:
    - a. Landscape Industry Certified Technician - Exterior.
    - b. Landscape Industry Certified Lawn Care Manager.
    - c. Landscape Industry Certified Lawn Care Technician.
  - 3. Pesticide Applicator: State licensed, commercial.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.
- B. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  - 3. Accompany each delivery of bulk materials with appropriate certificates.

## 1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

## PART 2 - PRODUCTS

### 2.1 TURFGRASS SOD

- A. Turfgrass Sod: Certified, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.
- B. Turfgrass Species, Cool-Season Grass: Sod of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
  - 1. Full Sun: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars.
  - 2. Sun and Partial Shade: Proportioned by weight as follows:
    - a. 50 percent Kentucky bluegrass (*Poa pratensis*).
    - b. 30 percent chewings red fescue (*Festuca rubra* variety).
    - c. 10 percent perennial ryegrass (*Lolium perenne*).
    - d. 10 percent redtop (*Agrostis alba*).
  - 3. Shade: Proportioned by weight as follows:
    - a. 50 percent chewings red fescue (*Festuca rubra* variety).
    - b. 35 percent rough bluegrass (*Poa trivialis*).
    - c. 15 percent redtop (*Agrostis alba*).

### 2.2 PESTICIDES

- A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  - 3. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

### 3.2 PREPARATION

- A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

### 3.3 TURF AREA PREPARATION

- A. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.
  - 1. Reduce elevation of planting soil to allow for soil thickness of sod.
- B. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### 3.4 SODDING

- A. Lay sod within 24 hours of harvesting unless a suitable preservation method is accepted by Architect prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air

pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 1:3.
  2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

### 3.5 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
  2. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).
1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
  2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow Kentucky bluegrass, annual ryegrass, chewings red fescue to a height of 1-1/2 to 2 inches (38 to 50 mm).
- D. Turf Postfertilization: Apply slow-release fertilizer after initial mowing and when grass is dry.
1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) to turf area.

### 3.6 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
  - 1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

### 3.7 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

### 3.8 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove nondegradable erosion-control measures after grass establishment period.

### 3.9 MAINTENANCE SERVICE

- A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:
  - 1. Sodded Turf: 30 days from date of Substantial Completion.

END OF SECTION 329210



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## REVISIONS

NO.	DATE	BY	DESCRIPTION OF CHANGE
01	05-19-2023	PKS	MOVE TREES AWAY FROM SIDEWALK, REVISE LOD
02	03-26-2023	PKS	ADD TREE FENCE PROTECTION
			ADD ALTERNATE SOD RESTORATION
			EXPAND VIEW TO INCLUDE TREES SOUTH OF FIELD

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ADDITIONS AND RENOVATIONS TO  
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SCHOOL DISTRICT OF HAVERFORD TOWNSHIP  
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BRYN MAWR, PA. 19010

PROJECT  
3758

C-107

## LANDSCAPE PLAN

PROJECT SCALE	AS SHOWN
FILENAME	
DATE	MARCH 10, 2025

## LEGEND

- EVERGREEN TREE
- DECIDUOUS TREE
- SMALL/MEDIUM DECIDUOUS TREE
- SHRUB
- TRANSPLANTED TREE
- PLANTING LABEL

## LANDSCAPE NOTES

### SITE PREPARATION

- PROTECT STRUCTURES, UTILITIES, SIDEWALKS, PAVEMENTS, AND OTHER FACILITIES, AND EXISTING EXTERIOR PLANTS FROM DAMAGE CAUSED BY PLANTING OPERATIONS. CONTACT PA-1 CALL 1-800-242-1776 AT A MINIMUM OF THREE WORKING DAYS PRIOR TO COMMENCEMENT OF WORK.
- PROVIDE EROSION CONTROL MEASURE TO PREVENT EROSION OR DISPLACEMENT OF SOILS AND DISCHARGE OF SOIL-BEARING WATER RUN-OFF OR AIRBORNE DUST TO ADJACENT PROPERTIES AND WALKWAYS.
- ALL TREE AND SHRUB REMOVAL AS SHOWN ON THE DEMOLITION PLAN SHALL HAVE ALL STUMPS AND ROOTS REMOVED BY MEANS OF STUMP GRINDING AND/OR BACKHOE. ALL BIODEGRADABLE PLANT MATERIAL FROM THE REMOVAL PROCESS SHALL BE COLLECTED AND REMOVED FROM THE SITE.

### PLANT BED ESTABLISHMENT

- CONTRACTOR TO CONFIRM EXISTING TOPSOIL DEPTH AND SHALL FURNISH SOIL ANALYSIS BY QUALIFIED LAB STATING PERCENTAGES OF ORGANIC MATTER, GRADUATION OF SAND, SILT AND CLAY CONTENT, DELETERIOUS MATERIAL, PH AND MINERAL, AND PLANT-NUTRIENT CONTENT OF TOPSOIL. CONTRACTOR TO PROVIDE DATA AT A MINIMUM OF 5 DIFFERENT PLANTING AREAS. CONTRACTOR TO SUBMIT EXISTING TOPSOIL DEPTH AND RECOMMENDED QUANTITIES OF NITROGEN, PHOSPHORUS AND POTASH INGREDIENTS TO BE ADDED TO PRODUCE A SATISFACTORY TOPSOIL TO LANDSCAPE ARCHITECT FOR APPROVAL.
- TOPSOIL SHALL HAVE ACTIVITY RANGE OF PH 5.0 TO PH 7.0 AND AN ORGANIC CONTENT OF AT LEAST 3-4%. MINIMUM TOPSOIL DEPTH IN PLANTING BEDS SHALL BE 12" BUT 18" IS RECOMMENDED. ADDITIONAL TOPSOIL SHALL BE ADDED WHEN POSSIBLE.
- APPLY APPROVED SOIL AMENDMENTS AND FERTILIZER ON SURFACE AND THOROUGHLY BLEND PLANTING SOIL MIX FOR PLANTING BACKFILL.
- LAY OUT INDIVIDUAL TREE LOCATIONS AND AREAS FOR MULTIPLE EXTERIOR PLANTINGS. STAKE LOCATIONS, OUTLINE AREAS, ADJUST LOCATIONS WHEN REQUESTED, AND OBTAIN LANDSCAPE ARCHITECTS ACCEPTANCE OF LAYOUT BEFORE PLANTING. MAKE MINOR ADJUSTMENTS AS REQUIRED.

### PLANT MATERIAL

- FURNISH NURSERY-GROWN TREES AND SHRUBS COMPLYING WITH ANSI Z60.1, WITH HEALTHY ROOT SYSTEMS DEVELOPED BY TRANSPLANTING OR ROOT PRUNING, PROVIDE WELL-SHAPED, FULLY BRANCHED, HEALTHY, VIGOROUS STOCK-FREE OF DISEASE, INSECTS, EGGS, LARVAE, AND DEFECTS SUCH AS KNOTS, SUN SCALE, INJURIES, ABRASIONS, AND DISFIGUREMENT.
- PROVIDE TREES OF SIZES AND GRADES COMPLYING WITH ANSI Z60.1 FOR THE TYPE OF TREES AND SHRUBS REQUIRED. TREES OF A LARGER SIZE MAY BE USED IF ACCEPTABLE TO ARCHITECT WITH A PROPORTIONATE INCREASE IN SIZE OF ROOTS OR BALLS.
- IF FORMAL ARRANGEMENTS OR CONSECUTIVE ORDER OF TREES IS SHOWN, SELECT STOCK FOR UNIFORM HEIGHT AND SPREAD, AND NUMBER LABEL TO ASSURE SYMMETRY IN PLANTING.

### CLEANUP AND PROTECTION

- DURING EXTERIOR PLANTING, KEEP ADJACENT PAVEMENTS AND CONSTRUCTION CLEAN AND WORK AREA IN AN ORDERLY CONDITION.
- PROTECT EXTERIOR PLANTS FROM DAMAGE DUE TO LANDSCAPE OPERATIONS, OPERATIONS BY OTHER CONTRACTORS AND TRADES, AND OTHERS. MAINTAIN PROTECTION DURING INSTALLATION AND MAINTENANCE PERIODS. TREAT, REPAIR, OR REPLACE DAMAGED EXTERIOR PLANTING.

### DISPOSAL

- REMOVE SURPLUS SOIL AND WASTE MATERIAL, INCLUDING EXCESS SUBSOIL, UNSUITABLE SOIL, TRASH, AND DEBRIS, AND LEGALLY DISPOSE OF THEM OFF OWNER'S PROPERTY.

### WARRANTY

- WARRANT THE FOLLOWING EXTERIOR PLANTS FOR THE WARRANTY PERIOD INDICATED IN THE SPECIFICATIONS, AGAINST DEFECTS INCLUDING DEATH AND UNSATISFACTORY GROWTH. WARRANTY PERIODS FOR ALL PLANT MATERIAL: ONE YEAR FROM DATE OF SUBSTANTIAL COMPLETION.
- REMOVE DEAD EXTERIOR PLANTS IMMEDIATELY. REPLACE IMMEDIATELY UNLESS REQUIRED TO PLANT IN THE SUCCEEDING PLANTING SEASON.
- REPLACE EXTERIOR PLANTS THAT ARE MORE THAN 25 PERCENT DEAD OR IN AN UNHEALTHY CONDITION AT END OF WARRANTY PERIOD.
- A LIMIT OF ONE REPLACEMENT OF EACH EXTERIOR PLANT WILL BE REQUIRED, EXCEPT FOR LOSSES OR REPLACEMENTS DUE TO FAILURE TO COMPLY WITH REQUIREMENTS.

### MISC. PLANTING NOTES

- ALL PLANTING MATERIAL TO BE INSTALLED AS PER SIZE INDICATED ON PLANT SCHEDULE.
- ANY SUBSTITUTIONS THAT MAY BE REQUIRED SHALL BE APPROVED BY THE LANDSCAPE ARCHITECT PRIOR TO ORDERING MATERIAL.
- ALL PLANTINGS AND PLANTING PROCEDURES SHALL CONFORM TO GOOD NURSERY AND LANDSCAPE PRACTICE AND THE STANDARDS SET FORTH BY THE AMERICAN ASSOCIATION OF NURSERMEN.
- PRIOR TO COMMENCEMENT OF WORK ALL UTILITIES BOTH ABOVE AND BELOW GROUND SHALL BE LOCATED THROUGH THE PA ICALL SYSTEM AND/OR THE GENERAL CONTRACTOR ON SITE. IF ANY CONFLICTS DO OCCUR THE LANDSCAPE ARCHITECT SHALL BE NOTIFIED IMMEDIATELY FOR RELOCATION.
- CONTRACTOR TO VERIFY ALL PLANT COUNTS AND LOCATIONS PRIOR TO ORDERING MATERIAL. K&W AND THE OWNER ACCEPT NO RESPONSIBILITY FOR TYPOGRAPHICAL ERRORS AND MISCOUNTS.
- ALL PLANTINGS SHALL HAVE WATER RETAINING CRYSTALS SUCH AS TERAZOROL, OR APPROVED EQUAL, INCORPORATED INTO PLANTING SOIL AS RECOMMENDED BY MANUFACTURER.
- ANY PLANT NOT INCLUDED IN A PLANTING BED SHALL HAVE A MULCHED CIRCLE. THE SIZE OF THE MULCHED CIRCLE SHALL BE DETERMINED ACCORDING TO THE OVERALL PLANT SIZE OR CALIPER. CONSULT THE LANDSCAPE ARCHITECT FOR CLARIFICATION IF REQUIRED.
- EACH PLANT SHALL BE PLANTED SUCH THAT THE ROOT FLARE IS VISIBLE AT THE TOP OF THE ROOT BALL. DO NOT, AT ANY TIME, COVER THE ROOTBALL WITH TOPSOIL BACKFILL.
- THE TOPSOIL BACKFILL SHALL BE FIRMLY TAMPED, COMPARABLE TO FOOT PRESSURE. IN 3" LIFTS TO STABILIZE THE ROOT BALL AND TO PREVENT AIR POCKETS.
- WATER ALL PLANTINGS INDIVIDUALLY WITH AN OPEN ENDED GARDEN HOSE SUBSEQUENT TO INSTALLATION. DO NOT USE MECHANICAL SPRINKLERS TO WATER PLANTINGS.
- LANDSCAPE MATERIAL PLANTING SHALL TAKE PLACE IN THE SPRING OR FALL DURING THE RECOGNIZED ACCEPTABLE PLANTING PERIODS AS NOTED IN THE SPECIFICATIONS. SUMMER PLANTING WILL NOT BE ACCEPTED.

## PLANT SCHEDULE

### PARKING LOT TREES

SYMBOL	BOTANICAL NAME/ COMMON PLANT NAME	QUANTITY	SIZE	ROOT
PCo	CELTIS OCCIDENTALIS/ COMMON HACKBERRY	2	2" CAL.	B&B
POV	OSTRYA VIRGINIANA/ AMERICAN HOPHORNBEAM	1	2" CAL.	B&B

### REPLACEMENT TREES - 2" CAL.

SYMBOL	BOTANICAL NAME/ COMMON PLANT NAME	QUANTITY	SIZE	ROOT
RAc	AMELANCHIER CANADENSIS/ SERVICEBERRY	3	2" CAL.	B&B
RAf	ABIES BALSAEAE/ BALSAM FIR	*5	2" CAL. MIN. 6' HT.	B&B
RCm	CORNUS MAS/ CORNELIAN CHERRY DOGWOOD	9	2" CAL.	B&B
RCv	CRATAEGUS X VIRIDIS 'WINTER KING'/ WINTER KING HAWTHORN	3	2" CAL.	B&B
RPs	PRUNUS SUBHIRTELLA 'AUTUMNALIS'/ HIGAN CHERRY	2	2" CAL.	B&B
	TOTAL	22		

### REPLACEMENT TREES - 2 1/2" CAL.

SYMBOL	BOTANICAL NAME/ COMMON PLANT NAME	QUANTITY	SIZE	ROOT
RGR	QUERCUS LAEVALIS 'NORMAN'/'NORMAN'S' THORNLESS HONEYLOCUST	2	2 1/2" CAL.	B&B
RNs	NYSSA SYLVATICA/ BLACKGUM	1	2 1/2" CAL.	B&B
RPo	PLATANUS OCCIDENTALIS/ AMERICAN SYCAMORE	*6	2 1/2" CAL.	B&B
RQb	QUERCUS BICOLOR/ SWAMP WHITE OAK	*7	2 1/2" CAL.	B&B
RTa	TILIA AMERICANA 'BOULEVARD'/' BOULEVARD AMERICAN BASSWOOD	2	2 1/2" CAL.	B&B
	TOTAL	18		

\* NOTE: FIVE (5) RAf, THREE (3) RPo AND TWO (2) RQb TO BE FIELD LOCATED BY LANDSCAPE ARCHITECT IN SOUTH ATHLETIC FIELD AREA.

### SHRUBS

SYMBOL	BOTANICAL NAME/ COMMON PLANT NAME	QUANTITY	SIZE	ROOT
Ag	ABELIA GRANDIFLORA 'FUNSHINE'/' FUNSHINE ABELIA	17	MIN. 30" HT.	CONT.
Ig	ILEX GLABRA 'SHARROCK'/'SHARROCK' SHARROCK HOLLY	24	MIN. 30" HT.	CONT.
Lf	LEUCOTHOE FONTANESANA 'PAISLEY PUP'/' PAISLEY PUP LEUCOTHOE	11	MIN. 30" HT.	CONT.
To	THUJA OCCIDENTALIS 'EMERALD GREEN'/' EMERALD GREEN ARBORVITAE	9	MIN. 6' HT.	B&B/ CONT.

## LANDSCAPE REQUIREMENTS

### PARKING LOT LANDSCAPING

REQUIREMENT: FIVE (5) PERCENT OF THE PARKING AREA TO BE LANDSCAPED.  
CALCULATION: 4,360 SF PARKING LOT x 5% = 218 SF  
REQUIRED LANDSCAPE AREA: 218 SF  
PROPOSED LANDSCAPE AREA: 1,025 SF (23%)

### TREE REPLACEMENT

REQUIREMENT:  
HERITAGE TREES (30" CAL. OR GREATER)  
REPLACEMENT FORMULA: 1" NEW TREE CALIPER FOR EVERY 1" TREE CALIPER REMOVED.  
(NO HERITAGE TREES ARE SLATED FOR REMOVAL)  
NON-HERITAGE TREES (LESS THAN 30" CAL.)  
REPLACEMENT FORMULA: 1" NEW TREE CALIPER FOR EVERY 4" TREE CALIPER REMOVED.

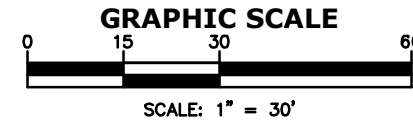
CAL. INCHES REQUIRED (REPLACEMENT VALUE): 30"

PROPOSED REPLACEMENT TREE QUANTITY / REPLACEMENT VALUE (2 1/2" CAL.): 18 / 45"

PROPOSED REPLACEMENT TREE QUANTITY / REPLACEMENT VALUE (2" CAL.): 22 / 44"

CAL. INCHES PROPOSED (REPLACEMENT VALUE): 89"

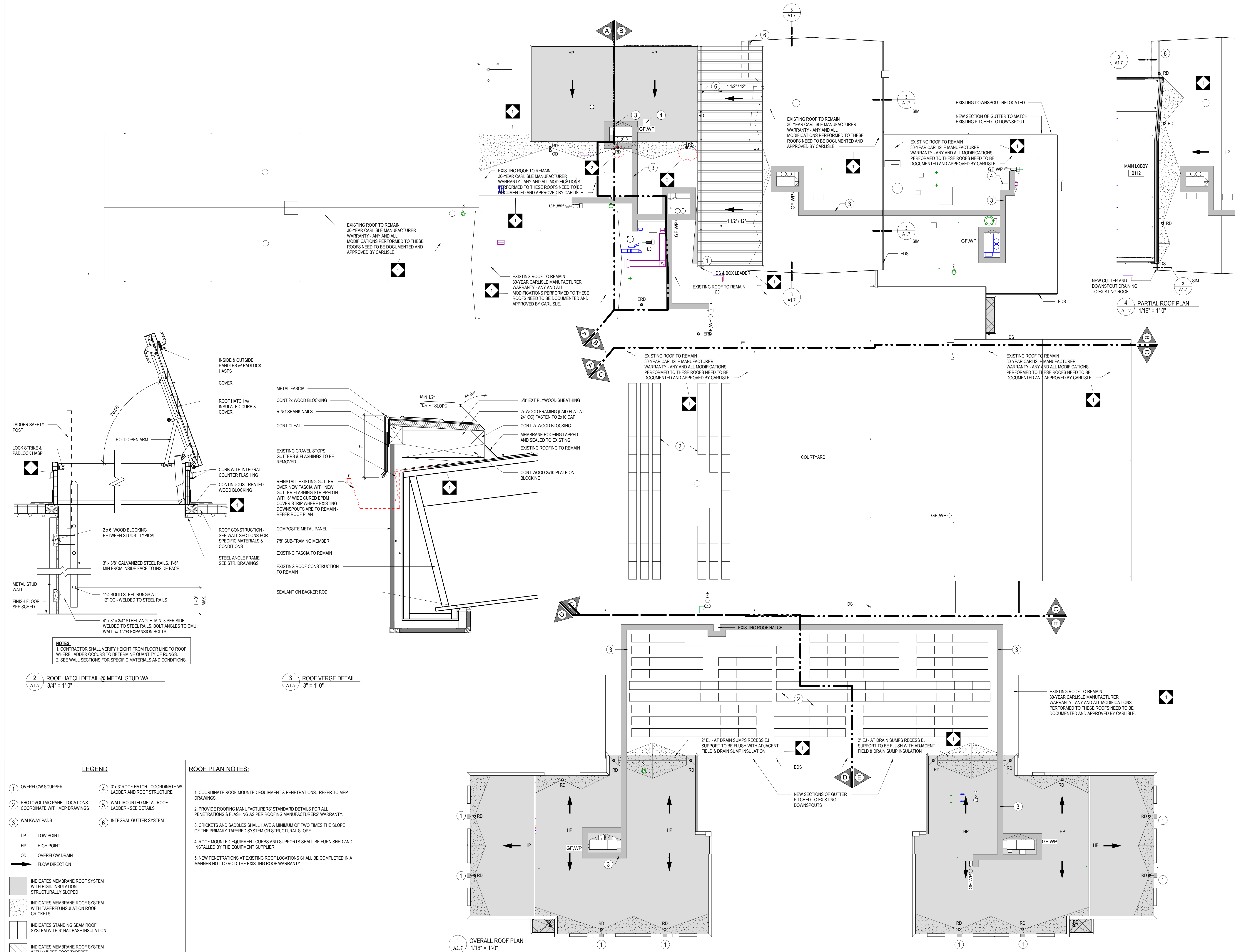
ADD ALTERNATE:  
SOCCER FIELD AND ADDITIONAL 10 FEET BEYOND  
FIELD BOUNDARY SHALL BE RESTORED WITH SOD.





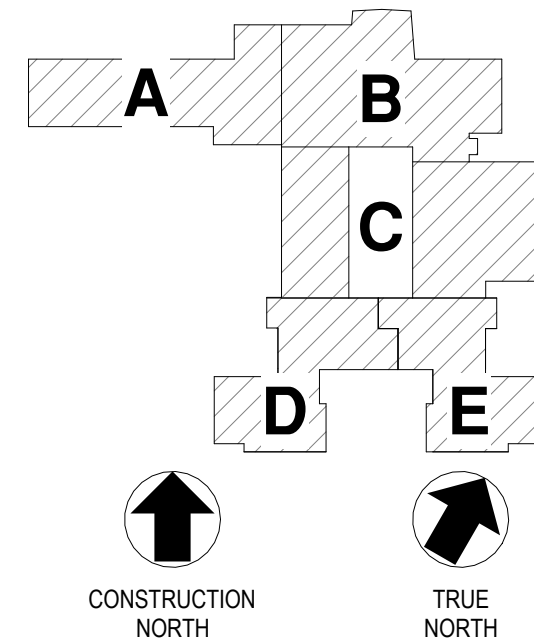






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## KEY PLAN

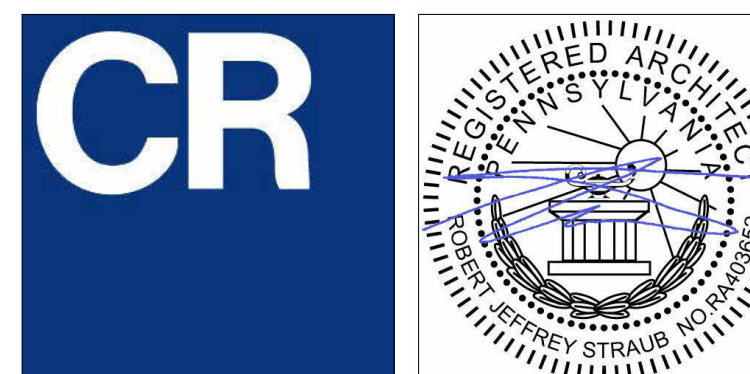


## REVISIONS

NO.	DATE	NAME	DESCRIPTION OF CHANGES
1	3/19/2025		ADDENDUM #1
2	3/28/2025		ADDENDUM #2

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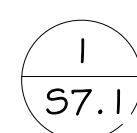
OVERALL ROOF PLAN

PLOT SCALE:  
As indicated  
FILENAME:  
DATE:  
MARCH 10, 2025

PROJECT  
3758

A1.7




$$1/8^{\circ} = 1'-0''$$
[illegible]

TOWSON, MARYLAND

CHARLOTTESVILLE, VIRGINIA  
WHITE SULPHUR SPRINGS, WEST VIRGINIA

ADDITIONS AND RENOVATIONS TO  
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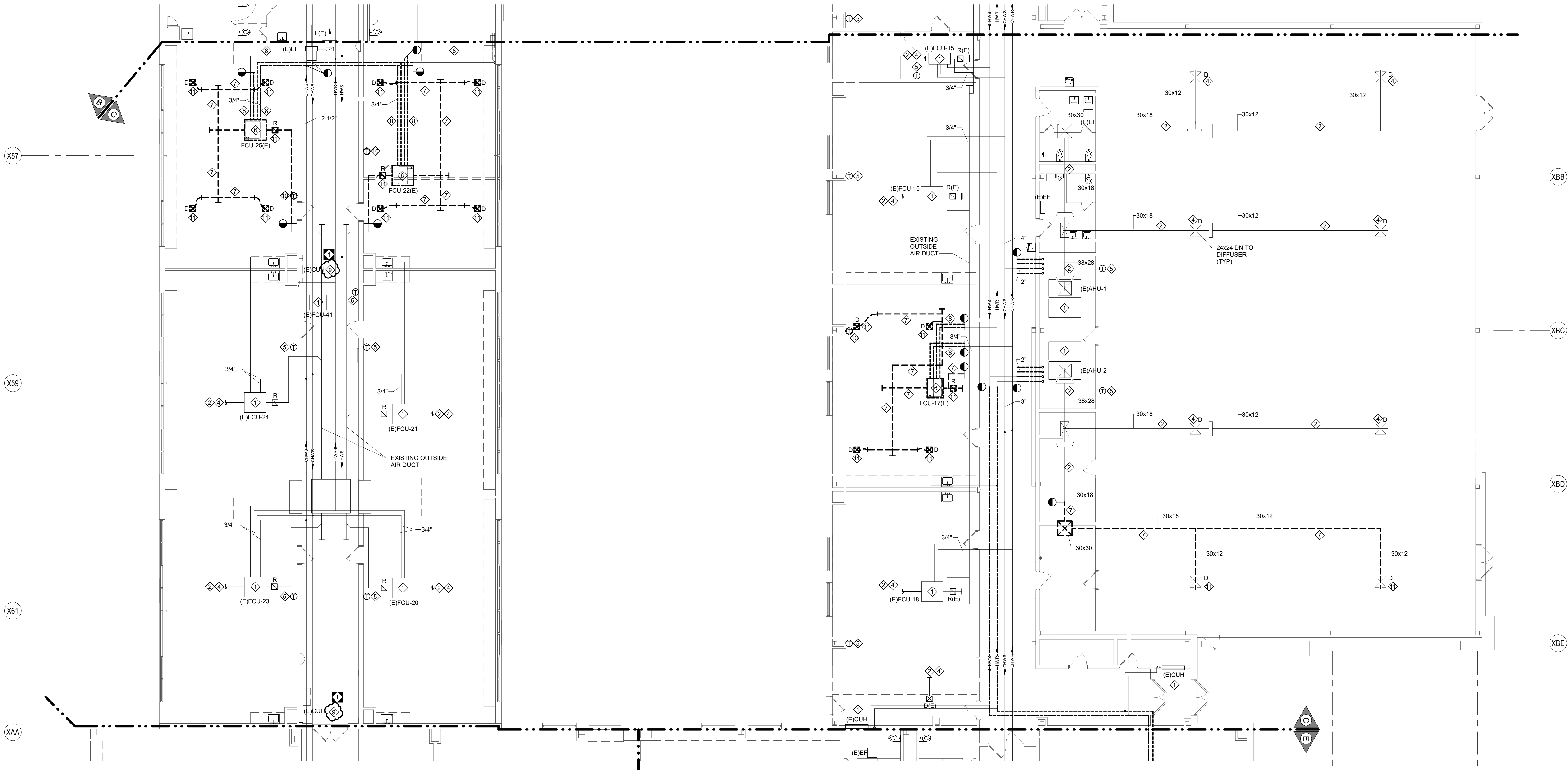


1547 Oregon Pike  
Lancaster, PA 17601  
717.290.7400  
o@bakingram.com  
bakingram.com

FILENAME:

DATE: MARCH 10, 2025

S7.1



1 FIRST FLOOR UNIT C HVAC DEMOLITION  
1/8" = 1'-0"

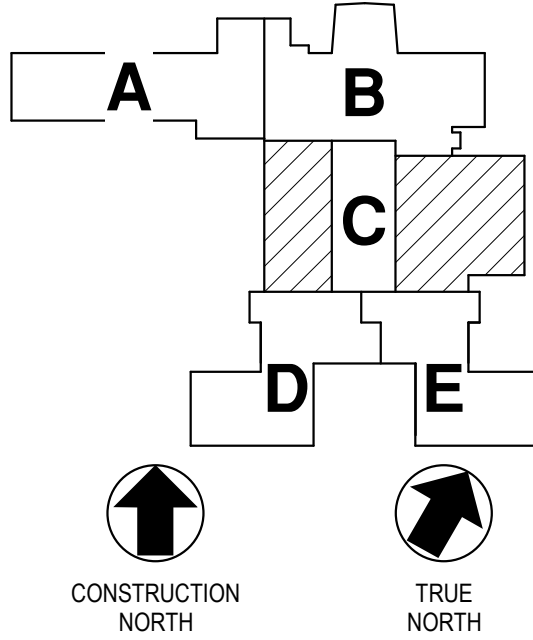
- DRAWING NOTES:**
- EXISTING HVAC EQUIPMENT TO REMAIN IN PLACE AND IN SERVICE.
  - EXISTING DUCTWORK TO REMAIN IN PLACE AND IN SERVICE.
  - EXISTING PIPING TO REMAIN IN PLACE AND IN SERVICE.
  - EXISTING AIR DEVICE TO REMAIN IN PLACE AND IN SERVICE.
  - EXISTING CONTROL DEVICE TO REMAIN IN PLACE AND IN SERVICE.
  - REMOVE AND RETAIN FAN COIL UNIT FOR RELOCATION OR TURN OVER TO OWNER.
  - REMOVE AND DISCARD DUCTWORK AND ASSOCIATED COMPONENTS.
  - REMOVE AND DISCARD PIPING AND ASSOCIATED COMPONENTS.
  - REMOVE HVAC EQUIPMENT AND ASSOCIATED COMPONENTS. TURN OVER EQUIPMENT TO OWNER.
  - REMOVE CONTROL DEVICE AND ASSOCIATED COMPONENTS. WHERE REQUIRED PATCH OPENING TO MATCH EXISTING. TURN OVER JCI CONTROL DEVICES TO OWNER.
  - REMOVE AND DISCARD AIR DEVICE AND ASSOCIATED COMPONENTS.



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### KEY PLAN



### REVISIONS

NO.	DATE	NAME	DESCRIPTION OF CHANGES
1	3/19/2025		ADDENDUM 1

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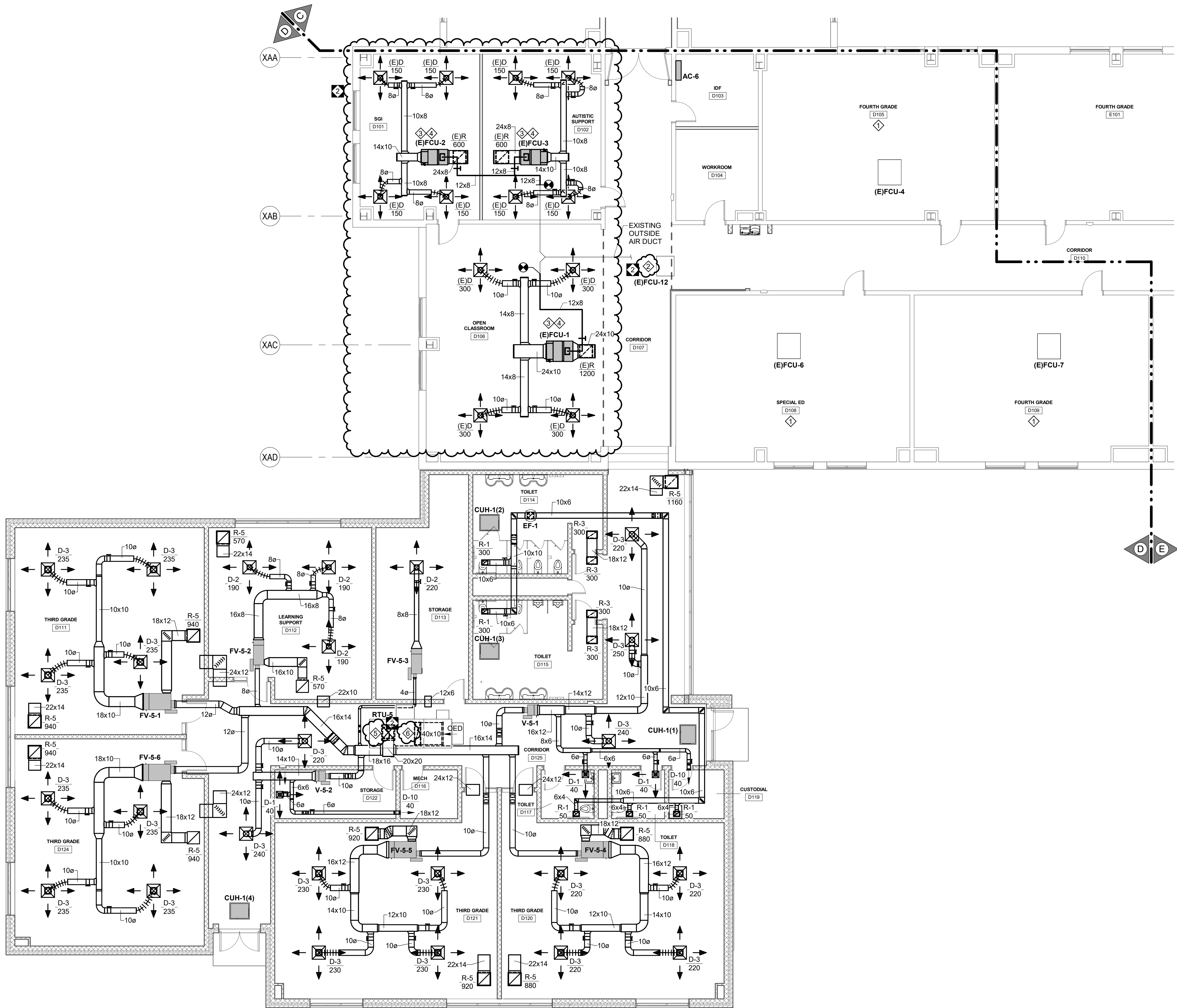
**CR**

FIRST FLOOR UNIT C HVAC  
DEMOLITION

PLOT SCALE:  
1/8" = 1'-0"  
FILENAME:  
240066  
DATE:  
MARCH 10, 2025

PROJECT  
3758

M1.3



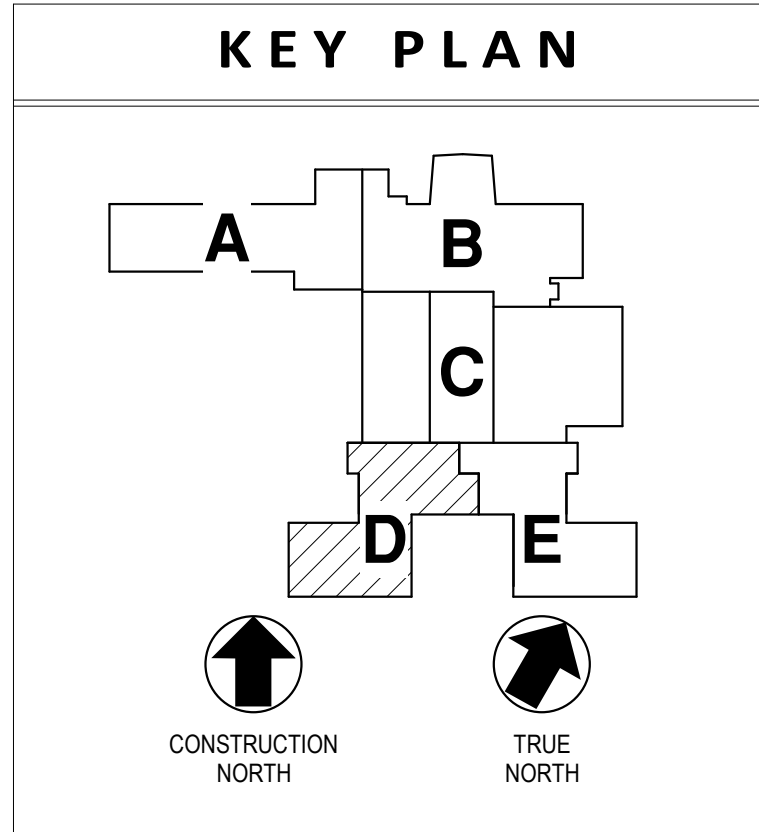
- DRAWING NOTES:**
1. ARCHITECT REPLACING ACT TILE ON EXISTING ACT GRID. HVAC DIFFUSERS, REGISTERS, AND RECESSED HVAC UNITS INTO NEW CEILING.
  2. ARCHITECT PROVIDING NEW ACT SYSTEM. RELOCATE DIFFUSERS, REGISTERS, AND RECESSED HVAC UNITS INTO NEW CEILING.
  3. RELOCATE FAN COIL UNIT, DIFFUSERS, REGISTERS, AND CONTROL DEVICE. PROVIDE RELOCATED UNIT WITH NEW DUCTWORK.
  4. HORIZONTAL FAN COIL ABOVE CEILING. REFER TO DETAIL. CONNECT OUTSIDE AIR DUCT TO FAN COIL.
  5. 20X20 SUPPLY AIR DUCT UP TO ROOFTOP UNIT.
  6. 40X10 RETURN AIR DUCT UP TO ROOFTOP UNIT.

1 FIRST FLOOR UNIT D HVAC  
1/8" = 1'-0"

**MOORE**  
ENGINEERING COMPANY

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**REVISIONS**

NO.	DATE	DESCRIPTION OF CHANGES
2	3/20/2025	ADDENDUM 2

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**CR**

FIRST FLOOR UNIT D HVAC

PLOT SCALE:  
1/8" = 1'-0"

FILENAME:  
240066

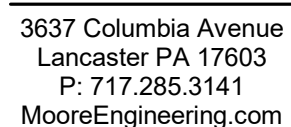
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MARCH 10, 2025

**PROJECT**  
3758

**M2.4**







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# ADDITIONS AND RENOVATIONS TO COOPERTOWN ELEMENTARY SCHOOL

COOPERTOWN ELEMENTARY SCHOOL  
SCHOOL DISTRICT OF HAVERFORD TOWNSHIP

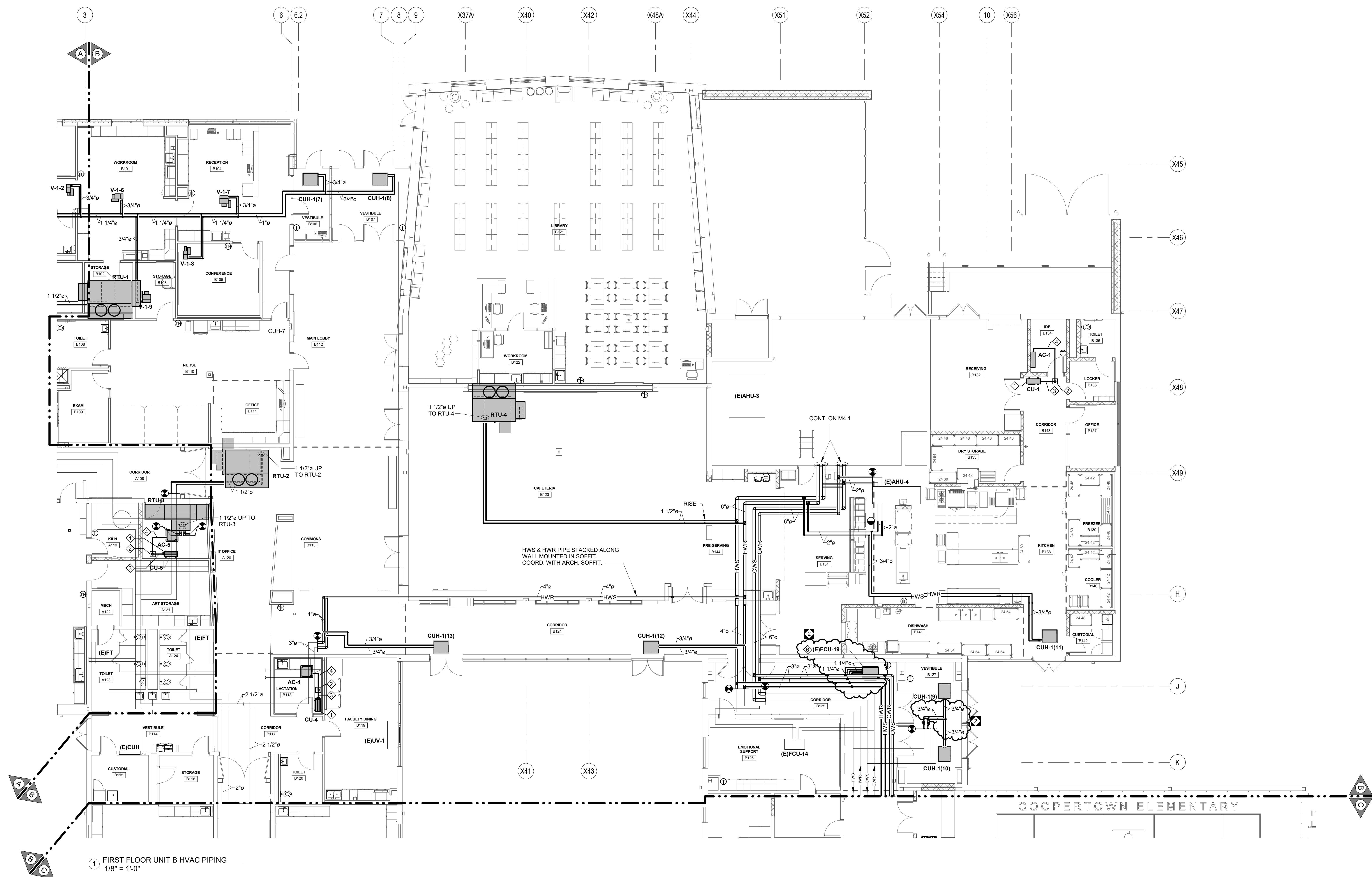
300 COOPERTOWN ROAD  
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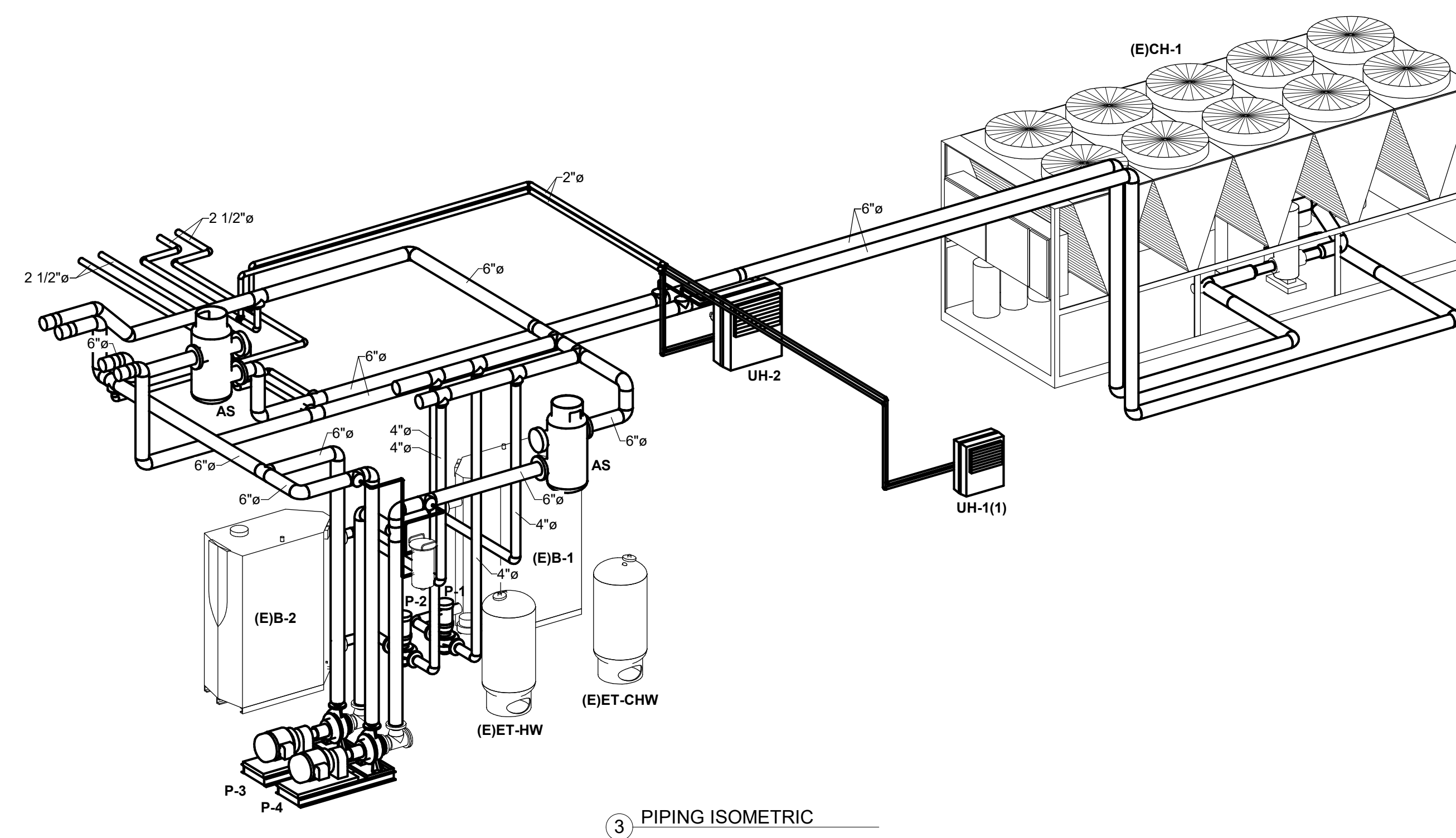
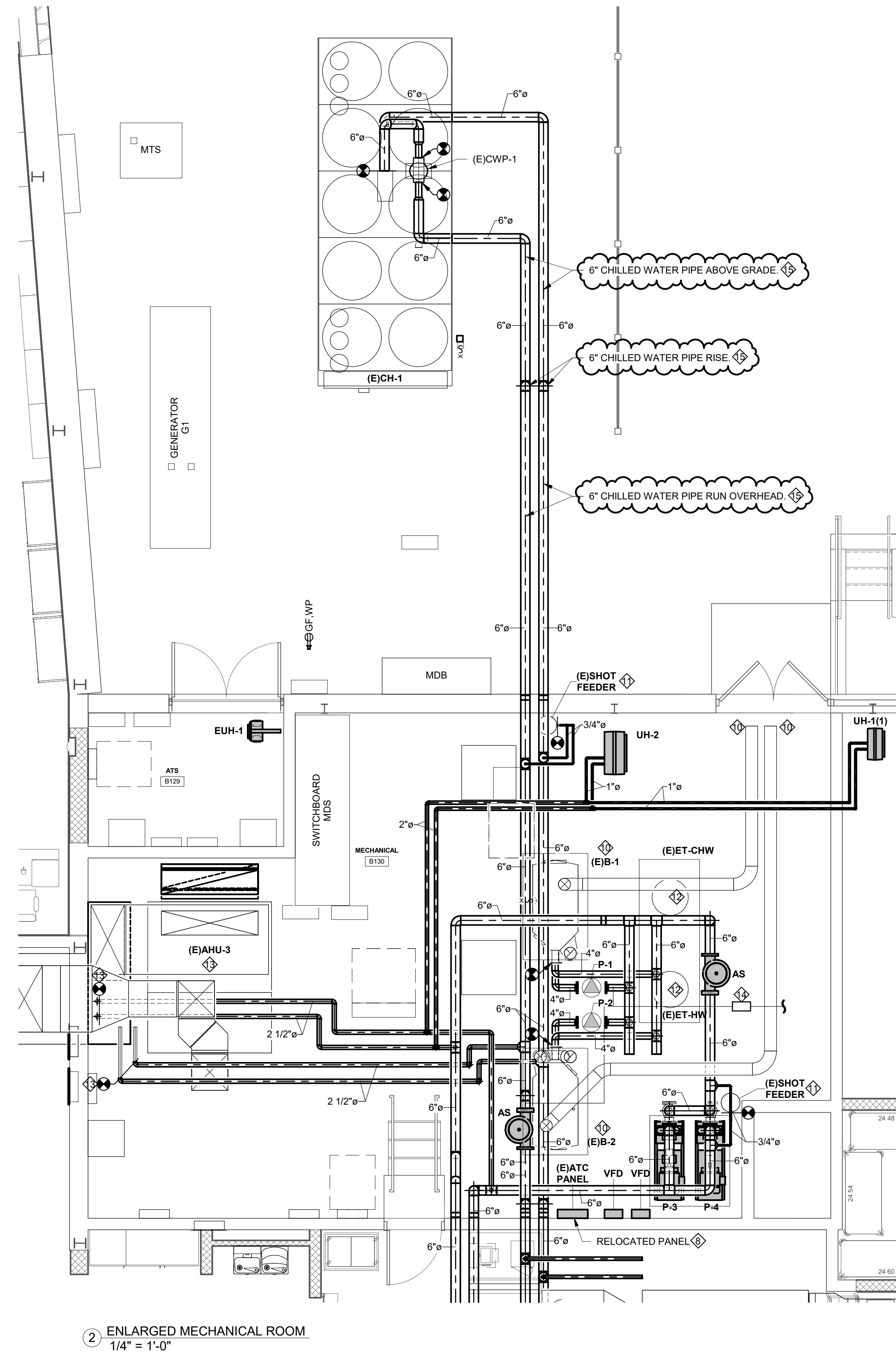
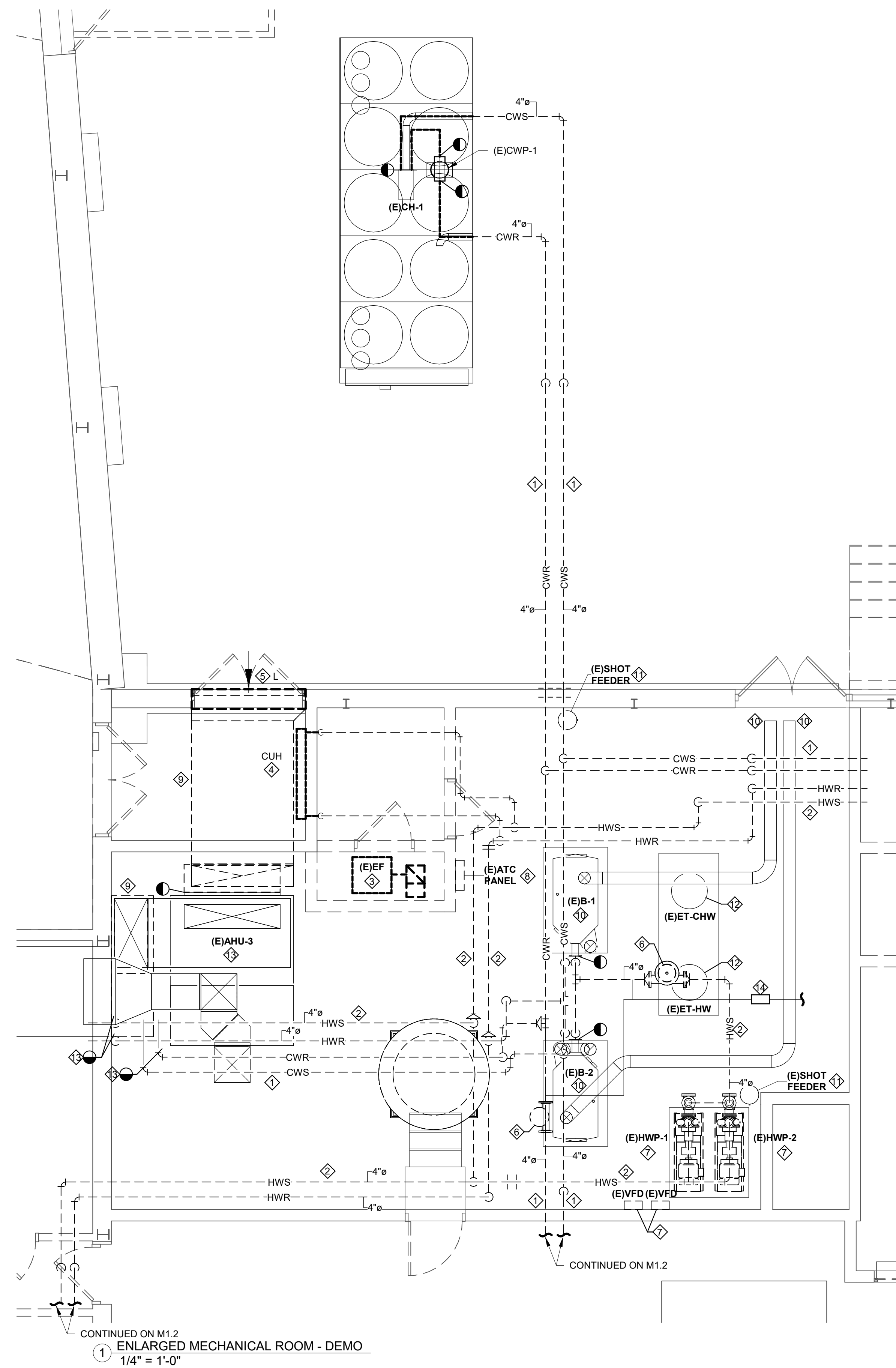
FIRST FLOOR UNIT B HVAC  
PIPING

LOT SCALE:  
1/8" = 1'-0"  
LENAME:  
4066  
ATE:  
MAR

**PROJECT**  
3758

## M3.2





**DRAWING NOTES:**

1. REMOVE AND DISCARD CHILLED WATER PIPING AND ASSOCIATED COMPONENTS.
2. REMOVE AND DISCARD HOT WATER PIPING AND ASSOCIATED COMPONENTS.
3. REMOVE AND DISCARD EXHAUST FAN, DUCTWORK, CONTROLS, AND ASSOCIATED COMPONENTS.
4. REMOVE AND DISCARD CABINET UNIT HEATER AND ASSOCIATED COMPONENTS.
5. REMOVE AND DISCARD LOUVER AND ASSOCIATED COMPONENTS.
6. REMOVE AND DISCARD AIR SEPARATOR AND ASSOCIATED COMPONENTS.
7. REMOVE HOT WATER PUMPS, VFD'S, AND ASSOCIATED COMPONENTS. TURN OVER TO OWNER.
8. RELOCATE ATC PANEL.
9. REMOVE AND DISCARD DUCTWORK AND ASSOCIATED COMPONENTS.
10. EXISTING BOILERS, INTAKE VENT, FLUE VENT, AND CONTROL COMPONENTS TO REMAIN
11. EXISTING SHOT FEEDER TO REMAIN. REMOVE ASSOCIATED PIPING CONNECTED TO DEMOLISHED 4" PIPE. PREPARE PIPE END FOR RECONNECTION TO NEW 6" PIPE. EXTEND PIPE AND CONNECT TO NEW 6" PIPE.
12. EXISTING EXPANSION TANKS, PIPE, RISER WITH RELIEF VALVE TO REMAIN. REMOVE ASSOCIATED PIPING CONNECTED TO DEMOLISHED 4" PIPE. PREPARE PIPE END FOR RECONNECTION TO NEW 6" PIPE. EXTEND PIPE AND CONNECT TO NEW 6" PIPE.
13. EXISTING AIR HANDLER TO REMAIN. EXISTING COIL PIPING AND CONTROLS TO REMAIN. RECONNECT TO NEW PIPING.
14. EXISTING MAKEUP WATER PIPING COMPONENTS TO REMAIN. SEE DETAIL. REMOVE ASSOCIATED PIPING CONNECTED TO DEMOLISHED 4" PIPE. PREPARE PIPE END FOR RECONNECTION TO NEW 6" PIPE. EXTEND PIPE AND CONNECT TO NEW 6" PIPE.
15. EXISTING EXTERIOR I-BEAM SUPPORT STRUCTURE TO REMAIN. REBUSH/SPUR STRUCTURE SUPPORT. PROVIDE ALL ADDITIONAL SUPPORT STRUCTURE, HANGERS, STRAPS, ETC. IN ORDER TO HANG NEW CHILLED WATER PIPING. ADD MISC. STEELS AS REQUIRED TO ACCOMMODATE THE 6"

## REVISIONS

[illegible]

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## ADDITIONS AND RENOVATIONS TO

COOPERTOWN ELEMENTARY SCHOOL

SCHOOL DISTRICT OF HAVERFORD TOWNSHIP

800 COOPERTOWN ROAD  
BRYN MAWR, PA. 19010



ENLARGED MECHANICAL  
ROOM PLANS

PLOT SCALE:  
1/4" = 1'-0"

FILENAME:  
24066

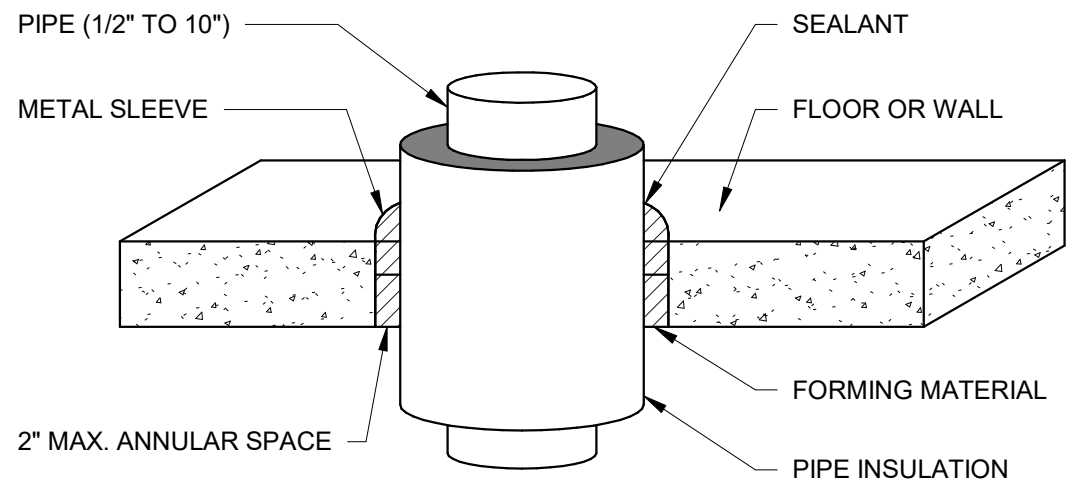
DATE:  
MARCH 1

**PROJECT**  
3758

M4.1





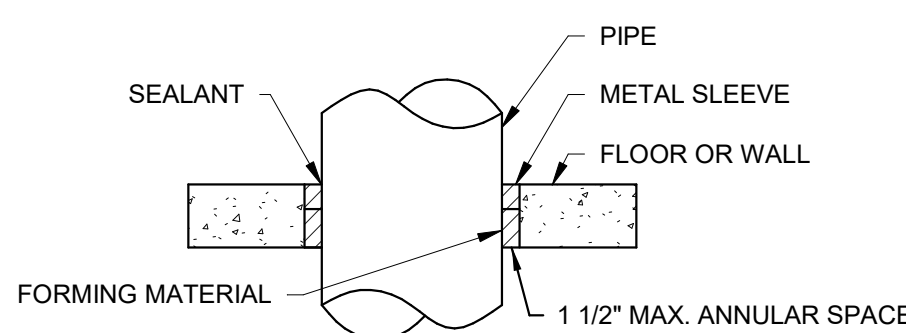


**NOTES:**

1. PIPE INSULATION - NOMINAL 1-1/2" THICK OR THINNER, FIBERGLASS INSULATION.
2. FORMING MATERIAL-TIGHTLY PACK MIN. 4pcf MINERAL WOOL BATT INSULATION TO FILL THE ANNULAR SPACE AND RECESS 1" FROM THE TOP SURFACE OF THE FLOOR OR FROM BOTH SURFACES OF THE WALL.
3. NELSON ES1399 SEALANT - OR EQUAL APPLY ES1399 SEALANT OVER THE FORMING MATERIAL TO A MIN. 1" DEPTH, FLUSH WITH THE TOP SURFACE OF THE FLOOR OR WITH BOTH SURFACES OF THE WALL. AT AREAS OF POINT OF CONTACT, APPLY A 3/8" BEAD AT THE INTERFACE BETWEEN THE INSULATED PIPE AND PERIPHERY OF THE OPENING.

**TYPICAL PIPE PENETRATION  
1-HOUR, 2-HOUR RATED WALL OR FLOOR  
COPPER OR STEEL PIPE-INSULATED**

NO SCALE

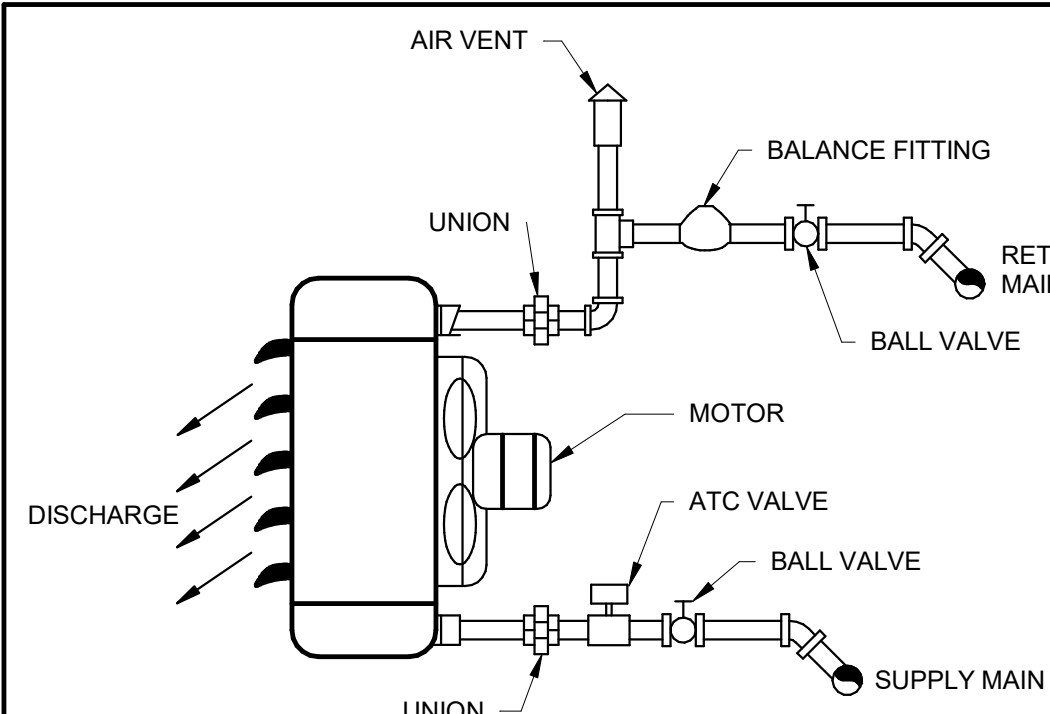


**NOTES:**

1. FORMING MATERIAL-TIGHTLY PACK MIN. 4pcf MINERAL WOOL BATT INSULATION OR 1" DIAMETER BACKER ROD TO FILL THE ANNULAR SPACE AND RECESS 1/2" FROM THE TOP SURFACE OF THE FLOOR OR FROM BOTH SURFACES OF THE WALL.
2. NELSON ES1399 SEALANT - OR EQUAL APPLY ES1399 SEALANT OVER THE FORMING MATERIAL TO A MIN. 1/2" DEPTH, FLUSH WITH THE TOP SURFACE OF THE FLOOR OR WITH BOTH SURFACES OF THE WALL. AT AREAS OF POINT OF CONTACT, APPLY A 3/8" BEAD AT THE INTERFACE BETWEEN THE PIPE AND THE FLOOR OR WALL.

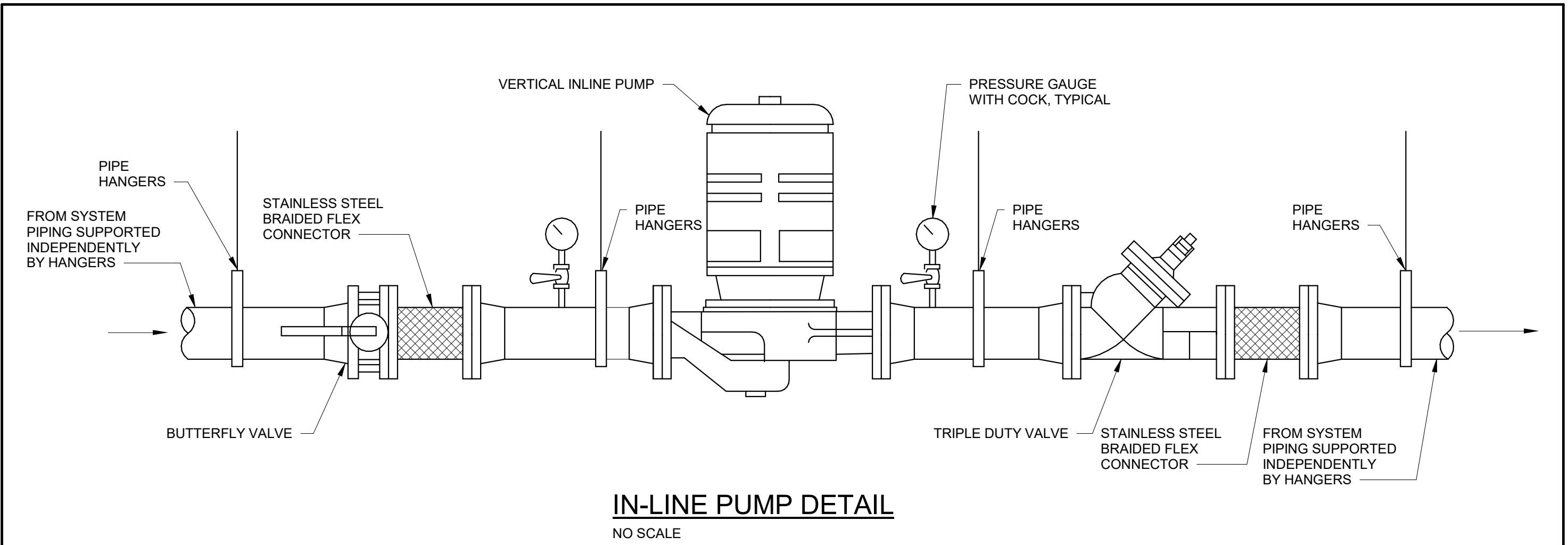
**TYPICAL PIPE PENETRATION  
1-HOUR, 2-HOUR RATED WALL OR FLOOR  
COPPER OR STEEL PIPE-UNINSULATED**

NO SCALE



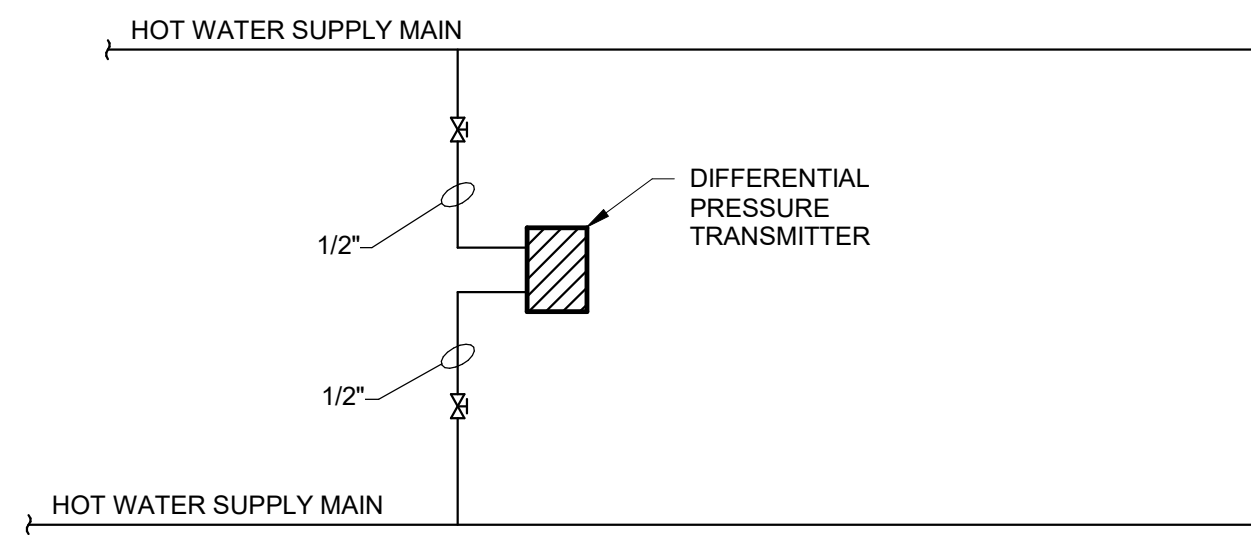
**HORIZONTAL UNIT HEATER**

NO SCALE



**IN-LINE PUMP DETAIL**

NO SCALE

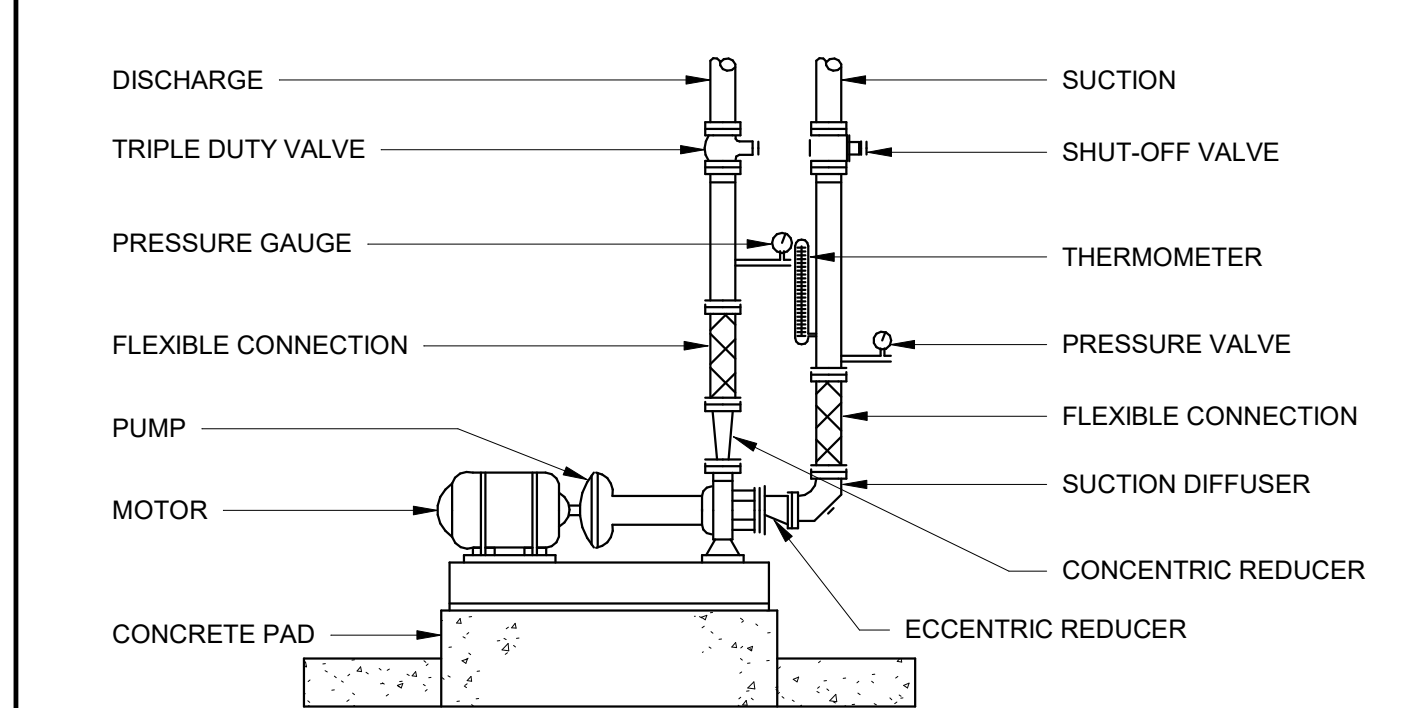


**NOTE:**

PROVIDE PIPING, TRANSMITTER, VALVES, ECT. AT ALL LOCATIONS NOTED ON PLANS.

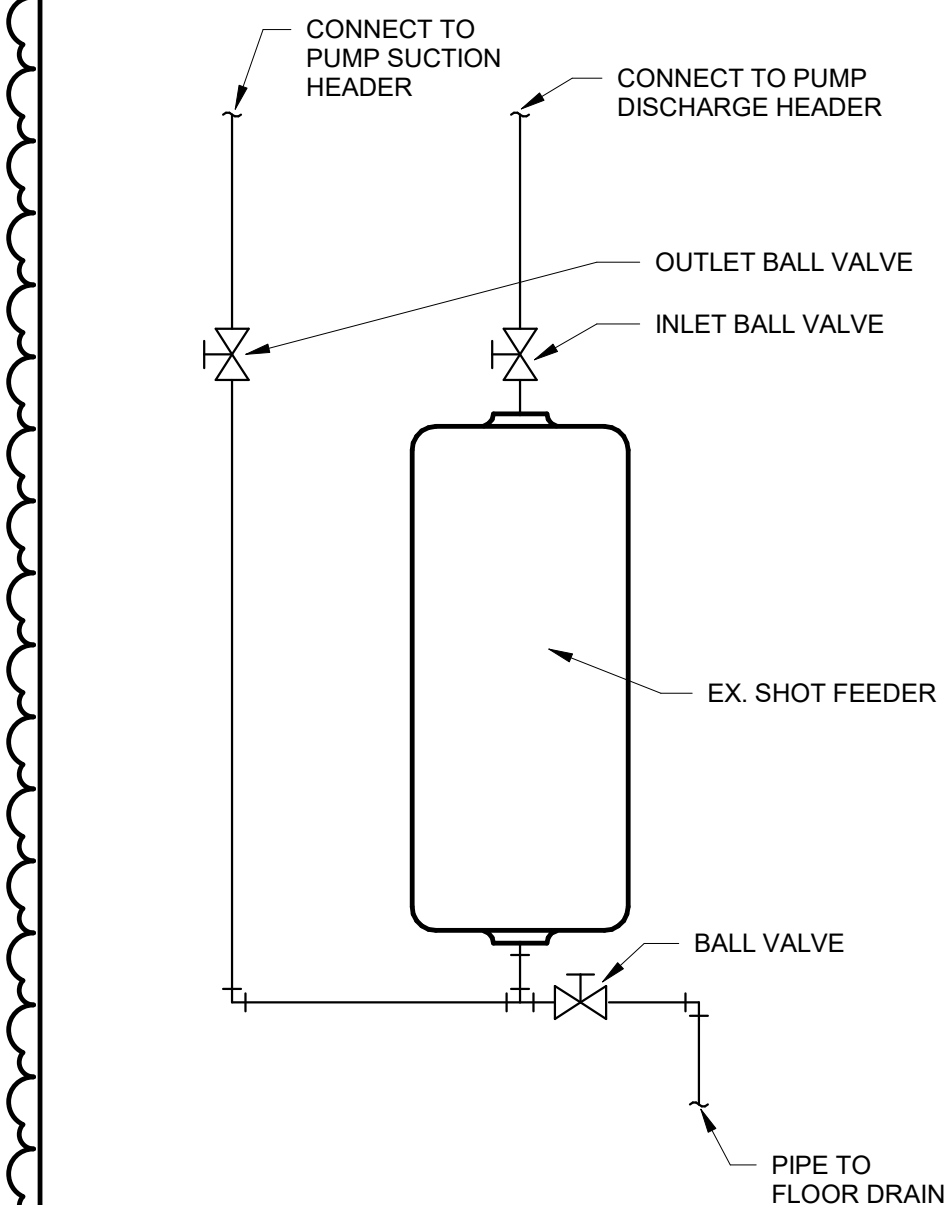
**TYPICAL PRESSURE TRANSMITTER  
PIPING SCHEMATIC**

NO SCALE



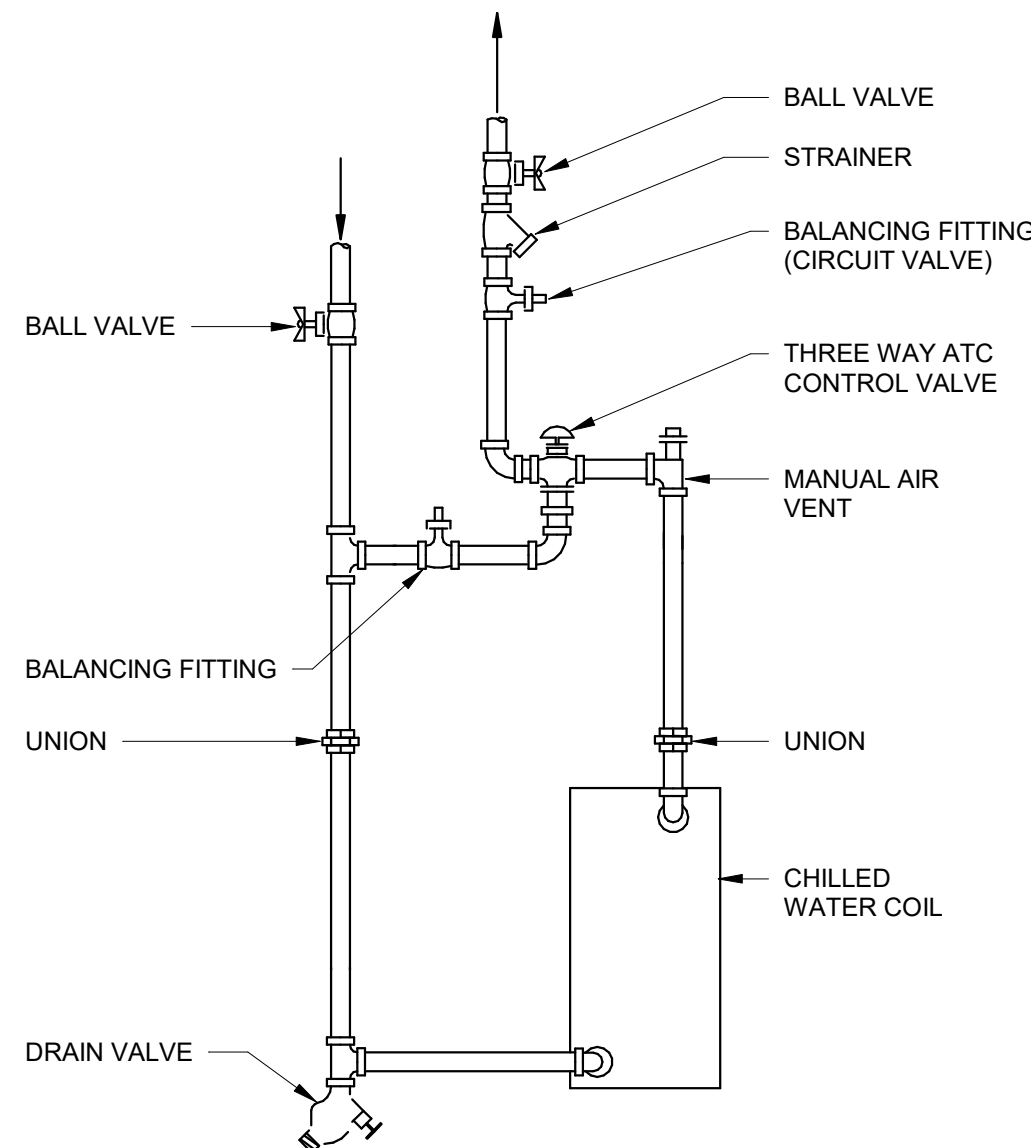
**BASE MOUNTED PUMP DETAIL**

NO SCALE



**SHOT FEEDER DETAIL**

NO SCALE

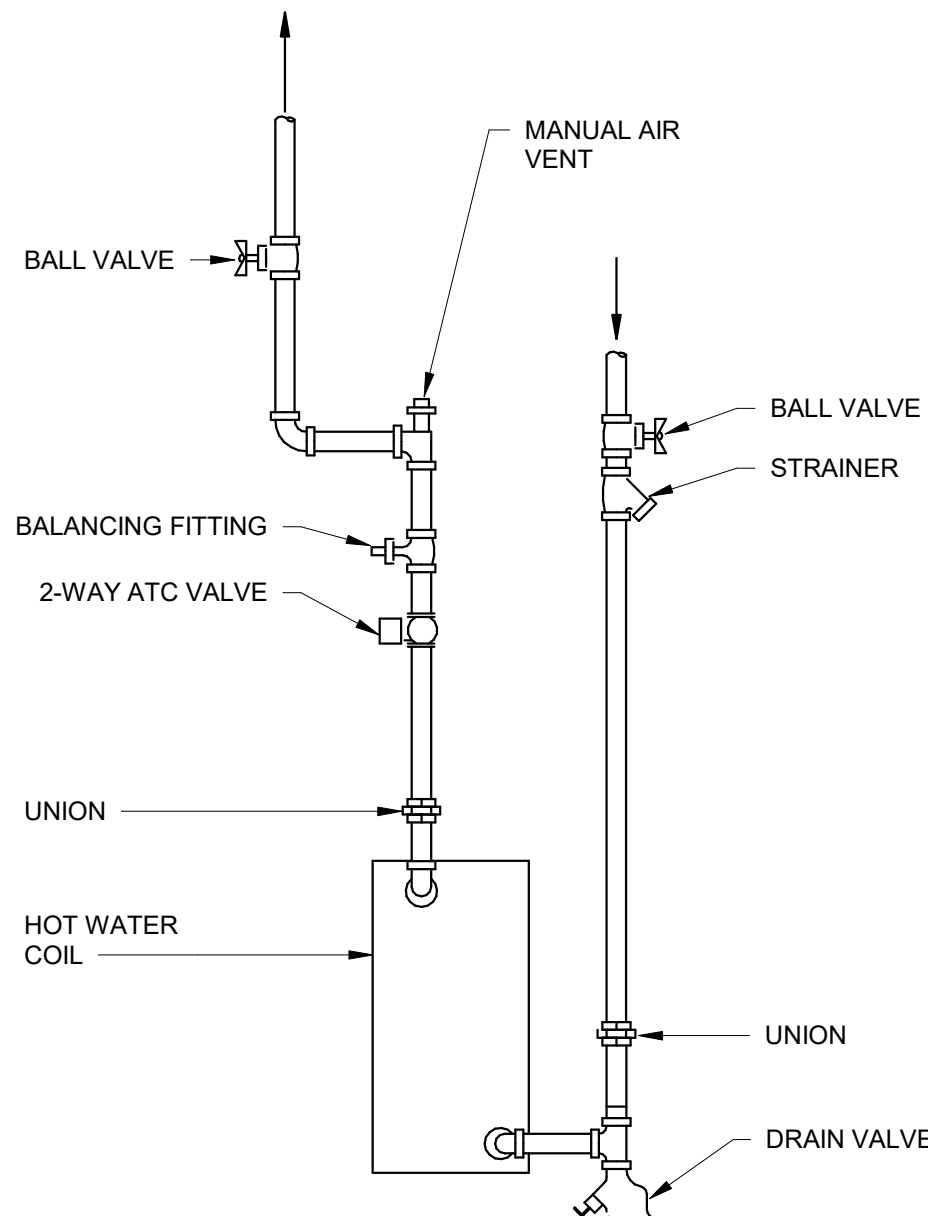


**NOTE:**

APPLIES TO EXISTING AHU'S.

**CHILLED WATER COIL**

NO SCALE

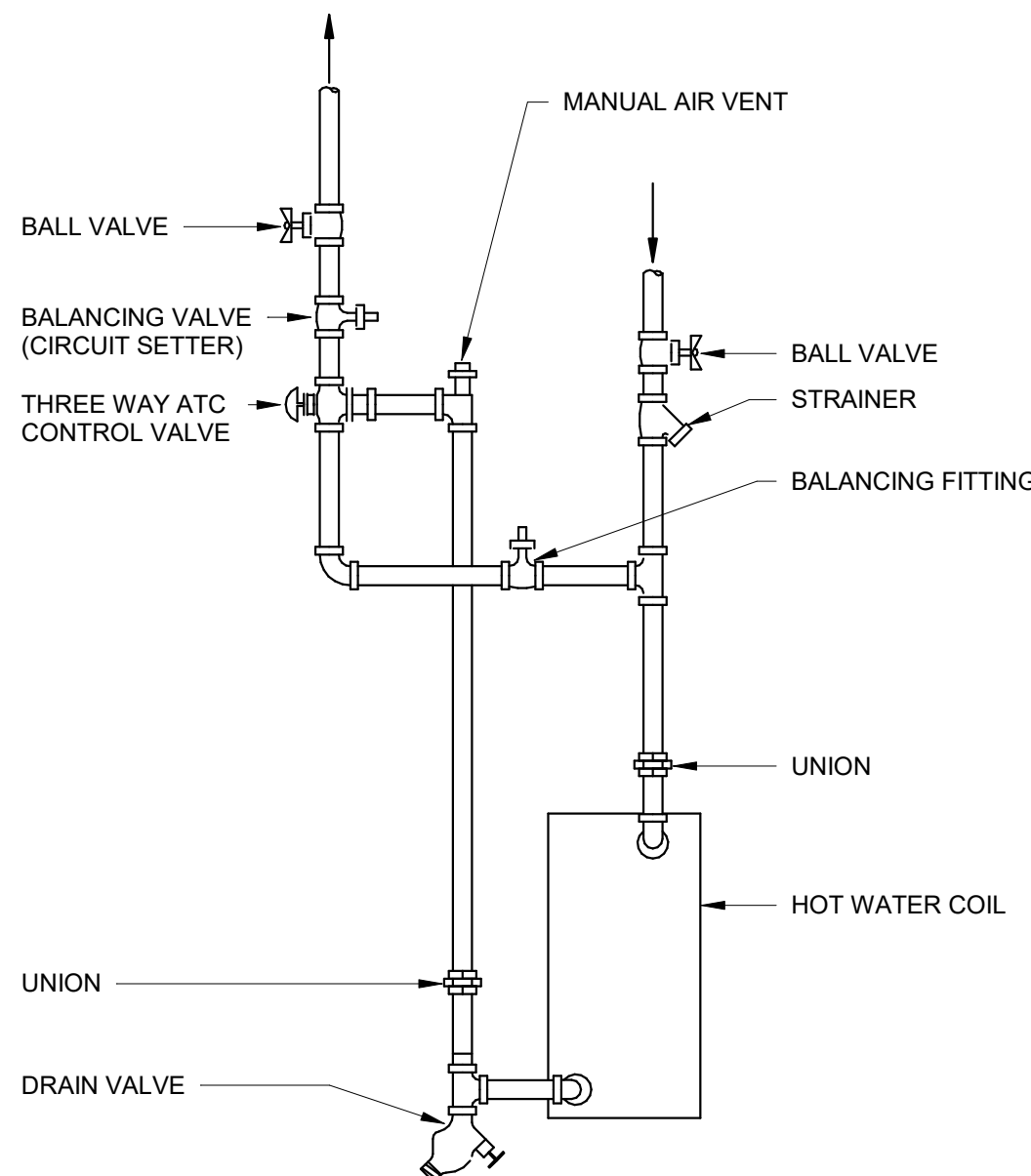


**NOTE:**

APPLIES TO VAV BOXES, FAN COIL UNITS, UNIT HEATERS, CABINET UNIT HEATERS, AND UNIT VENTILATOR.

**CHILLED WATER COIL DETAIL**

NO SCALE

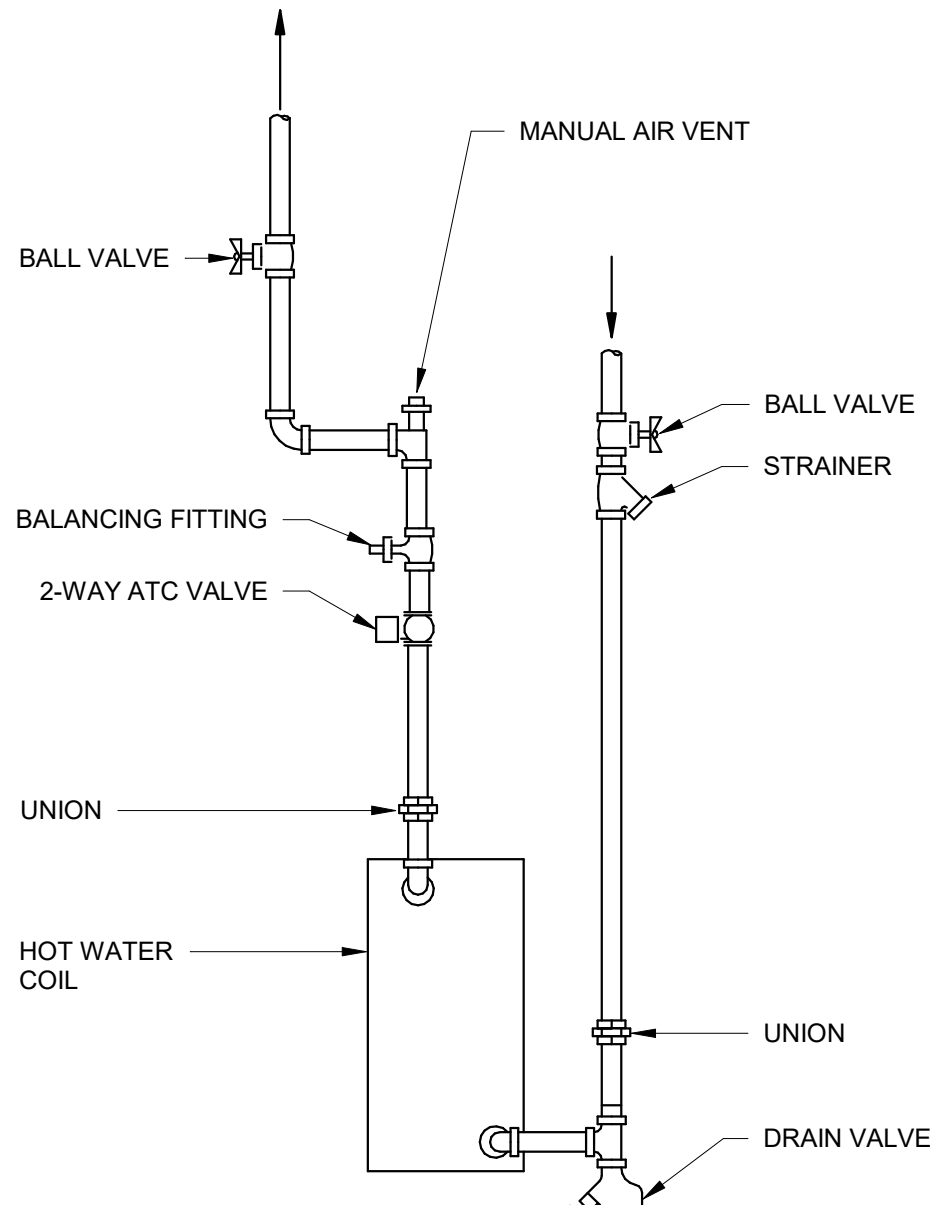


**NOTE:**

APPLIES TO EXISTING AHU'S

**HOT WATER COIL**

NO SCALE

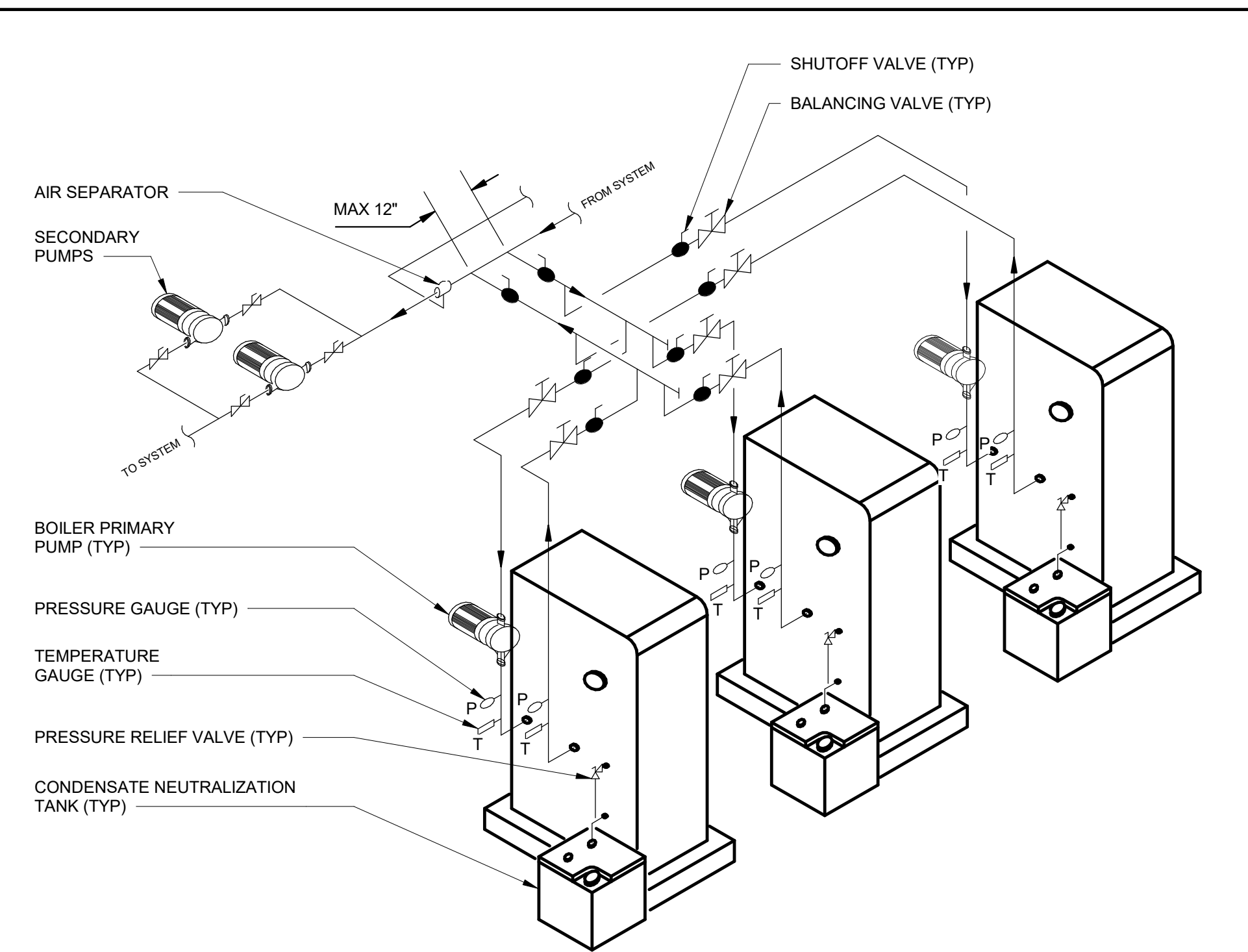


**NOTE:**

APPLIES TO VAV BOXES, FAN COIL UNITS, UNIT HEATERS, CABINET UNIT HEATERS, AND UNIT VENTILATOR.

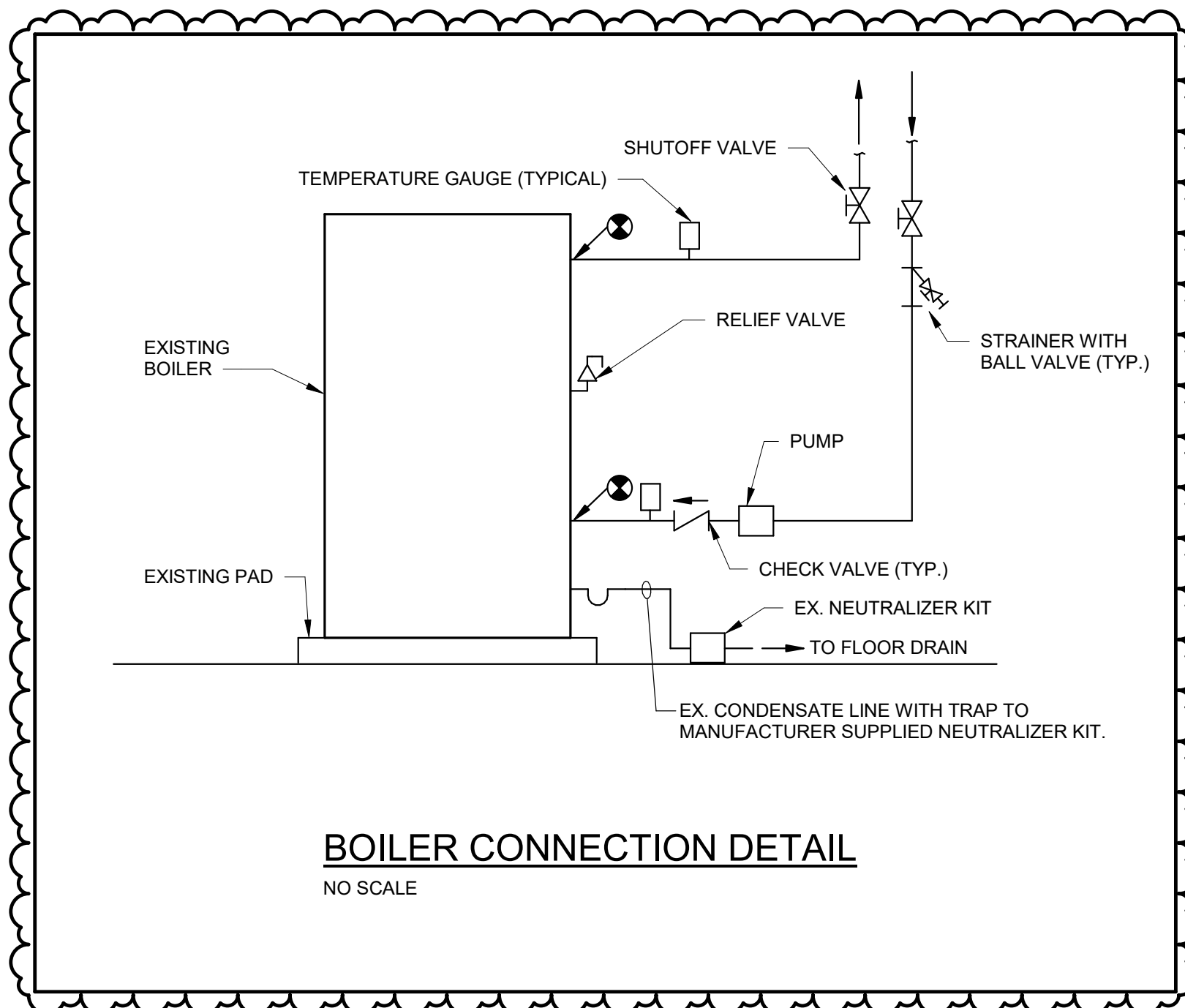
**HOT WATER COIL DETAIL**

NO SCALE



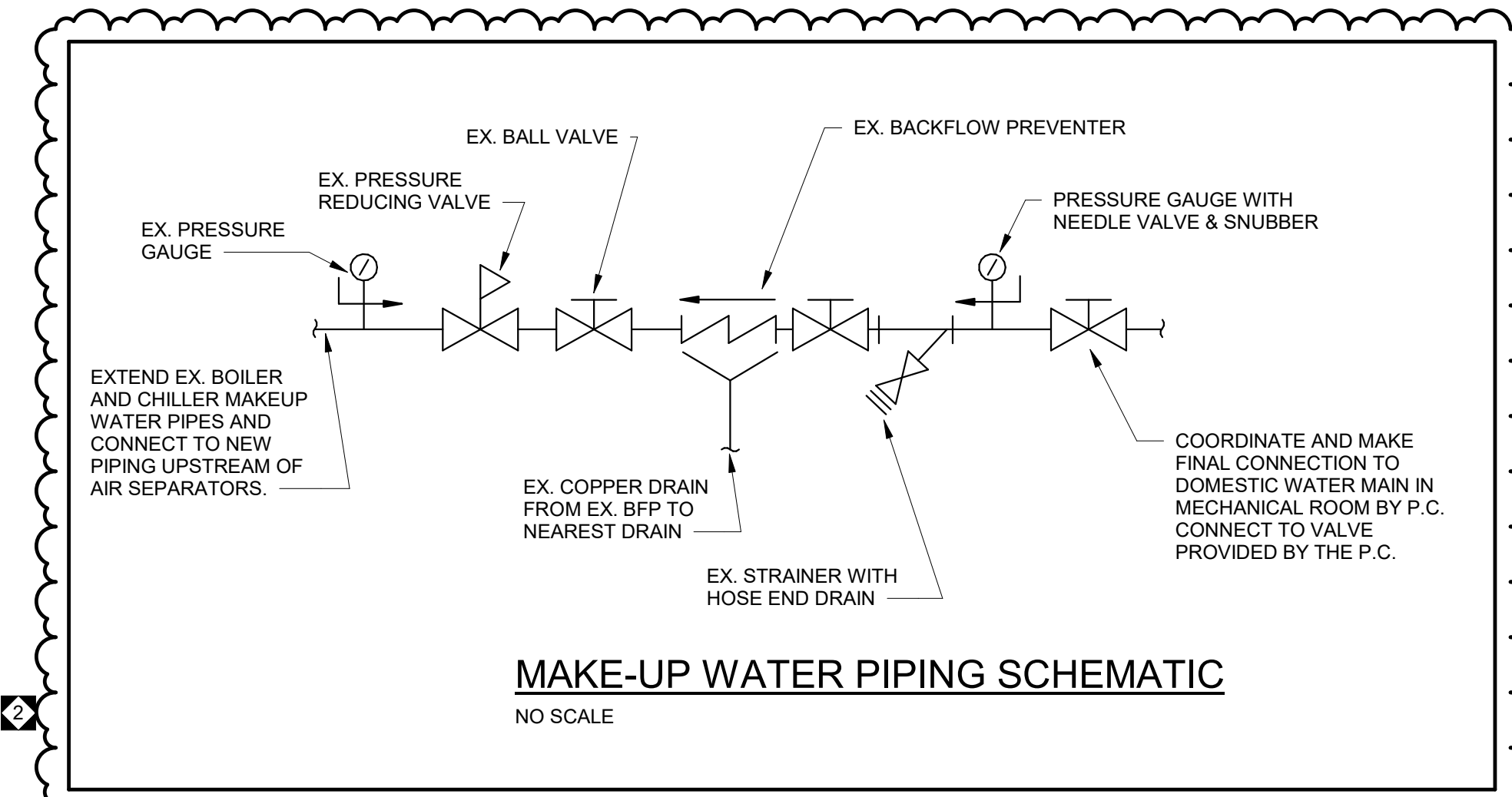
**CONDENSING BOILER PIPING SCHEMATIC**

NO SCALE



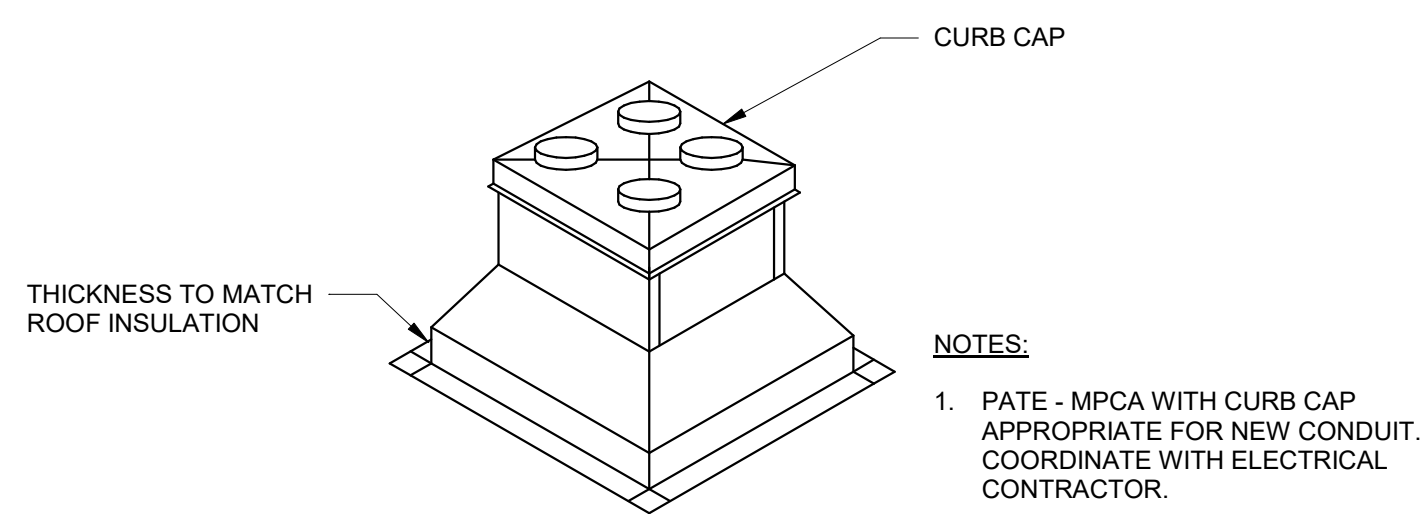
**BOILER CONNECTION DETAIL**

NO SCALE



**MAKE-UP WATER PIPING SCHEMATIC**

NO SCALE



**PIPE PORTAL DETAIL**

NO SCALE

**NOTES:**

1. PATE - MPCA WITH CURB CAP. APPROPRIATE FOR NEW CONDUIT. COORDINATE WITH ELECTRICAL CONTRACTOR.
2. SEAL ROOF OPENING WATERTIGHT.



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2	3/28/2025			ADDENDUM 2

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ADDITIONS AND RENOVATIONS TO  
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SCHOOL DISTRICT OF HAVERFORD TOWNSHIP

800 COOPERTOWN ROAD  
BRYN MAWR, PA. 19010

**CR**

HVAC DETAILS

PLOT SCALE:

As indicated

FILENAME:

24066

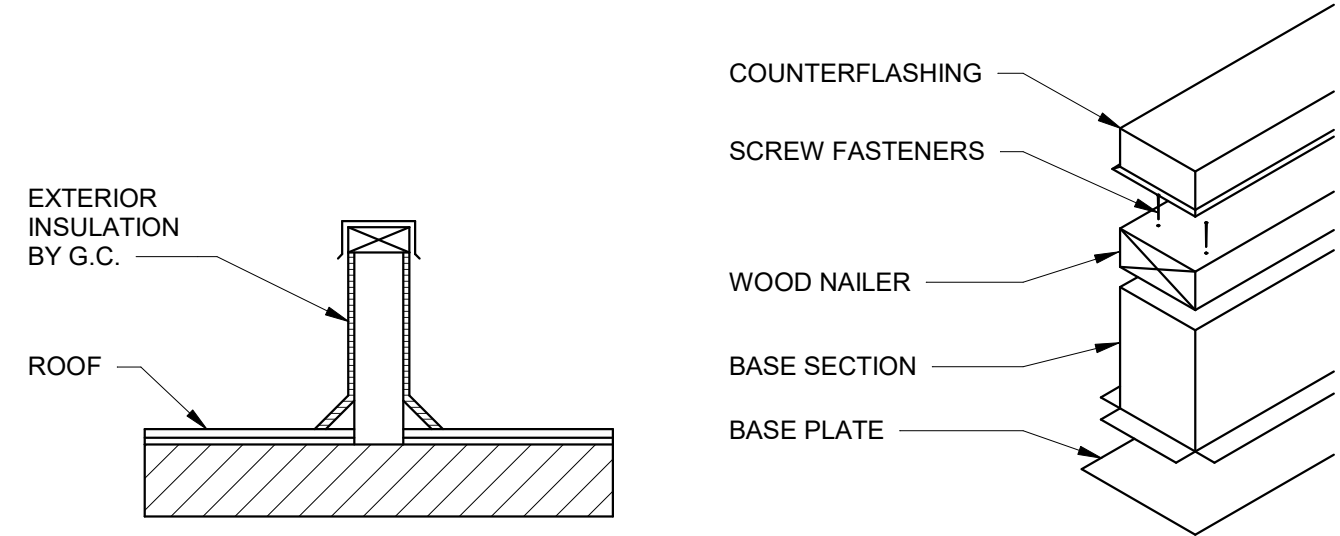
DATE:

MARCH 10, 2025

**PROJECT**

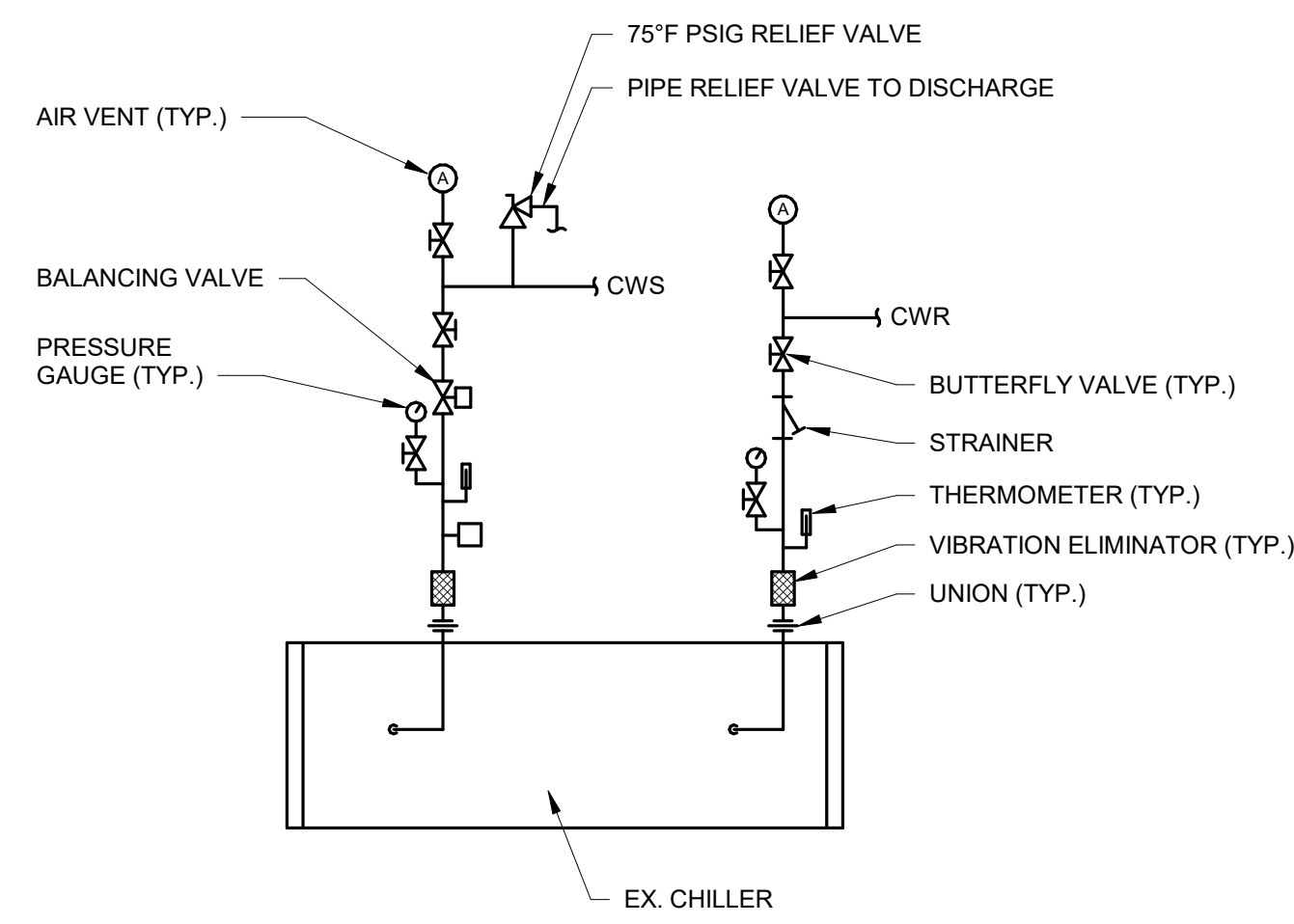
3758

**M6.1**



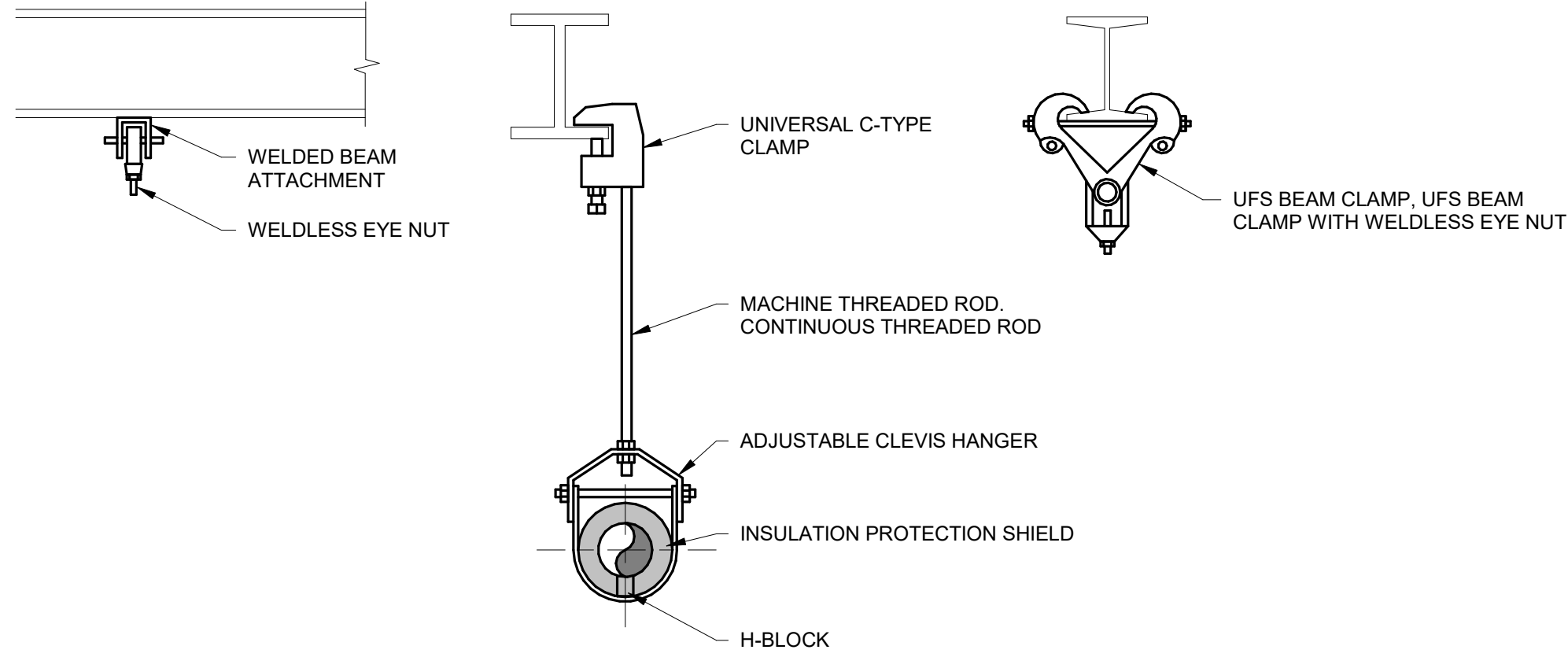
### ROOFTOP EQUIPMENT RAIL DETAIL

NO SCALE:



### AIR COOLED CHILLER PIPING DIAGRAM

NO SCALE

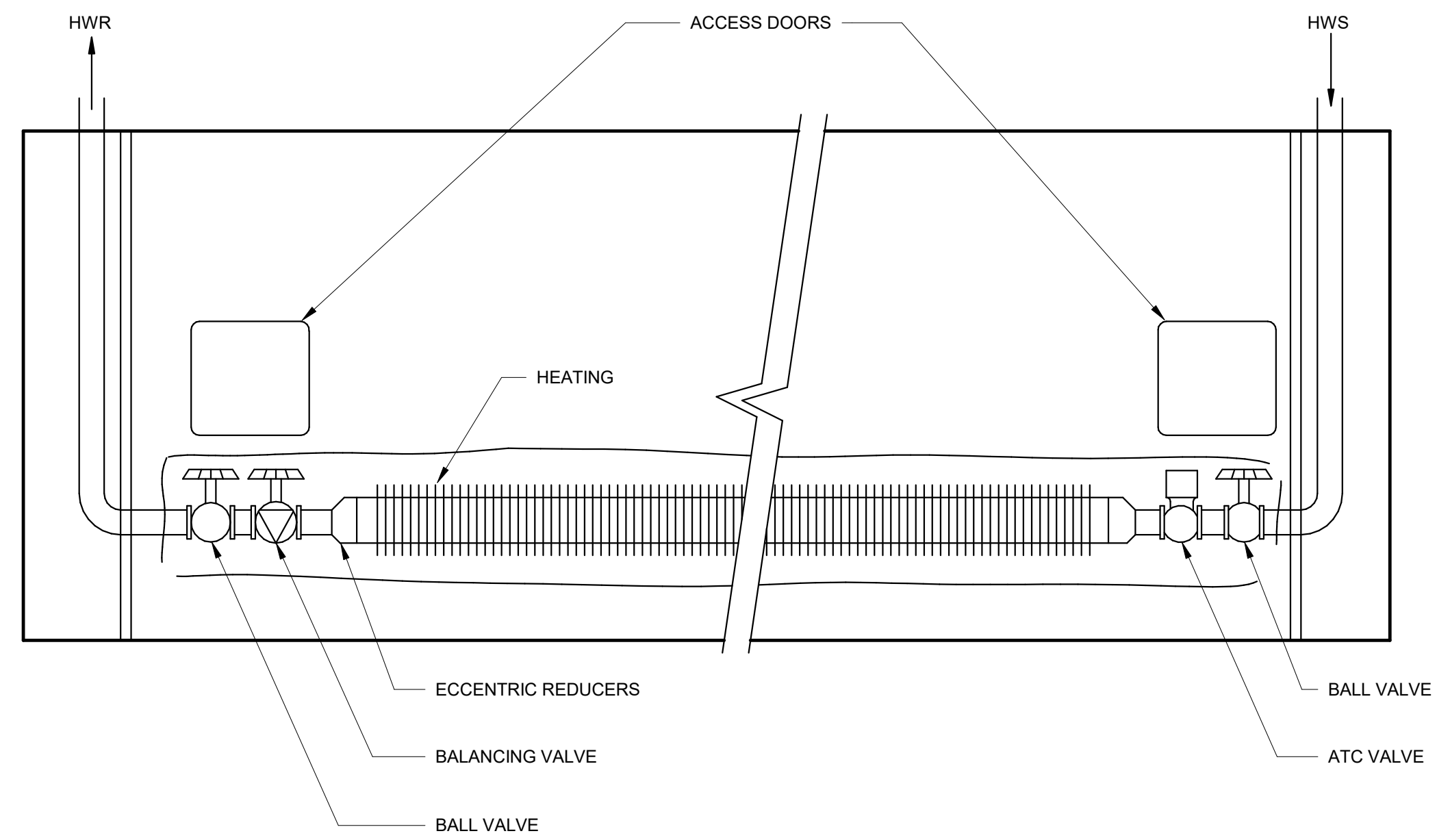


#### NOTES:

- PIPE HANGERS SHALL BE OVERSIZED AS REQUIRED TO ACCOMMODATE THICKNESS OF INSULATION. SPECIFIED HANGER SHALL NOT COME INTO CONTACT WITH THE INSULATION DIRECTLY, EITHER AT THE VERTICAL YOKE OR AT THE POINT OF SUPPORT. FOR REQUIREMENTS OF INSULATORS USED WITH PIPE HANGERS, SEE SPECIFICATIONS.
- TOTAL LOADING ON EACH CONCRETE INSERT OR OTHER TYPE OF HANGER ROD ANCHORS SHALL NOT EXCEED MANUFACTURERS RECOMMENDATIONS.
- FOR UNINSULATED PIPES, SIZE CLEVIS HANGER FOR OUTSIDE DIAMETER OF PIPE.

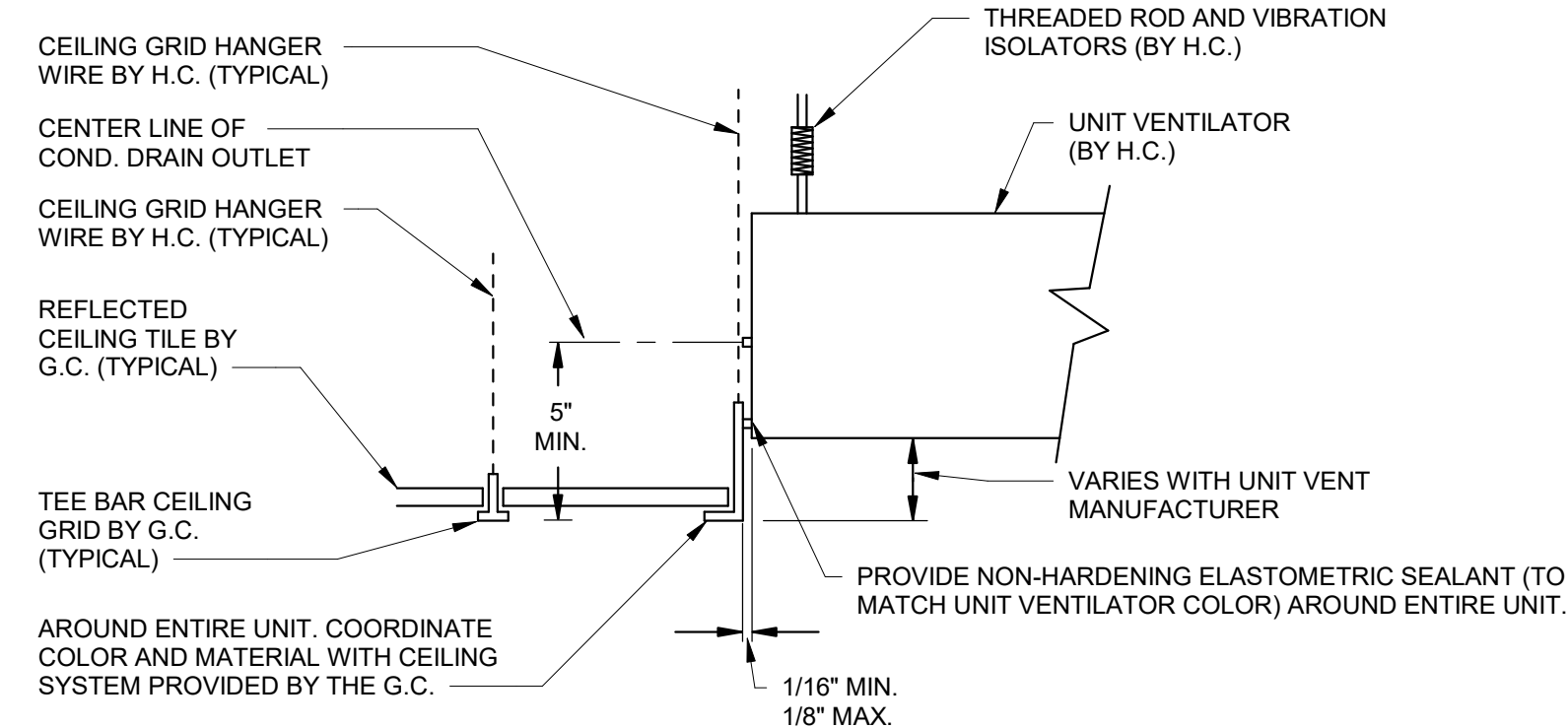
### CLEVIS PIPE HANGER DETAIL

NO SCALE



### TYPICAL INSTALLATION CABINET HEATER & RADIATION CONVECTOR

NO SCALE

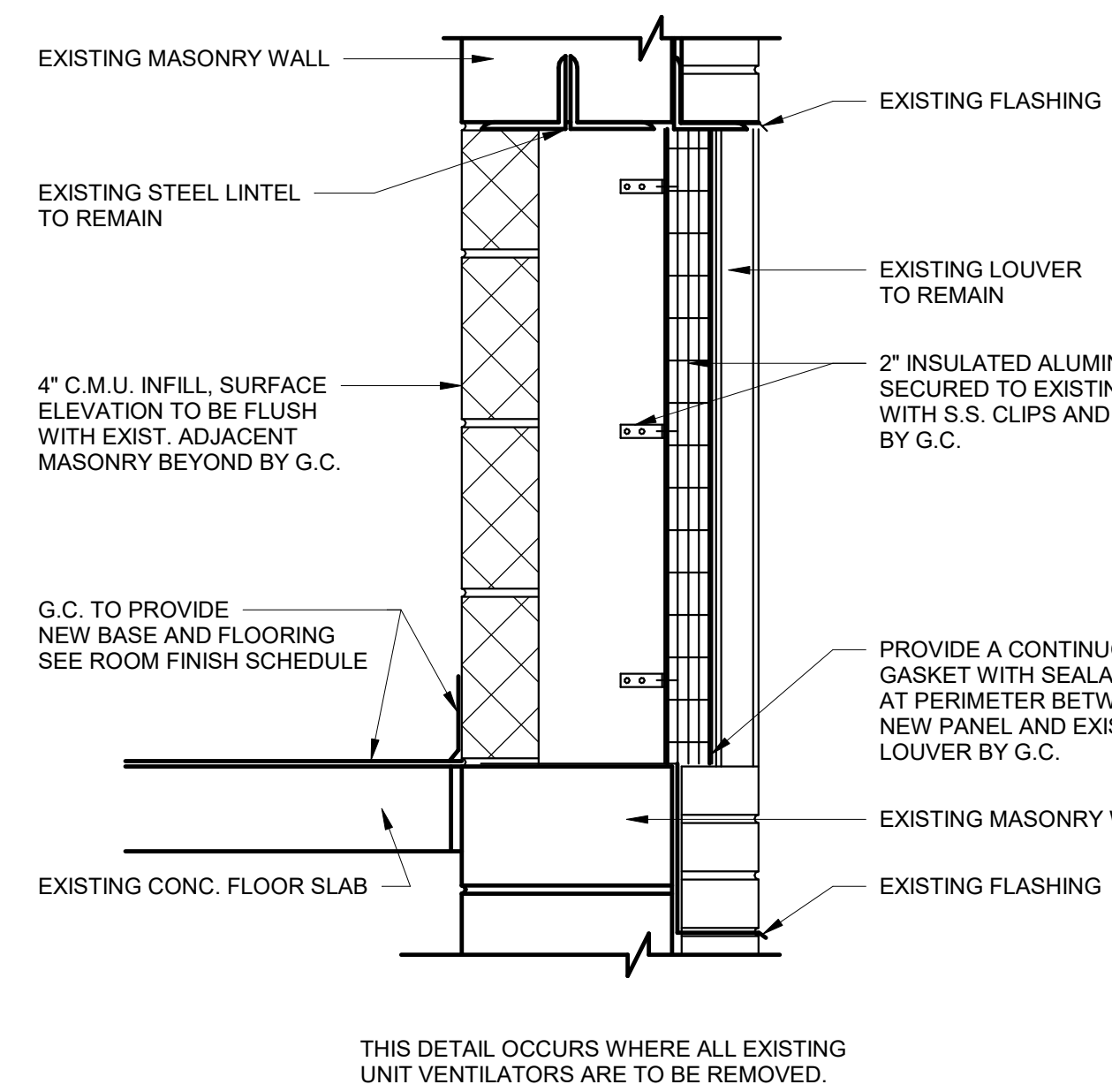


#### NOTES:

- MOUNT CABINET HEATERS SIMILAR EXCEPT FLUSH WITH CEILING.
- PROVIDE EXTENDED GRID ANGLE AROUND ENTIRE UNIT. COORDINATE COLOR AND MATERIAL WITH CEILING COLOR AND MATERIAL WITH CEILING.

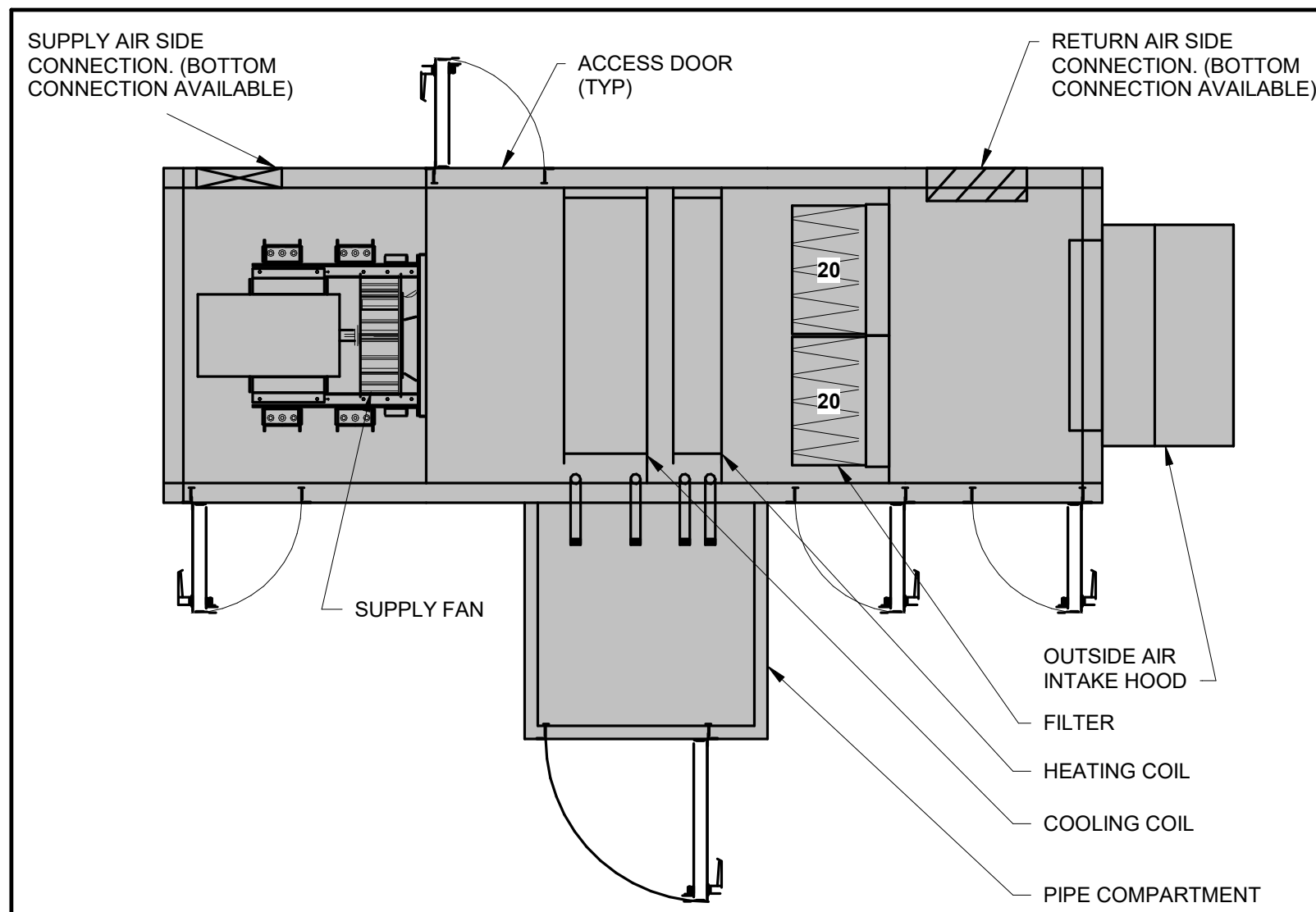
### TYPICAL RECESSED UNIT MOUNTING DETAIL

NO SCALE



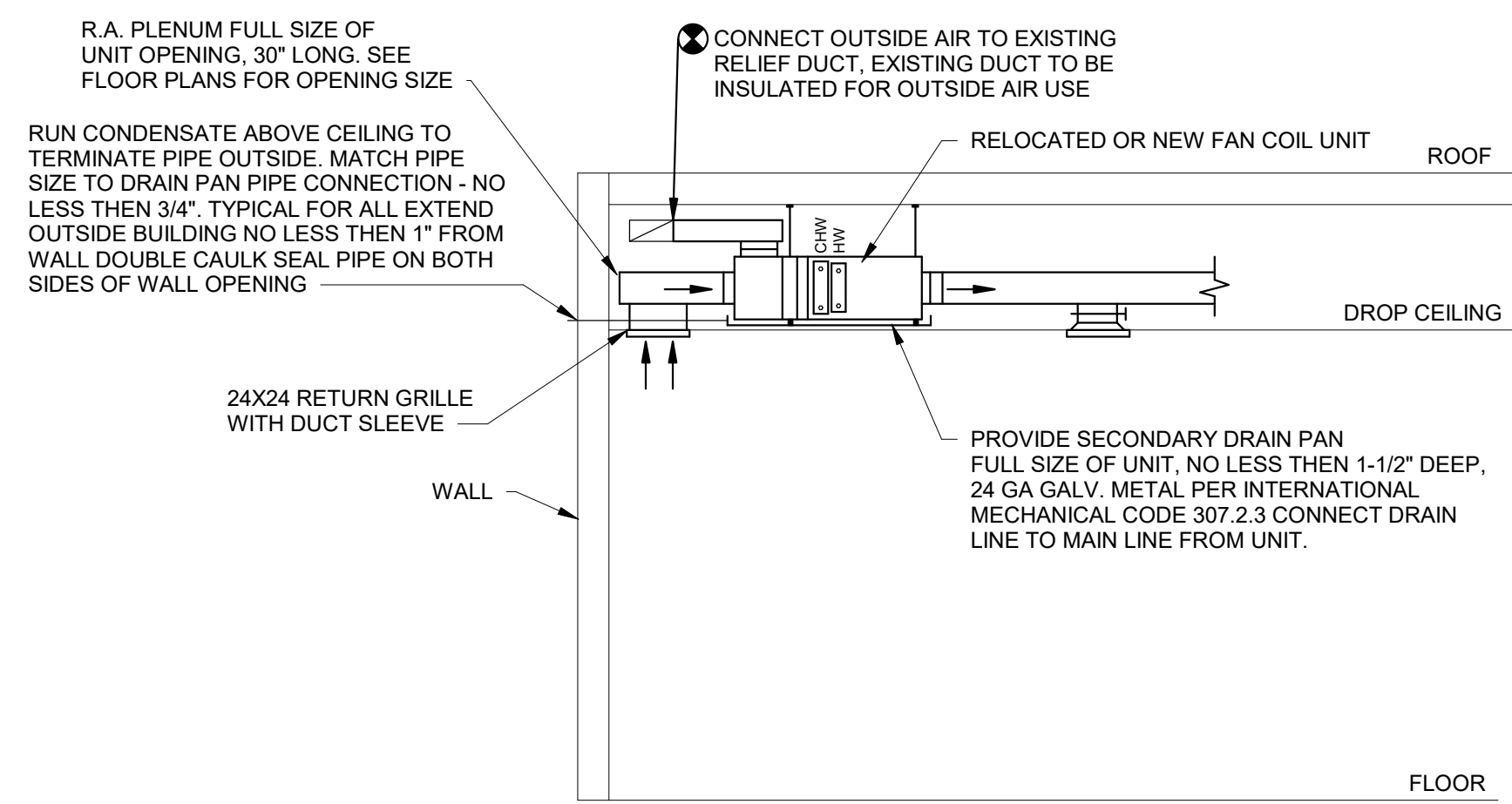
### TYPICAL U.V. LOUVER INFILL DETAIL

NO SCALE



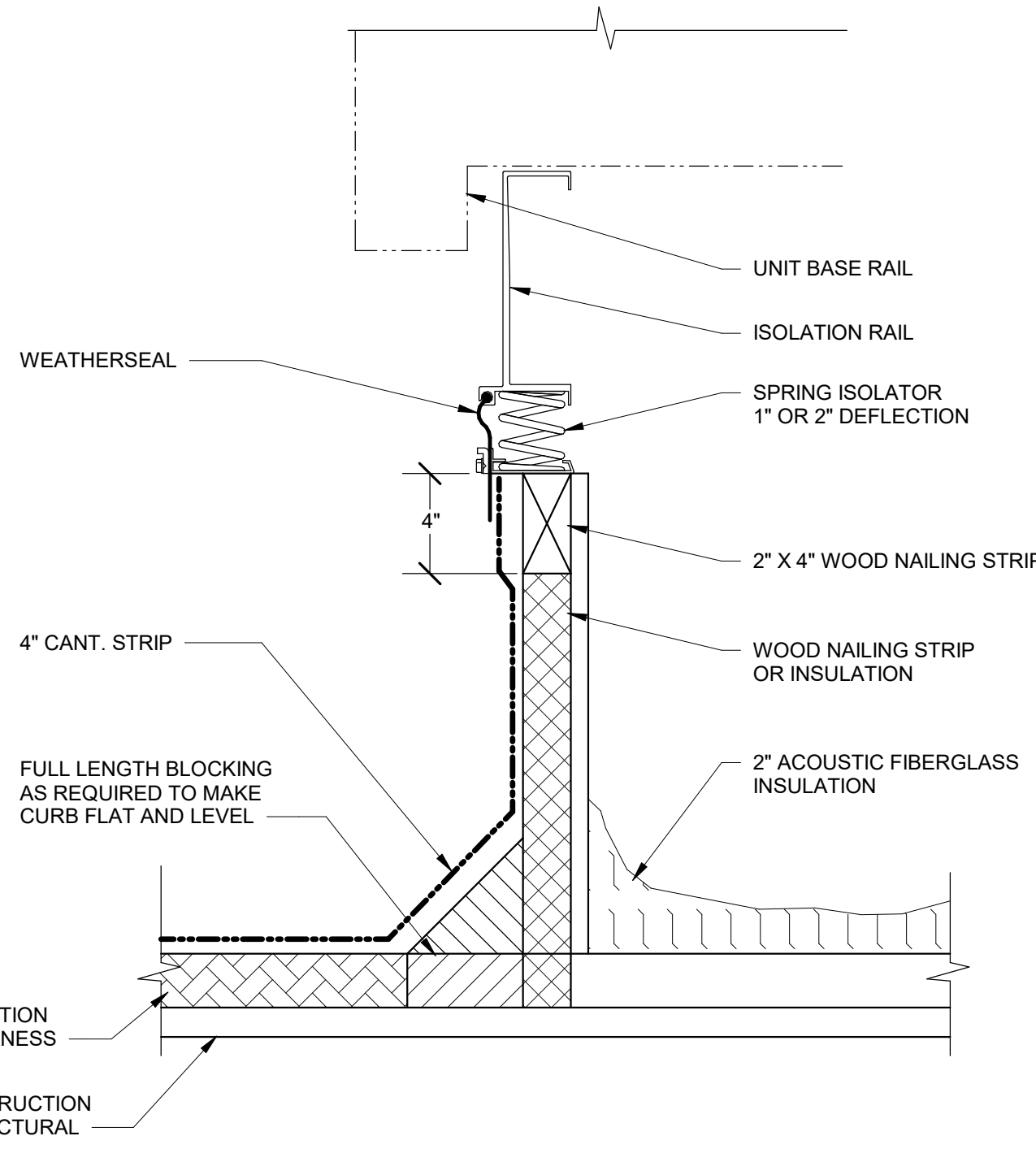
### TYPICAL ROOFTOP UNIT

NO SCALE



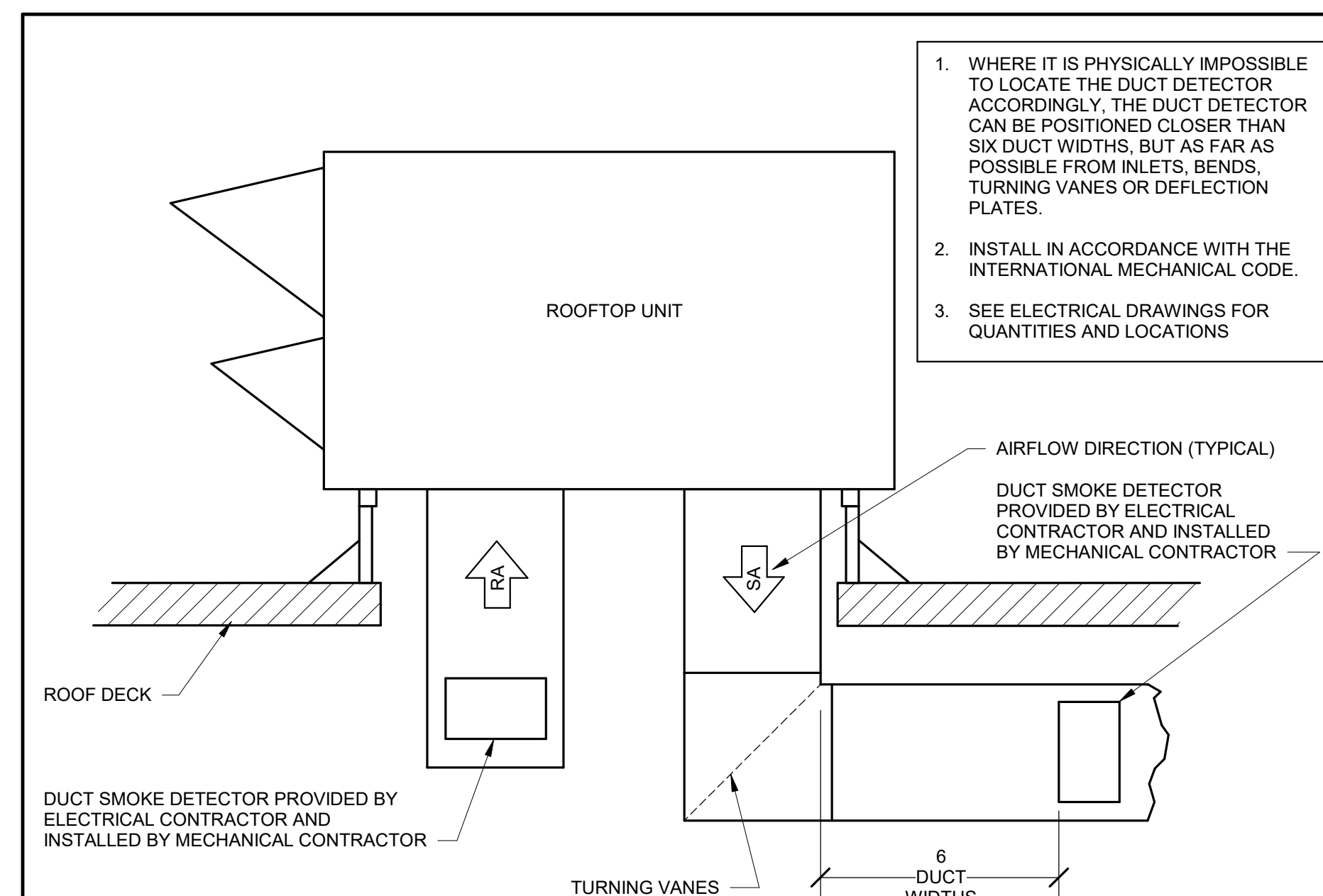
### HORIZONTAL FAN COIL UNIT DETAIL

NO SCALE



### VIBRATION ISOLATION CURB DETAIL

NO SCALE:



### DUCT SMOKE DETECTOR INSTALLATION

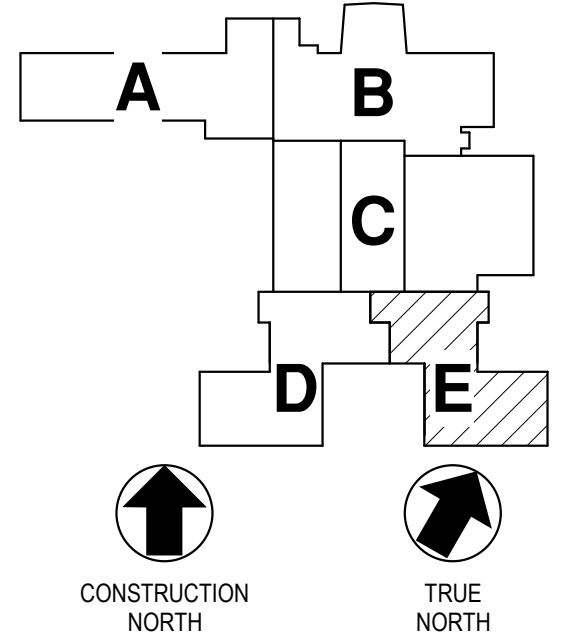
NO SCALE:



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### KEY PLAN



### REVISIONS

NO.	DATE	NAME	DESCRIPTION OF CHANGES
2	3/28/2025		ADDENDUM 2

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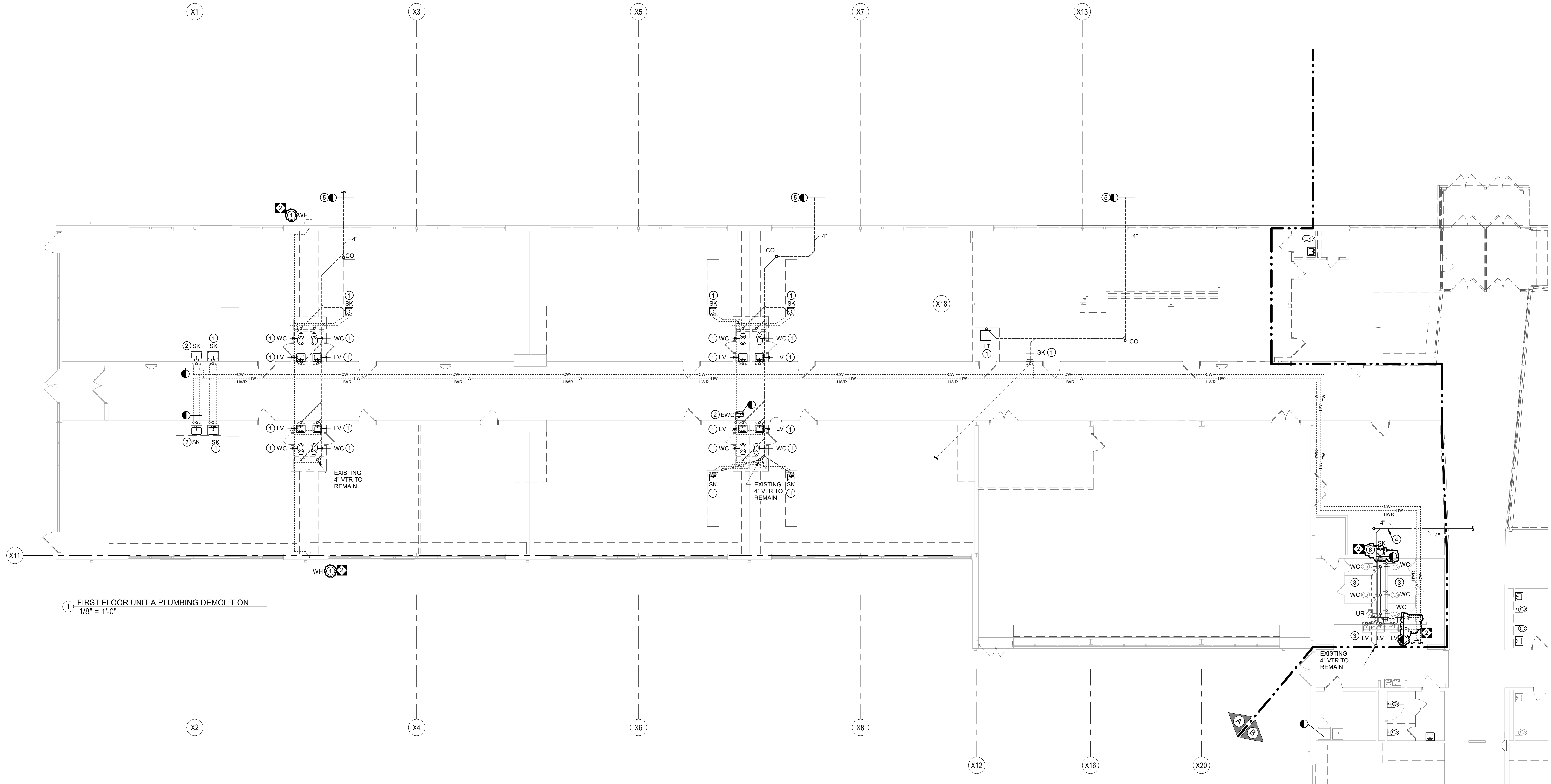
#### HVAC DETAILS

PLOT SCALE:  
12" = 1'-0"  
FILENAME:  
24066  
DATE:  
MARCH 10, 2025

**PROJECT**  
3758

**M6.3**

ADDITIONS AND RENOVATIONS TO  
COOPERTOWN ELEMENTARY SCHOOL  
SCHOOL DISTRICT OF HAVERFORD TOWNSHIP  
800 COOPERTOWN ROAD  
BRYN MAWR, PA. 19010



1 FIRST FLOOR UNIT A PLUMBING DEMOLITION  
1/8" = 1'-0"

GENERAL DEMOLITION NOTES:

1. RESPECTIVE CONTRACTOR IS RESPONSIBLE FOR PERFORMING ANY DEMOLITION WORK (EVEN IF NOT SHOWN ON THE PLANS) NECESSARY FOR COMPLETION OF PROJECT. THIS INCLUDES REMOVAL OF ANY EQUIPMENT AND MATERIALS THAT WILL NO LONGER BE UTILIZED AFTER COMPLETION OF THIS PROJECT.
2. EQUIPMENT THAT IS REMOVED SHALL BE TURNED OVER TO OWNER. IF OWNER DOES NOT WANT EQUIPMENT, IT SHALL BE DISPOSED OF PROPERLY BY RESPECTIVE CONTRACTOR.
3. PLUMBING CONTRACTOR SHALL REMOVE ALL EXISTING PLUMBING FIXTURES, PIPING, AND ALL ASSOCIATED APPURTENANCES IN ENTIRE BUILDING UNLESS NOTED OTHERWISE ON PLANS.
4. PLUMBING CONTRACTOR SHALL REMOVE ALL PIPING, HANGERS, VALVES, SUPPORTS, PADS, AND ALL OTHER ASSOCIATED APPURTENANCES ASSOCIATED PLUMBING FIXTURES AND EQUIPMENT TO BE REMOVED EVEN IF NOT SHOWN ON PLANS.
5. PLUMBING CONTRACTOR IS RESPONSIBLE FOR PATCHING ALL OPENING TO MATCH EXISTING EQUIPMENT OR FIXTURES ARE REMOVED AND NOT REPLACED.
6. PLUMBING PIPING, VALVES, FIXTURES, AND EQUIPMENT SHOWN ARE APPROXIMATE. PLUMBING CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS.
7. ANY UNDERGROUND PIPING THAT IS TO BE REMOVED MUST INCLUDE ALL NECESSARY CONCRETE CUTTING WORK, WHICH SHALL BE RESPONSIBILITY OF THE PLUMBING CONTRACTOR.

2 DRAWING NOTES:

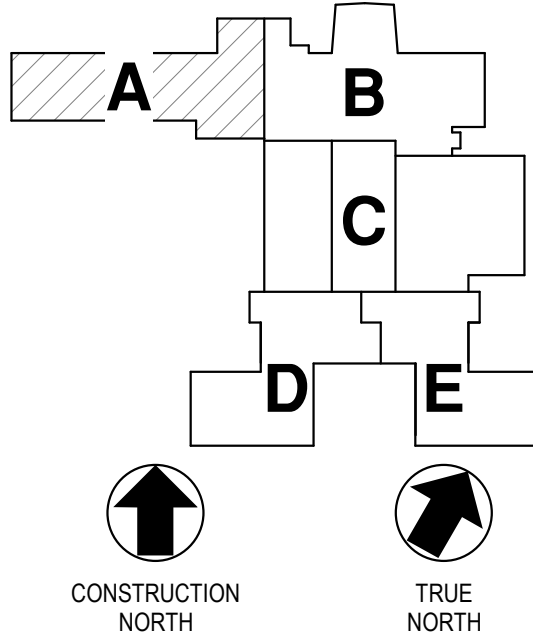
1. REMOVE EXISTING PLUMBING FIXTURES AND ALL ASSOCIATED PIPING.
2. P.C. SHALL REMOVE EXISTING PLUMBING FIXTURE AND PREPARE ROUGH-IN FOR NEW INSTALLATION. REFER TO NEW WORK FOR LOCATION.
3. EXISTING PLUMBING FIXTURE TO REMAIN.
4. THE EXISTING SANITARY PIPING SHALL REMAIN IN PLACE. THE P.C. SHALL BE RESPONSIBLE FOR FLUSHING AND CLEANING THE EXISTING SANITARY PIPING.
5. EXTEND DEMOLITION 5'-0" FROM BUILDING.
6. REMOVE SINK AND DISCARD. EXTEND DEMOLITION BACK TO WALL AND CAP. ABANDON PIPING INSIDE GANGING TOILET PLUMBING CHASE.



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NO.	DATE	NAME	DESCRIPTION OF CHANGES
2	3/20/2025		ADDENDUM 2

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ADDITIONS AND RENOVATIONS TO  
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SCHOOL DISTRICT OF HAVERFORD TOWNSHIP  
800 COOPERTOWN ROAD  
BRYN MAWR, PA. 19010

**CR**

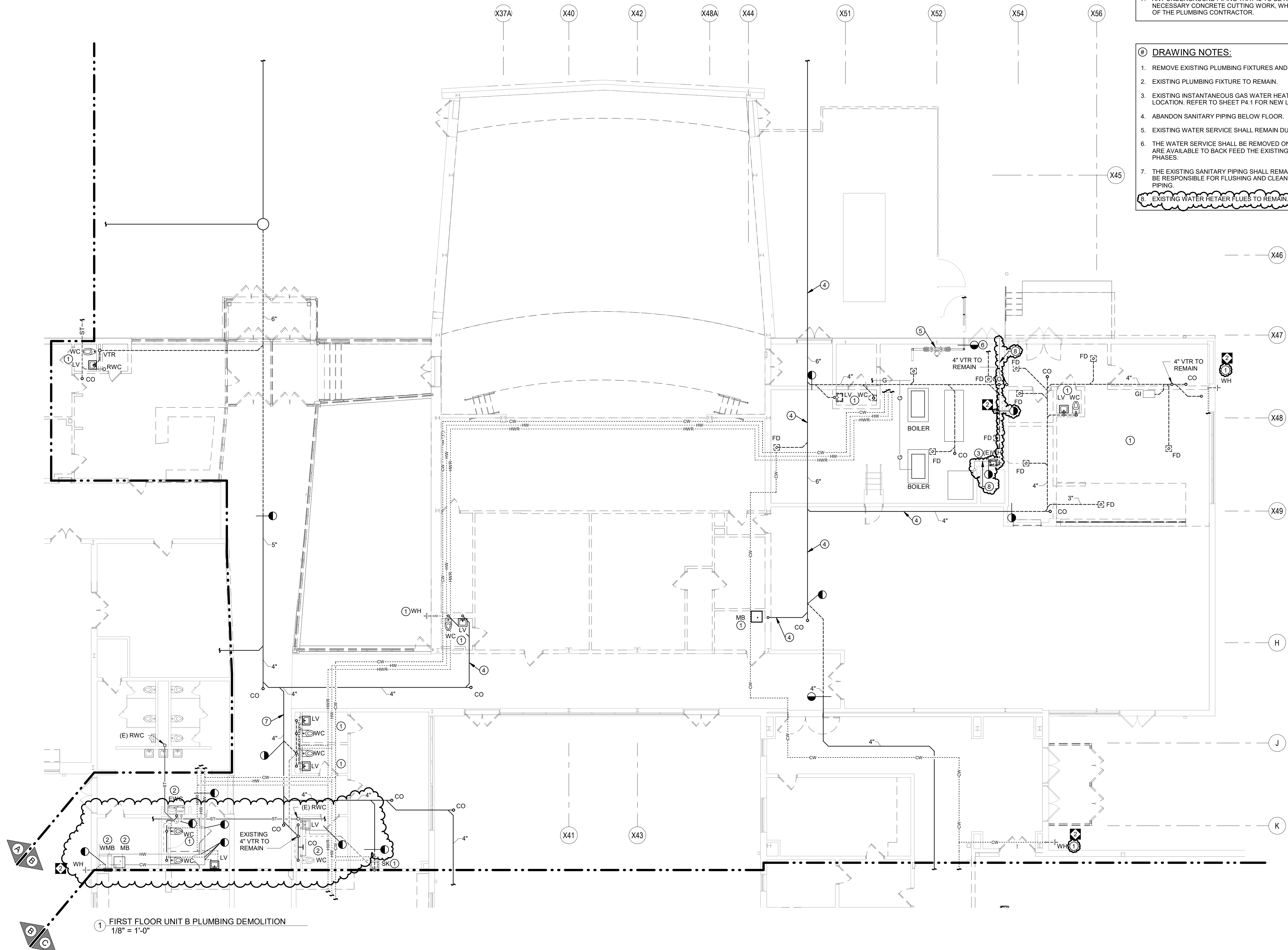
FIRST FLOOR UNIT A  
PLUMBING DEMOLITION

PLOT SCALE:  
1/8" = 1'-0"  
FILENAME:  
24066  
DATE:  
MARCH 10, 2025

PROJECT  
3758

P1.1





**GENERAL DEMOLITION NOTES:**

1. RESPECTIVE CONTRACTOR IS RESPONSIBLE FOR PERFORMING ANY DEMOLITION WORK (EVEN IF NOT SHOWN ON THE PLANS) NECESSARY FOR COMPLETION OF PROJECT. THIS INCLUDES REMOVAL OF ANY EQUIPMENT AND MATERIALS THAT WILL NO LONGER BE UTILIZED AFTER COMPLETION OF THIS PROJECT.
2. EQUIPMENT THAT IS REMOVED SHALL BE TURNED OVER TO OWNER. IF OWNER DOES NOT WANT EQUIPMENT, IT SHALL BE DISPOSED OF PROPERLY BY RESPECTIVE CONTRACTOR.
3. PLUMBING CONTRACTOR SHALL REMOVE ALL EXISTING PLUMBING FIXTURES, PIPING, AND ALL ASSOCIATED APPURTENANCES IN ENTIRE BUILDING UNLESS NOTED OTHERWISE ON PLANS.
4. PLUMBING CONTRACTOR SHALL REMOVE ALL PIPING, HANGERS, VALVES, SUPPORTS, PADS, AND ALL OTHER ASSOCIATED APPURTENANCES ASSOCIATED PLUMBING FIXTURES AND EQUIPMENT TO BE REMOVED EVEN IF NOT SHOWN ON PLANS.
5. PLUMBING CONTRACTOR IS RESPONSIBLE FOR PATCHING ALL OPENING TO MATCH EXISTING EQUIPMENT OR FIXTURES ARE REMOVED AND NOT REPLACED.
6. PLUMBING PIPING, VALVES, FIXTURES, AND EQUIPMENT SHOWN ARE APPROXIMATE. PLUMBING CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS.
7. ANY UNDERGROUND PIPING THAT IS TO BE REMOVED MUST INCLUDE ALL NECESSARY CONCRETE CUTTING WORK, WHICH SHALL BE RESPONSIBILITY OF THE PLUMBING CONTRACTOR.

**DRAWING NOTES:**

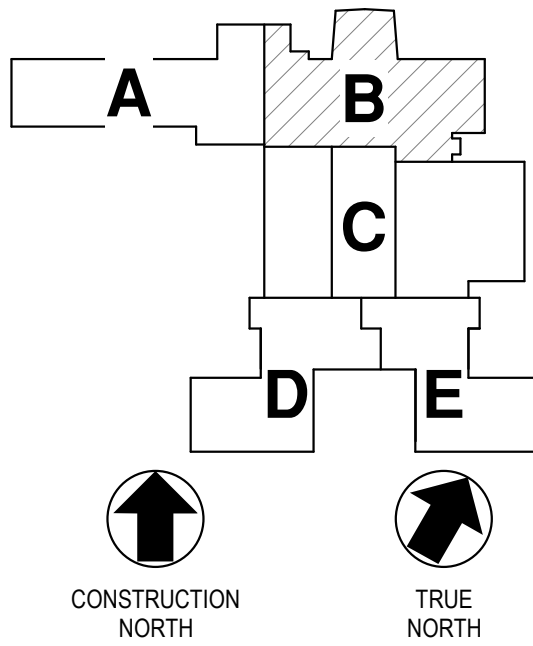
1. REMOVE EXISTING PLUMBING FIXTURES AND ALL ASSOCIATED PIPING.
2. EXISTING PLUMBING FIXTURE TO REMAIN.
3. EXISTING INSTANTANEOUS GAS WATER HEATER TO REMAIN IN NEW LOCATION. REFER TO SHEET P4-1 FOR NEW LOCATION.
4. ABANDON SANITARY PIPING BELOW FLOOR.
5. EXISTING WATER SERVICE SHALL REMAIN DURING PHASE 1.
6. THE WATER SERVICE SHALL BE REMOVED ONCE THE NEW WATER SERVICE ARE AVAILABLE TO BACK FEED THE EXISTING SYSTEM DURING OTHER PHASES.
7. THE EXISTING SANITARY PIPING SHALL REMAIN IN PLACE. THE P/C SHALL BE RESPONSIBLE FOR FLUSHING AND CLEANING THE EXISTING SANITARY PIPING.
8. EXISTING WATER HEATER FLUES TO REMAIN.



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**KEY PLAN**



**REVISIONS**

NO.	DATE	BY	DESCRIPTION OF CHANGES
2	3/20/2025		ADDENDUM 2

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ADDITIONS AND RENOVATIONS TO

COOPERTOWN ELEMENTARY SCHOOL

SCHOOL DISTRICT OF HAVERFORD TOWNSHIP

800 COOPERTOWN ROAD

BRYN MAWR, PA. 19010

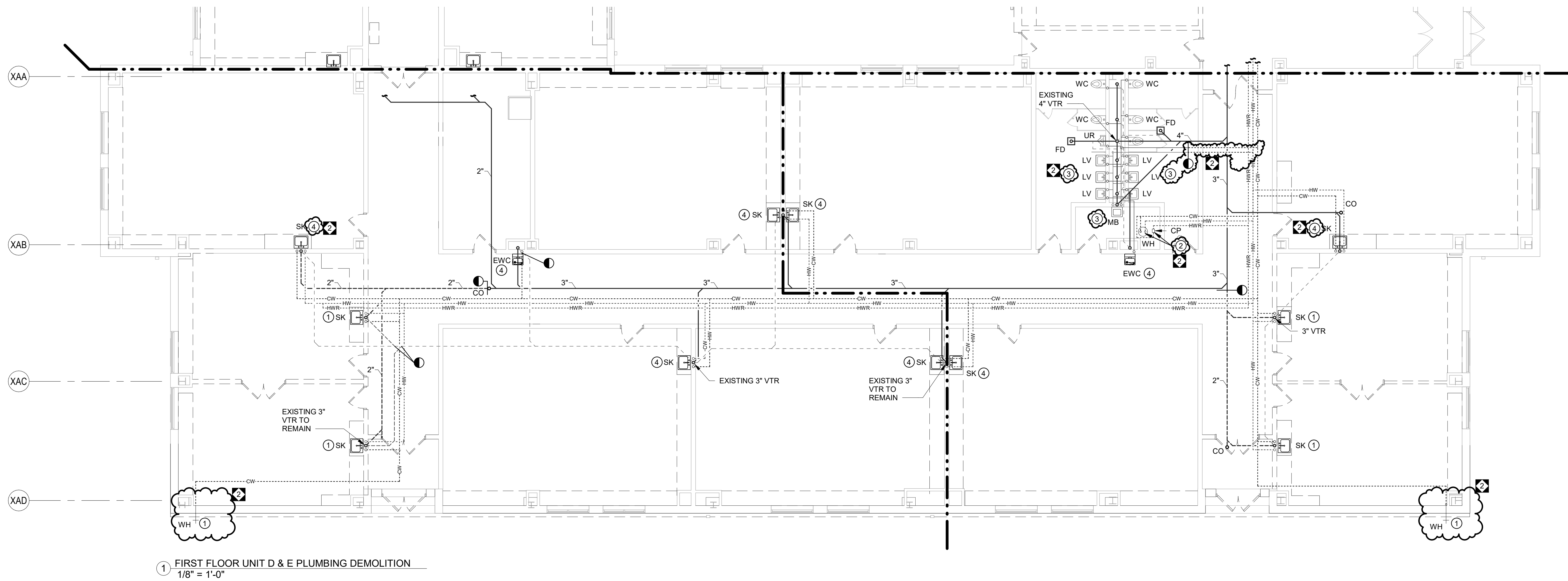
**CR**

FIRST FLOOR UNIT B  
PLUMBING DEMOLITION

PLOT SCALE:  
1/8" = 1'-0"  
FILENAME:  
24056  
DATE:  
MARCH 10, 2025

**PROJECT**  
3758

**P1.2**



1 FIRST FLOOR UNIT D & E PLUMBING DEMOLITION  
1/8" = 1'-0"

GENERAL DEMOLITION NOTES:

- RESPECTIVE CONTRACTOR IS RESPONSIBLE FOR PERFORMING ANY DEMOLITION WORK (EVEN IF NOT SHOWN ON THE PLANS) NECESSARY FOR COMPLETION OF PROJECT. THIS INCLUDES REMOVAL OF ANY EQUIPMENT AND MATERIALS THAT WILL NO LONGER BE UTILIZED AFTER COMPLETION OF THIS PROJECT.
- EQUIPMENT THAT IS REMOVED SHALL BE TURNED OVER TO OWNER. IF OWNER DOES NOT WANT EQUIPMENT, IT SHALL BE DISPOSED OF PROPERLY BY RESPECTIVE CONTRACTOR.
- PLUMBING CONTRACTOR SHALL REMOVE ALL EXISTING PLUMBING FIXTURES, PIPING, AND ALL ASSOCIATED APPURTENANCES IN ENTIRE BUILDING UNLESS NOTED OTHERWISE ON PLANS.
- PLUMBING CONTRACTOR SHALL REMOVE ALL PIPING, HANGERS, VALVES, SUPPORTS, PADS, AND ALL OTHER ASSOCIATED APPURTENANCES ASSOCIATED PLUMBING FIXTURES AND EQUIPMENT TO BE REMOVED EVEN IF NOT SHOWN ON PLANS.
- PLUMBING CONTRACTOR IS RESPONSIBLE FOR PATCHING ALL OPENING TO MATCH EXISTING EQUIPMENT OR FIXTURES ARE REMOVED AND NOT REPLACED.
- PLUMBING PIPING, VALVES, FIXTURES, AND EQUIPMENT SHOWN ARE APPROXIMATE. PLUMBING CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS.
- ANY UNDERGROUND PIPING THAT IS TO BE REMOVED MUST INCLUDE ALL NECESSARY CONCRETE CUTTING WORK, WHICH SHALL BE RESPONSIBILITY OF THE PLUMBING CONTRACTOR.

DRAWING NOTES:

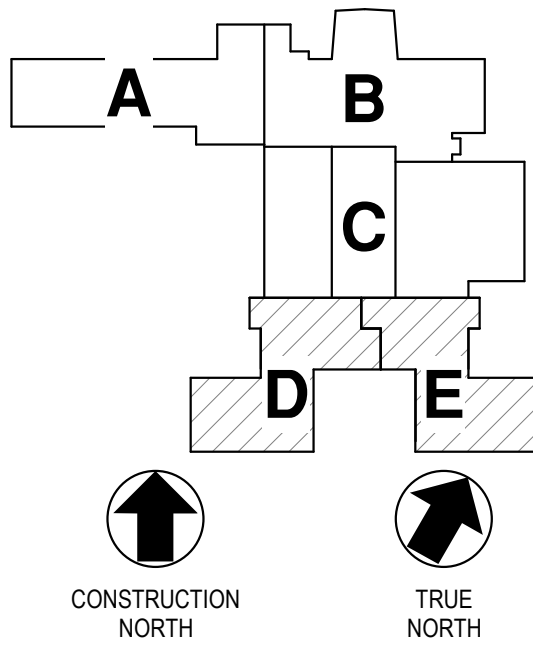
- REMOVE EXISTING PLUMBING FIXTURES AND ALL ASSOCIATED PIPING.
- P.C. SHALL REMOVE EXISTING WATER HEATER, CIRCULATOR PUMP, INCLUDING ALL ASSOCIATED PIPING AND CONCRETE PAD.
- EXISTING PLUMBING FIXTURE TO REMAIN.
- P.C. SHALL REMOVE EXISTING PLUMBING FIXTURE AND PREPARE ROUGH-IN FOR NEW INSTALLATION. REFER TO NEW WORK FOR LOCATION.



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KEY PLAN



REVISIONS

NO.	DATE	NAME	DESCRIPTION OF CHANGES
2	3/20/2025		ADDENDUM 2

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MECHANICSBURG PA 17055

717-458-0272

ADDITIONS AND RENOVATIONS TO

COOPERTOWN ELEMENTARY SCHOOL

SCHOOL DISTRICT OF HAVERFORD TOWNSHIP

800 COOPERTOWN ROAD

BRYN MAWR, PA. 19010

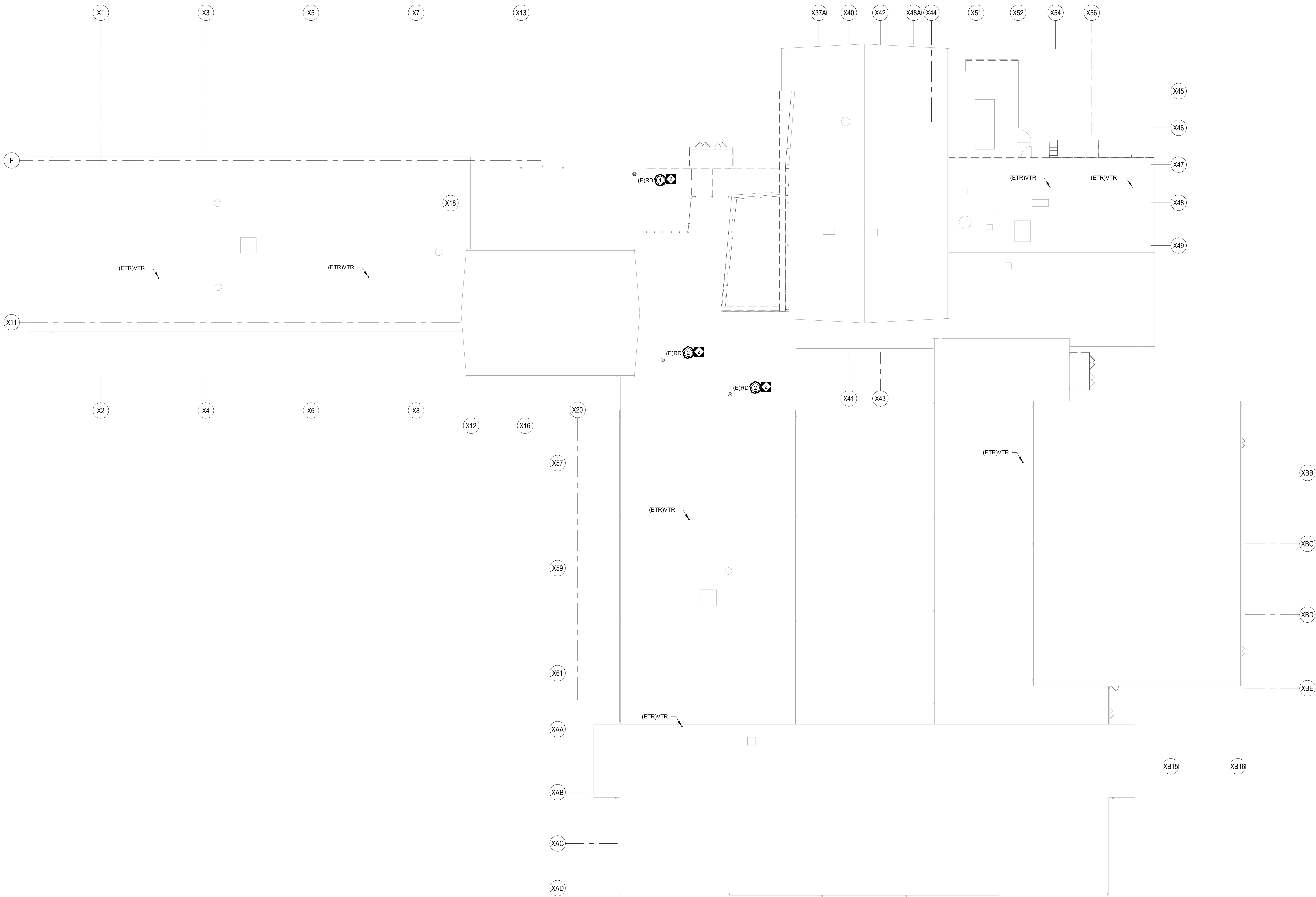
CR

FIRST FLOOR UNIT D & E  
PLUMBING DEMOLITION

PLOT SCALE:  
1/8" = 1'-0"  
FILENAME:  
24066  
DATE:  
MARCH 10, 2025

PROJECT  
3758

P1.4



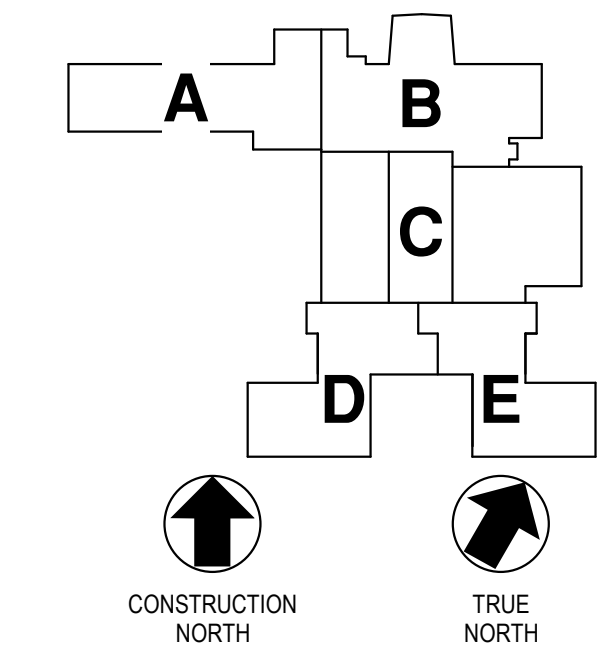
- DRAWING NOTES:**
- REMOVE EXISTING ROOF DRAIN.
  - EXISTING ROOF DRAIN TO REMAIN.



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#### KEY PLAN



#### REVISIONS

NO.	DATE	NAME	DESCRIPTION OF CHANGES
2	3/20/2025		ADDENDUM 2

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ROOF PLAN PLUMBING  
DEMOLITION

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

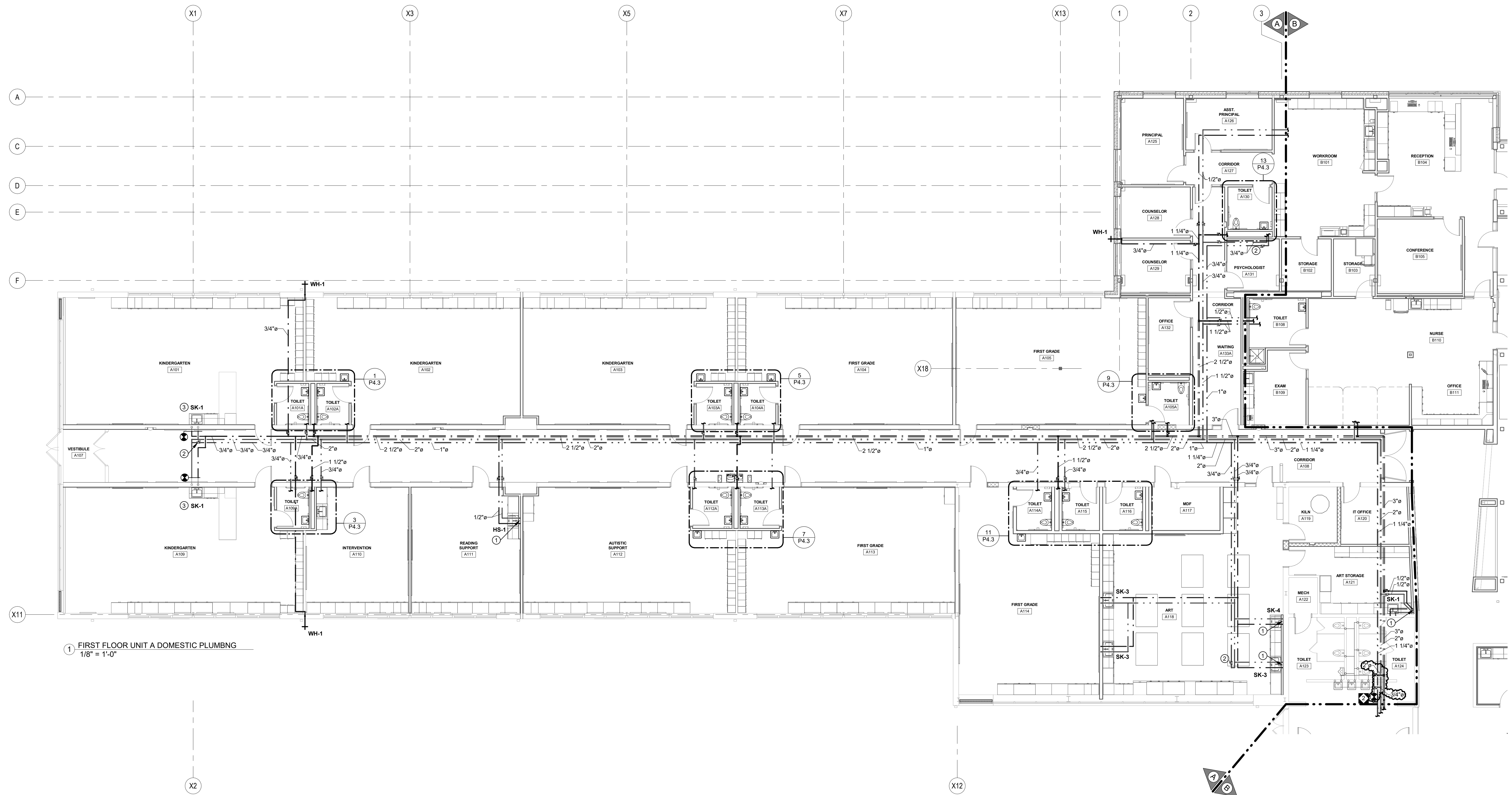
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MARCH 10, 2025

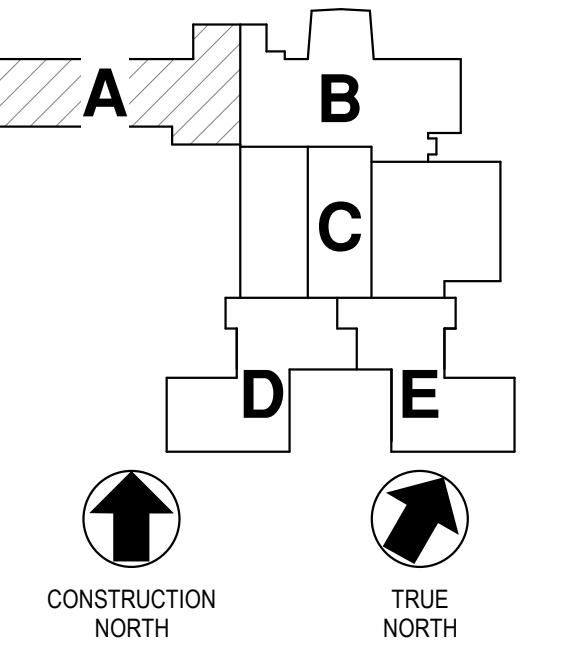
PROJECT  
3758

P1.5

1 ROOF PLAN PLUMBING DEMOLITION  
1/16" = 1'-0"



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**PROJECT**  
3758

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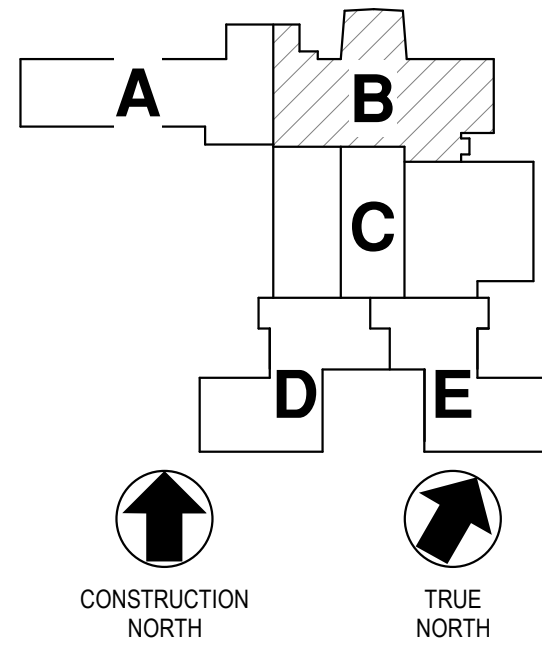
MARCH 10, 2025



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## REVISIONS

NO.	DATE	NAME	DESCRIPTION OF CHANGES
2	3/28/2025		ADDENDUM 2

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# CR

FIRST FLOOR UNIT B  
DOMESTIC WATER PIPING

PLOT SCALE:  
1/8" = 1'-0"

FILENAME:  
24066

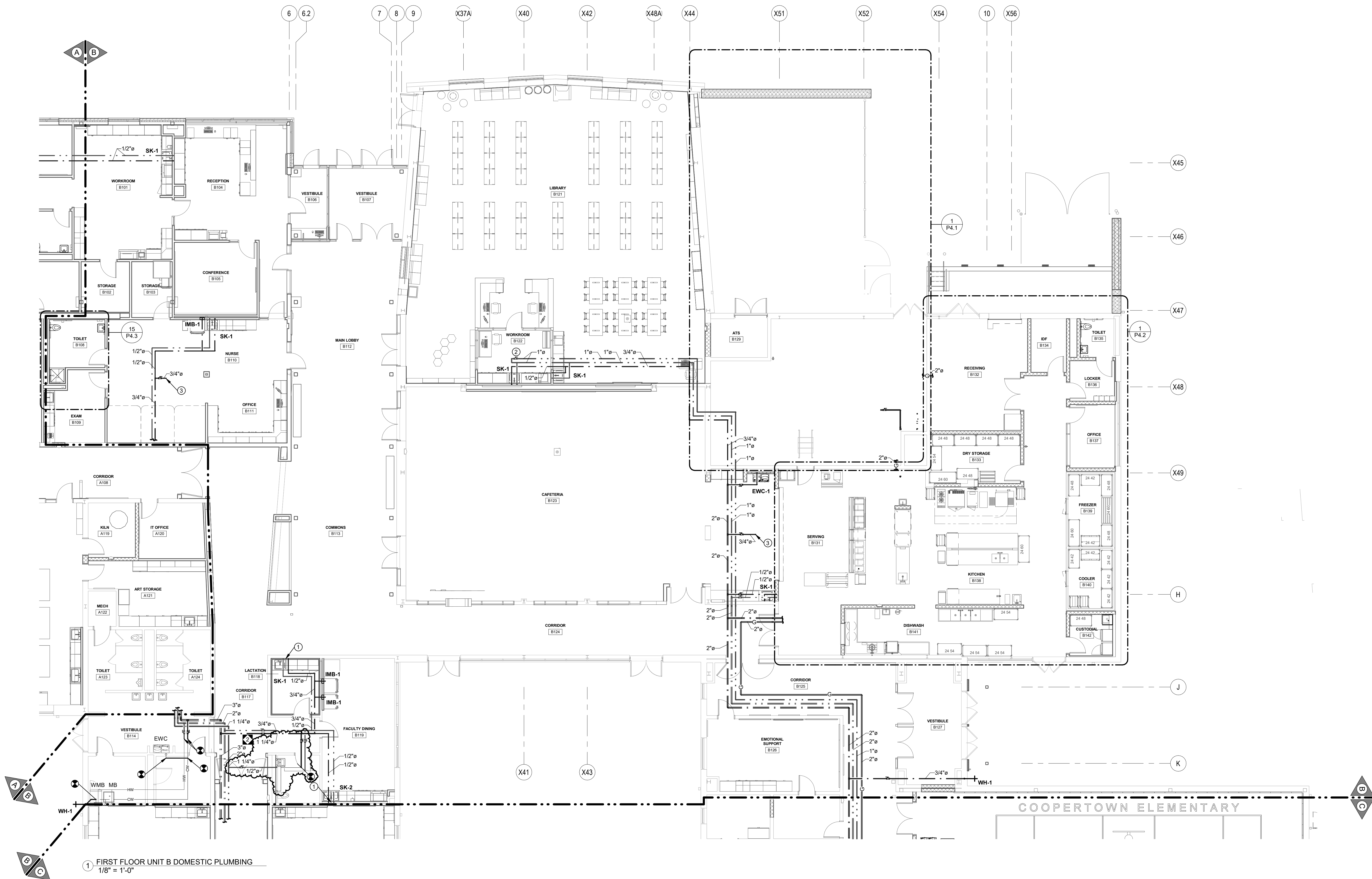
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MARCH 10, 2025

PROJECT  
3758

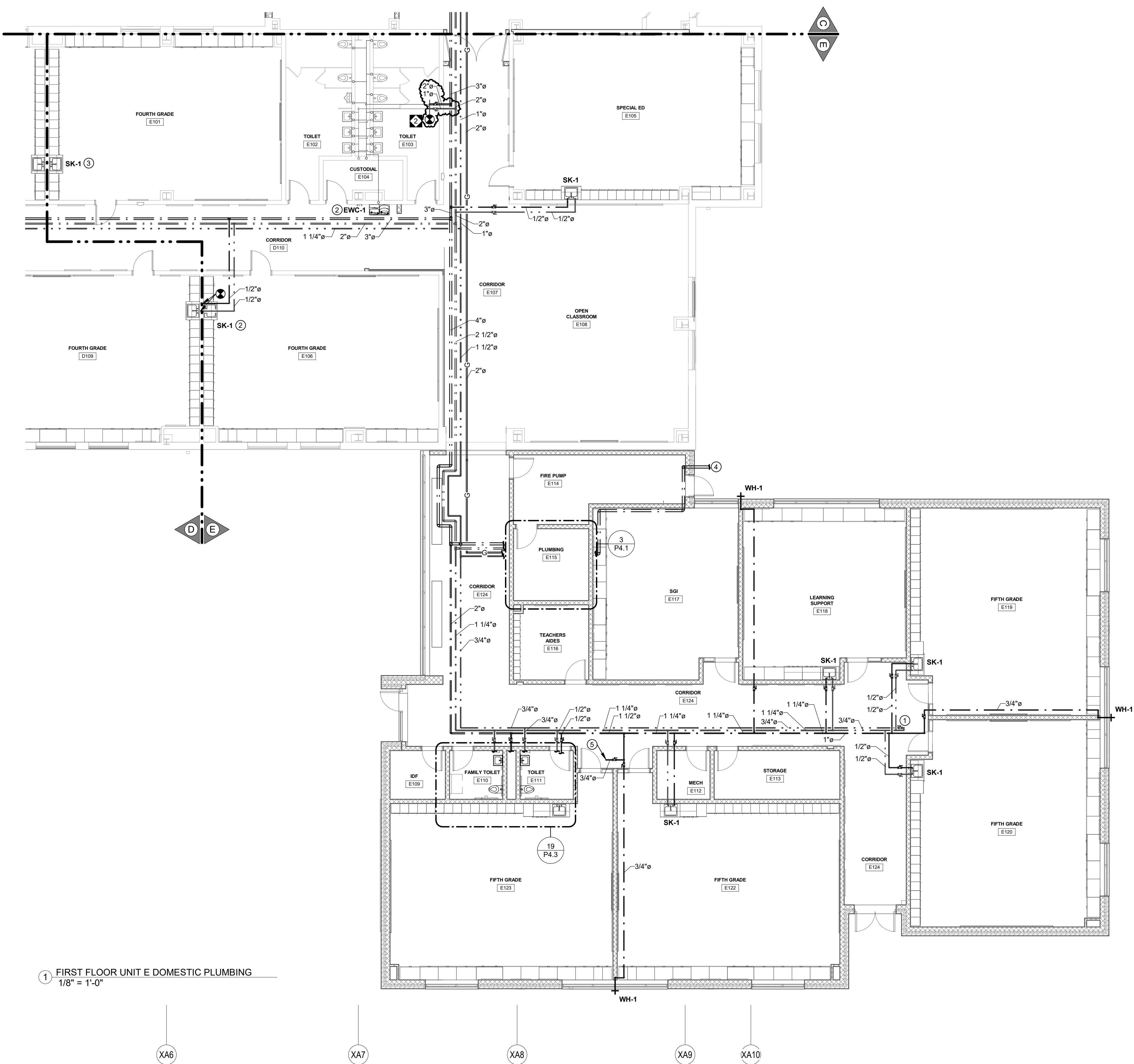
P2.2

### DRAWING NOTES:

- DROP DOMESTIC WATER PIPING INSIDE FURRED-OUT WALL.
- INSTALL SHUT-OFF VALVE, CHECK VALVE AND BALANCING VALVE, REFER TO DETAIL.
- RUN PIPING UP THRU PIPE PORTAL TO RH-1 ON ROOF.







1 FIRST FLOOR UNIT E DOMESTIC PLUMBING  
1/8" = 1'-0"

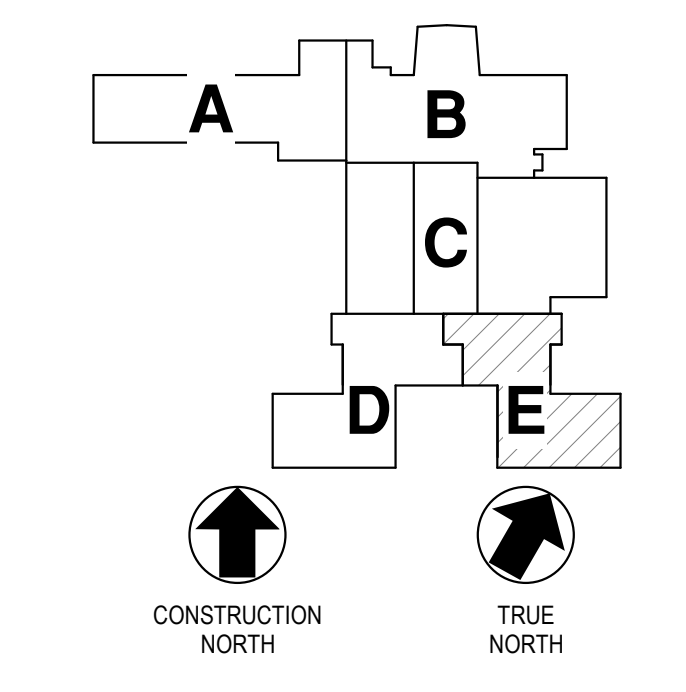
- DRAWING NOTES:**
1. INSTALL SHUT-OFF VALVE, CHECK VALVE AND BALANCING VALVE, REFER TO DETAIL.
  2. INSTALL NEW FIXTURE AND CONNECT TO EXISTING DOMESTIC PIPING.
  3. SEE P2.4 FOR NEW DOMESTIC PIPING CONNECTION.
  4. RUN DOMESTIC WATER SERVICE PIPING 5'-0" FROM BUILDING AND CONNECT TO SITE PIPING. PROVIDE A MINIMUM OF 4 FEET OF COVER OVER PIPING.
  5. RUN PIPING UP THRU PIPE PORTAL TO RH-1 ON ROOF.



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**KEY PLAN**



**REVISIONS**

NO.	DATE	NAME	DESCRIPTION OF CHANGES
2	3/20/2025		ADDENDUM 2

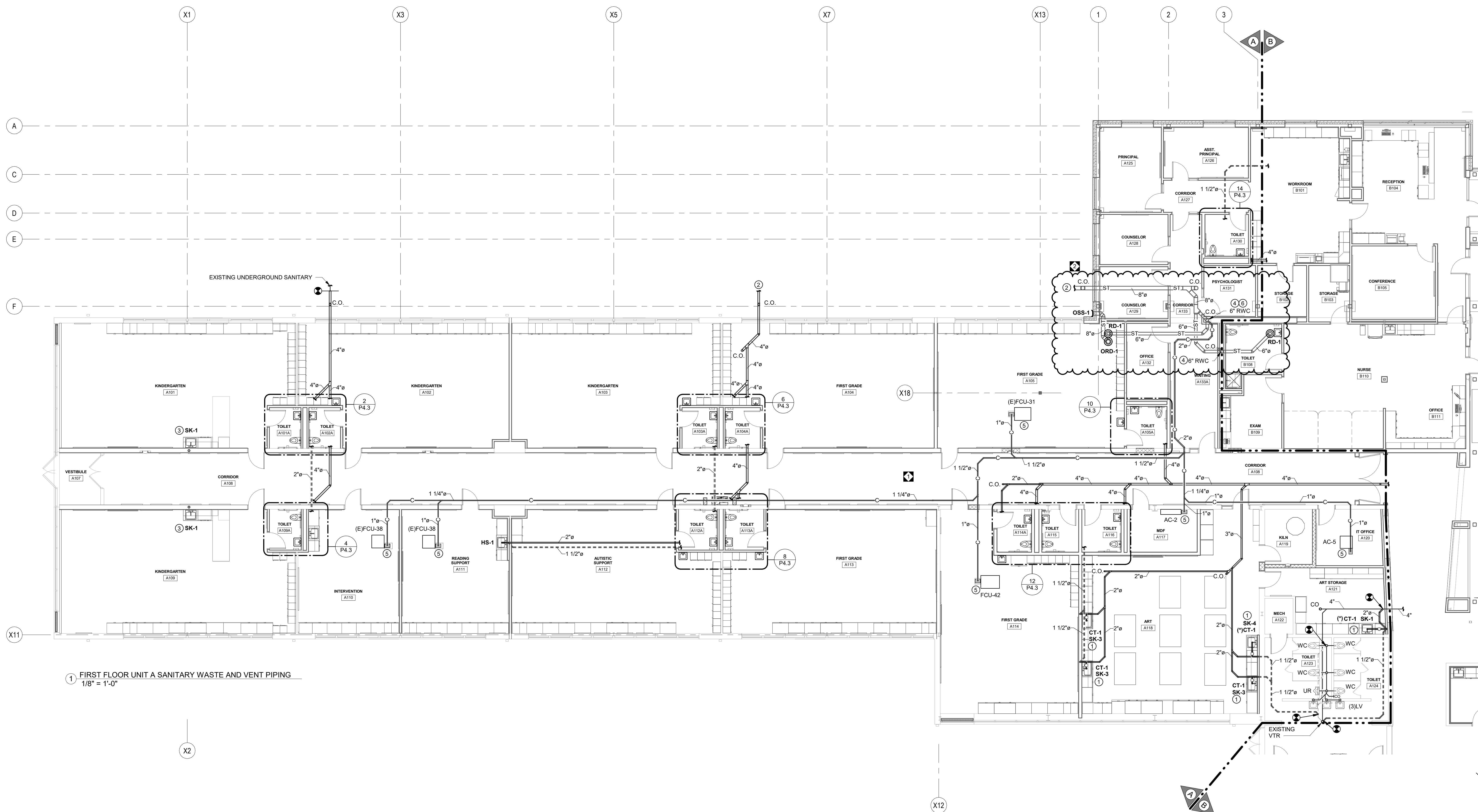
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FIRST FLOOR UNIT E  
DOMESTIC WATER PIPING  
PLOT SCALE:  
1/8" = 1'-0"  
FILENAME:  
240066  
DATE:  
MARCH 10, 2025

**PROJECT**  
3758  
**P2.5**

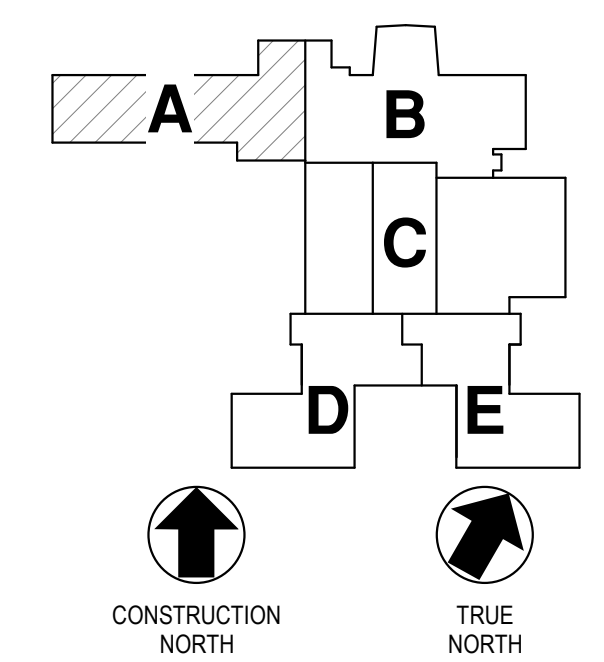


- ## DRAWING NOTES:
1. ALL ART CLASSROOM SINKS SHALL BE INTEGRAL WITH THE COUNTER TOP, FURNISHED AND INSTALLED BY THE G.C. THE P.C. SHALL BE RESPONSIBLE TO FURNISH AND INSTALL A SOLID INTERCEPT CT-1 TO ALL ART SINKS. SOLIDS INTERCEPTOR FOR ADA SINK SHALL BE LOCATED IN ADJACENT CABINET NOTED WITH AN ASTERISK (\*).
  2. RUN SANITARY PIPING 5" Ø FROM BUILDING AND CONNECT TO SITE PIPING, PROVIDE CLEANOUT.
  3. INSTALL NEW FUTURE AND CONNECT TO EXISTING SANITARY AND VENT PIPING.
  4. RUN STORM WATER (RWG) DOWN TO BELOW FLOOR, PROVIDE CLEANOUT AT BASE.
  5. CONNECT CONDENSATE FROM UNIT TO A CONDENSATE PUMP AND RISE TO BOTTOM OF STRUCTURE. PROVIDE CLEANOUT. RUN PIPING AS HIGH AS POSSIBLE WITH SLOPE.
  6. RUN CONDENSATE FROM CONDENSATE PUMP AND CONNECT TO A STORM RISER PER DETAIL.



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## KEY PLAN



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ADDITIONS AND RENOVATIONS TO  
COOPERTOWN ELEMENTARY SCHOOL  
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**PROJECT**  
3758

### P3.1

**CR**

FIRST FLOOR UNIT A  
SANITARY WASTE & VENT  
PIPING

---

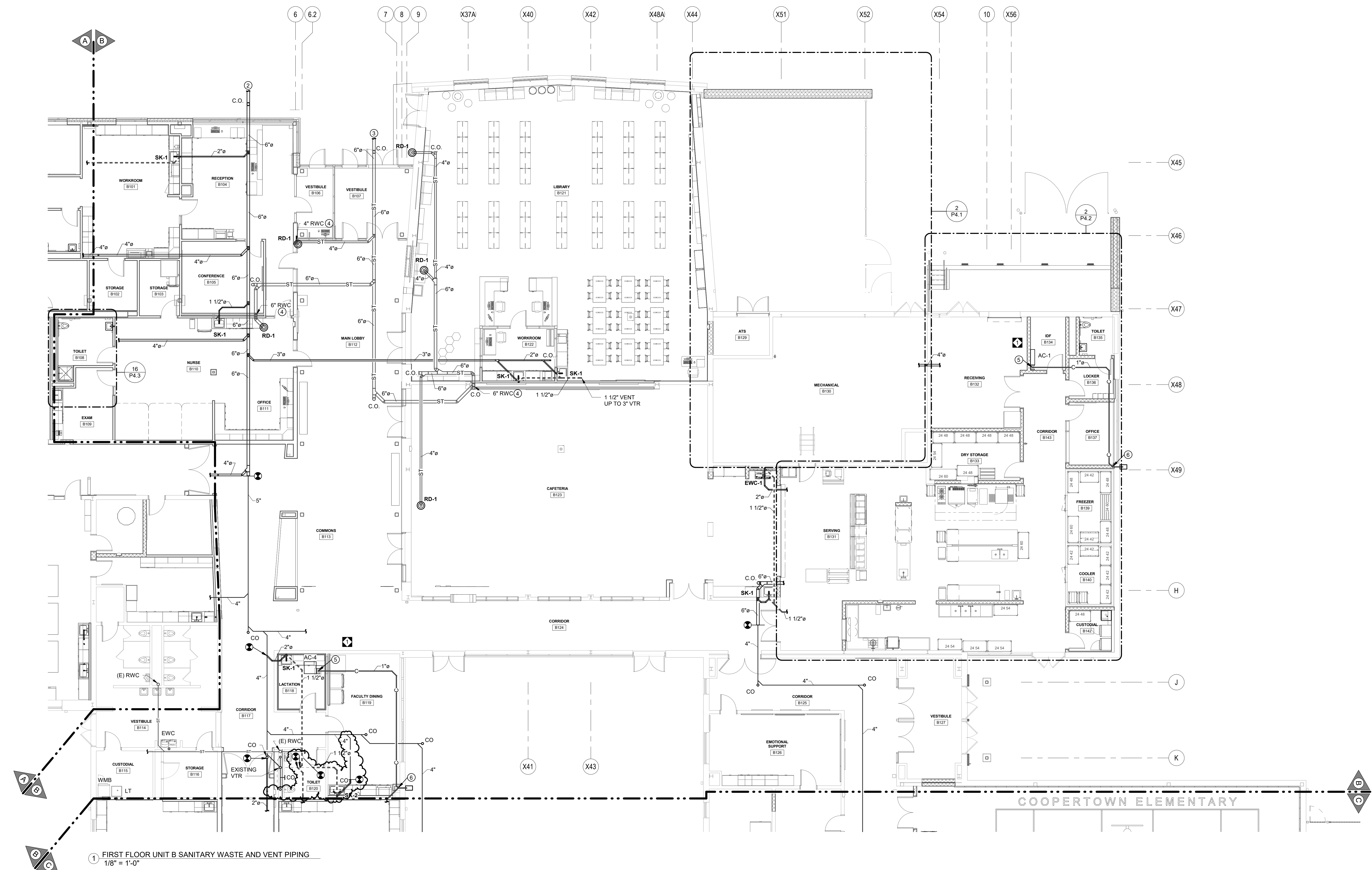
PLOT SCALE:  
1/8" = 1'-0"

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FILENAME:  
24066

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DATE:  
MARCH 10, 2025



1 FIRST FLOOR UNIT B SANITARY WASTE AND VENT PIPING  
1/8" = 1'-0"

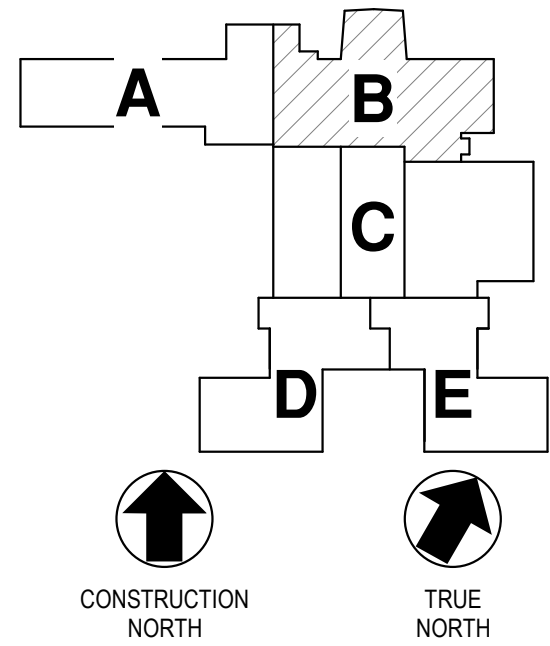
- DRAWING NOTES:**
1. P.C. SHALL FIELD VERIFY EXISTING INVERT ELEVATION AND SIZE IN FIELD PRIOR TO ANY INSTALLATION.
  2. RUN SANITARY PIPING 5'-0" FROM BUILDING AND CONNECT TO SITE PIPING. PROVIDE CLEANOUT.
  3. RUN STORM PIPING 5'-0" FROM BUILDING AND CONNECT TO SITE PIPING. PROVIDE CLEANOUT.
  4. RUN STORM WATER (RWC) DOWN TO BELOW FLOOR. PROVIDE CLEANOUT AT BASE.
  5. CONNECT CONDENSATE FROM UNIT TO A CONDENSATE PUMP AND RISE TO BOTTOM OF STRUCTURE. PROVIDE CLEANOUT. RUN PIPING AS HIGH AS POSSIBLE WITH SLOPE.
  6. DROP CONDENSATE IN WALL TO SPILL ON GRADE ONTO A SPLASH BLOCK. REFER TO DETAIL.



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### REVISIONS

NO.	DATE	DESCRIPTION OF CHANGES
1	3/19/2025	ADDENDUM 1
2	3/26/2025	ADDENDUM 2

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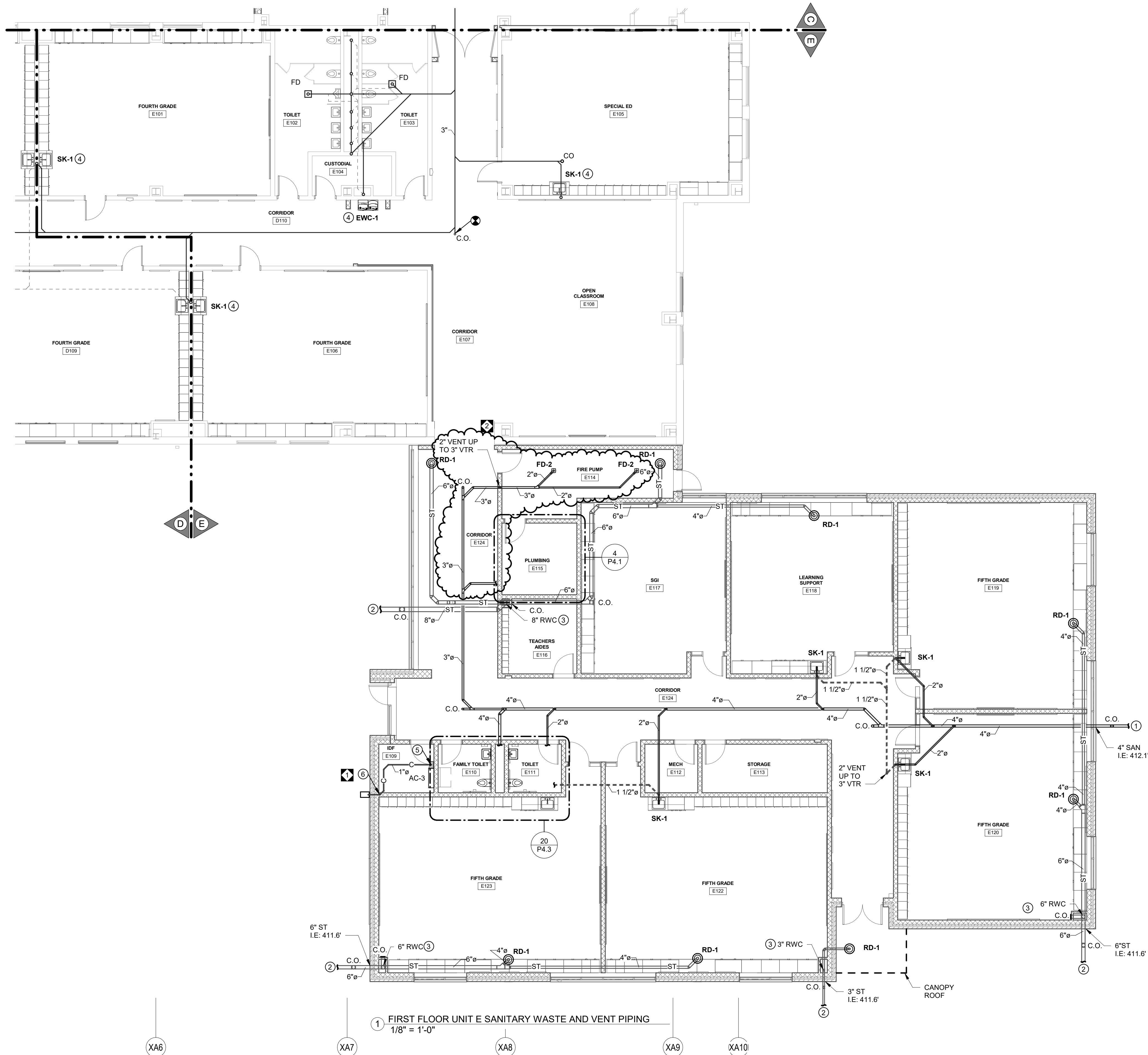
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FIRST FLOOR UNIT B  
SANITARY WASTE & VENT  
PIPING

PLOT SCALE:  
1/8" = 1'-0"  
FILENAME:  
24066  
DATE:  
MARCH 10, 2025

**PROJECT**  
3758

**P3.2**



**DRAWING NOTES:**

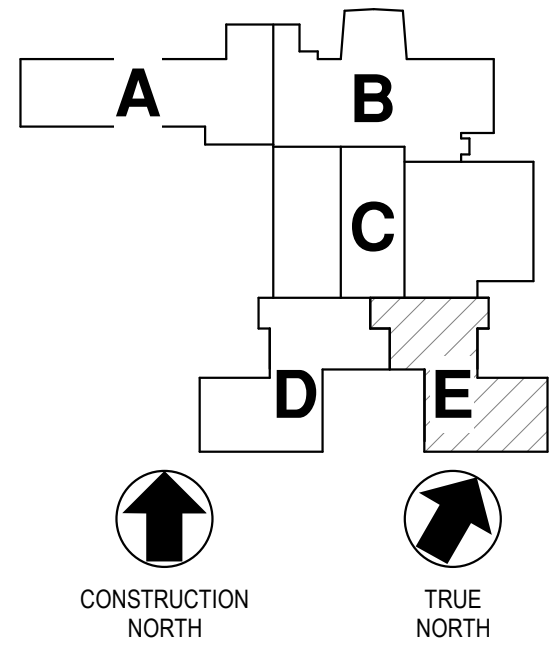
1. RUN SANITARY PIPING 5'-0" FROM BUILDING AND CONNECT TO SITE PIPING PROVIDE CLEANOUT.
2. RUN STORM PIPING 5'-0" FROM BUILDING AND CONNECT TO SITE PIPING PROVIDE CLEANOUT.
3. RUN STORM WATER (RWC) DOWN TO BELOW FLOOR, PROVIDE CLEANOUT AT BASE.
4. INSTALL NEW FIXTURE AND CONNECT TO EXISTING SANITARY AND VENT PIPING.
5. CONNECT CONDENSATE FROM UNIT TO A CONDENSATE PUMP AND RISE TO BOTTOM OF STRUCTURE, PROVIDE CLEANOUT. RUN PIPING AS HIGH AS POSSIBLE WITH SLOPE.
6. DROP CONDENSATE IN WALL TO SPILL ON GRADE ONTO A SPLASH BLOCK. REFER TO DETAIL.



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**REVISIONS**

NO.	DATE	NAME	DESCRIPTION OF CHANGES
1	3/19/2025	ADDENDUM 1	
2	3/28/2025	ADDENDUM 2	

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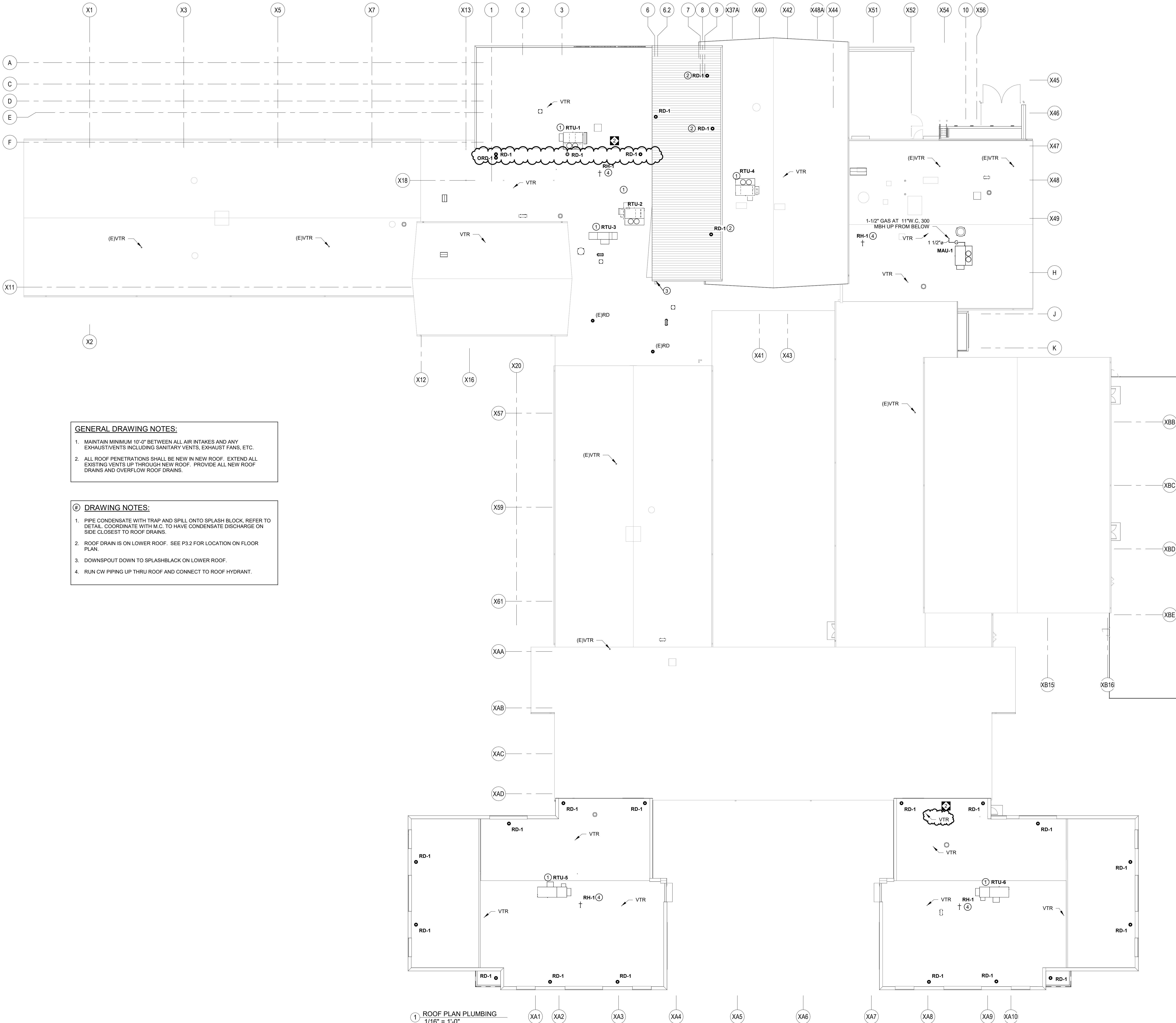
FIRST FLOOR UNIT E  
SANITARY WASTE & VENT  
PIPING

PLOT SCALE:  
1/8" = 1'-0"  
FILENAME:  
24056  
DATE:  
MARCH 10, 2025

**PROJECT**  
3758

**P3.5**





**GENERAL DRAWING NOTES:**

1. MAINTAIN MINIMUM 10'-0" BETWEEN ALL AIR INTAKES AND ANY EXHAUST/VENTS INCLUDING SANITARY VENTS, EXHAUST FANS, ETC.
2. ALL ROOF PENETRATIONS SHALL BE NEW IN NEW ROOF. EXTEND ALL EXISTING VENTS UP THROUGH NEW ROOF. PROVIDE ALL NEW ROOF DRAINS AND OVERFLOW ROOF DRAINS.

**DRAWING NOTES:**

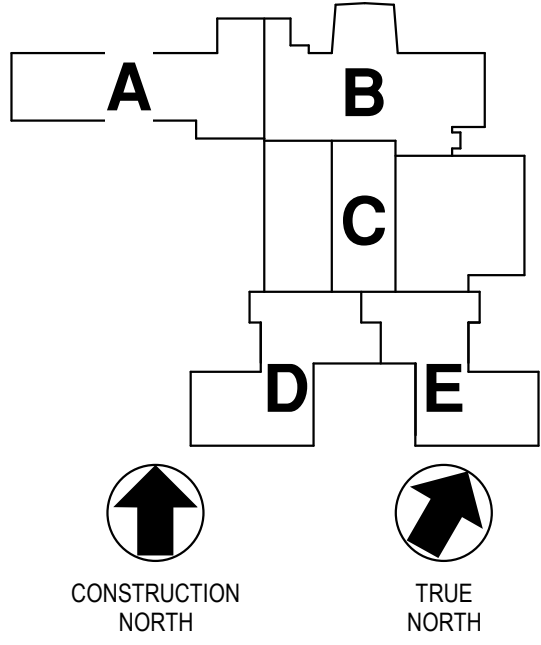
1. PIPE CONDENSATE WITH TRAP AND SPILL ONTO SPLASH BLOCK. REFER TO DETAIL. COORDINATE WITH M.C. TO HAVE CONDENSATE DISCHARGE ON SIDE CLOSEST TO ROOF DRAINS.
2. ROOF DRAIN IS ON LOWER ROOF. SEE P32 FOR LOCATION ON FLOOR PLAN.
3. DOWNSPOUT DOWN TO SPLASHBLACK ON LOWER ROOF.
4. RUN CW PIPING UP THRU ROOF AND CONNECT TO ROOF HYDRANT.



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NO.	DATE	NAME	DESCRIPTION OF CHANGES
2	3/28/2025		ADDENDUM 2

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ADDITIONS AND RENOVATIONS TO

COOPERTOWN ELEMENTARY SCHOOL

SCHOOL DISTRICT OF HAVERFORD TOWNSHIP

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ROOF PLUMBING

PLOT SCALE:

1/16" = 1'-0"

FILENAME:

24056

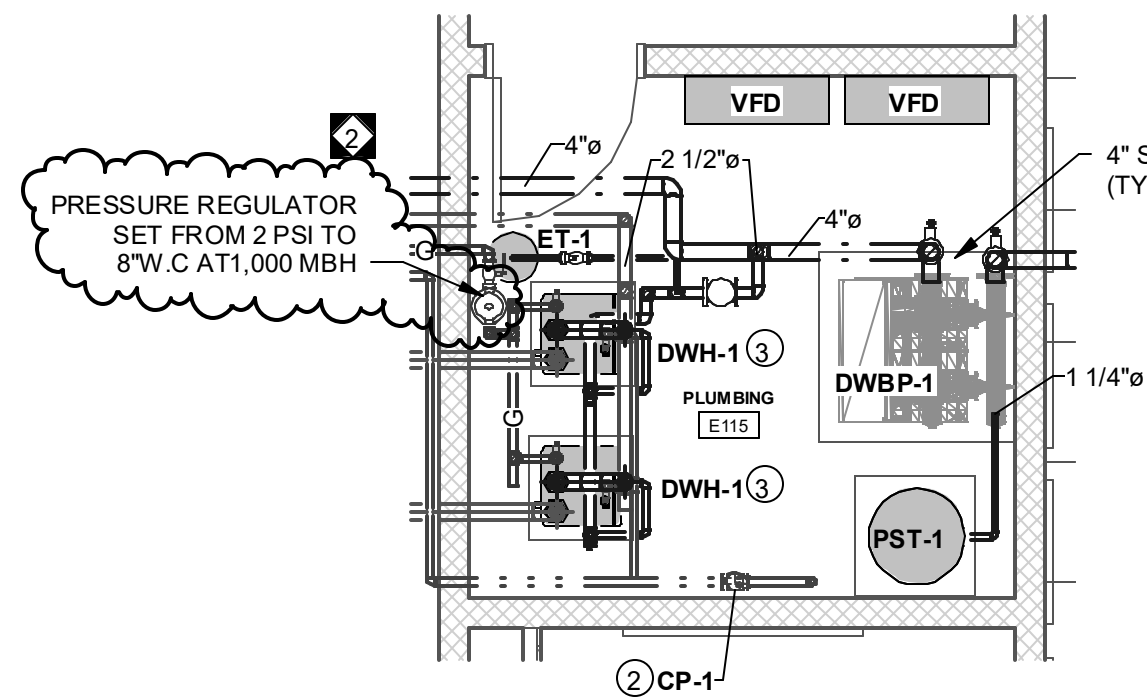
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MARCH 10, 2025

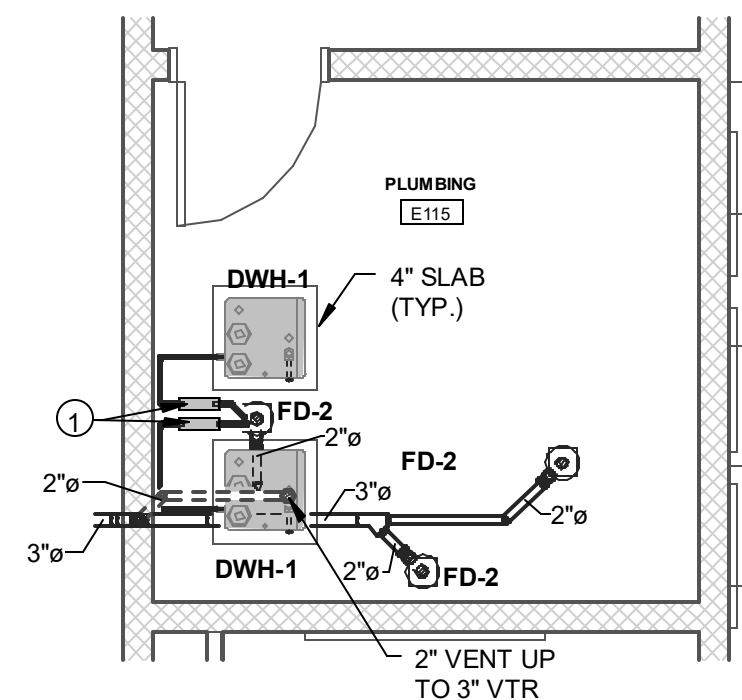
PROJECT

3758

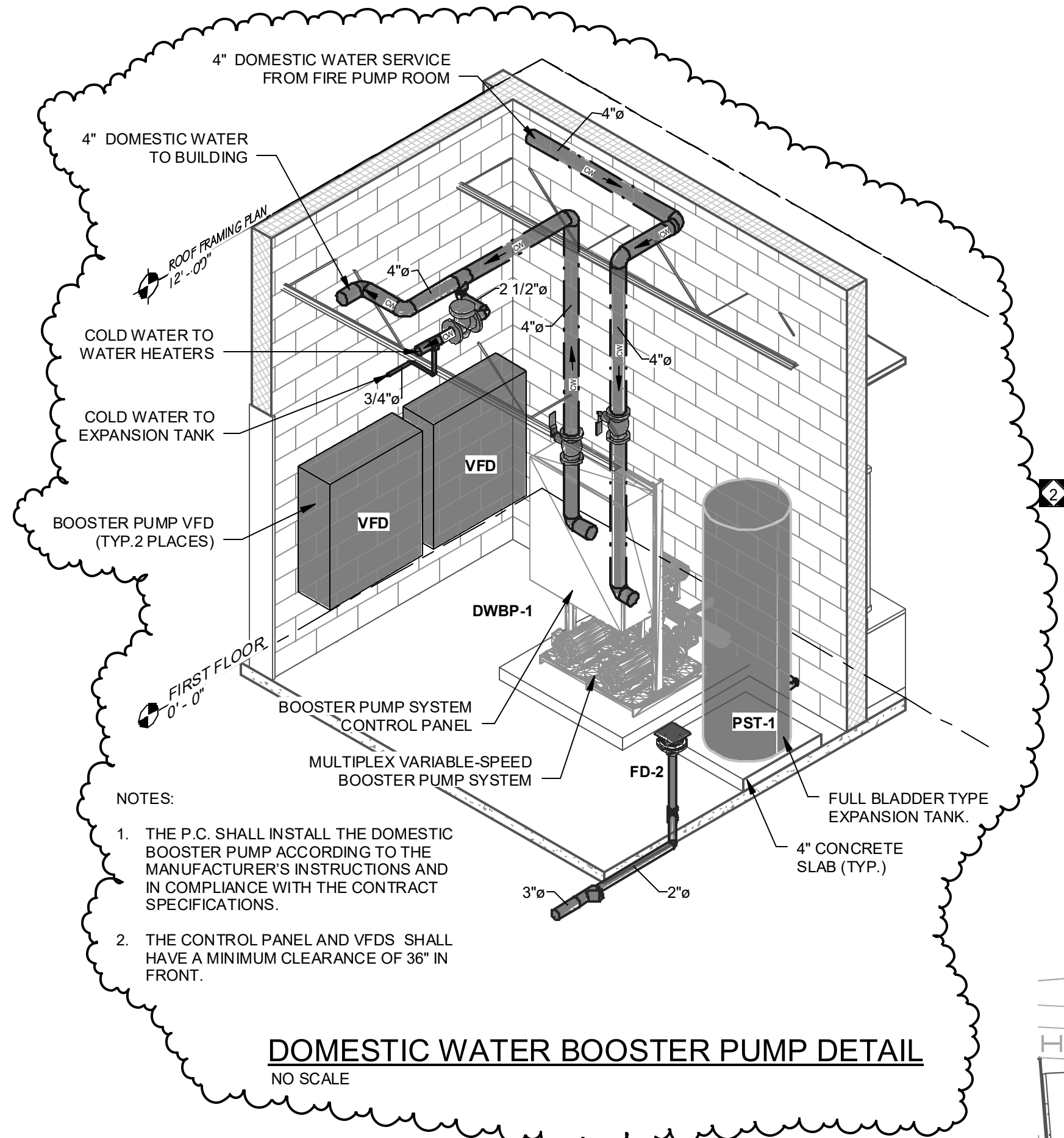
P3.6



3 PLUMBING RM. E115 DOMESTIC PIPING  
1/4" = 1'-0"

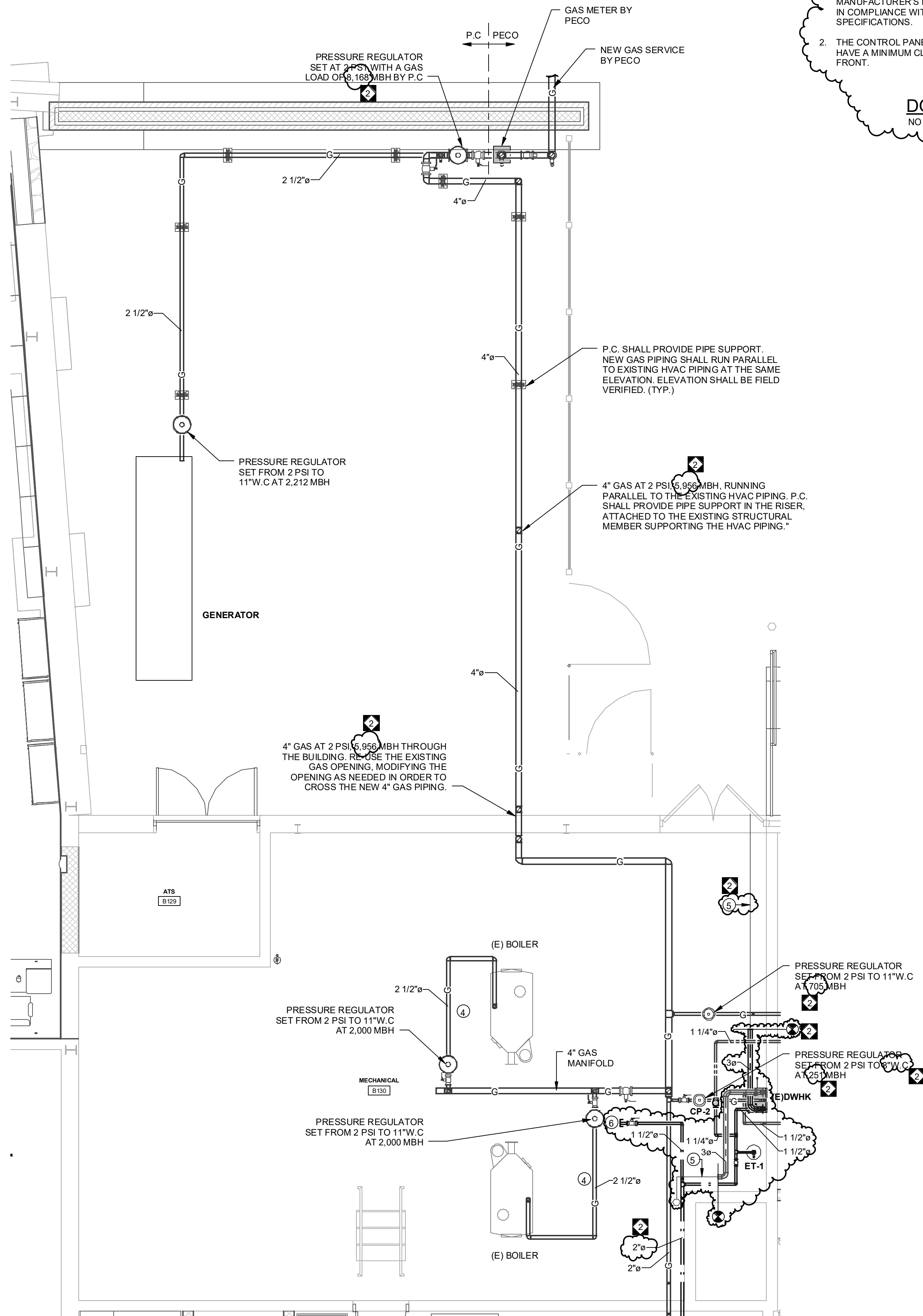


4 PLUMBING RM. E115 SANITARY PIPING  
1/4" = 1'-0"

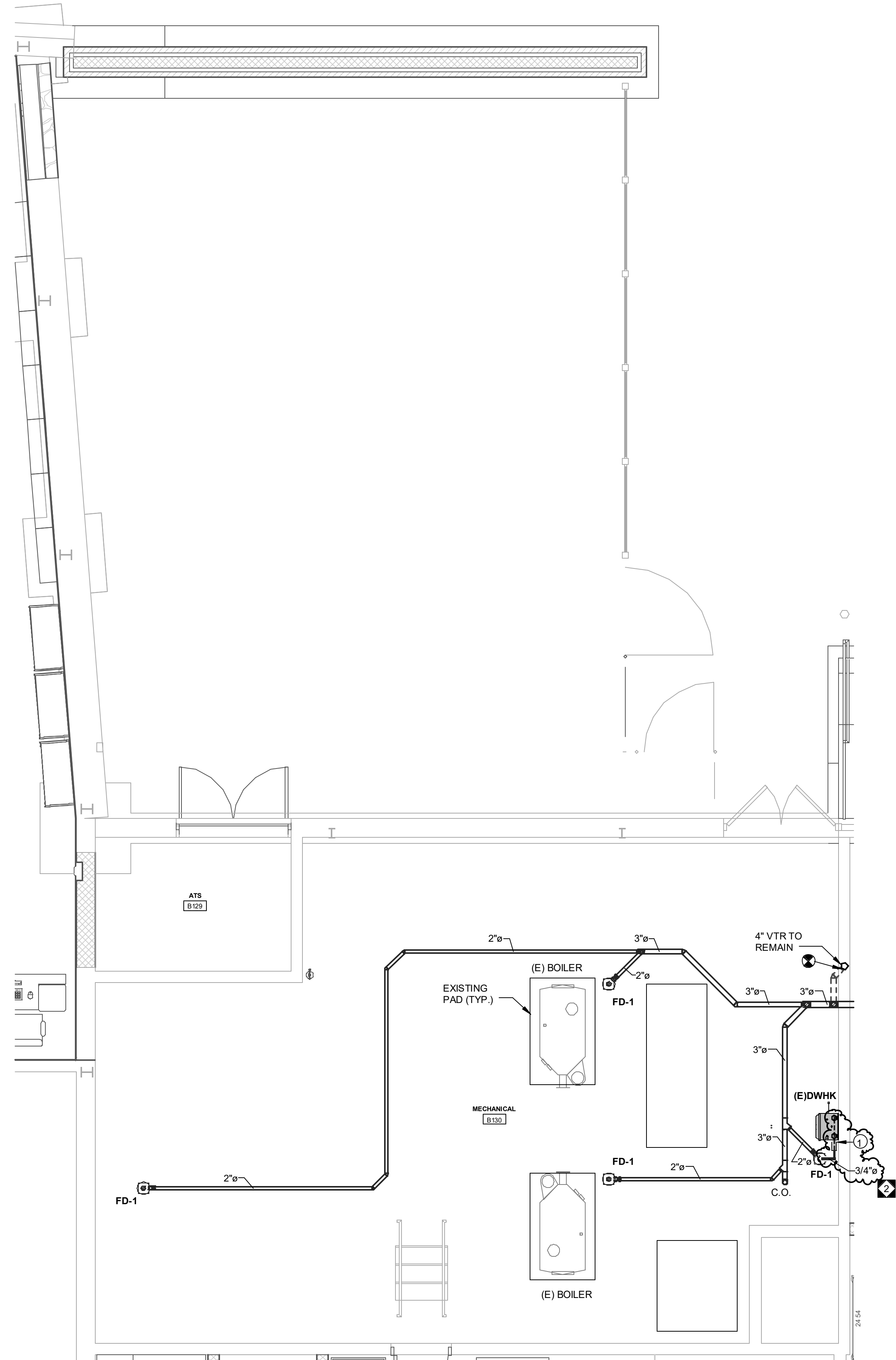


#### DRAWING NOTES:

1. THE WATER HEATER SHALL BE PROVIDED WITH AN IN-LINE ACID NEUTRALIZER SYSTEM IN THE CONDENSATE LINE AS PER THE MANUFACTURER'S RECOMMENDATIONS.
2. THE DOMESTIC HOT WATER CIRCULATOR PUMP (CP-1) SHALL BE INSTALLED BETWEEN 24" TO 48" FROM THE FINISH FLOOR.
3. DOMESTIC WATER HEATER (DWH-1) SHALL BE INSTALLED AS PER THE MANUFACTURER'S RECOMMENDATIONS. REFER TO DETAIL.
4. KEEP A MINIMUM DISTANCE OF 10'-0" FROM GAS PRESSURE REGULATOR TO A BOILER INLET.
5. EXISTING WATER HEATER FLUES TO REMAIN.
6. MAKE-UP WATER TO BOILER AND CHILLER. P.C. SHALL FIELD VERIFY EXISTING TO REMAIN MAKE-UP WATER LOCATION. FINAL CONNECTION TO EXISTING TO REMAIN MAKE-UP WATER BY M.C.



1 MECH. ROOM B130 DOMESTIC PIPING  
1/4" = 1'-0"



2 MECH. ROOM B130 SANITARY PIPING  
1/4" = 1'-0"



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#### REVISIONS

NO.	DATE	NAME	DESCRIPTION OF CHANGES
2	3/28/2025		ADDENDUM 2

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SCHOOL DISTRICT OF HAVERFORD TOWNSHIP  
800 COOPERTOWN ROAD  
BRYN MAWR, PA. 19010

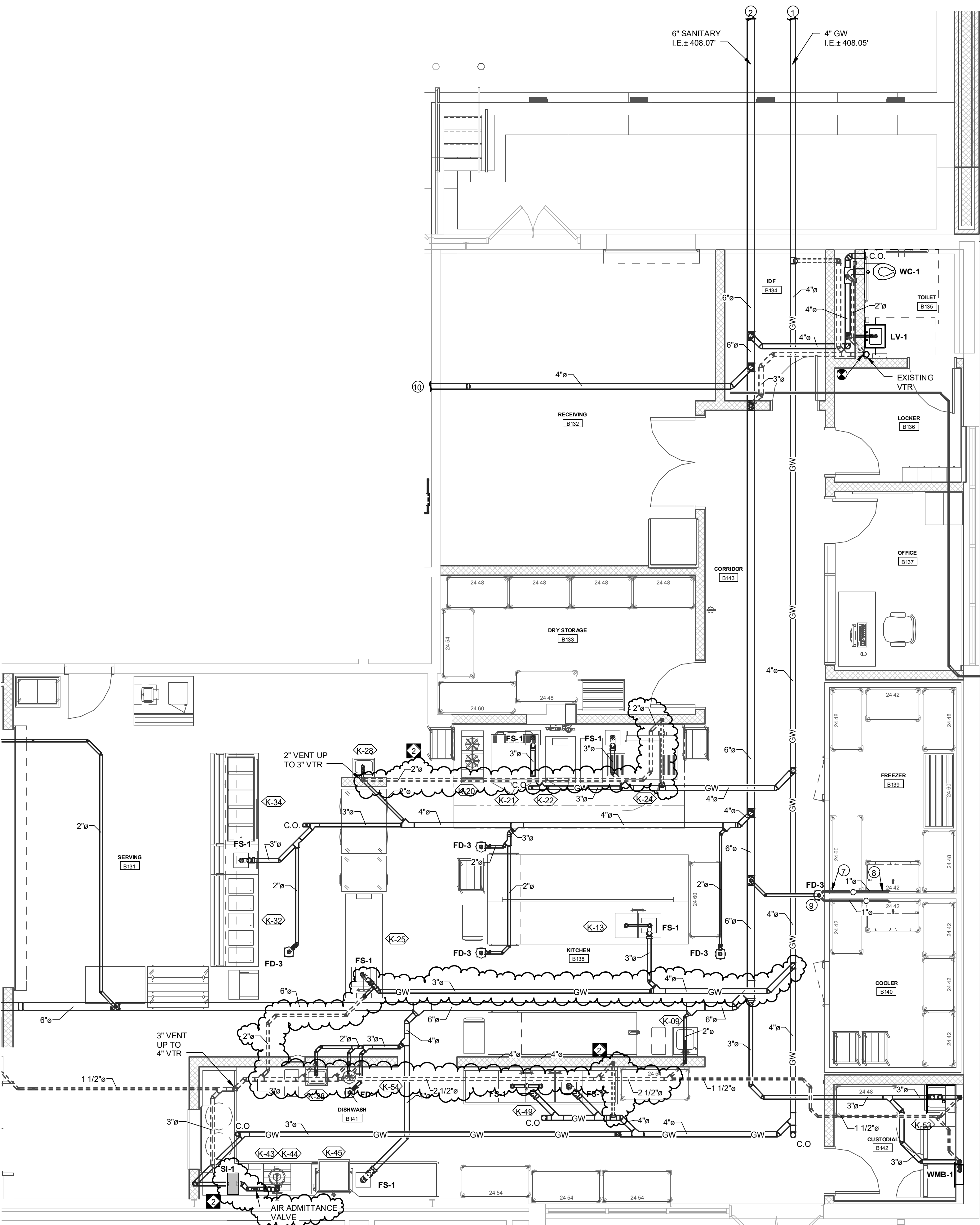
**CR**

ENLARGED PLANS

PLOTS/SCALE  
1/4" = 1'-0"  
FILENAME  
240066  
DATE  
MARCH 10, 2025

PROJECT  
3758

P4.1



② KITCHEN B138 SANITARY PIPING  
1/4" = 1'-0"

#### DRAWING NOTES:

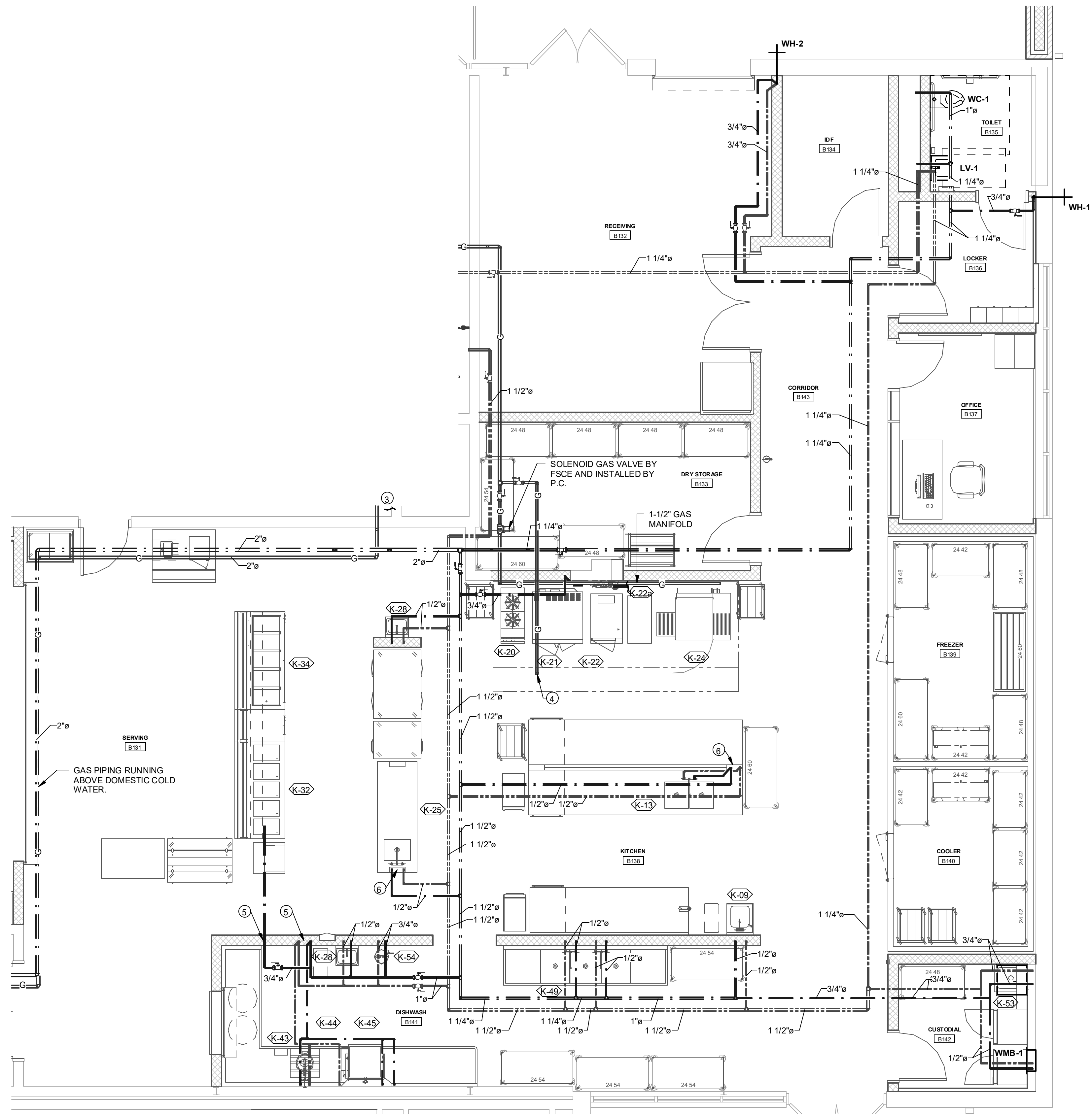
1. RUN GREASE WASTE SANITARY 5'-0" FROM BUILDING AND CONNECT TO SITE PIPING. SEE P1.0 FOR CONTINUATION.
2. RUN SANITARY 5'-0" FROM BUILDING AND CONNECT TO SITE PIPING. SEE P1.0 FOR CONTINUATION.
3. 3" CW TO DWHK IN BOILER ROOM.
4. 1-1/2" GAS AT 11"W.C. 300 MBH UP TO ROOF. FOR CONTINUATION REFER TO SHEET P3.8.
5. RUN PIPING DOWN TO BELOW FLOOR, RUN PIPING BELOW FLOOR IN PVC SLEEVE. SLEEVE SHALL TURN UP TO 6" ABOVE FINISHED FLOOR. PROVIDE ACCESS PANEL IN WALL.
6. DOMESTIC WATER PIPES DOWN IN UTILITY CHASE PROVIDED BY FOOD CONSULTANTS.
7. CONDENSATE PIPE DOWN IN WALL TO SPILL INTO A FLOOR DRAIN WITH AN INDIRECT CONNECTION.
8. PROVIDE HEAT TAPE INSULATION CONDENSATE IN COOLER AND FREEZER.
9. PROVIDE FD-3 WITH FUNNEL DRAIN.
10. 4" SANITARY FROM BOILER ROOM.

#### FOOD SERVICE EQUIPMENT PLUMBING CONNECTION SCHEDULE

ITEM	EQUIPMENT DESCRIPTION	WATER		WASTE		GAS	MBTU/HR	REMARKS
		COLD	HOT	DIRECT	INDIRECT			
K-09 *	ADA HAND SINK	1/2"	* 1/2"	1 1/2"				
K-13	WORK TABLE WITH SINKS	1/2"	1/2"		2 @ 2"			
K-20	2-BURNER RANGE					3/4"	80	
K-21	DOUBLE DECK CONVECTION OVEN					1"	120	
K-22	DOUBLE DECK CONVECTION STEAMER	1/2"			1-1/2"	3/4"	125	RUN 3/4" CW FROM K-22 TO DRAIN TEMPERING DEVICE
K-22a	WATER FILTER	3/4"						
K-24	DOUBLE DECK CONVEYOR OVEN					(2)3/4"	80	
K-25	WORK TABLE WITH SINK	1/2"	1/2"		2"			
K-28 *	HAND SINK	1/2"	* 1/2"	1 1/2"				
K-32	HOT FOOD COUNTER	3/4"			1"			RUN 3/4" CW FROM K-32 TO DRAIN TEMPERING DEVICE
K-34	COLD FOOD COUNTER				1"			
K-43	3-HP DISPOSER W/ CONTROL	1/2"		2"				
K-44	PRE-RINSE SPRAY ASSEMBLY	1/2"	1/2"					
K-45	DISH MACHINE	(2)1/2"	1/2"		1 1/2"			RUN 1/2" CW FROM K-45 TO DRAIN TEMPERING DEVICE
K-49	3-BOWL POT AND PAN SINK	1/2"	1/2"		3 @ 2"			
K-53	MOP SINK	1/2"	1/2"	2"				
K-54	EYE WASH STATION	1/2"	1/2"	1-1/4"				F.S.C SHALL PROVIDE EYEWASH WITH MIXING VALVE IN ACCORDANCE WITH ASSE 1071

- NOTES: 1. ALL FOOD SERVICE EQUIPMENT AND FIXTURES PROVIDED AND INSTALLED BY FOOD SERVICE CONTRACTOR. CONNECTIONS TO THE EQUIPMENT LISTED ABOVE ARE BY THE P.C.; REFER TO FOOD SERVICE DRAWINGS FOR ALL ROUGH-IN HEIGHTS.
2. P.C. SHALL SUPPLY ALL NECESSARY FITTINGS REQUIRED TO MAKE FINAL CONNECTIONS TO THE LISTED EQUIPMENT. FITTINGS SHALL INCLUDE, BUT NOT LIMITED TO, VALVES, TRAPS, TAILPIECES AND WASTE / SUPPLY PIPING. REFER TO THE KITCHEN EQUIPMENT DRAWINGS FOR ADDITIONAL INFORMATION.
3. PROVIDE 140°F DOMESTIC HOT WATER TO ALL FIXTURES SCHEDULED ABOVE UNLESS NOTED OTHERWISE.

\* PROVIDE THERMOSTATIC MIXING VALVE IN SUPPLY PIPING TO FIXTURE IN ACCORDANCE WITH ASSE 1070



① KITCHEN B138 DOMESTIC PIPING  
1/4" = 1'-0"



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NO.	DATE	DESCRIPTION OF CHANGES
1	3/19/2025	ADDENDUM 1
2	3/26/2025	ADDENDUM 2

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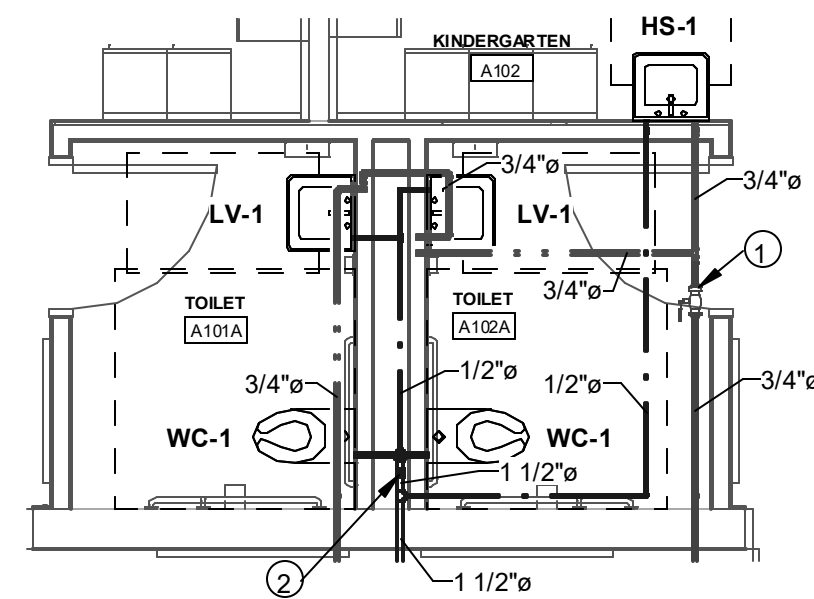
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PLOTS/SCALE  
As indicated  
FILENAME  
240066  
DATE  
MARCH 10, 2025

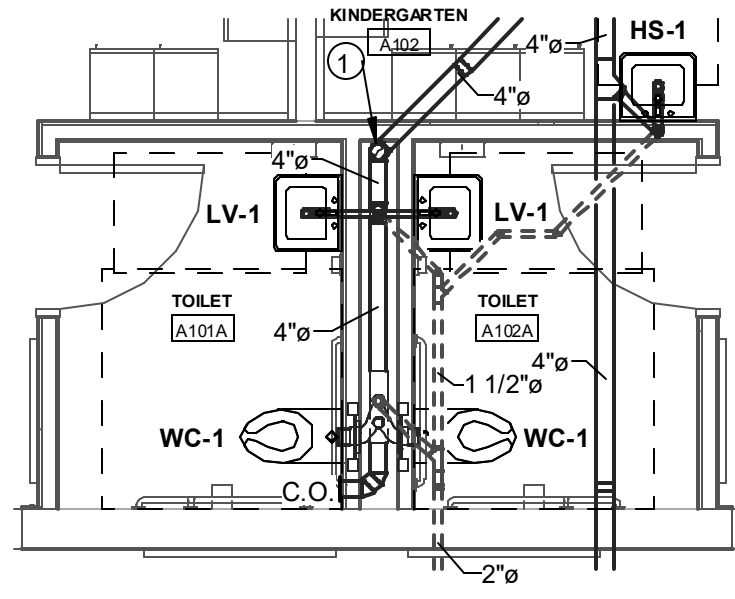
PROJECT  
3758

P4.2

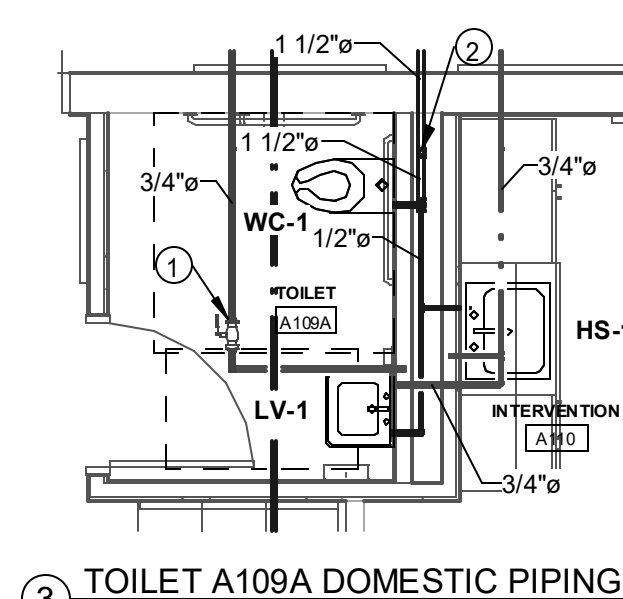




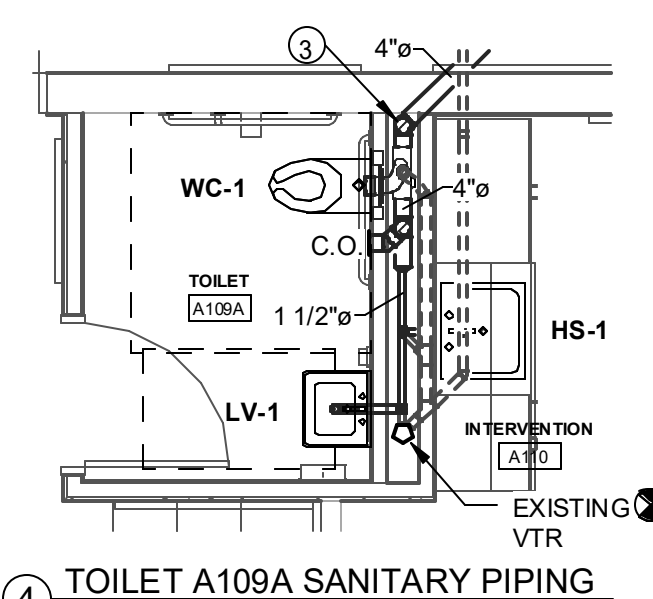
① TOILETS A101A & A102A DOMESTIC PIPING  
1/4" = 1'-0"



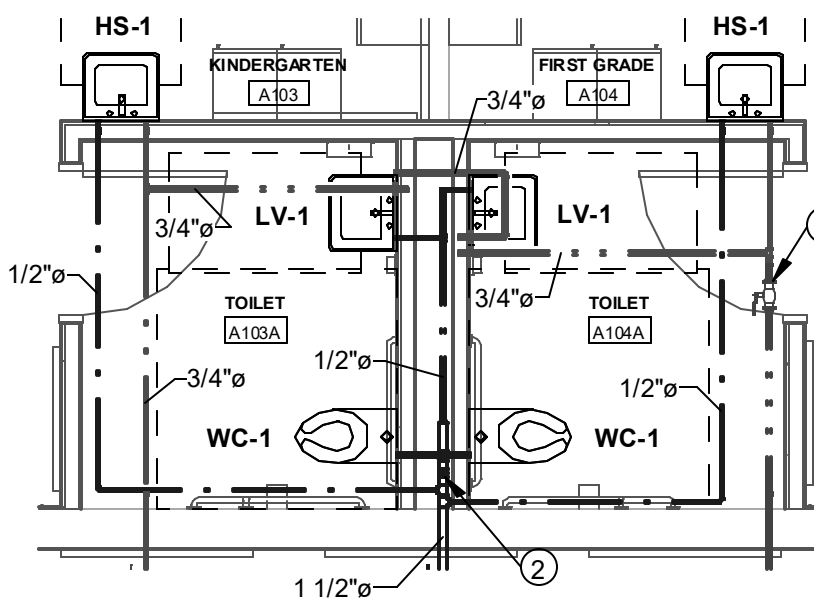
② TOILETS A101A & A102 SANITARY PIPING  
1/4" = 1'-0"



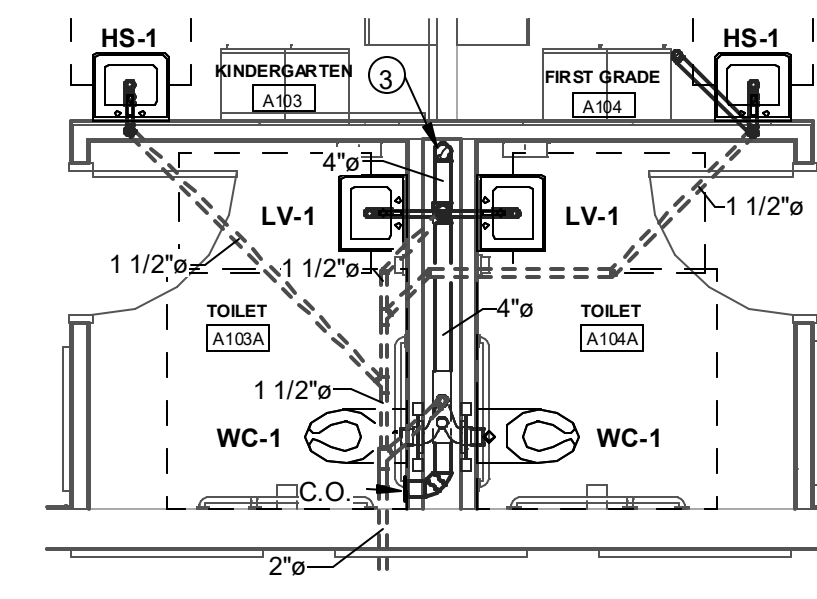
③ TOILET A109A DOMESTIC PIPING  
1/4" = 1'-0"



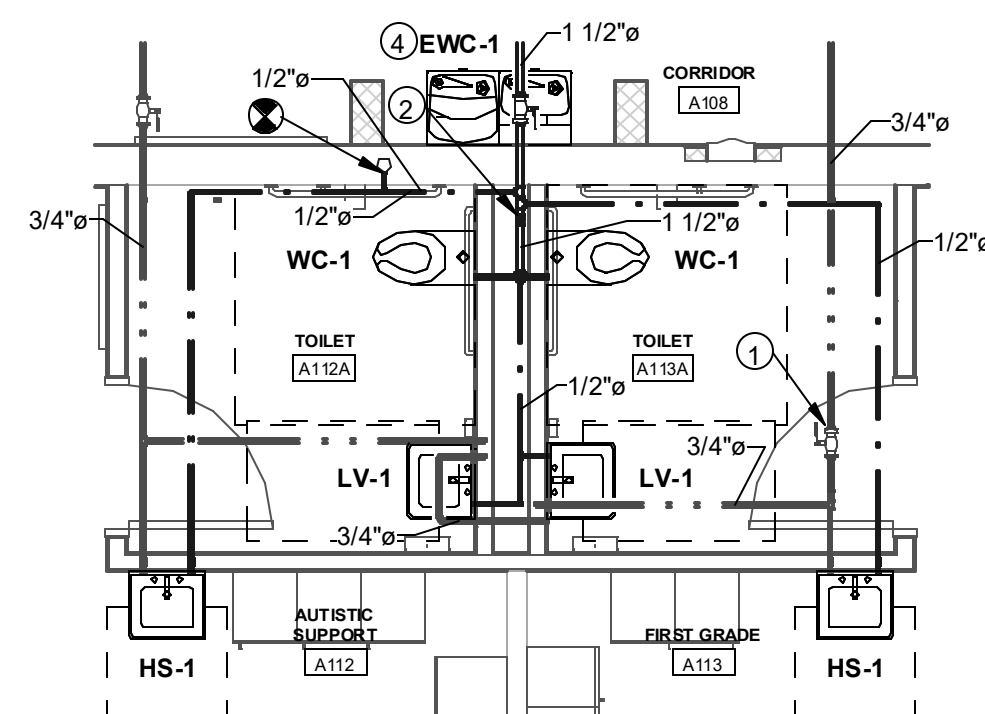
④ TOILET A109A SANITARY PIPING  
1/4" = 1'-0"



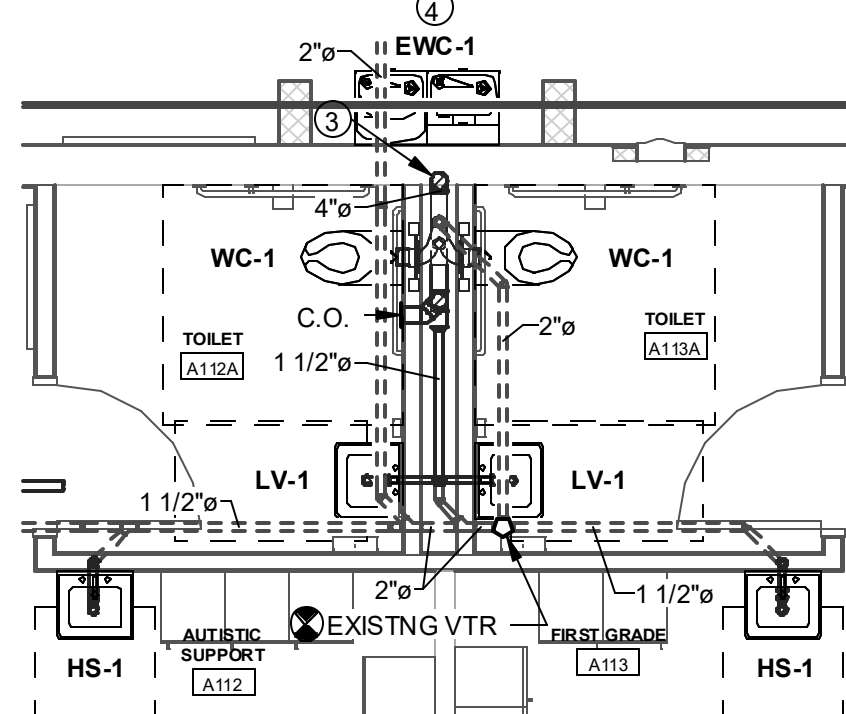
⑤ TOILETS A103A & A104A DOMESTIC PIPING  
1/4" = 1'-0"



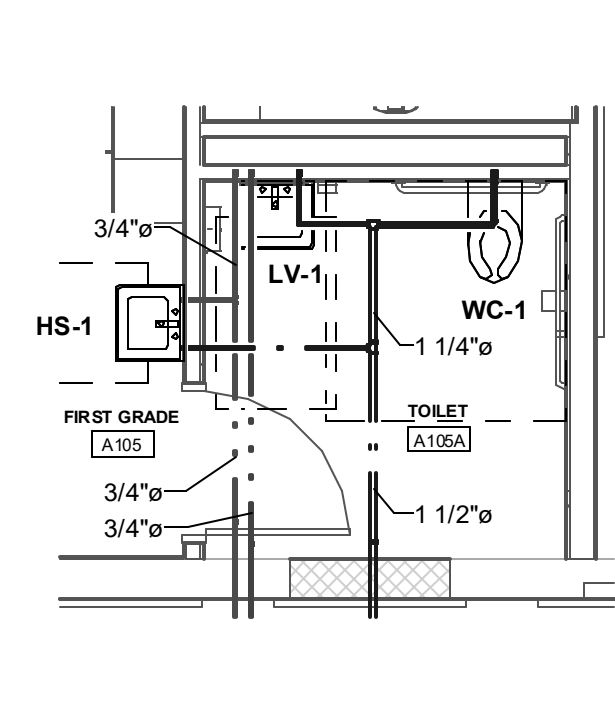
⑥ TOILETS A103A & A104A SANITARY PIPING  
1/4" = 1'-0"



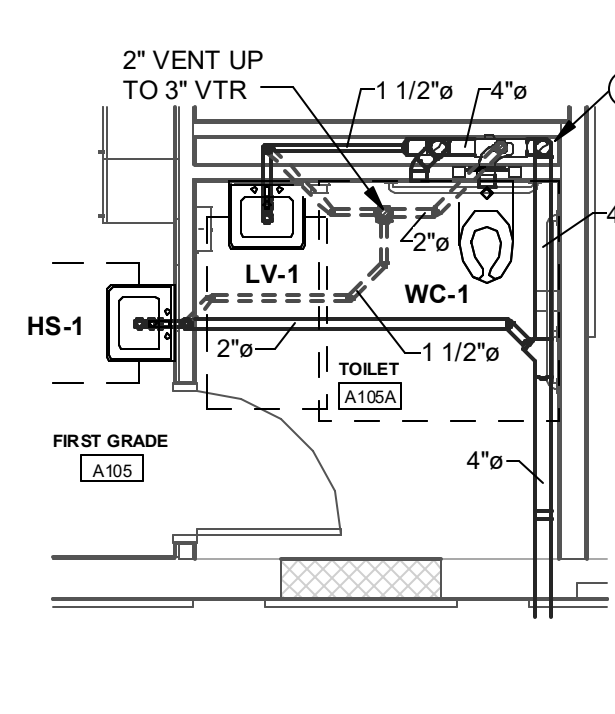
⑦ TOILETS A112A & A113A DOMESTIC PIPING  
1/4" = 1'-0"



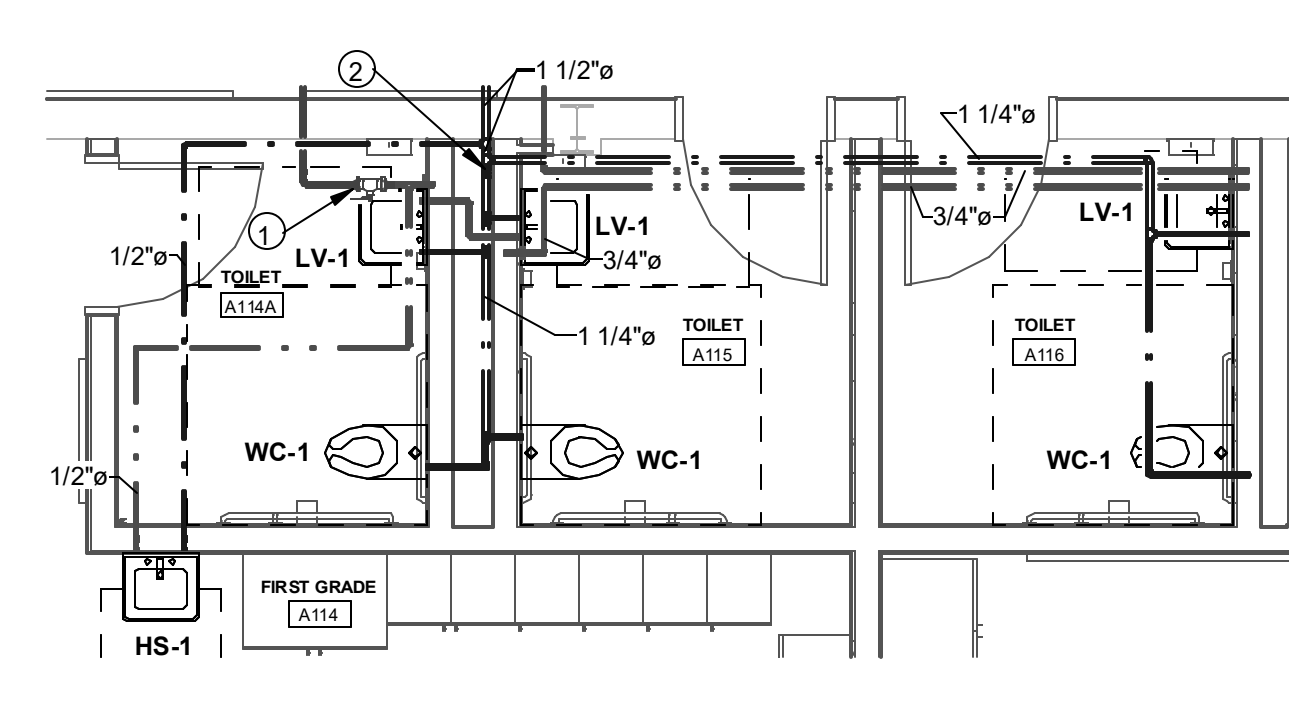
⑧ TOILETS A112A & A113A SANITARY PIPING  
1/4" = 1'-0"



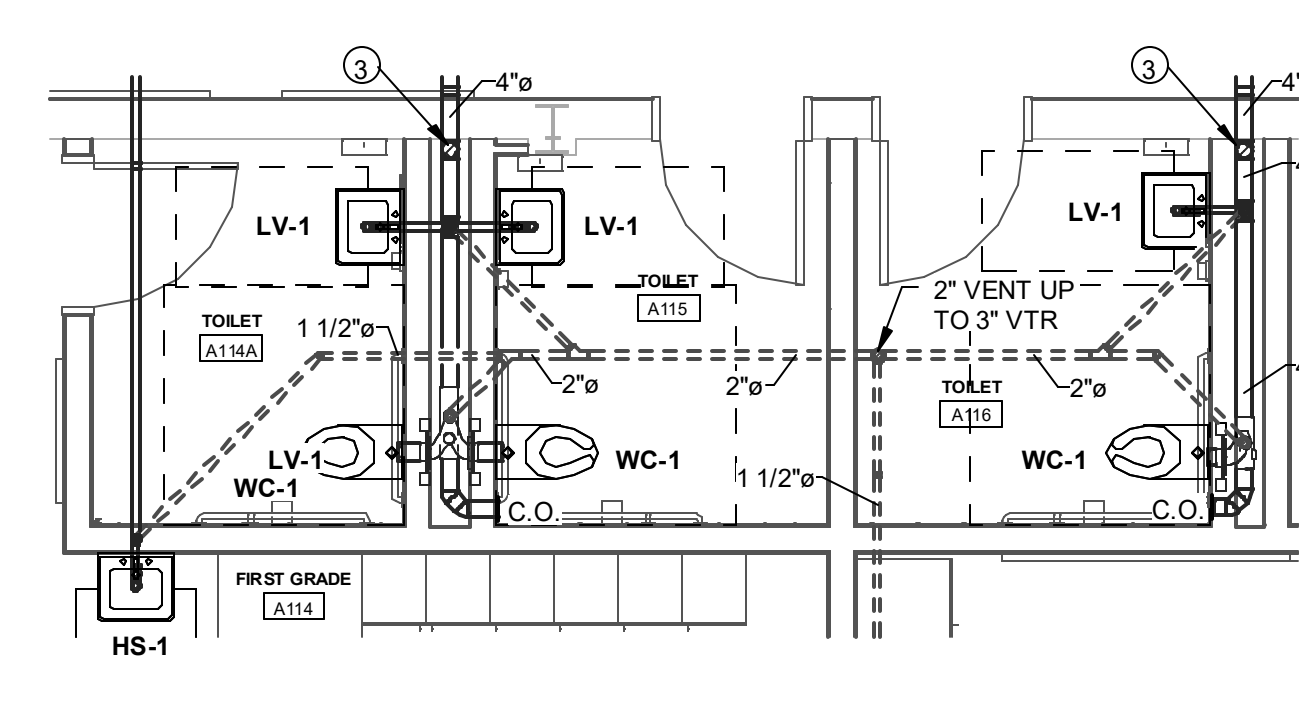
⑨ TOILET A105A DOMESTIC PIPING  
1/4" = 1'-0"



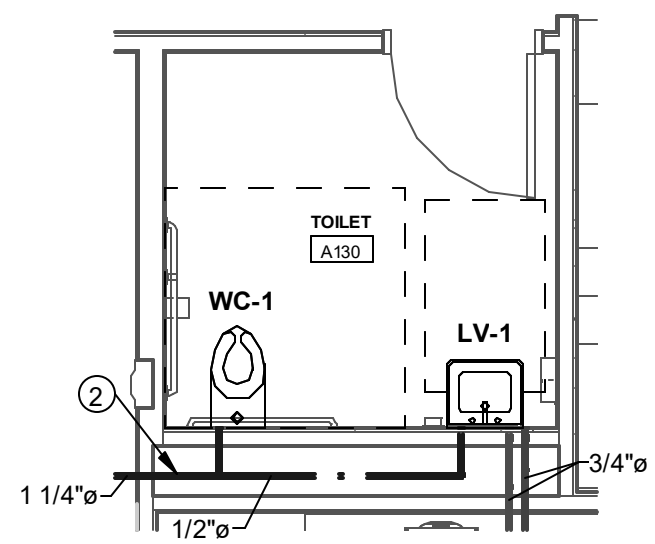
⑩ TOILET A105A SANITARY PIPING  
1/4" = 1'-0"



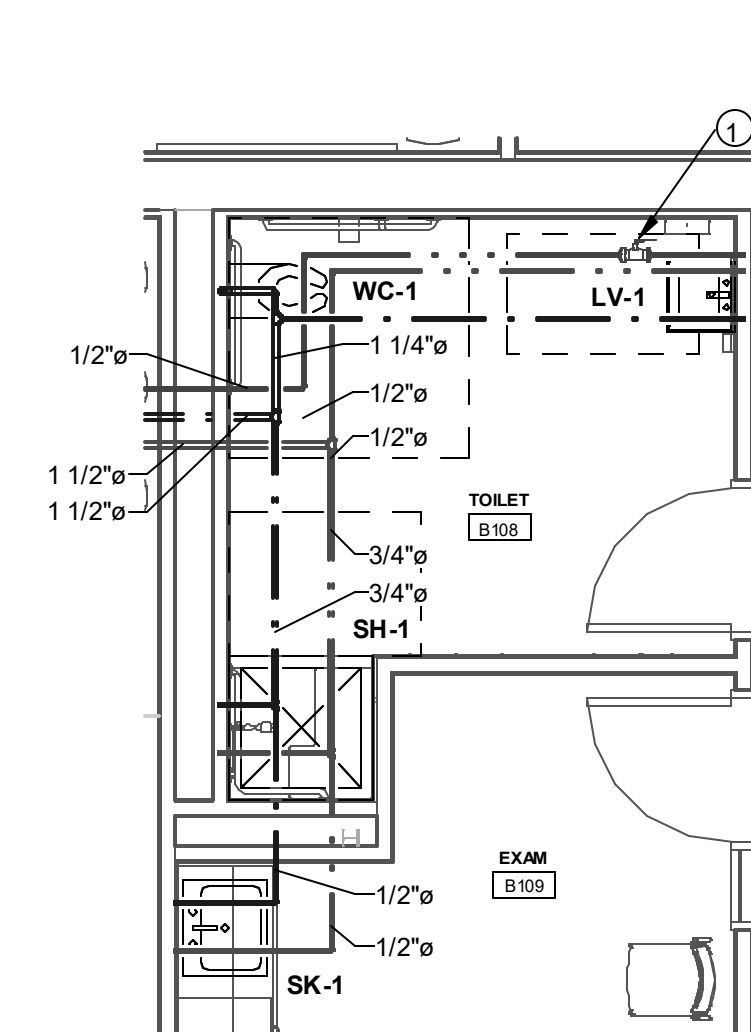
⑪ TOILETS A114A, A115, A116 DOMESTIC PIPING  
1/4" = 1'-0"



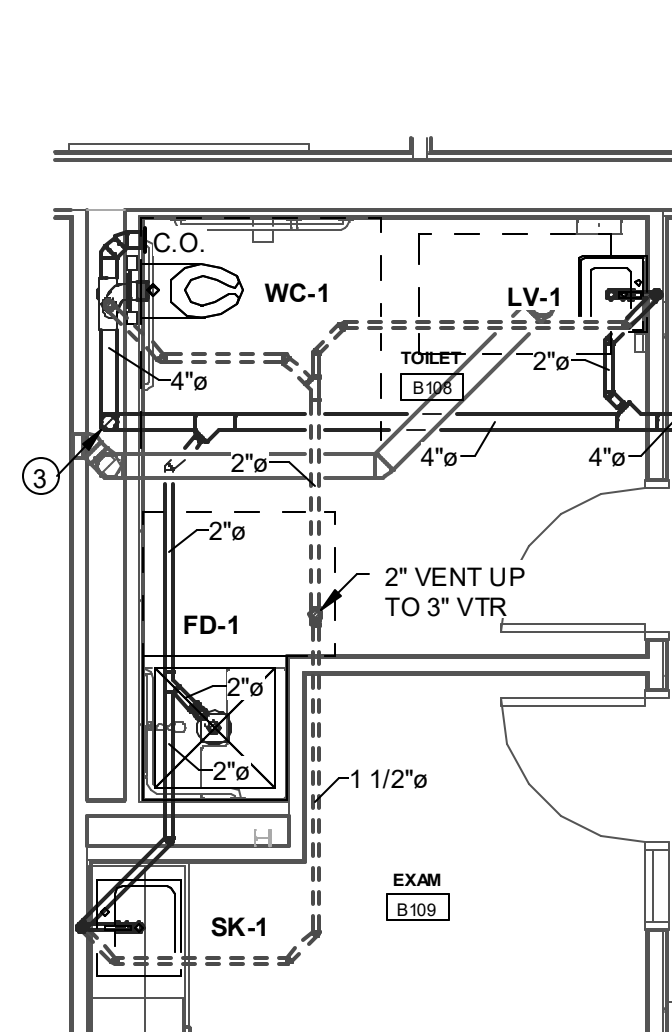
⑫ TOILETS A114A, A115, A116 SANITARY PIPING  
1/4" = 1'-0"



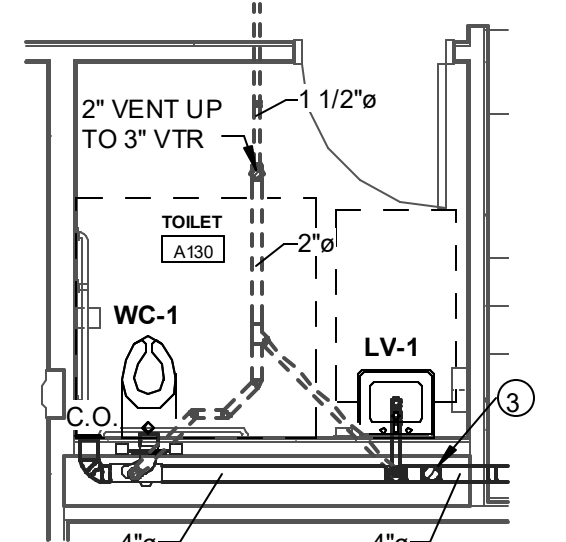
⑬ TOILET A130 DOMESTIC PIPING  
1/4" = 1'-0"



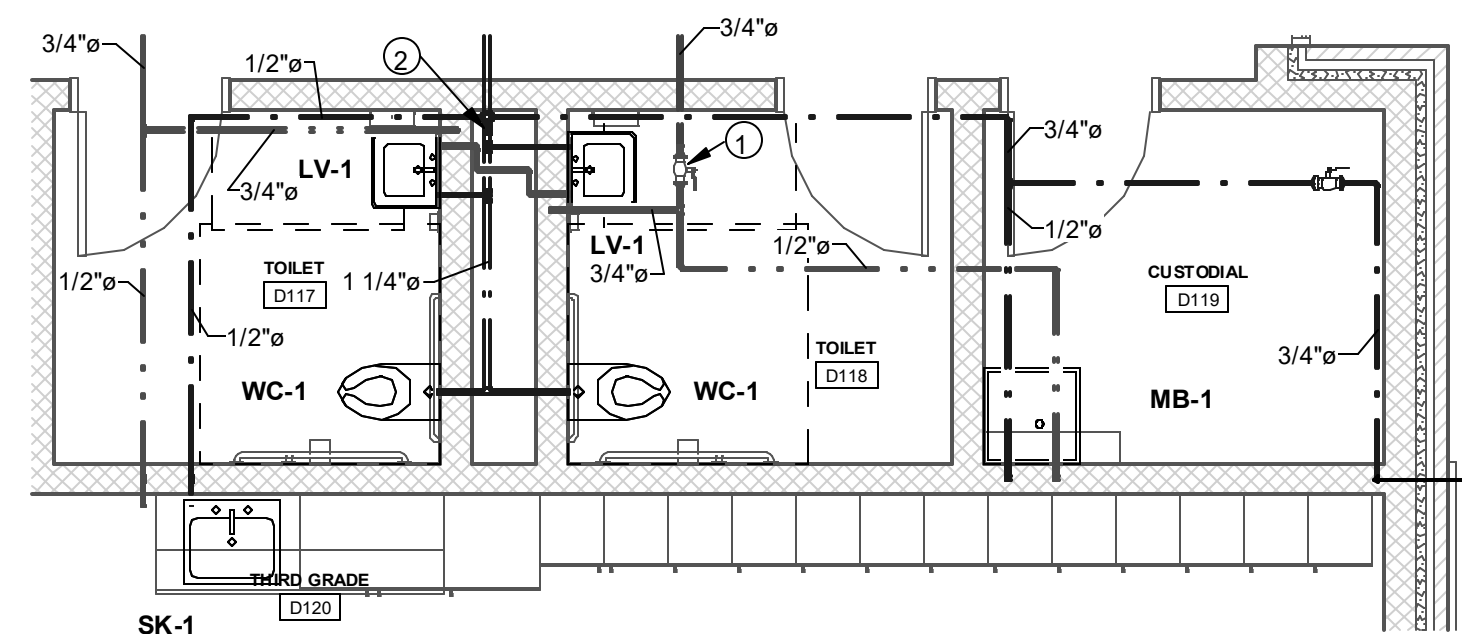
⑮ TOILET B108 DOMESTIC PIPING  
1/4" = 1'-0"



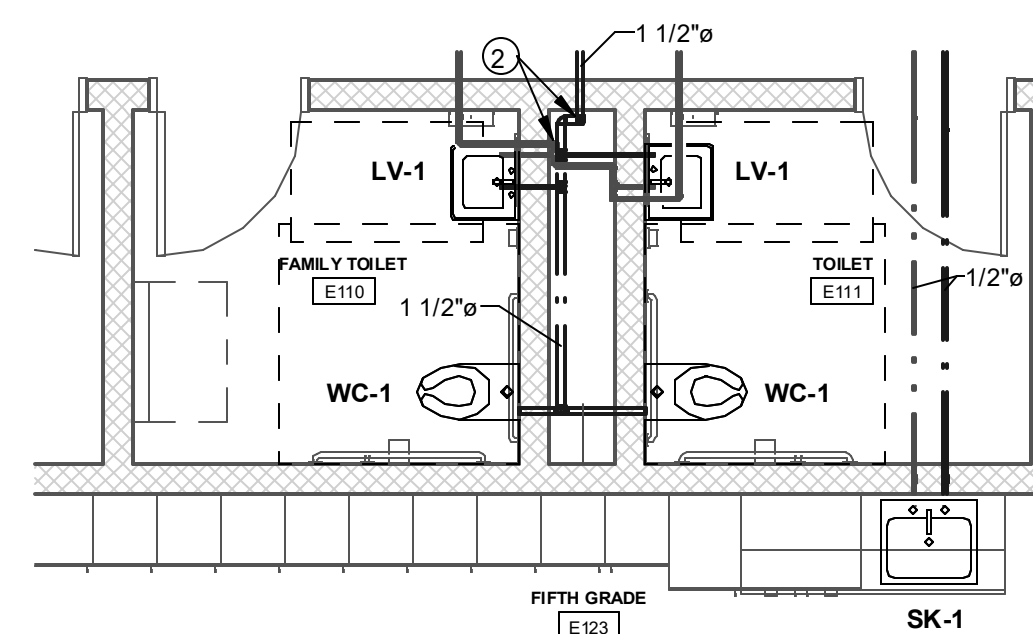
⑮ TOILET B108 SANITARY PIPING  
1/4" = 1'-0"



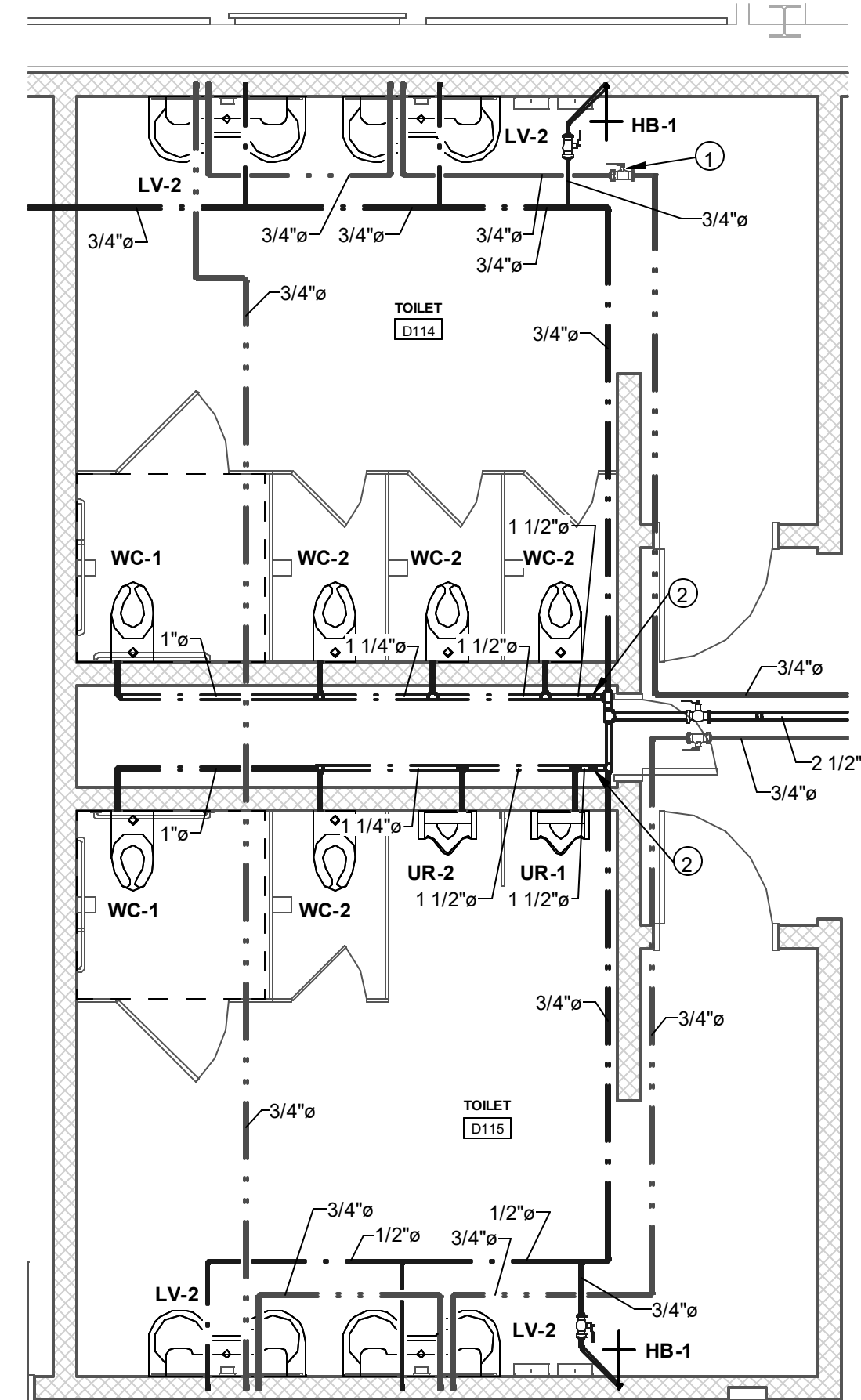
⑭ TOILET A130 SANITARY PIPING  
1/4" = 1'-0"



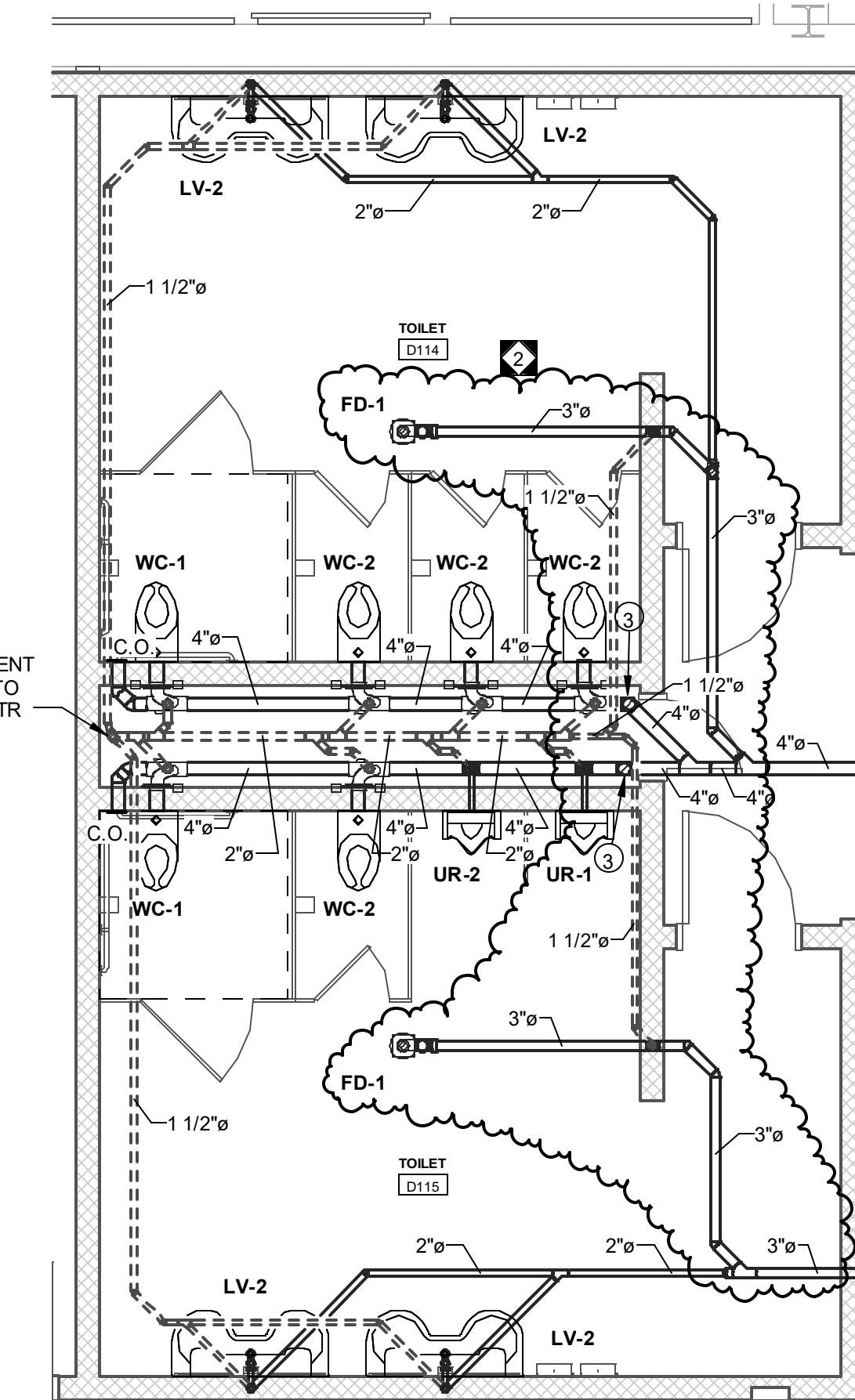
⑰ TOILETS D117 & D118 DOMESTIC PIPING  
1/4" = 1'-0"



⑰ TOILETS E110 & E111 DOMESTIC PIPING  
1/4" = 1'-0"



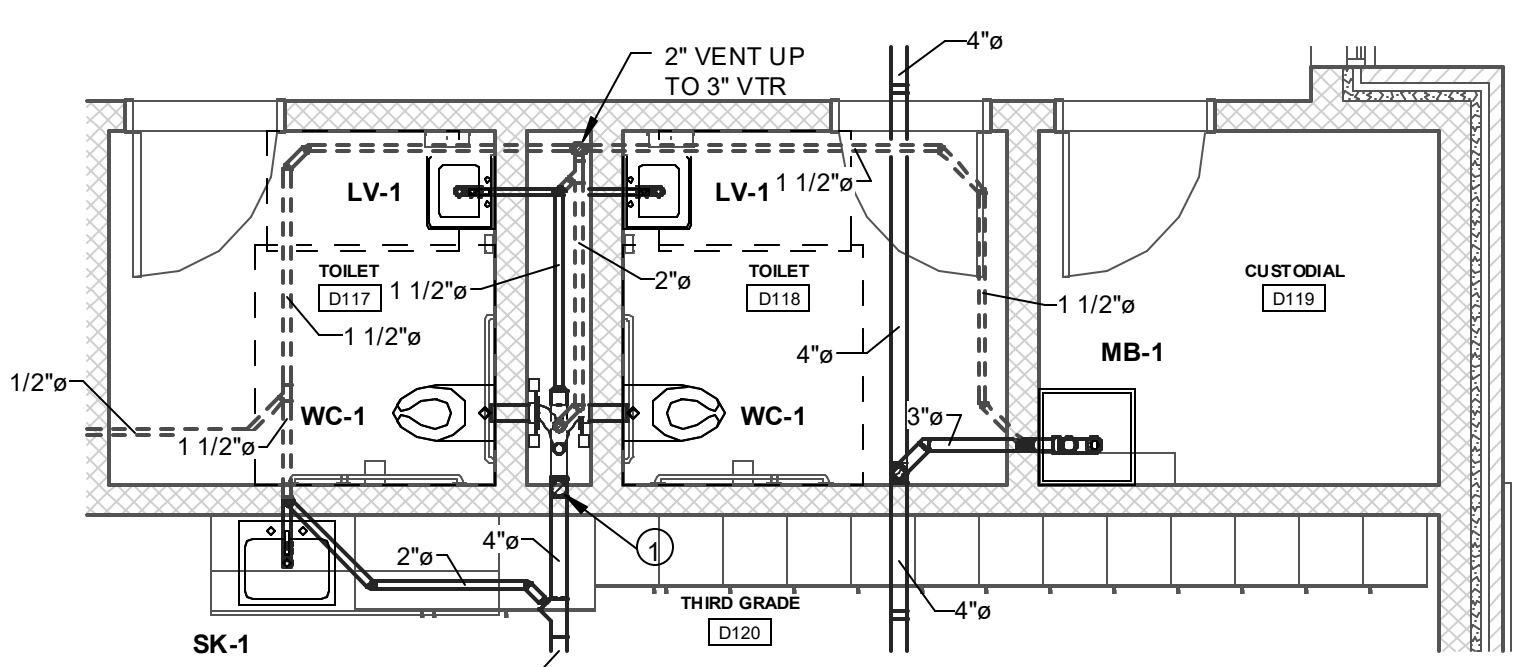
⑳ TOILETS D114 & D115 DOMESTIC PIPING  
1/4" = 1'-0"



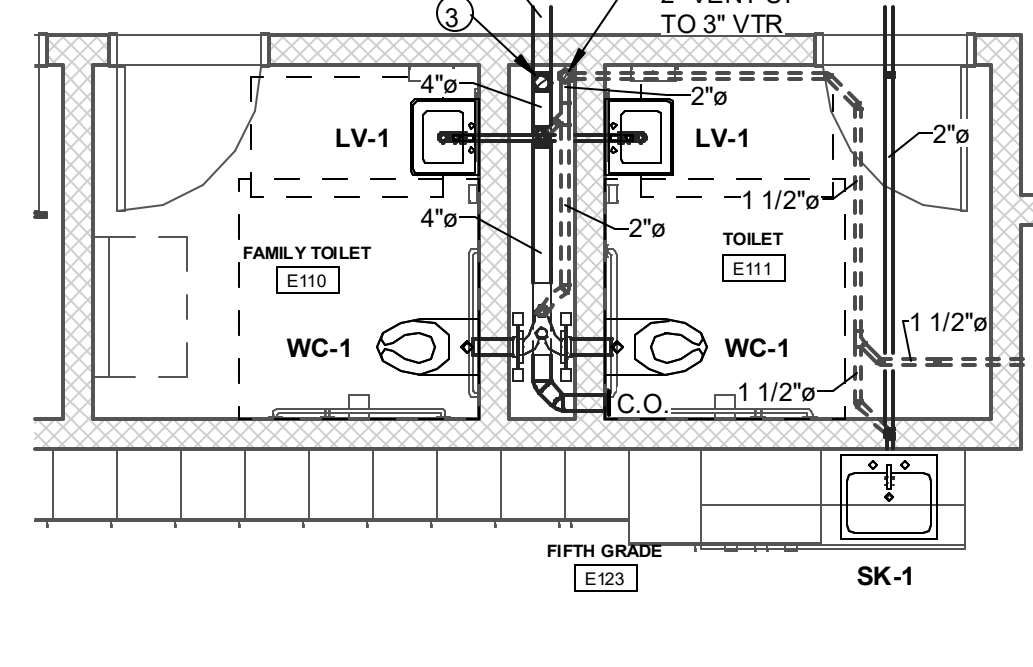
㉒ TOILETS D114 & D115 SANITARY PIPING  
1/4" = 1'-0"

#### ④ DRAWING NOTES:

1. INSTALL SHUT-OFF VALVE, CHECK VALVE AND BALANCING VALVE, REFER TO DOMESTIC HW VALVE DETAIL.
2. RUN PIPING DOWN INTO CHASE SPACE.
3. RUN PIPING DOWN TO BELOW FLOOR.
4. CONNECT NEW FIXTURE TO EXISTING PIPING.



⑱ TOILETS D117 & D118 SANITARY PIPING  
1/4" = 1'-0"



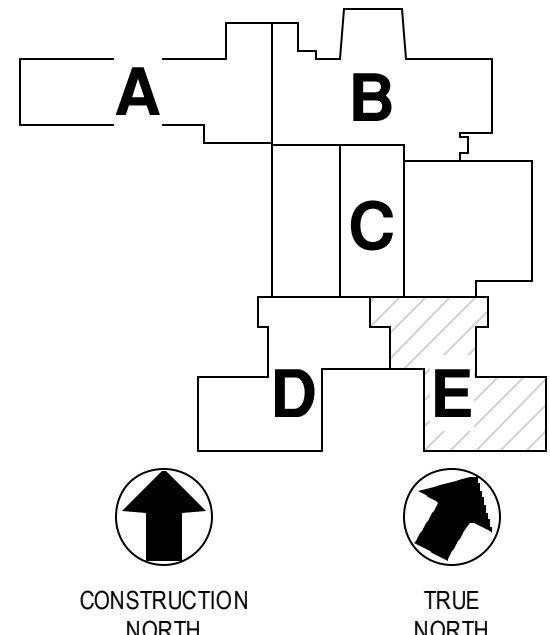
㉒ TOILETS E110 & E111 SANITARY PIPING  
1/4" = 1'-0"



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#### KEY PLAN



#### REVISIONS

NO.	DATE	NAME	DESCRIPTION OF CHANGES
2	3/28/2025		ADDENDUM 2

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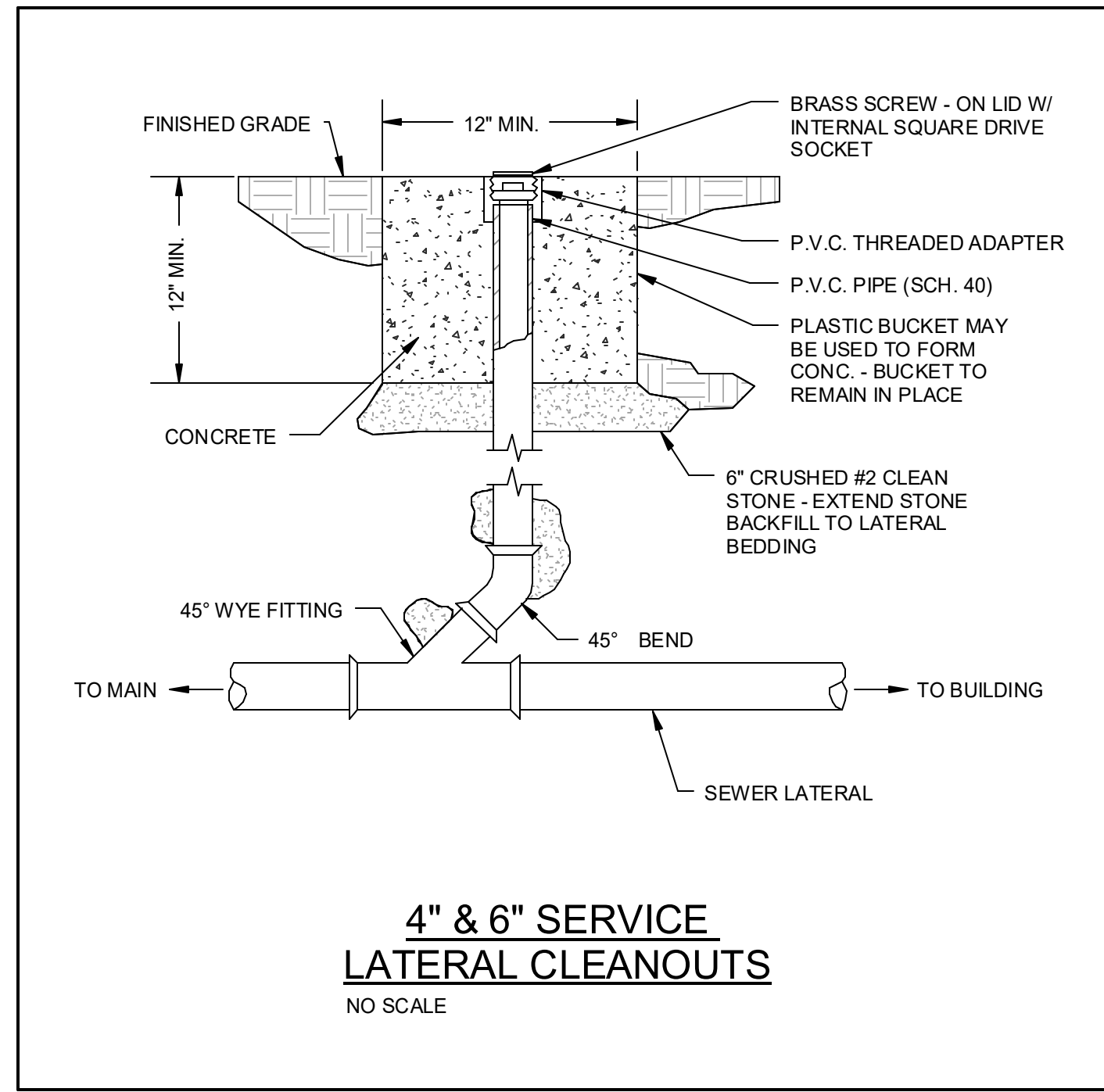
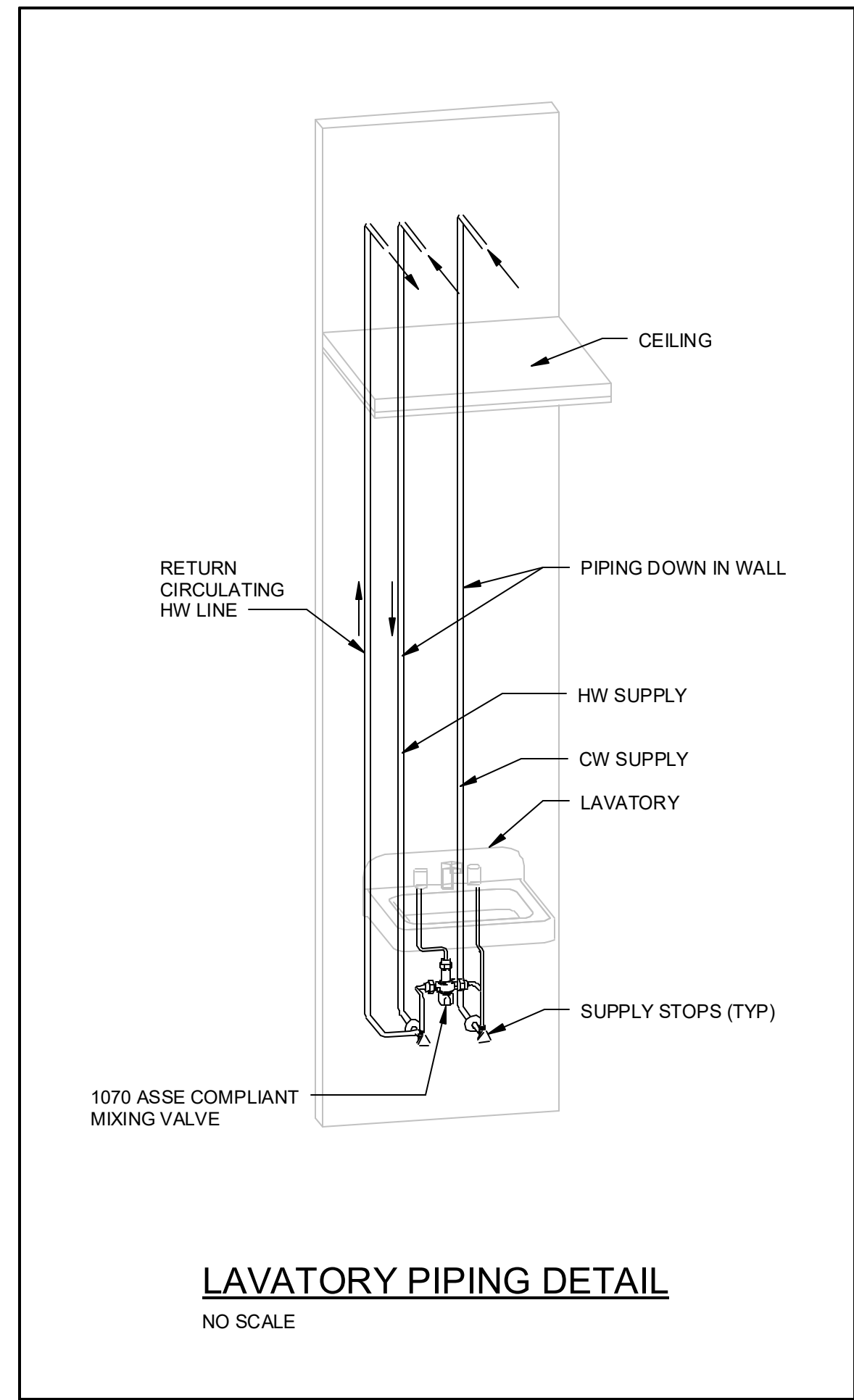
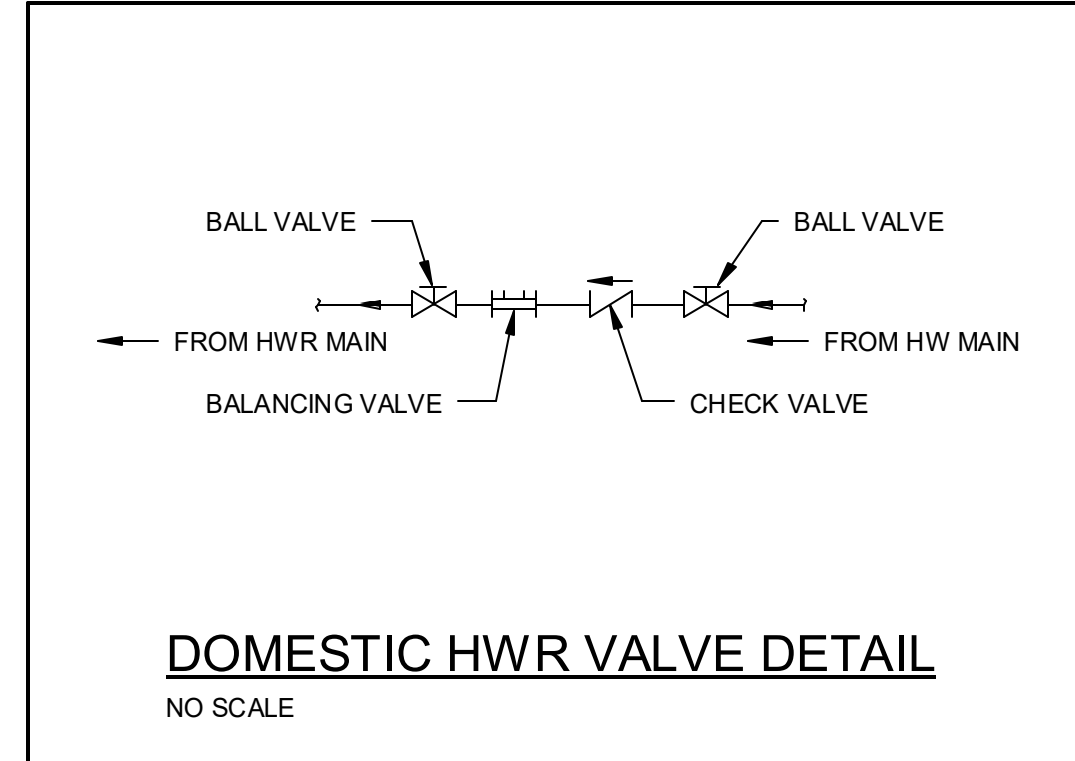
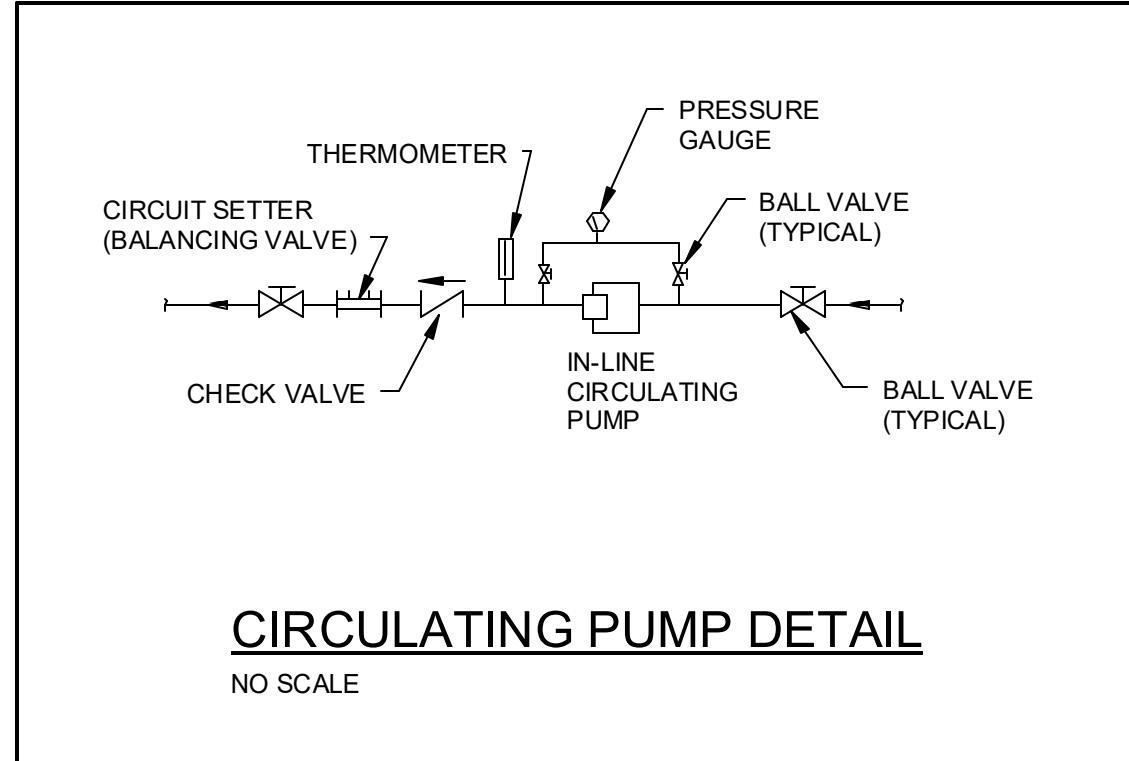
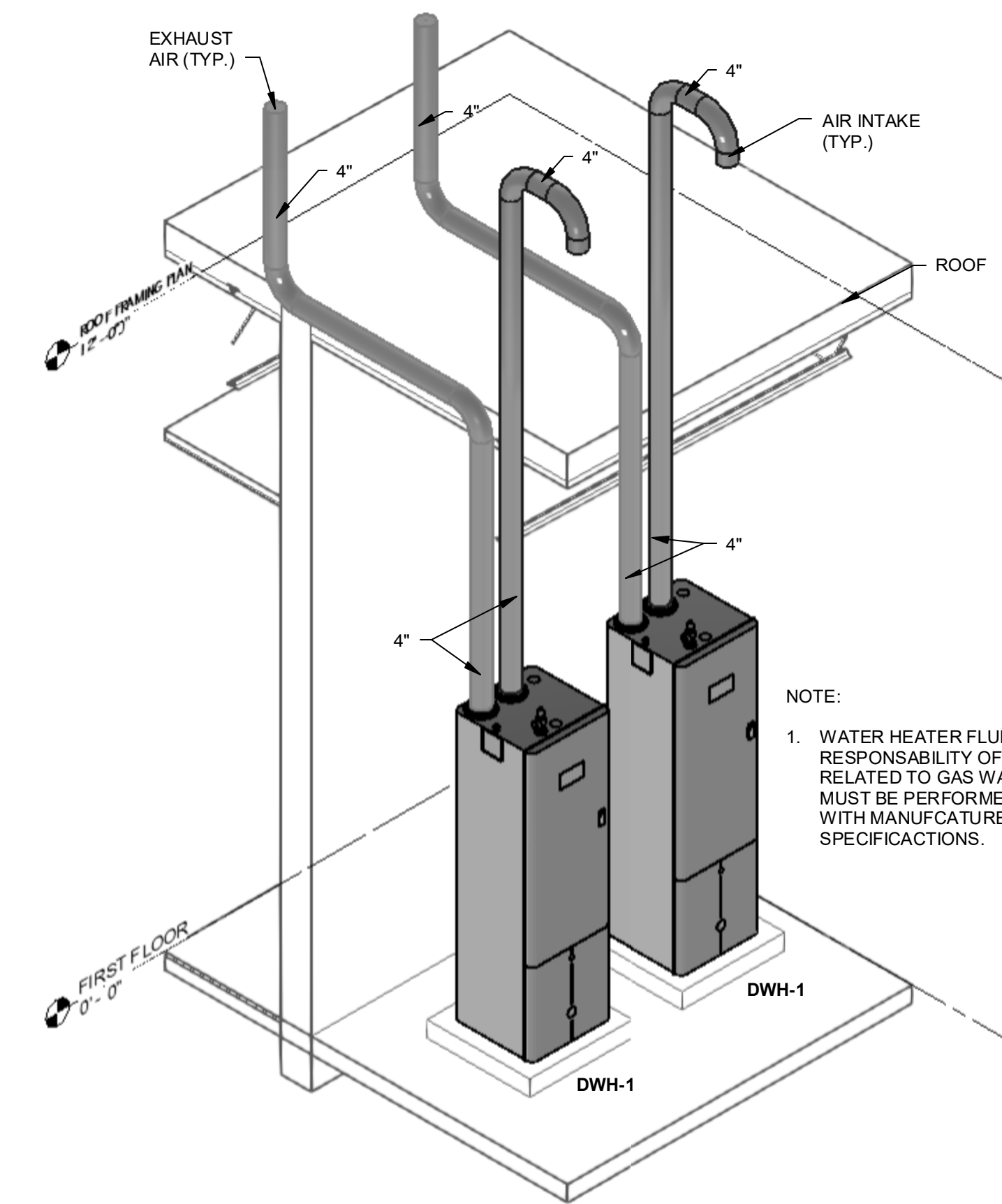
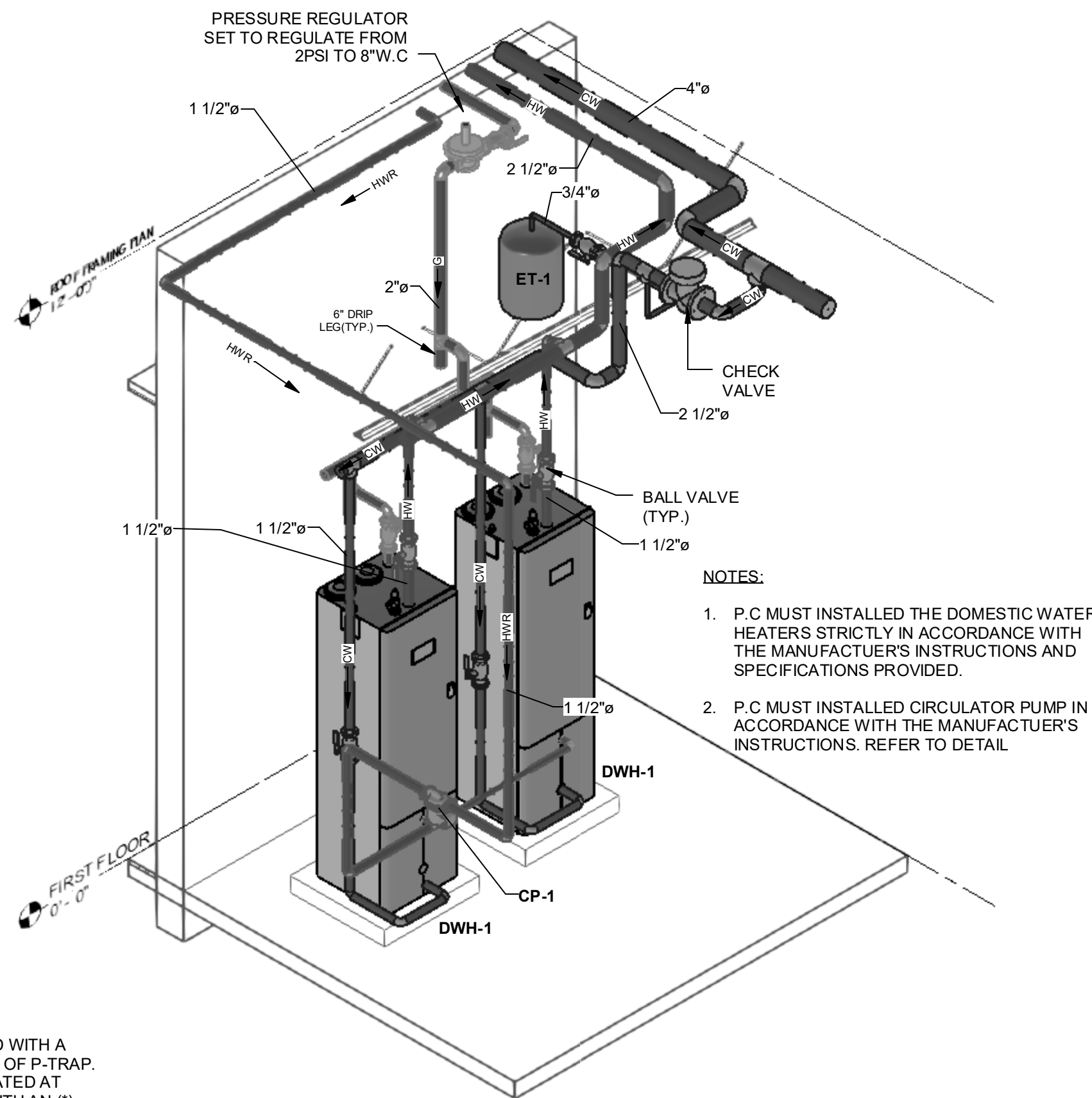
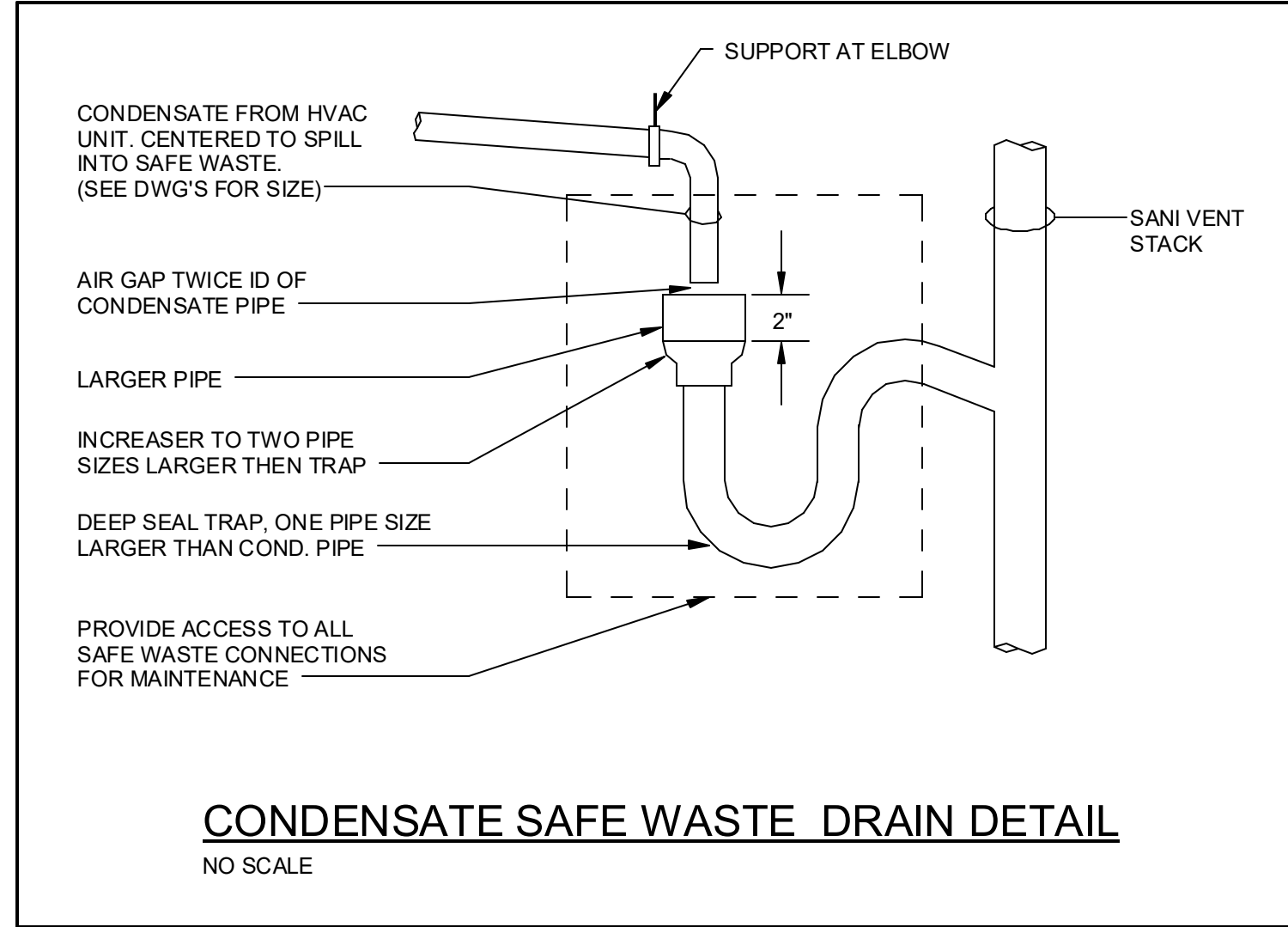
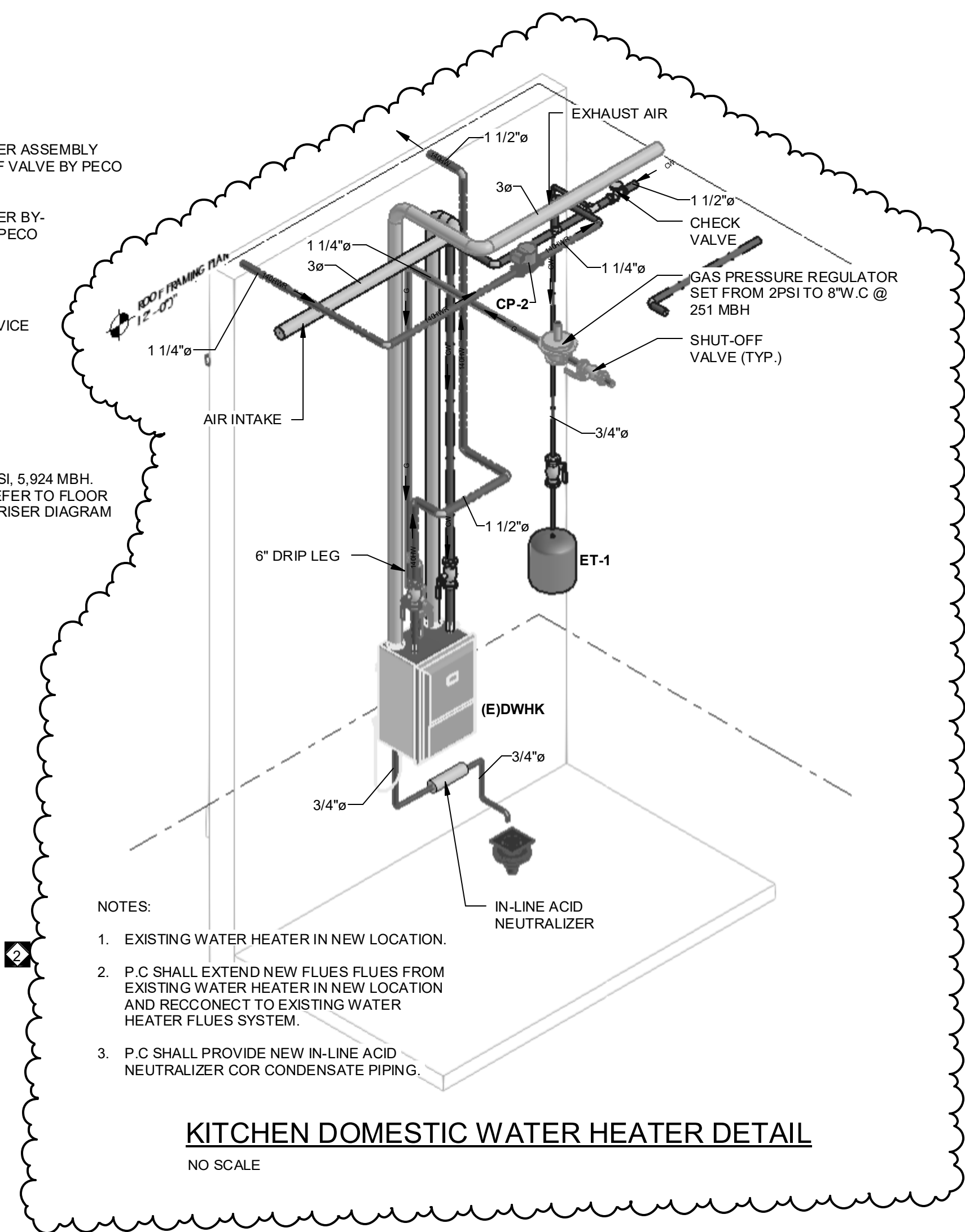
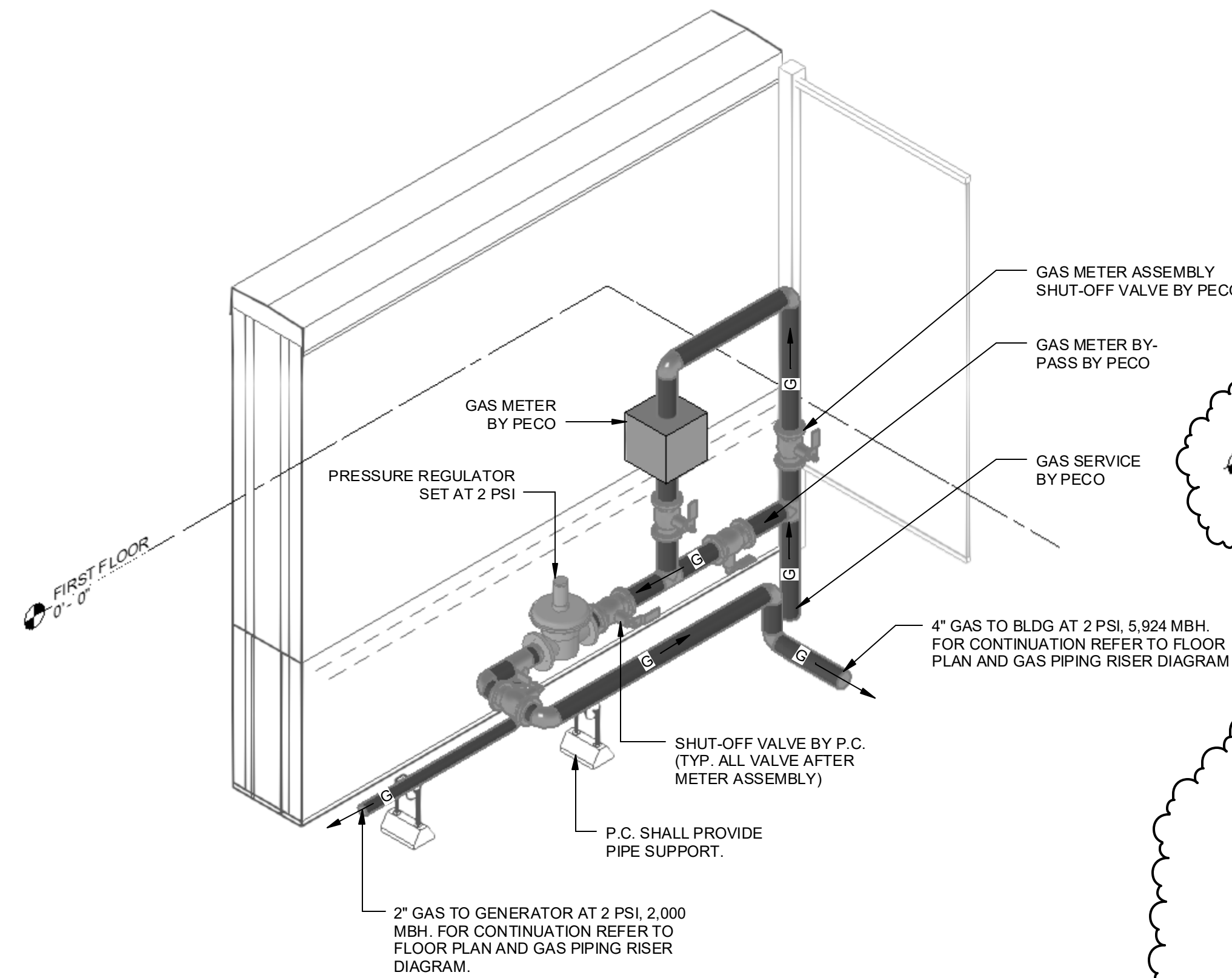
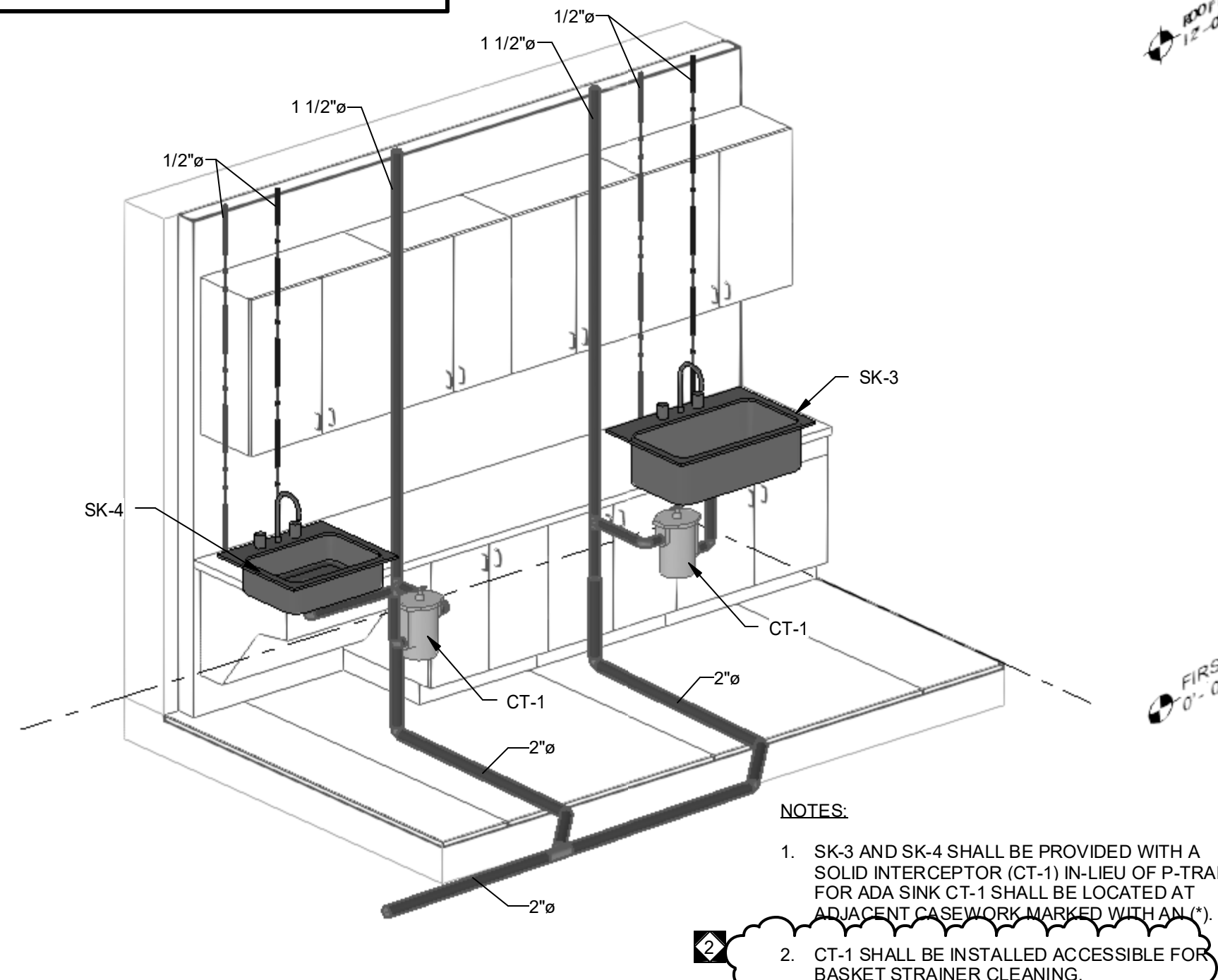
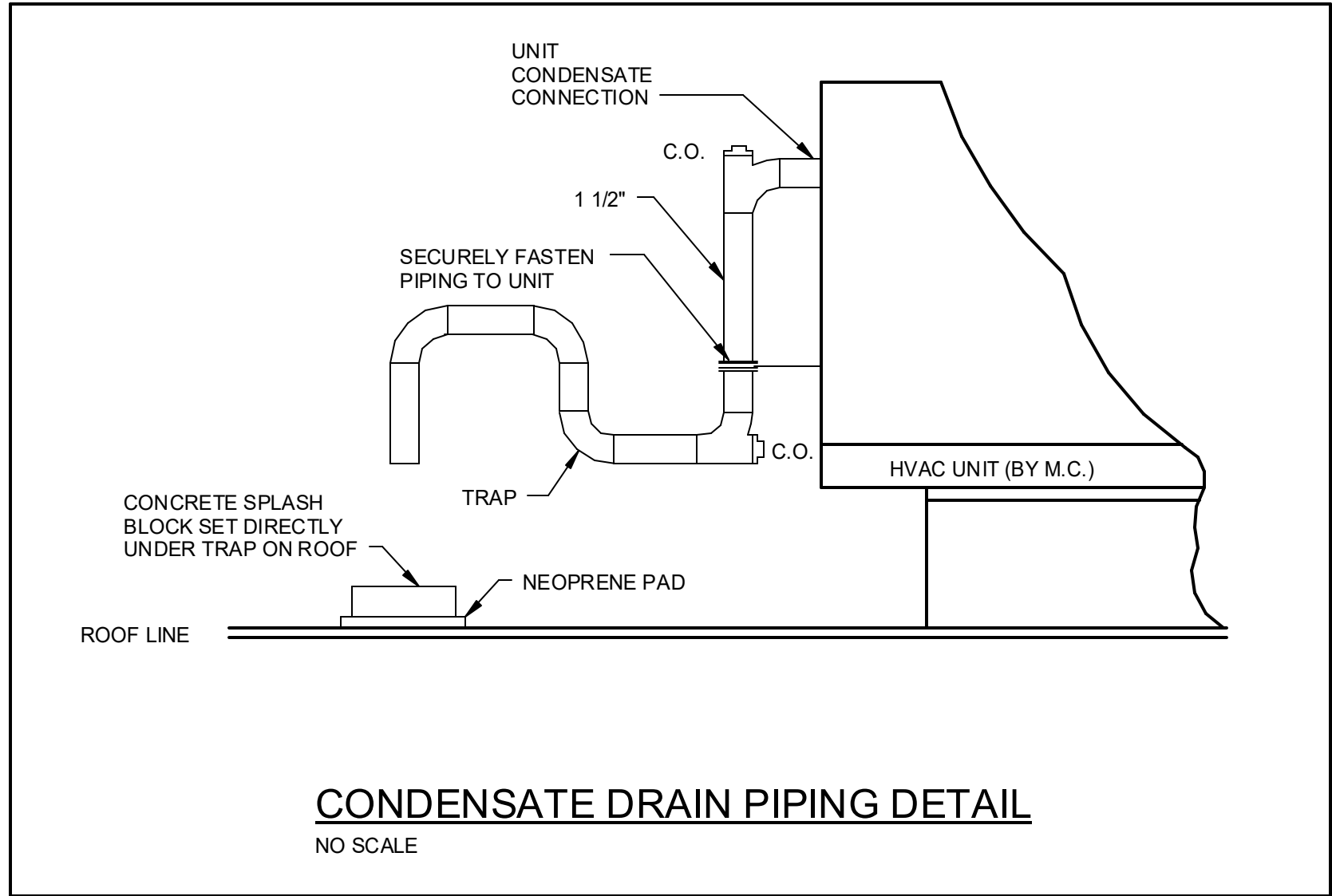
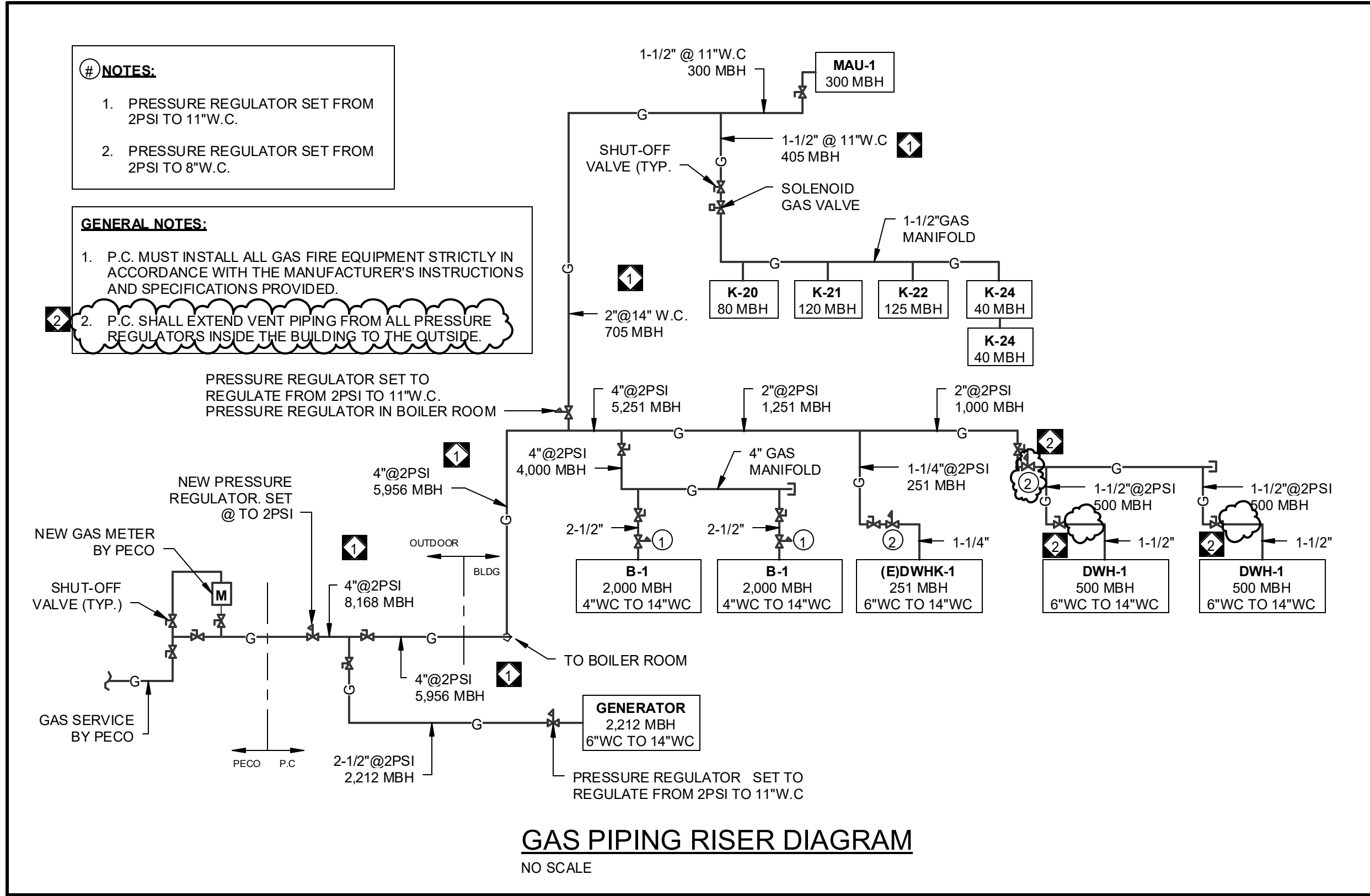
ENLARGED PLANS

PLOTSIZE  
1/4" = 1'-0"  
FILENAME  
240056  
DATE  
MARCH 30, 2025

PROJECT  
3758

P4.3

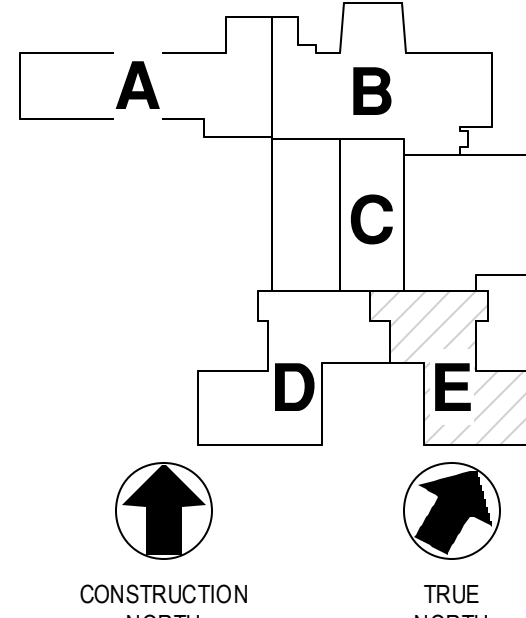




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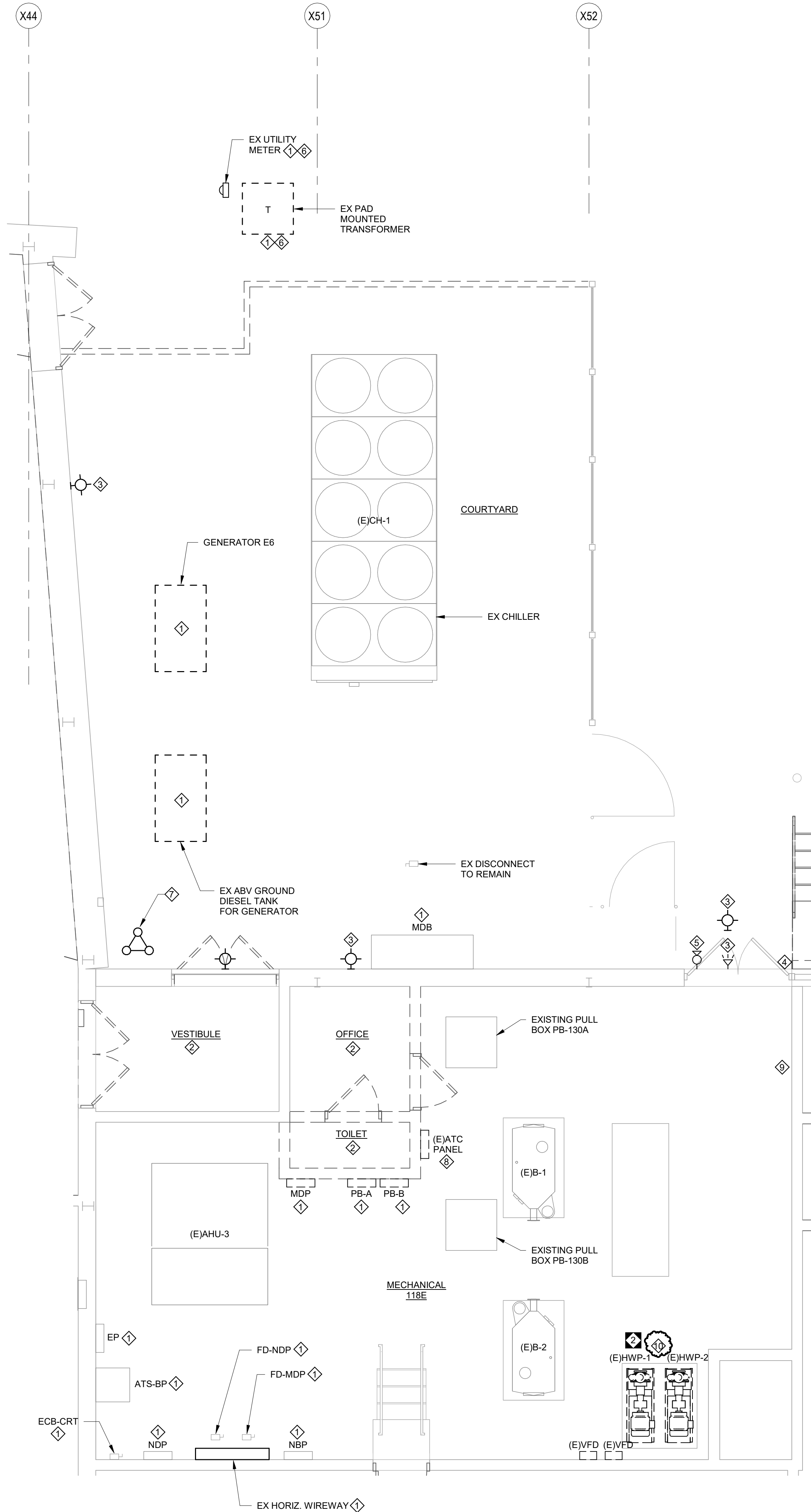


## DETAILS

PLOTS/SCALE  
As indicated  
FILENAME  
24066  
DATE  
MARCH 10, 2025

**PROJECT**  
3758

**P5.1**



1 ENLARGED PLAN DEMOLITION - MECHANICAL ROOM AND COURTYARD  
1/4" = 1'-0"

- DRAWING NOTES:**
- REFER TO EXISTING POWER RISER ON DRAWING E9.1 FOR WORK.
  - DISCONNECT AND REMOVE ALL LUMINAIRES AND ASSOCIATED CONTROLS, AND ALL ELECTRICAL EQUIPMENT AND DEVICES IN THIS SPACE/AREA, INCLUDING ALL WIRING/CONDUIT BACK TO SOURCE. THOROUGHLY CLEAN AND STORE LUMINAIRES TO REUSE AS SHOWN ON THE NEW WORK PLANS.
  - DISCONNECT AND REMOVE EXISTING LIGHT FIXTURE AND ASSOCIATED WIRING.
  - THREE EXISTING PHOTOCELLS AND EXISTING WIRING TO BE REMOVED.
  - EXISTING EXTERIOR CCTV CAMERA TO REMAIN. DISCONNECT AND REFEED AS NOTED ON DWGS.
  - REMOVE PAD MOUNTED TRANSFORMER PAD AND UTILITY METER IN THEIR ENTIRETY. ROUGH-IN GRADE TO MATCH ADJACENT AREA AND PREPARE SURFACE FOR FINAL FINISHES.
  - REMOVE EXISTING ANTENNA TOWER, ANTENNAS AND CABLING.
  - COORDINATE RELOCATION OF EXISTING ATC PANEL. TEMPORARILY EXTEND EXISTING BRANCH CIRCUIT TO RELOCATED PANEL UNTIL NEW SERVICE AND DISTRIBUTION IS AVAILABLE.
  - REPLACE EXISTING TELEPHONE BUILDING ENTRANCE TERMINAL AND COAX DISTRIBUTION SPLITTERS/TAPS.
  - DISCONNECT AND REMOVE EXISTING WIRE/CONDUIT AND ASSOCIATED ELECTRICAL DEVICES FOR PUMPS BEING REPLACED.



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ENLARGED DEMO PLAN

PLOT SCALE:  
1/4" = 1'-0"  
FILENAME:  
24066  
DATE:  
MARCH 10, 2025

PROJECT  
3758

E1.2



- GENERAL NOTES:**
1. ALL EXI EXIT SIGNS ARE EXISTING AND TO BE REMOVED/REINSTALLED AS REQUIRED FOR CONSTRUCTION. EX1A EXIT SIGNS ARE NEW. PROVIDE A NEW EXIT SIGN CIRCUIT AND CONNECT ALL EXIT SIGNS (EX1/EX1A) TO CIRCUIT ELA1-19.
  2. LIGHTING ROOM CONTROLLER LOCATIONS SHOWN ON DRAWINGS ARE FOR REFERENCE ONLY. MOUNT LIGHTING ROOM CONTROLLERS ABOVE ACCESSIBLE CEILINGS AT OR CLOSE TO ROOM/AREA ENTRANCES WHERE POSSIBLE.
  3. LIGHTING FIXTURES MUST BE COMPATIBLE WITH CONTROLS IN ALL SPACES. PROVIDE ADDITIONAL CONTROLLERS, WIRING/CONDUIT AND DEVICES AS REQUIRED FOR COMPLETE AND OPERABLE SYSTEM.

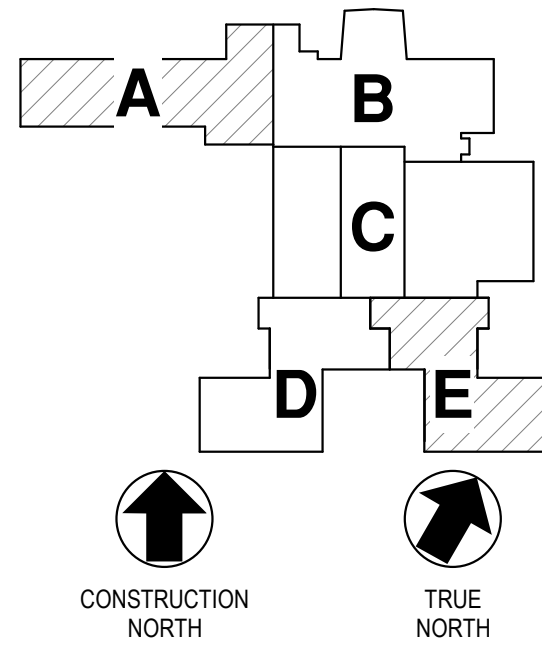
- DRAWING NOTES:**
1. REINSTALL EXISTING LIGHTING AS SHOWN. REWORK EXISTING WIRING/CONDUIT AND PROVIDE NEW AS REQUIRED FOR THE NEW LAYOUT.
  2. LIGHTING AND CONTROLS IN THIS SPACE ARE EXISTING TO REMAIN. PROVIDE REWORK OF EXISTING WIRING/CONDUIT AS REQUIRED FOR CONSTRUCTION.
  3. WIRE CIRCUIT THRU RELAY PANEL LCPA.
  4. EXISTING EMERGENCY LIGHTING CONTROL RELAY(S)/CONTROLLER(S). REINSTALL IN ACCESSIBLE LOCATION TO BE COORDINATED WITH CONSTRUCTION AND OTHER TRADES.
  5. EXISTING LIGHTING CONTROL RELAY(S)/CONTROLLERS. REINSTALL IN ACCESSIBLE LOCATION TO BE COORDINATED WITH CONSTRUCTION AND OTHER TRADES.
  6. EXISTING LIGHTING AND CONTROLS TO REMAIN. HOMERUN TO CIRCUIT INDICATED.
  7. EXISTING DISPLAY CASE LIGHT TO REMAIN. REWIRE AS SHOWN.
  8. CONNECT TYPE OC1 FIXTURES IN CANOPY TO CANOPY ROOM CONTROLLER SHOWN ON DRAWING E2.2.
  9. CONTINUED ON DRAWING E2.2 FOR TYPE OW2B FIXTURES.
  10. DAYLIGHT ZONE.
  11. CONNECT TO ROOM CONTROLLERS IN CORRIDOR A108.
  12. SPACE TYPE OG1 FIXTURES 120 DEGREES AROUND FLAG POLE.
  13. REINSTALL EXISTING LIGHTS AND LIGHTING CONTROL DEVICES IN THIS SPACE. PROVIDE REWORK OF EXISTING WIRING/CONDUIT AND PROVIDE NEW AS REQUIRED FOR CONSTRUCTION.
  14. FOR ROOM EXHAUST FAN SHOWN ON E3.1.

**MOORE**  
ENGINEERING COMPANY

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**KEY PLAN**



**REVISIONS**

NO.	DATE	DESCRIPTION OF CHANGES
1	3/19/2025	ADDENDUM 1
2	3/26/2025	ADDENDUM 2

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717-458-0272

TOWSON, MARYLAND  
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WHITE SULPHUR SPRINGS, WEST VIRGINIA

ADDITIONS AND RENOVATIONS TO  
**COOPERTOWN ELEMENTARY SCHOOL**  
SCHOOL DISTRICT OF HAVERFORD TOWNSHIP  
800 COOPERTOWN ROAD  
BRYN MAWR, PA. 19010

**CR**

FIRST FLOOR UNIT A  
LIGHTING

PLOT SCALE:  
1/8" = 1'-0"

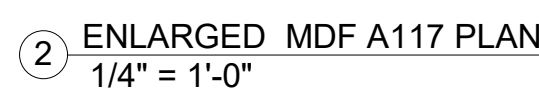
FILENAME:  
24066

DATE:  
MARCH 10, 2025

**PROJECT**  
3758

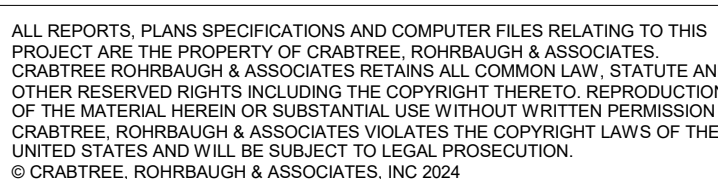
**E2.1**





1. ALL RECEPTACLES SHALL BE TAMPER RESISTANT.
2. PROVIDE NEW SURFACE MATE RACEWAY TO SERVICE POWER AND DATA FOR EXISTING WALLS. DEVICES IN NEW WALLS SHALL BE FLUSH MOUNTED. COORDINATE ALL OUTLETS AND RACEWAY LOCATIONS/ELEVATIONS WITH ARCHITECT AND OWNERS PRIOR TO RUSH-IN.
3. FOR EXISTING CLASSROOMS REFER TO TEACHING WALL TYPICAL DETAIL ON SHEET E-2.
4. FOR ALL ROOMS CONTAINING TELEPHONE, DATA, FIRE ALARM, PAGING, CLOCK AND SECURITY/ACCESS CONTROL OUTLETS/DEVICES, PROVIDE A 2" CONDUIT SLEEVE FOR LOW VOLTAGE CABLING FROM THE ROOM TO AN ADJACENT HALLWAY OR CEILING OR ADJACENT SPACE WITH A CONCEALED CEILING CONTAINING A LOW VOLTAGE SLEEVE TO ACCESSIBLE CORRIDOR CEILING.
5. REFER TO SPECIFICATIONS SECTION 260620 (2) FOR PANELBOARD SCHEDULES.
6. UNLESS OTHERWISE NOTED, RECEPTACLES SHOWN ON THIS SHEET ARE

1. PROVIDE WIRING/CONDUIT TO CU ON ROOF.
2. REFER TO DETAILS ON DRAWINGS E9.3 THROUGH E9.6 FOR WHETHER A SINGLE OR DOUBLE DUPLEX SHOULD BE PROVIDED.
3. SURFACE MOUNT ALONG BASE OF I.T. RACK/CABINET. ROUTE CONDUIT ALONG BASE OF RACK/CABINET TO WALL. COORDINATE WITH OWNER FOR LOCATION OF POWER ON RACK.
4. PROVIDE WALL MOUNTED TELECOMMUNICATION GROUNDING BUSBAR. REFER TO SPECIFICATION SECTION 270500, 3.2 FOR GROUNDING INFORMATION.
5. PROVIDE (3) 3" SQUARE E-Z-PATH ACOUSTICS/SMOKE SLEEVES OR EQUIVALENT TO ABOVE ADJACENT CORRIDOR CEILING.
6. COVER WALL WITH WALL MOUNTED, FIRE-RATED, PAINTED PLYWOOD BACKBOARD.
7. CUT AND PATCH WALL AS REQUIRED TO INSTALL PANELS RECESSED IN EXISTING WALL.
8. I.T. RACK/CABINET, TYP. REFER TO TELECOM RISER ON DWG E9.3.
9. DISPLAY CASE RECEPTACLE. REFER TO DWG NOTE 24/E1.1.
10. CONNECT TO EXISTING RECEPTABLES IN THIS SPACE AND PROVIDE HOMERUN AS SHOWN.
11. REWORK/EXTEND AND PROVIDE NEW WIRE/CONDUIT AS REQUIRED TO RELOCATE FIRE ALARM CIRCUITS TO PANEL AL1A AFTER THAT PANEL IS IN OPERATION. REFER TO PANELBOARD SCHEDULES FOR ADDITIONAL INFORMATION.
12. VERTICAL WIRE MANAGER ADJACENT TO EACH SIDE OF I.T. RACK.
13. COORDINATE EXACT RACEWAY ROUTING AND OUTLET HEIGHTS WITH ARCHITECT AND OWNER PRIOR TO ROUGH-IN.
14. DIVIDE SURFACE METAL RACEWAY (TYPICAL). ROUTE VERTICAL, CLOSE TO CORNER OF ROOM OR CABINETS/AS PRACTICAL.
15. ALIGN END OF RACEWAY WITH EDGE OF MARKER BOARD.
16. PROVIDE BUMP-UP DEVICE PLATES AT TEACHERS OUTLET AND TV OUTLET.
17. FOR COUNTERTOP SPRAY BOOTH, PROVIDE CLASS 1, DIVISION 1 OUTLET BOXES FOR WIRING CONNECTIONS TO BOOTH AND ELECTRICAL OUTLETS WITHIN 3 FEET OF BOTH OPENING OR WITHIN BOOTH. PROVIDE WIRING TO EXISTING FAN, INVERTER, CLARO 1000 1 EXPLOSION PROOF LIGHT FIXTURE (RAB MODEL PS-25) AND ASSOCIATED SWITCH.
18. AREA WITHIN SPRAY BOOTH AND 3 FEET FROM SPRAY BOOTH FRONT UPSWING SHALL BE WIRED AS A CLASS 1, DIVISION 1 HAZARDOUS AREA.
19. CONNECT TO EXISTING FAN SERVING THIS SPACE AND PROVIDE HOMERUN AS SHOWN.
20. WIRE TO WINDOW SHADE CONTROLLER "MLC" AT CEILING PER DETAIL 4/E9.2.
21. WINDOW SHADE CONTROLLER (MLC) AT CEILING. REFER TO DETAIL 4/E9.2 FOR WIRING. COORDINATE RAISE/LOWER WALL STATION(S) LOCATION WITH GC AND ARCHITECT. BASE BID, INCLUDE ONE STATION PER M.C.
22. WIRE FOR CONTROL VIA LIGHT SWITCH. REFER TO E2.1.

[illegible]

WHITE SULPHUR SPRINGS, WEST VIRGINIA

ADDITIONS AND RENOVATIONS TO  
COOPERTOWN ELEMENTARY SCHOOL  
SCHOOL DISTRICT OF HAVERFORD TOWNSHIP  
800 COOPERTOWN ROAD

800 COOPERTOWN ROAD  
BRYN MAWR, PA. 19010

PROJECT  
3758

### E3.1

CR

FIRST FLOOR UNIT A POWER

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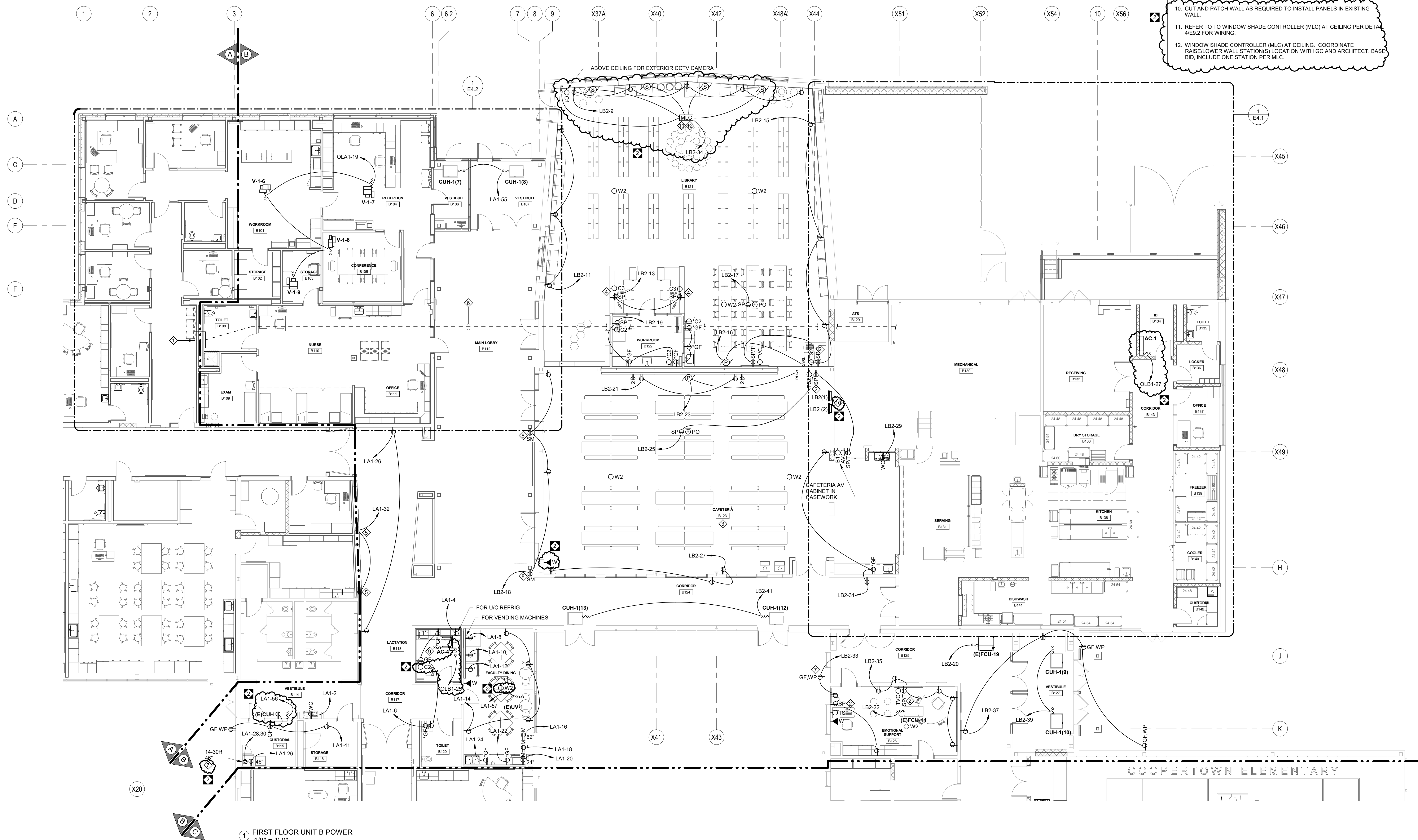
PLOT SCALE:  
**As indicated**

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FILENAME:  
**24066**

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DATE:  
**MARCH 10, 2025**



- ### GENERAL NOTES

- #### DRAWING NOTES:

## KEY PLAN

## REVISIONS

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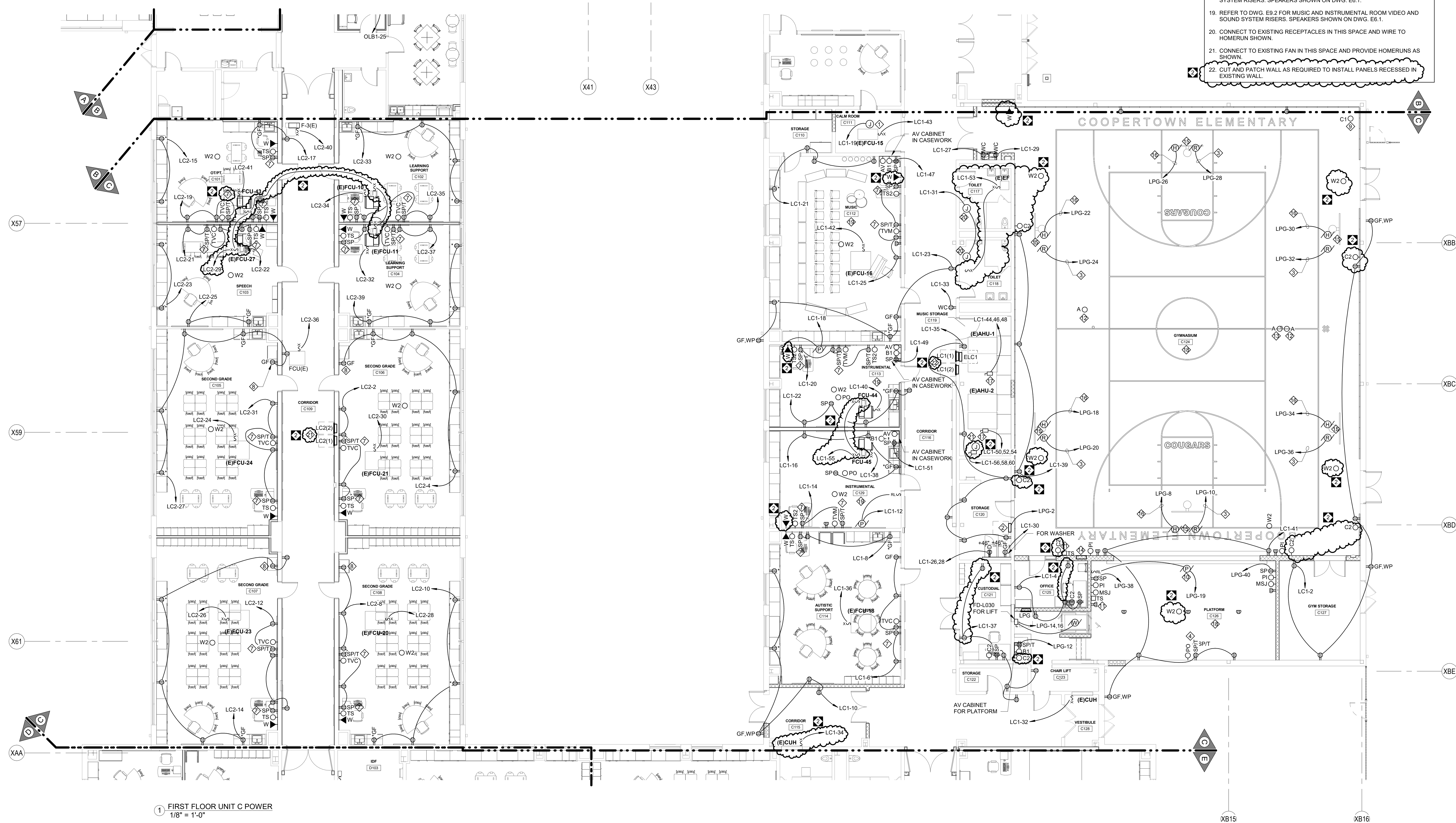
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3758

### E3.2





- ### GENERAL NOTES

-  DRAWING NOTES:

## KEY PLAN

## REVISIONS

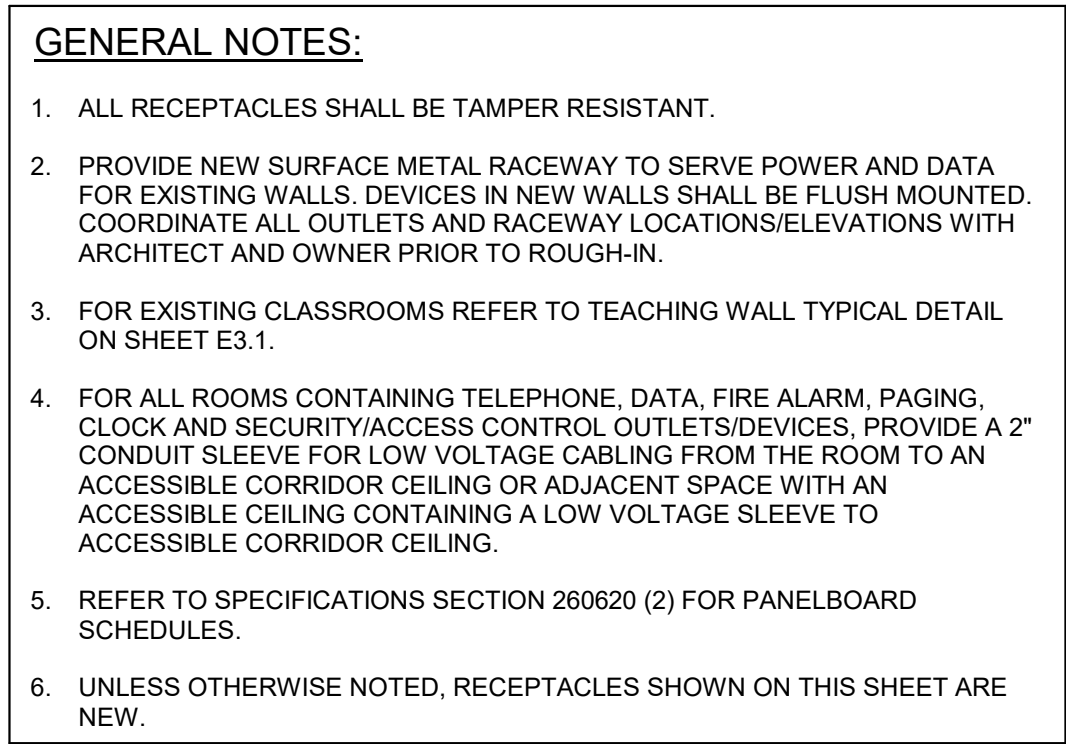
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### E3.3



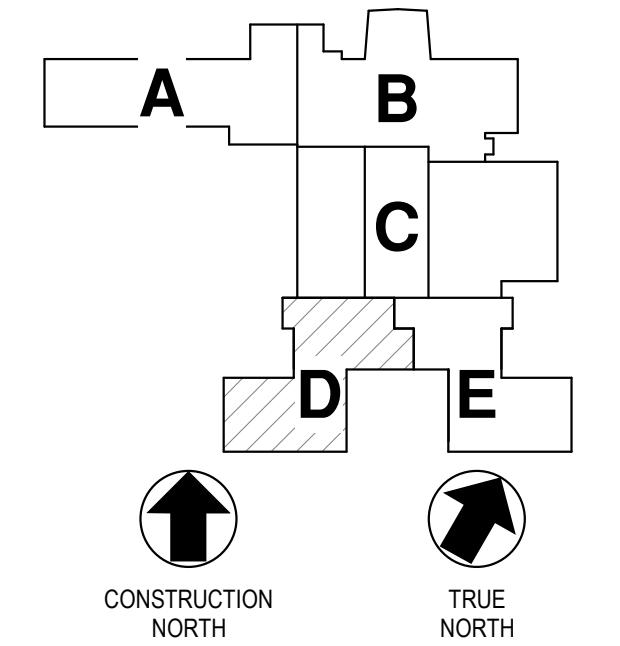
- ### DRAWING NOTES:
1. REFER TO DETAILS ON DWGS E9.3 THROUGH E9.6 FOR WHETHER A SINGLE OR DOUBLE DUCT SHALL BE PROVIDED.
  2. FOR MOBILE LAPTOP CHARGING CART.
  3. SURFACE MOUNT ALONG BASE OF I.T. RACK/CABINET. ROUTE CONDUIT ALONG BASE OF RACK/CABINET TO WALL. COORDINATE WITH OWNER FOR LOCATION OF POWER ON RACK.
  4. PROVIDE NEMA 1, 240V, 30A/2P FUSIBLE DISCONNECT SWITCH. PROVIDE FUSES PER EQUIPMENT MOPP.
  5. VERTICAL WIRE MANAGER ON BOTH SIDES OF IT RACK.
  6. PROVIDE WIRE/CONDUIT TO CU ON ROOF.
  7. REFER TO DWG. E9.3 FOR IDF RACKS/CABINETS AND EQUIPMENT.
  8. CUT AND PATCH WALL AS REQUIRED TO INSTALL PANELS RECESSED IN EXISTING WALL.
  9. WINDOW SHADE CONTROLLER (M/C) AT CEILING. COORDINATE BASE/LOWER WALL STATION/S WITH LOCATION WITH GC AND ARCHITECT. BASE BID, INCLUDE ONE STATION PER M/C.
  10. REFER TO WINDOW SHADE CONTROLLER (M/C) AT CEILING PER DETAIL 4E9.2 FOR WIRING.



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## KEY PLAN



## REVISIONS

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## ADDITIONS AND RENOVATIONS TO

COOPERTOWN ELEMENTARY SCHOOL

3800 COOPERTOWN ROAD  
BRYN MAWR, PA. 19010



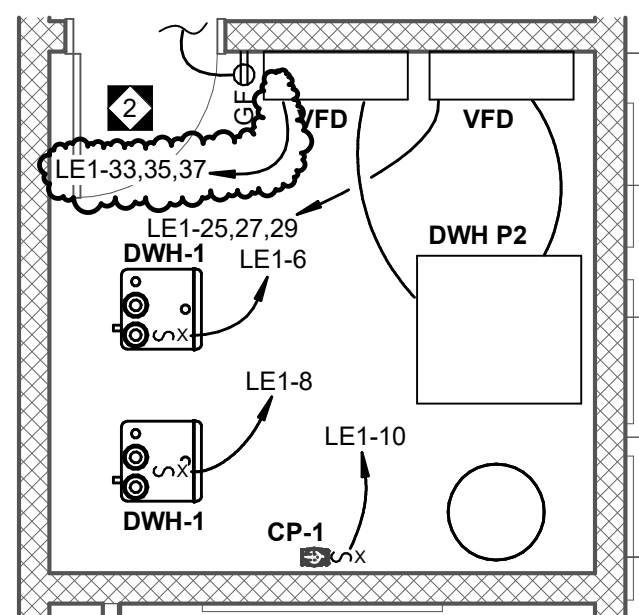
FIRST FLOOR UNIT D POWER

PLOT SCALE:	As indicated
FILENAME:	24066
DATE:	MARCH 10

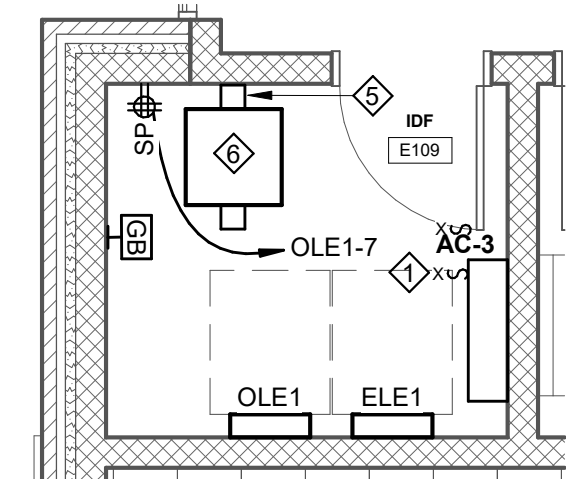
**PROJECT**  
3758

### E3.4

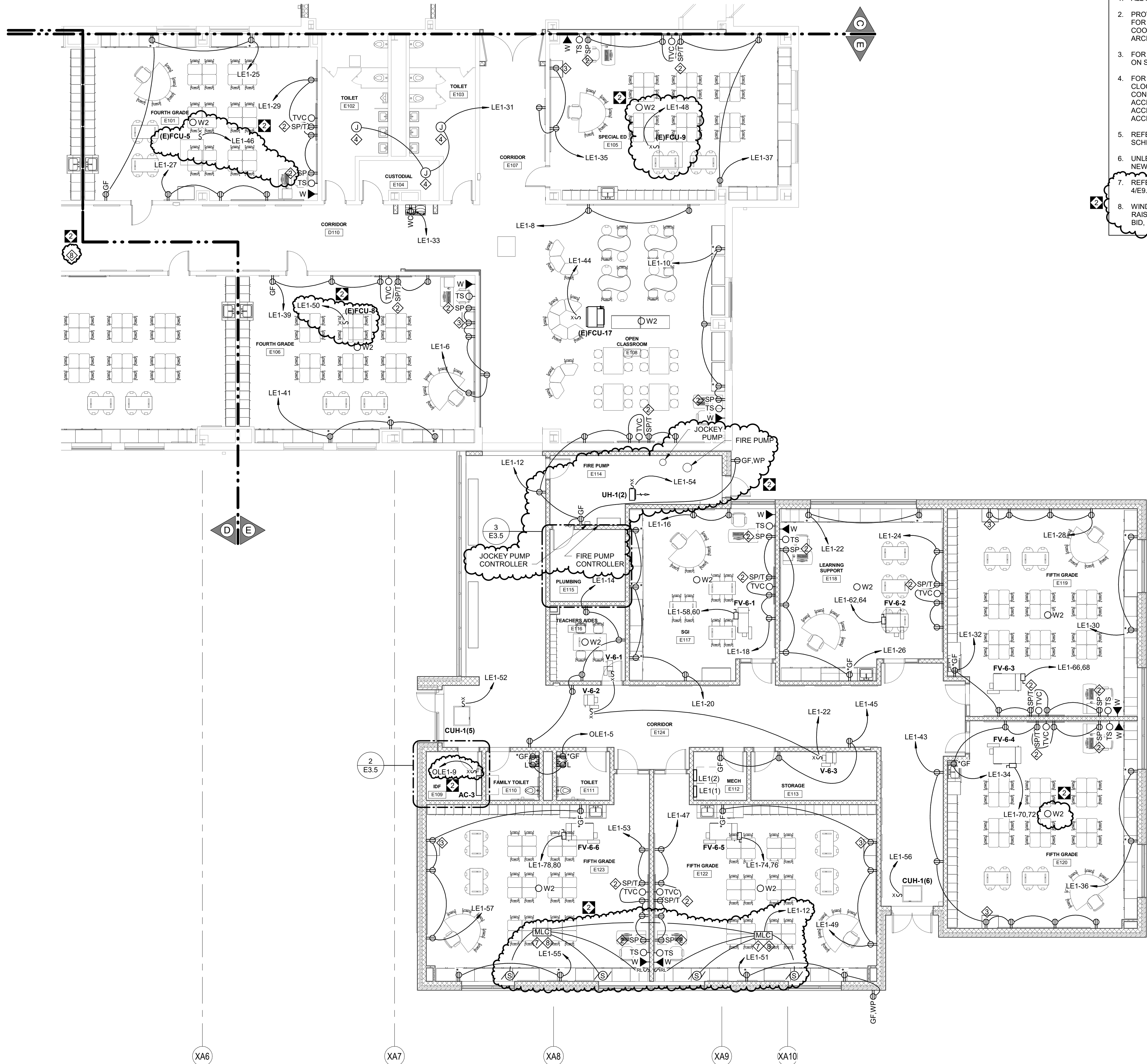




3 ENLARGED PLUMBING E115  
1/4" = 1'-0"



2 ENLARGED IDF E109  
1/4" = 1'-0"



1 FIRST FLOOR UNIT E POWER  
1/8" = 1'-0"

#### DRAWING NOTES:

1. PROVIDE WIRING/CONDUIT TO CU ON ROOF.
2. REFER TO DETAILS ON DRAWINGS E9.3 THROUGH E9.6 FOR WHETHER A SINGLE OR DOUBLE DUPLEX SHOULD BE PROVIDED.
3. FOR MOBILE LAPTOP CART.
4. CONNECT TO EXISTING RECEPTACLES IN THIS SPACE AND PROVIDE HOMERUN AS SHOWN.
5. VERTICAL MANAGER ON BOTH SIDES OF RACK.
6. FLOOR MOUNTED RACK. REFER TO DWG. E8.3 FOR RACK INFORMATION AND EQUIPMENT.

#### GENERAL NOTES:

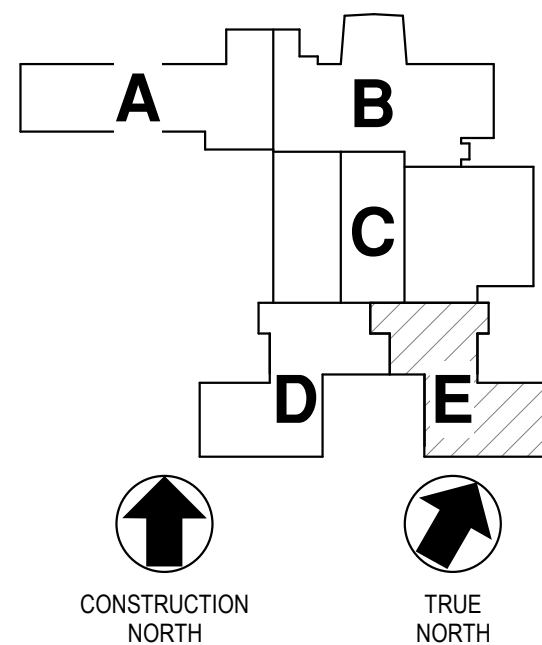
1. ALL RECEPTACLES SHALL BE TAMPER RESISTANT.
2. PROVIDE NEW SURFACE METAL RACEWAY TO SERVE POWER AND DATA FOR EXISTING WALLS. DEVICES IN NEW WALLS SHALL BE FLUSH MOUNTED. COORDINATE ALL OUTLETS AND RACEWAY LOCATIONS/ELEVATIONS WITH ARCHITECT AND OWNER PRIOR TO ROUGH-IN.
3. FOR EXISTING CLASSROOMS REFER TO TEACHING WALL TYPICAL DETAIL ON SHEET E3.1.
4. FOR ALL ROOMS CONTAINING TELEPHONE, DATA, FIRE ALARM, PAGING, CLOCK AND SECURITY/ACCESS CONTROL OUTLETS/DEVICES, PROVIDE A 2" CONDUIT SLEEVE FOR LOW VOLTAGE CABLING FROM THE ROOM TO AN ACCESSIBLE CORRIDOR CEILING OR ADJACENT SPACE WITH AN ACCESSIBLE CEILING CONTAINING A LOW VOLTAGE SLEEVE TO ACCESSIBLE CORRIDOR CEILING.
5. REFER TO SPECIFICATIONS SECTION 280620 (2) FOR PANELBOARD SCHEDULES.
6. UNLESS OTHERWISE NOTED, RECEPTACLES SHOWN ON THIS SHEET ARE NEW.
7. REFER TO WINDOW SHADE CONTROLLER (MLC) AT CEILING PER DETAIL 4/E9.2 FOR WIRING.
8. WINDOW SHADE CONTROLLER (MLC) AT CEILING. COORDINATE RAISE/LOWER WALL STATION(S) LOCATION WITH GC AND ARCHITECT. BASE BID. INCLUDE ONE STATION PER MLC.



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#### KEY PLAN



#### REVISIONS

NO.	DATE	BY	DESCRIPTION OF CHANGES
2	3/28/2025		ADDENDUM 2

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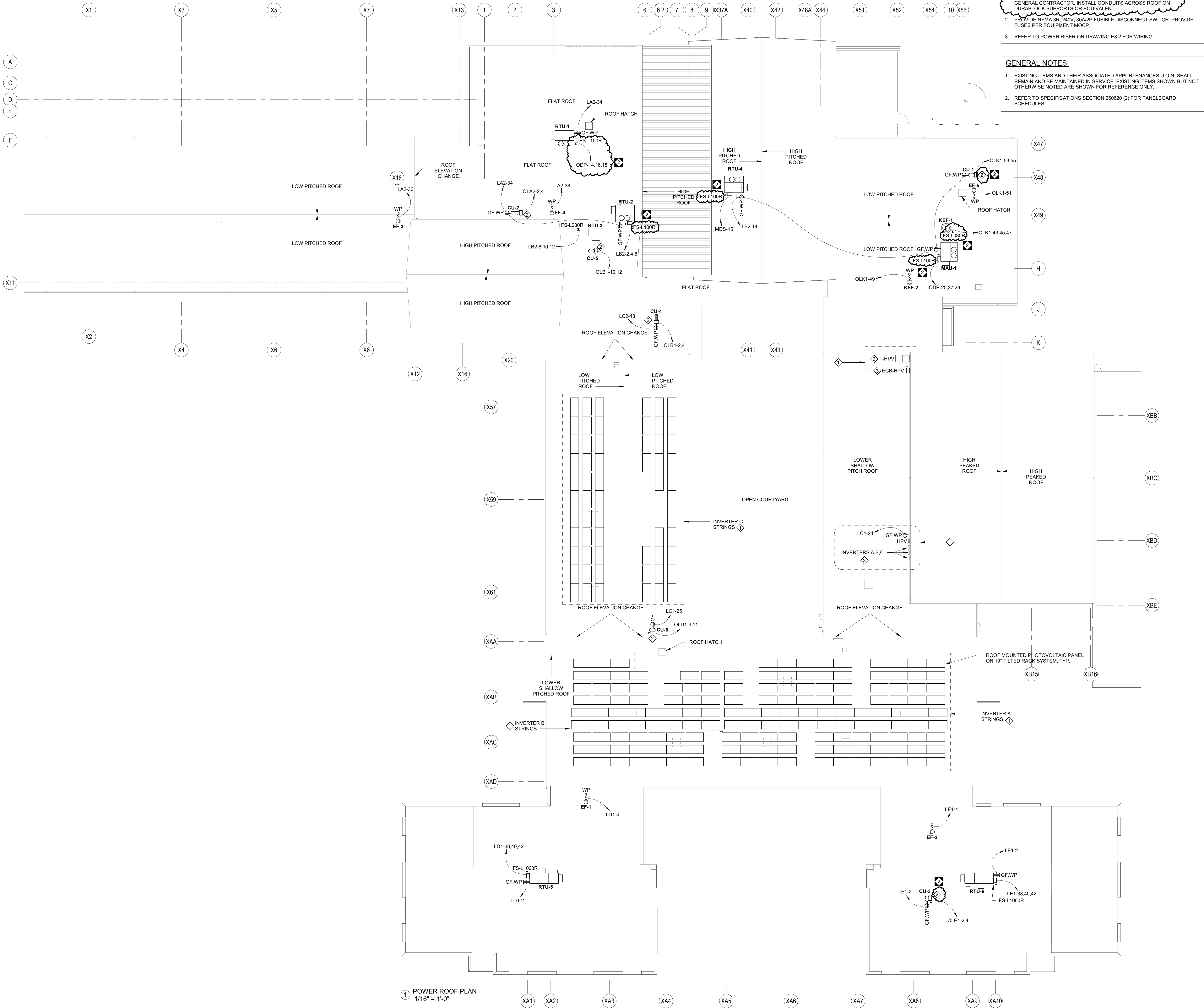
FIRST FLOOR UNIT E POWER

PLOT SCALE:  
As indicated  
24066  
DATE:  
MARCH 10, 2025

PROJECT  
3758

E3.5





- DRAWING NOTES:**
1. WORK PROVIDED AS PART OF ELECTRICAL ALTERNATE EC-3. ROUTE CABLES OVER ROOF ON SUPPORTS AS REQUIRED. ELECTRICAL CONTRACTOR SHALL COORDINATE ALL ROOF PENETRATIONS WITH GENERAL CONTRACTOR. INSTALL CONDUITS ACROSS ROOF ON DURABLE LOOK SUPPORTS OR EQUIVALENT.
  2. PROVIDE NEMA 3R, 240V, 30A/2P FUSIBLE DISCONNECT SWITCH. PROVIDE FUSES PER EQUIPMENT MOC.
  3. REFER TO POWER RISER ON DRAWING E8.2 FOR WIRING.

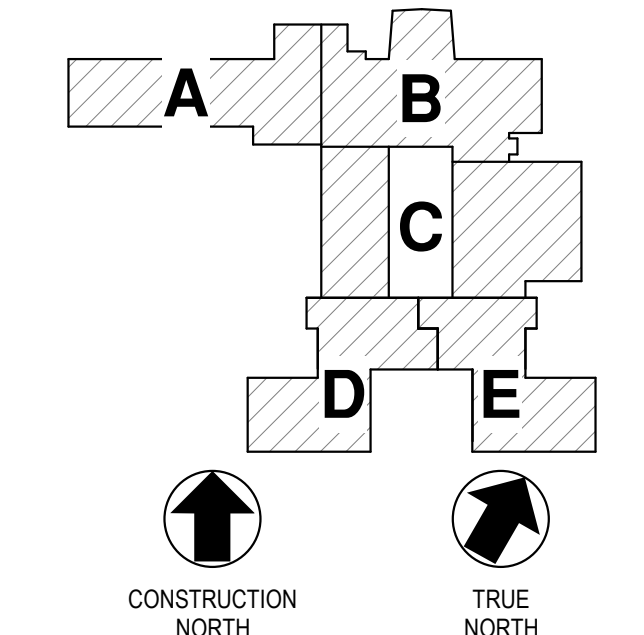
- GENERAL NOTES:**
1. EXISTING ITEMS AND THEIR ASSOCIATED APPURTENANCES U.O.N. SHALL REMAIN AND BE MAINTAINED IN SERVICE. EXISTING ITEMS SHOWN BUT NOT OTHERWISE NOTED ARE SHOWN FOR REFERENCE ONLY.
  2. REFER TO SPECIFICATIONS SECTION 260620 (2) FOR PANELBOARD SCHEDULES.



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### KEY PLAN



### REVISIONS

NO.	DATE	NAME	DESCRIPTION OF CHANGES
2	3/28/2025		ADDENDUM 2

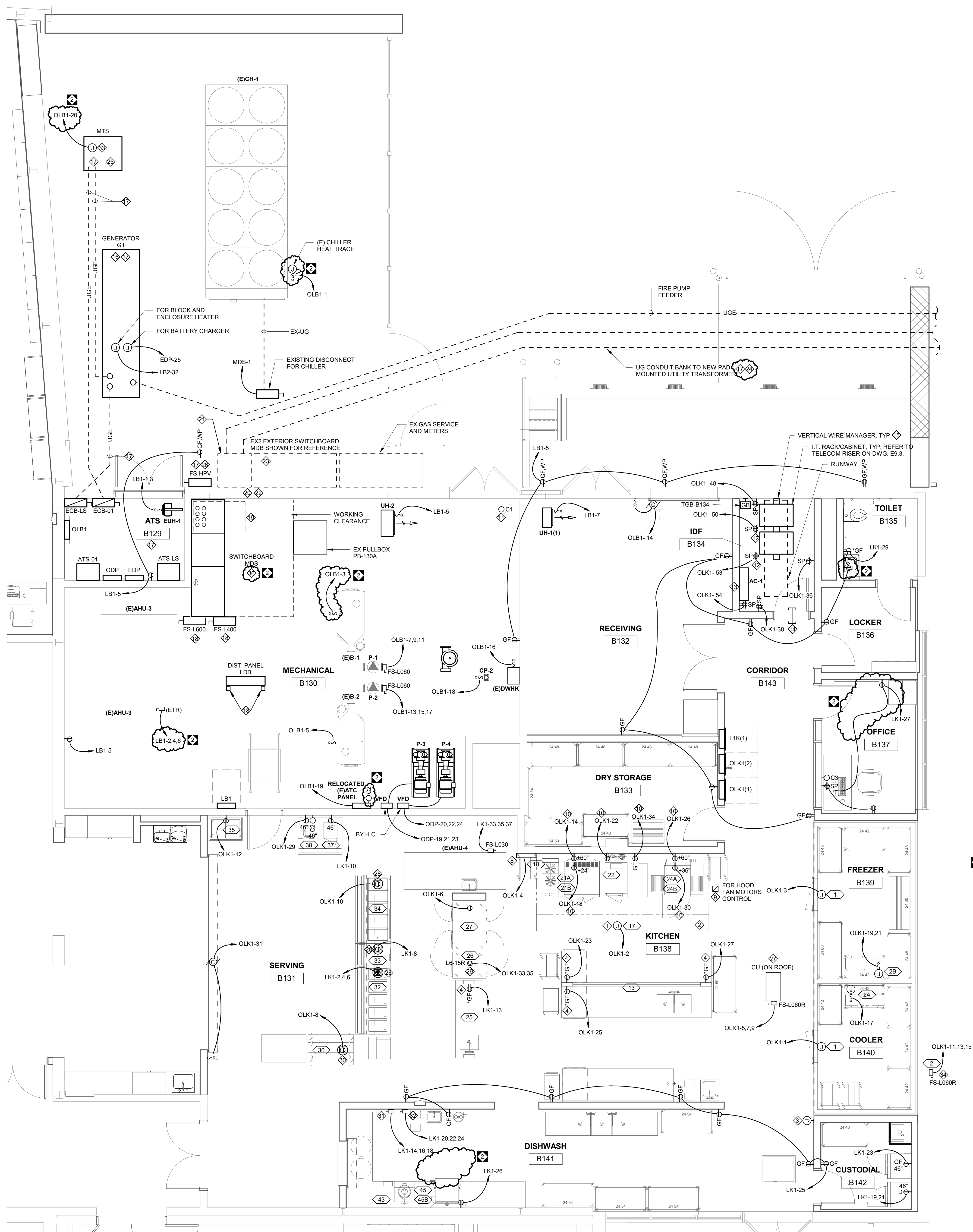
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ROOF ELECTRICAL  
PLOT SCALE:  
1/16" = 1'-0"  
FILENAME:  
24066  
DATE:  
MARCH 10, 2025

PROJECT  
3758  
E3.6



1 ENLARGED KITCHEN / MECHANICAL PLAN  
1/4" = 1'-0"

GENERAL NOTES:

1. PROVIDE ALL FOOD SERVICE ROUGH-INS PER FOOD SERVICE EQUIPMENT PLAN FS102.
2. COORDINATE ALL FINAL KITCHEN EQUIPMENT WIRING DEVICES AND OUTLET LOCATIONS WITH THE APPROVED KITCHEN EQUIPMENT ROUGH-IN DRAWINGS.
3. IF FINAL KITCHEN EQUIPMENT HAS A CORD AND PLUG CONNECTION IN LIEU OF HARDWIRED, PROVIDE GROUND FAULT PROTECTION IN ACCORDANCE WITH NEC 210.8(B).
4. REFER TO SPECIFICATIONS SECTION 260620 (2) FOR PANELBOARD SCHEDULES.

DRAWING NOTES:

1. PROVIDE ALL CONDUIT/WIRING AS REQUIRED FOR HOOD, HOOD ACCESSORIES AND HOOD CONTROL SYSTEM. REFER TO HOOD CONTROL DETAIL ON FOOD SERVICE DRAWINGS.
2. PROVIDE CONDUIT/WIRING AS REQUIRED BETWEEN HOOD CONTROL SYSTEM AND ROOF TOP HOOD EXHAUST SYSTEM.
3. PROVIDE FLUSH MOUNTED OCTAGONAL BOX AND CONCEALED 3/4" CONDUIT WITH NO 90-DEGREE BENDS BETWEEN RECESSED REMOTE PULL STATION AND FIRE SUPPRESSION SYSTEM PANEL.
4. STUB DOWN FROM ABOVE CEILING, WIRE THROUGH UTILITY CHASE. COUNTER PROVIDED WITH EMPTY BOXES, EC TO PROVIDE ALL WIRING/CONDUIT OUTLETS AND CONNECTIONS AS REQUIRED.
5. NOT USED
6. NOT USED
7. NOT USED
8. PROVIDE WIRING TO CONTROL 6-POLE CONTACTOR AND GAS SOLENOIDS USED WITH EQUIPMENT PROTECTED BY RESPECTIVE FIRE SUPPRESSION SYSTEM.
9. PROVIDE 6-POLE MECHANICALLY HELD CONTACTOR WITH 2-WIRE CONTROL COIL IN A NEMA 1 ENCLOSURE. CONTACTOR SHALL BE USED WITH CIRCUITS AT HOOD EQUIPMENT #17. CONTACTOR SHALL BE LOCATED ABOVE CEILING AT PANEL OLK1. REFER TO HOOD CONTROL AND TYPICAL ANSUL UL300 R-102 FIRE PROTECTION SYSTEM DETAILS.
10. WIRE CIRCUIT THRU 6-POLE CONTACTOR.
11. FOR EXTERIOR CCTV CAMERA.
12. SURFACE MOUNT ALONG BASE OF I.T. RACK/CABINET ROUTE CONDUIT ALONG BASE OF RACK/CABINET TO WALL.
13. COVER 4" WIDE WIDTH OF WALL WITH FIRE-RATED, PAINTED PLYWOOD BACKBOARD.
14. PROVIDE TWO (2) 3" SQUARE EZ-PATH ACOUSTIC/SMOKE SLEEVE OR EQUIVALENT TO ABOVE ADJACENT ACCESSIBLE CEILING AREA.
15. PROVIDE ON EACH SIDE OF EACH I.T. RACK.
16. REFER TO POWER RISER ON DRAWING E8.2 FOR GENERATOR START WIRING AND ANNUNCIATOR WIRING. INSTALL WIRING IN DEDICATED RACEWAYS.
17. REFER TO POWER RISER FOR WIRING ON DRAWING E8.2.
18. MOUNT ON UNISTRUT SUPPORTS.
19. PROVIDE PULL BOX ABOVE SWITCHBOARD SIZED AS REQUIRED.
20. PROVIDE BLANK OFF PANEL FOR WINDOW PENETRATION OF CONDUIT BANK.
21. PROVIDE LARGE EXTERIOR PULL BOX PB-SE FOR SERVICE FEEDER CONDUIT RISE FROM UNDERGROUND.
22. SERVICE ENTRANCE FEEDER ROUTING ABOVE EXISTING SWITCHBOARD MDB.
23. PROVIDE TEMPORARY FIRE PUMP TAP. REFER TO EXISTING POWER RISER ON E8.1.
24. CONDUIT BANK INCLUDES SERVICE ENTRANCE FEEDER, FIRE PUMP FEEDER (TEMPORARY AND PERMANENT) AND FIRE PUMP GENERATOR START CIRCUIT.
25. PROVIDE GENERATOR START CIRCUIT FOR RENTAL GENERATOR IN SEPARATE DEDICATED CONDUIT.
26. FOR UTILITY/FIRST RESPONDER PHOTOVOLTAIC SHUTOFF. PLACARD PER NEC REQUIREMENTS.
27. COORDINATE LOCATION WITH GC AND PSEC.
28. PROVIDE KITCHEN FLOOR PEDASTAL OUTLET.
29. PROVIDE 3-FOOT TYPE 50 CORD WITH L6-15P CONNECTOR AND A 6-15P CONNECTOR. CONFIRM AND COORDINATE RECEPTACLE AND PLUG CONFIGURATION IN FIELD PRIOR TO ROUGH-IN.
30. PROVIDE RECESSED FLOOR OUTLET.
31. PROVIDE 30A, 240V, 3-POLE FUSIBLE DISCONNECT SWITCH IN NEMA 4X ENCLOSURE. PROVIDE FUSED SIZED FOR EQUIPMENT.
32. PROVIDE 60A, 240V, 3-POLE FUSIBLE DISCONNECT SWITCH IN NEMA 4X ENCLOSURE. PROVIDE FUSED SIZED FOR EQUIPMENT.
33. FOR MTS STRIP HEATER.
34. COORDINATE IN FIELD EXACT LOCATION OF WALK-IN COOLER/FREEZER REFRIGERATION RACK SYSTEM ON GRADE OR ON ROOF WITH FOOD SERVICE INSTALLER PRIOR TO ROUGH-IN. LOCATION WITHIN 100 CONDUCTOR FEET OF THIS LOCATION SHALL BE INCLUDED IN BID.
35. PROVIDE GENERATOR PAD PER DETAIL 1/E8.2
36. PROVIDE 4" HOUSEKEEPING PAD FOR SWITCHBOARD.



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NO.	DATE	NAME	DESCRIPTION OF CHANGES
2	3/28/2025		ADDENDUM 2

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800 COOPERTOWN ROAD  
BRYN MAWR, PA. 19010

CR

PARTIAL PLANS

PLOT SCALE:  
1/4" = 1'-0"  
FILENAME:  
240066  
DATE:  
MARCH 10, 2025

PROJECT  
3758

E4.1



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NO.	DATE	NAME	DESCRIPTION OF CHANGES
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## ADDITIONS AND RENOVATIONS TO

## COOPERTOWN ELEMENTARY SCHOOL

## SCHOOL DISTRICT OF HAVERFORD TOWNSHIP

800 COOPERTOWN ROAD

BRYN MAWR, PA. 19010

# CR

ENLARGED PLANS

PLOT SCALE:  
1/4" = 1'-0"  
FILENAME:  
240066  
DATE:  
MARCH 10, 2025

PROJECT  
3758

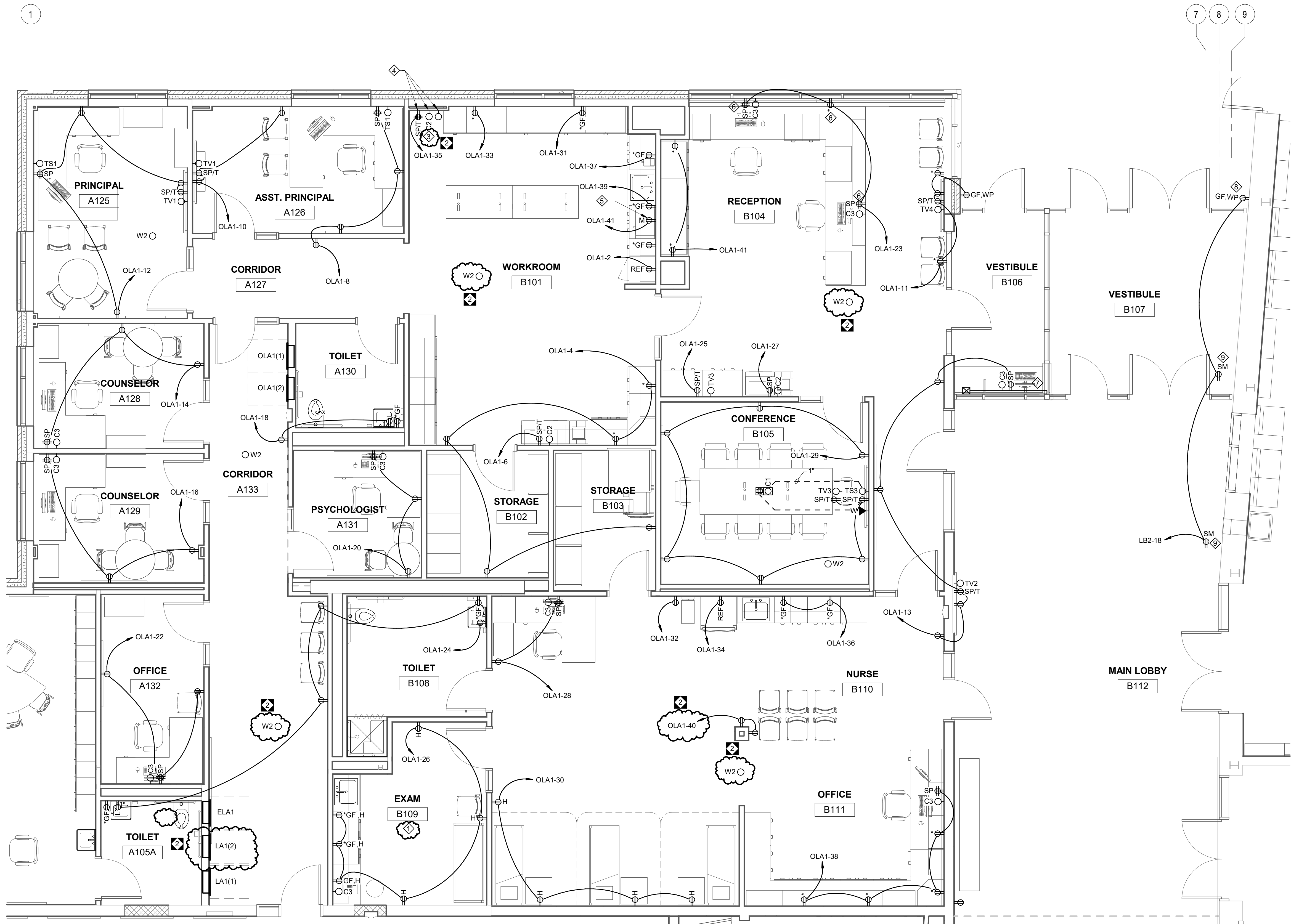
# E4.2

### GENERAL NOTES:

- COORDINATE ALL TELEVISION MOUNTING HEIGHTS AND LOCATIONS IN FIELD PRIOR TO ROUGH-IN.
- ALL RECEPTACLES SHALL BE TAMPER RESISTANT.
- REFER TO SPECIFICATIONS SECTION 260620 (2) FOR PANELBOARD SCHEDULES.

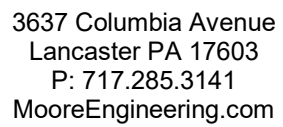
### DRAWING NOTES:

- PROVIDE HOSPITAL GRADE DEVICES AND WIRING IN THIS ROOM.
- PROVIDE 2-CHANNEL SURFACE RACEWAY TO UNDERSIDE OF COUNTER SURFACE, FACING DOWN. PAINT IN COLOR SELECTED BY ARCHITECT.
- FOR INTERCOM/PA SYSTEM CABINET.
- PROVIDE 12"x12"x4" FLUSH MOUNTED PULLBOX AT 18" AFF FOR INTERCOM/PA SYSTEM WIRING COVER. PROVIDE (2) 1-1/2" CONDUIT FROM BOX AND STUB OUT ABOVE CEILING WITH PLASTIC BUSHINGS.
- COORDINATE MOUNTING HEIGHT AND LOCATION IN FIELD WITH MICROWAVE SHELF AND ARCHITECTURAL ELEVATIONS.
- CONCEAL WIRING IN CASEWORK TO WALL.
- MOUNT IN SURFACE RACEWAY UNDER COUNTER.
- CUT AND PATCH STONE WALL FINISH AS REQUIRED TO INSTALL RECEPTACLE FLUSH.
- HOMERUN TO RECEPTACLE SHALL BE WIRED BELOW FINISHED FLOOR.



1 ENLARGED ADMIN PLAN  
1/4" = 1'-0"





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01	MM-DD-YR	NAME	DESCRIPTION OF CHANGES
2	3/26/2025		ADDENDUM 2

01	MM-DD-YR	NAME	DESCRIPTION OF CHANGES
2	3/26/2025		ADDENDUM 2

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800 COOPERTOWN ROAD

PROJECT  
3758

## E5.1

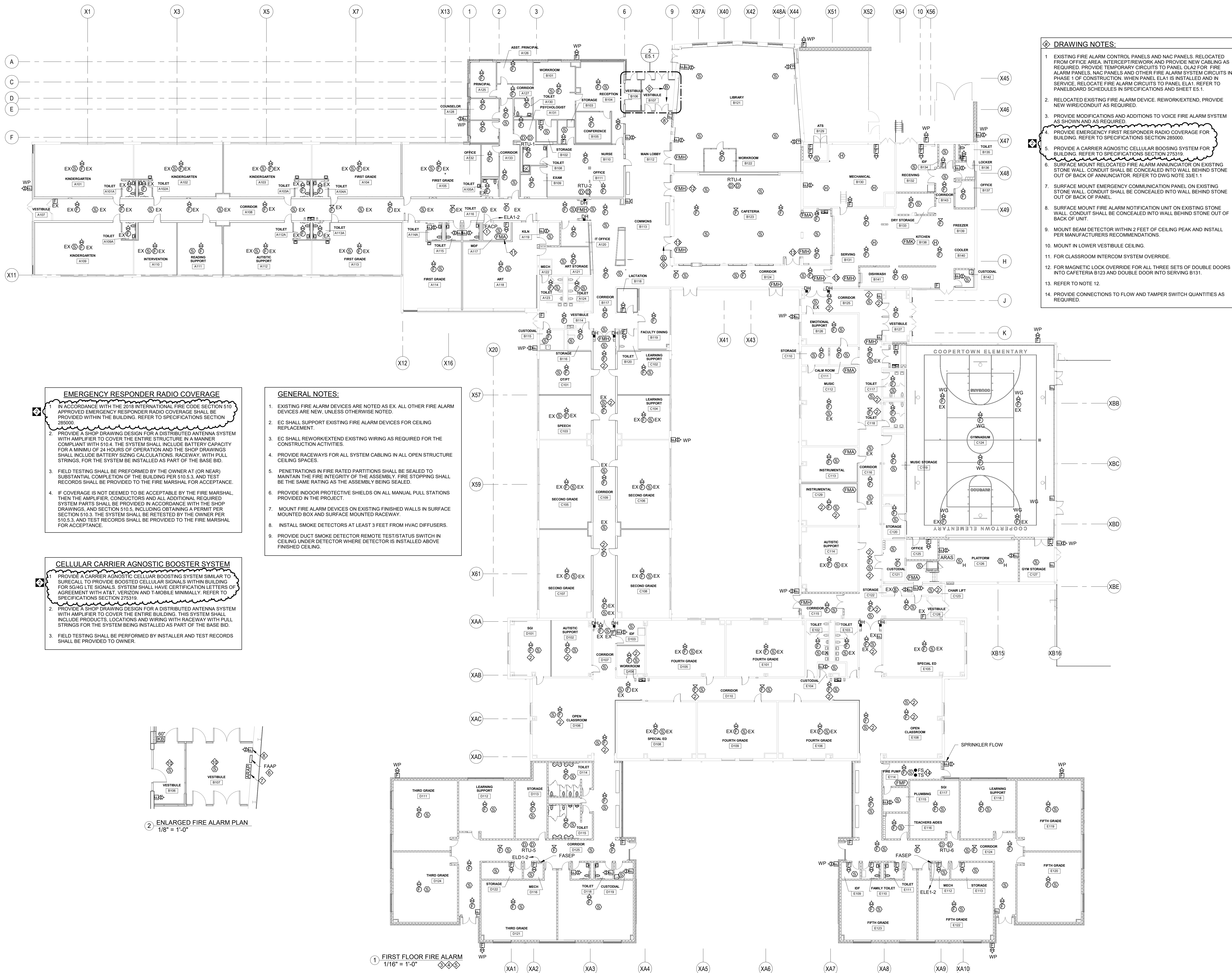
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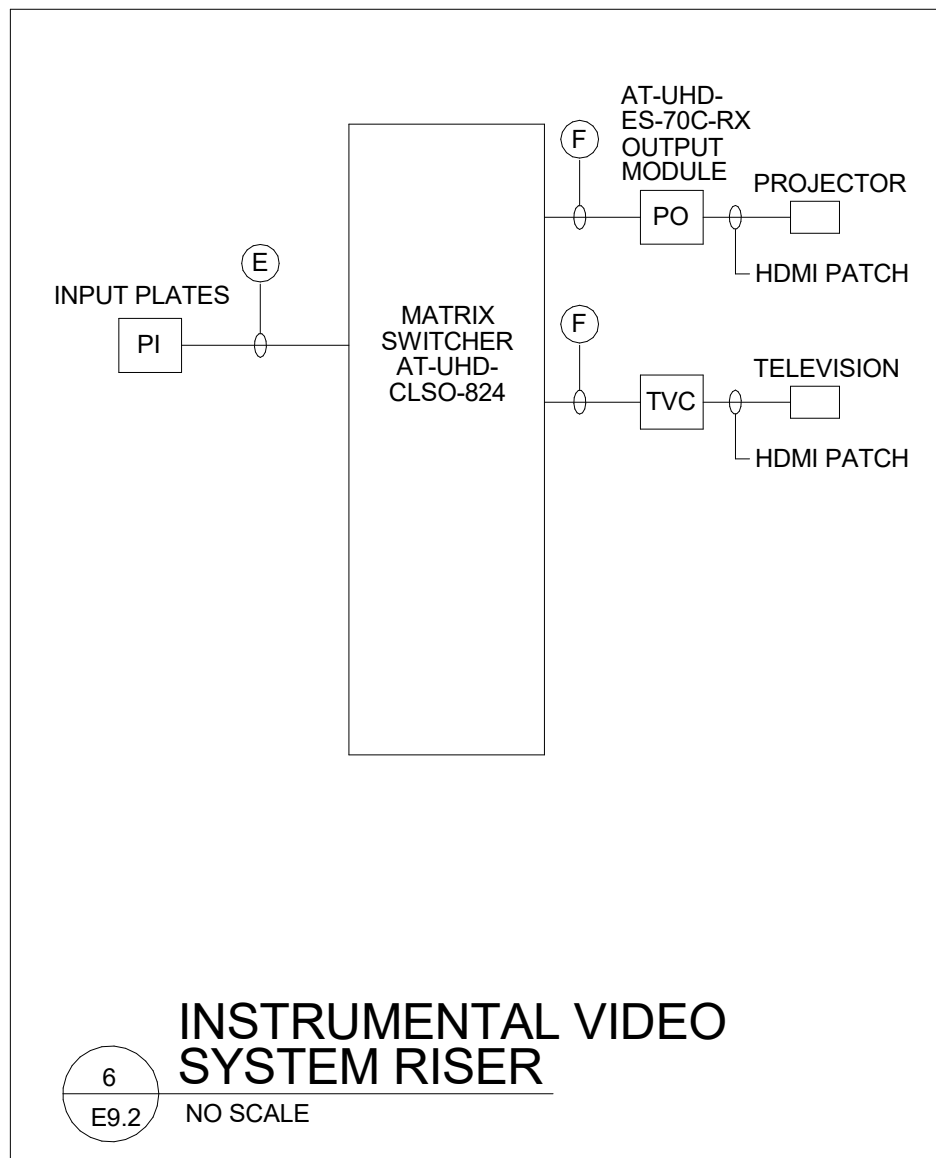
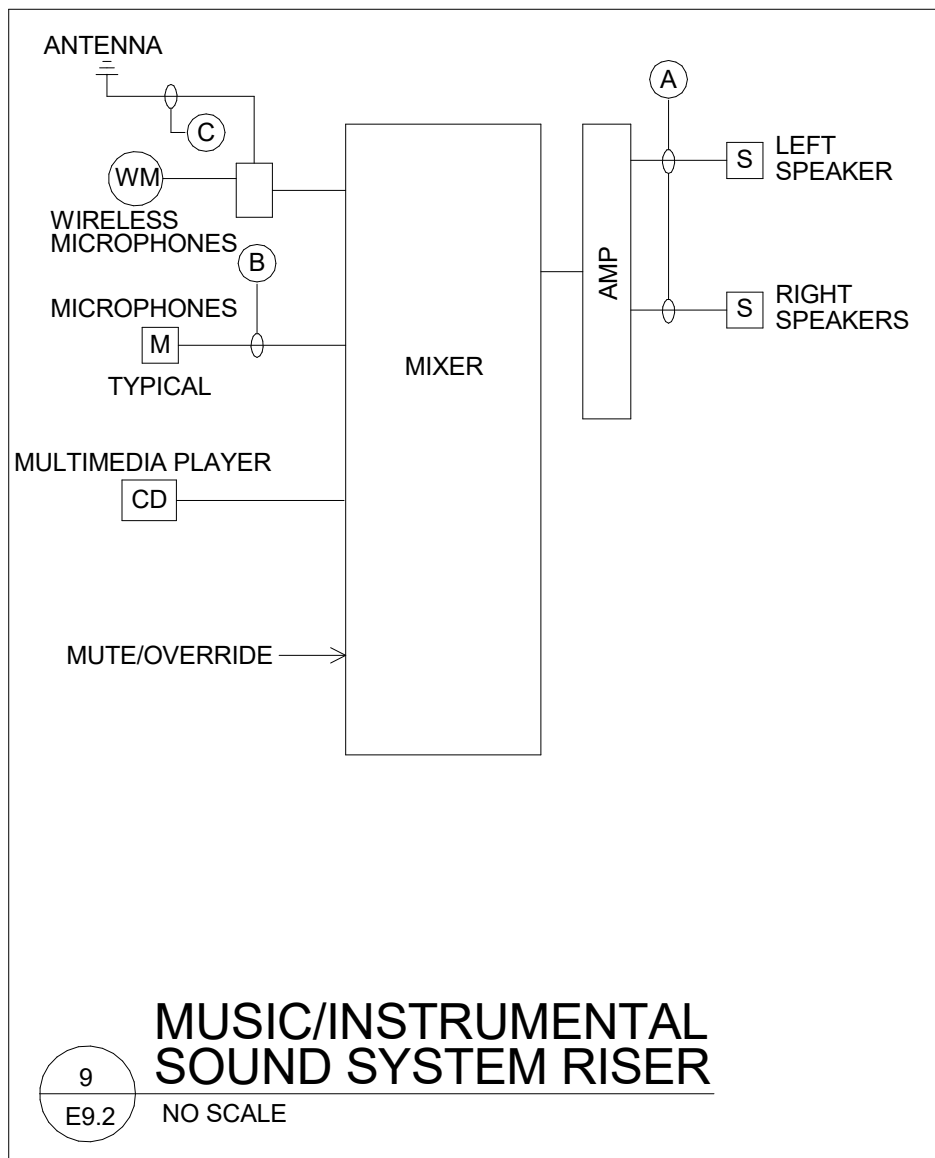
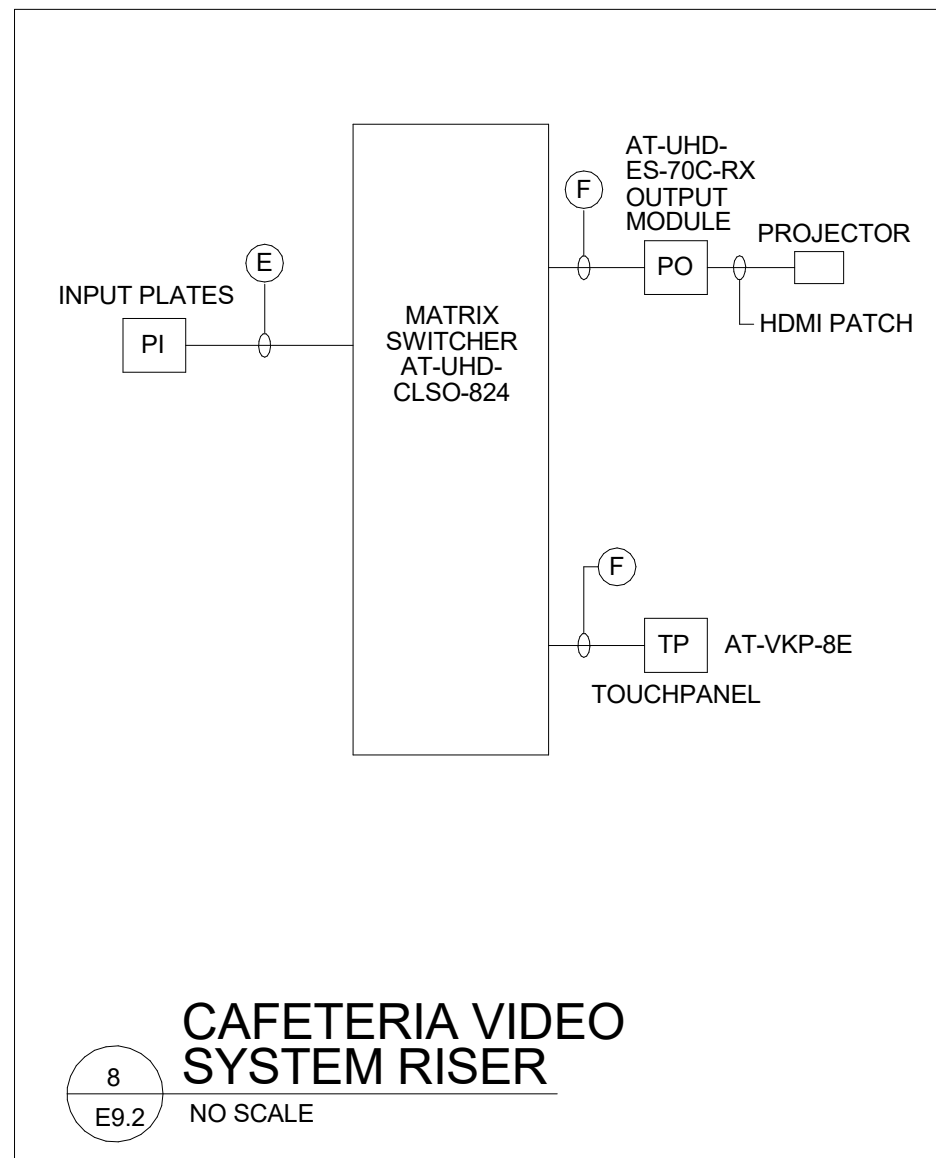
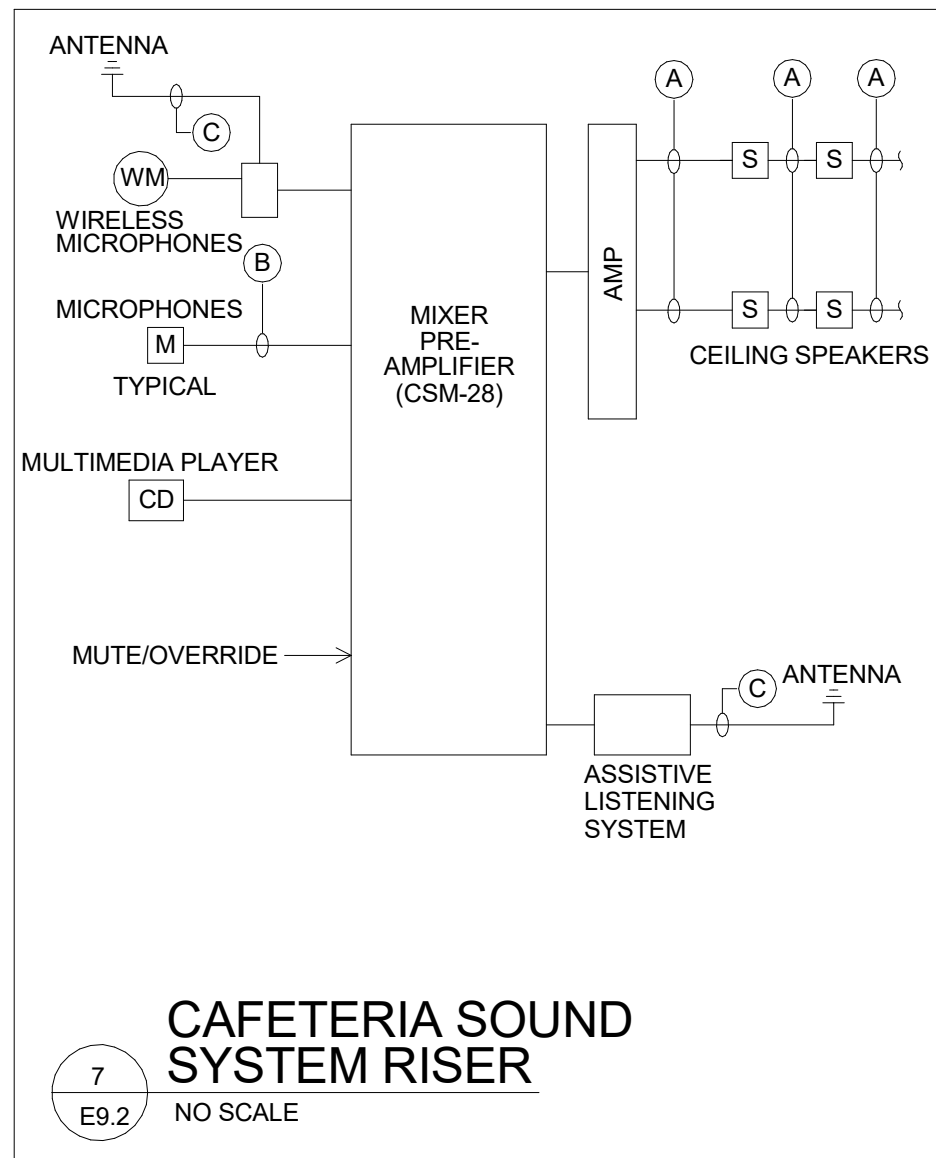
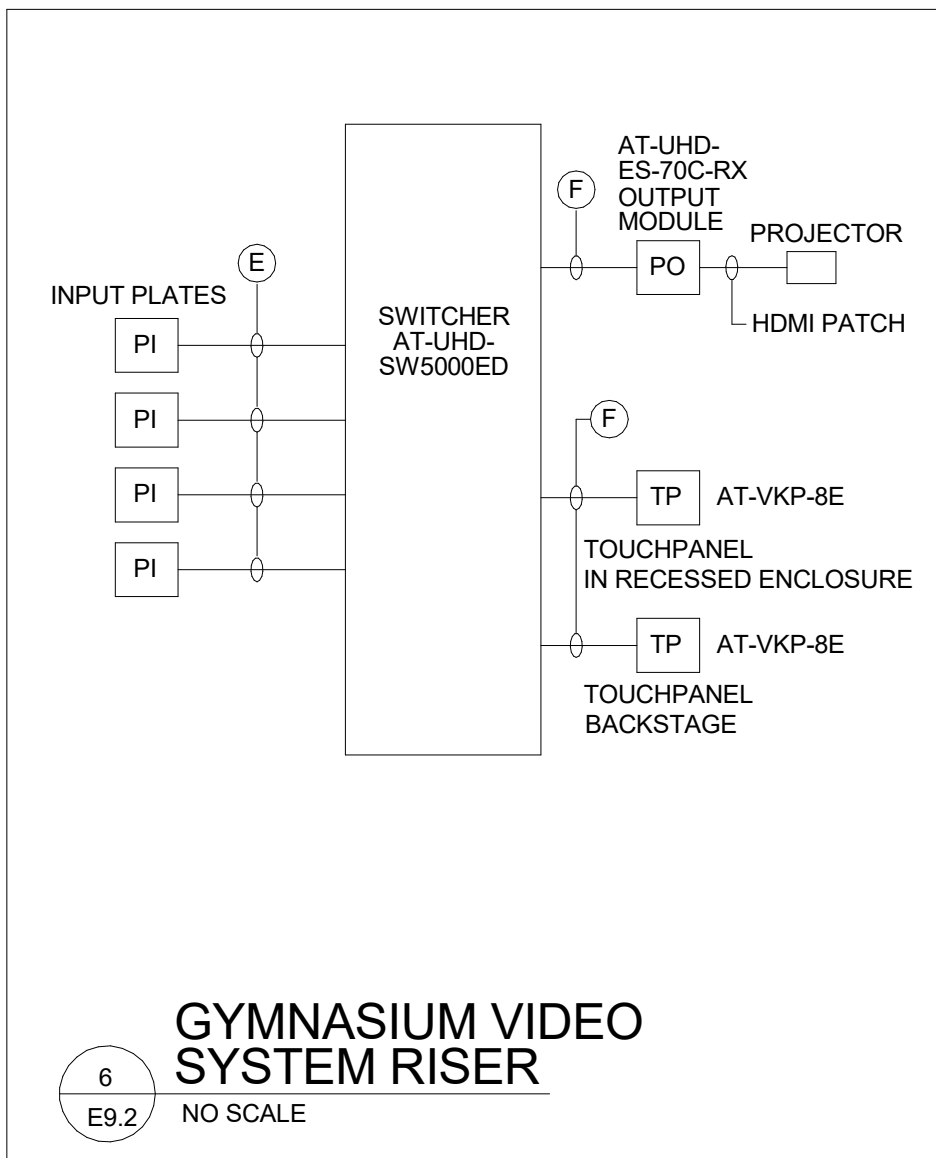
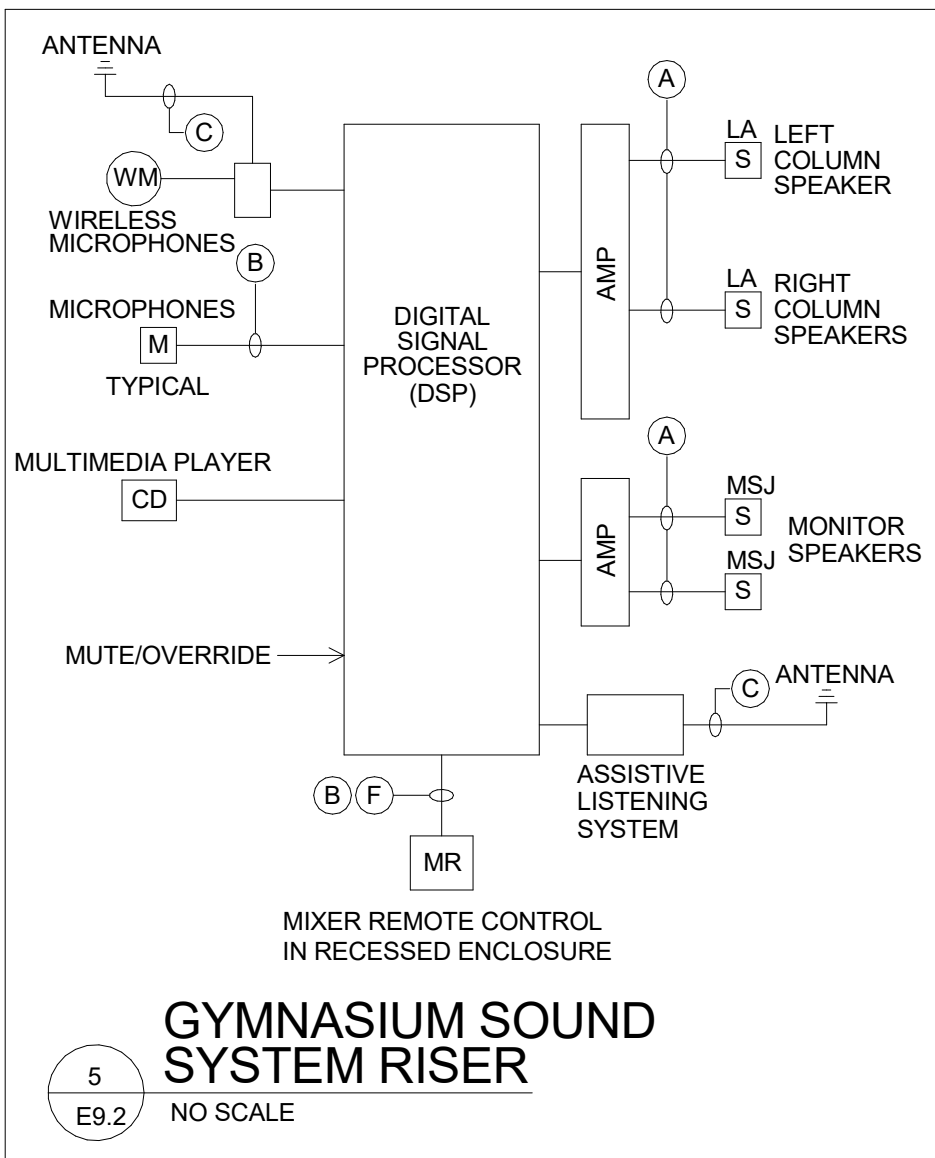
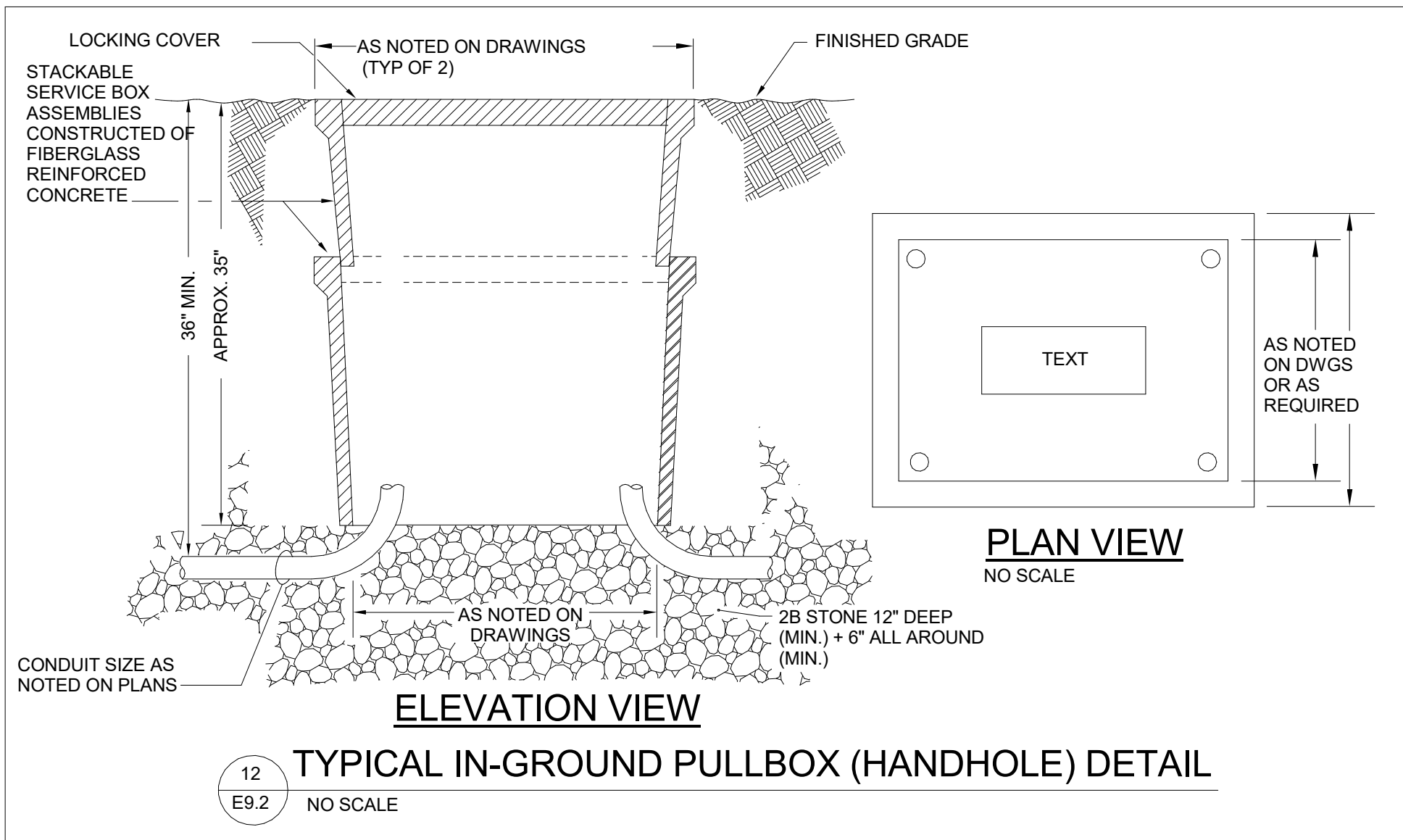
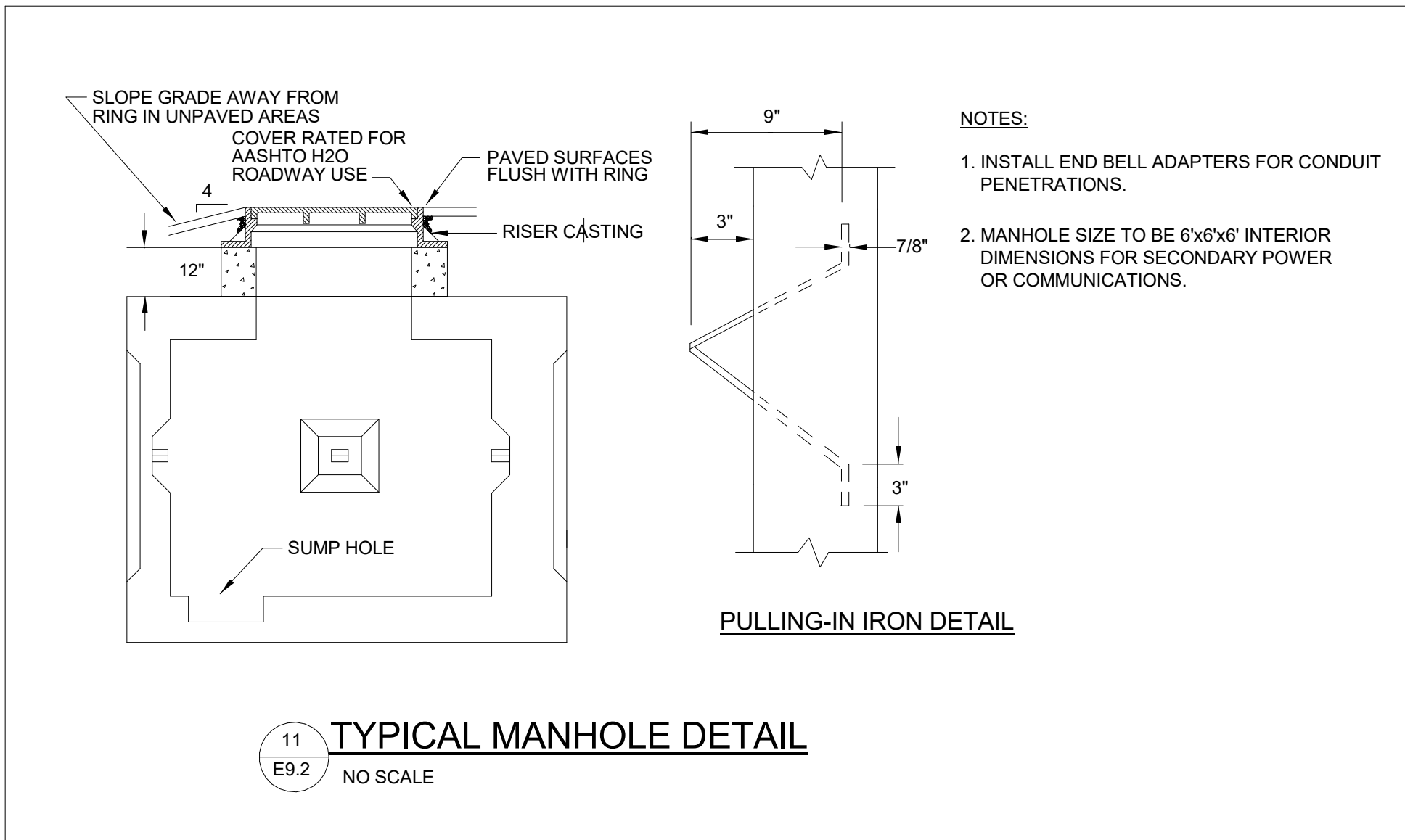
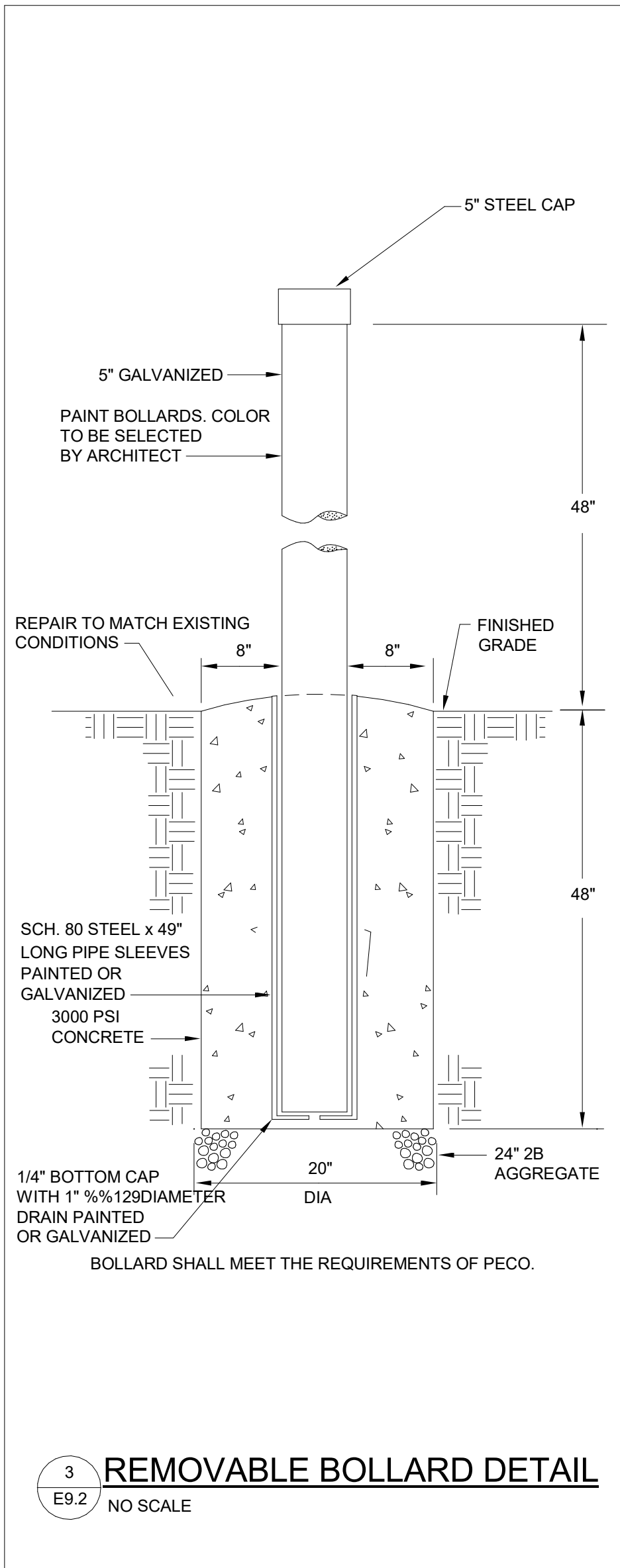
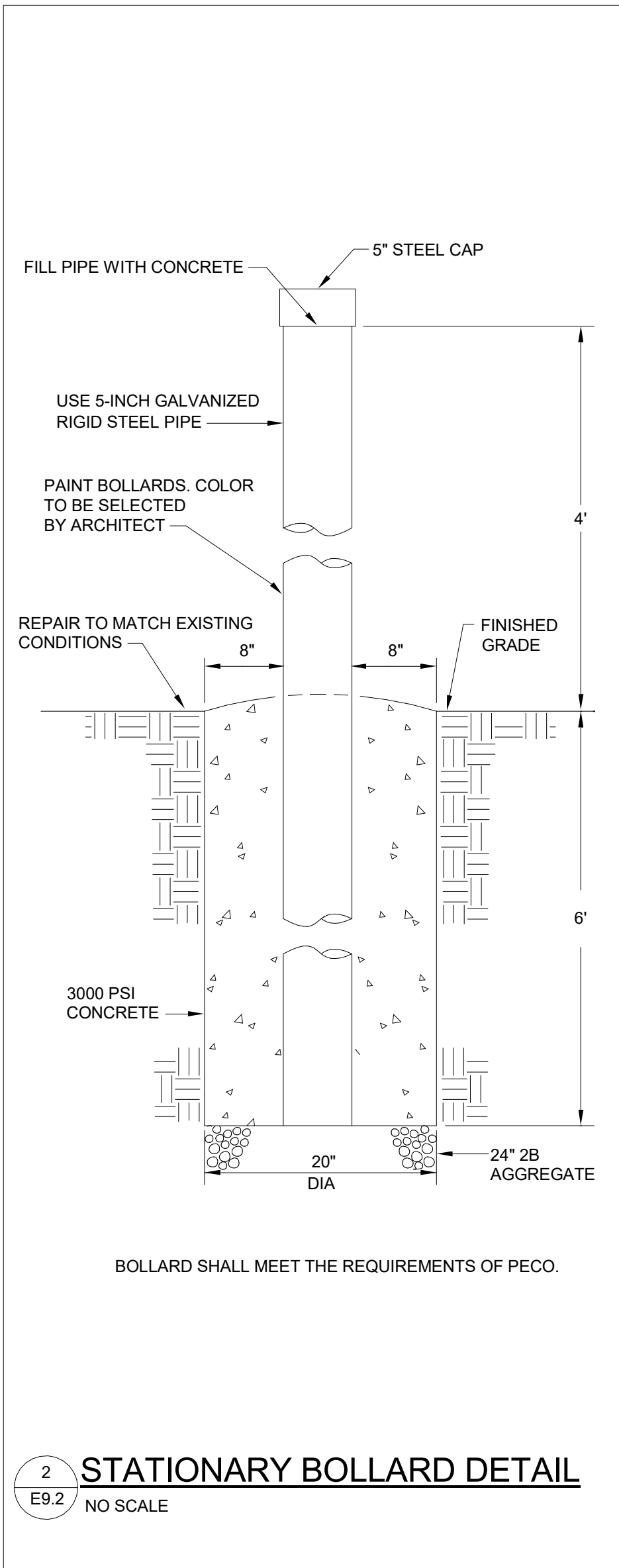
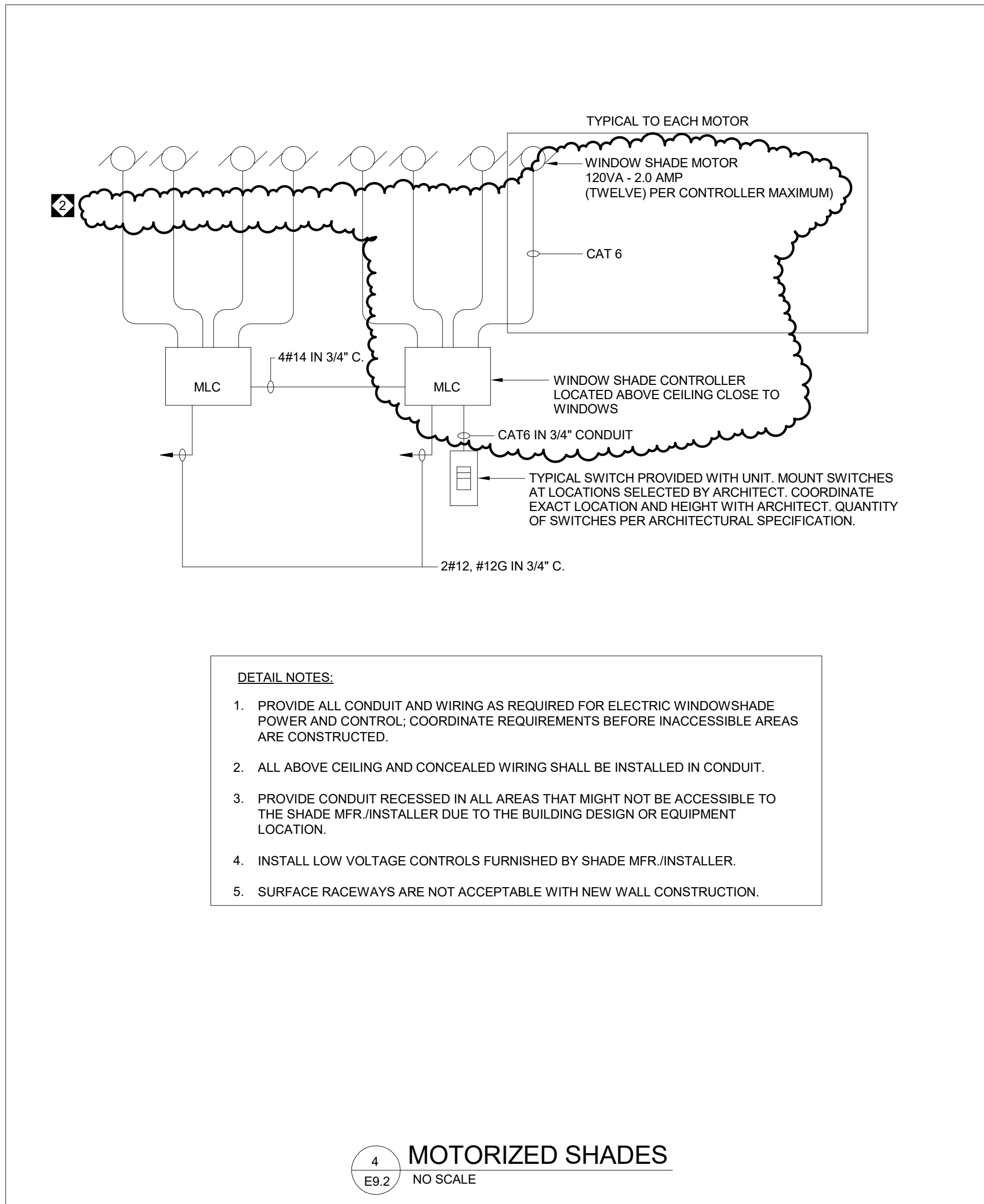
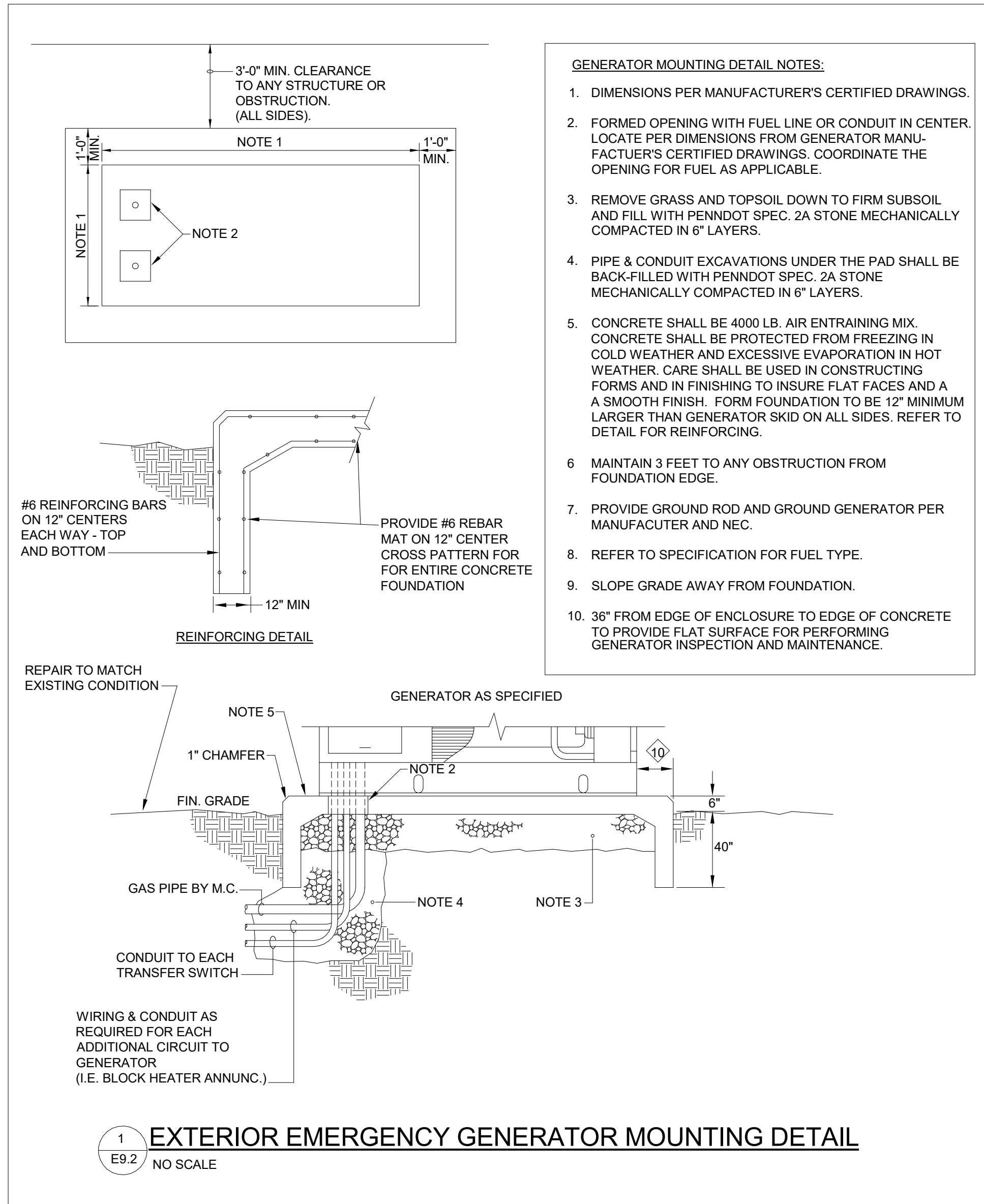
## FIRST FLOOR FIRE ALARM AND CELLULAR EXTENSION

PLOT SCALE:  
As indicated

FILENAME:  
24066

DATE: MARCH 10, 2025





WIRE SCHEDULE			
CABLE TYPE	MANUFACTURER	MODEL NUMBER (PLENUM)	DESCRIPTION
(A)	WEST PENN	25227B	SPEAKER CABLE
(B)	WEST PENN	25293B	MICROPHONE CABLE
(C)	WEST PENN	25815	RG-59/U COAXIAL
(D)	WEST PENN	25225B	SPEAKER CABLE
(E)	WEST PENN	25424B	CATEGORY 6 CABLE
(F)	WEST PENN	2542326F	SHIELDED CATEGORY 6A CABLE

- GENERAL NOTES:**
1. PROVIDE ADDITIONAL CABLING AS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM.
  2. PROVIDE A MINIMUM 3/4" CONDUIT FOR ALL WIRES IN THE SYSTEMS.



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ELECTRICAL DETAILS

PLOT SCALE:

FILENAME:

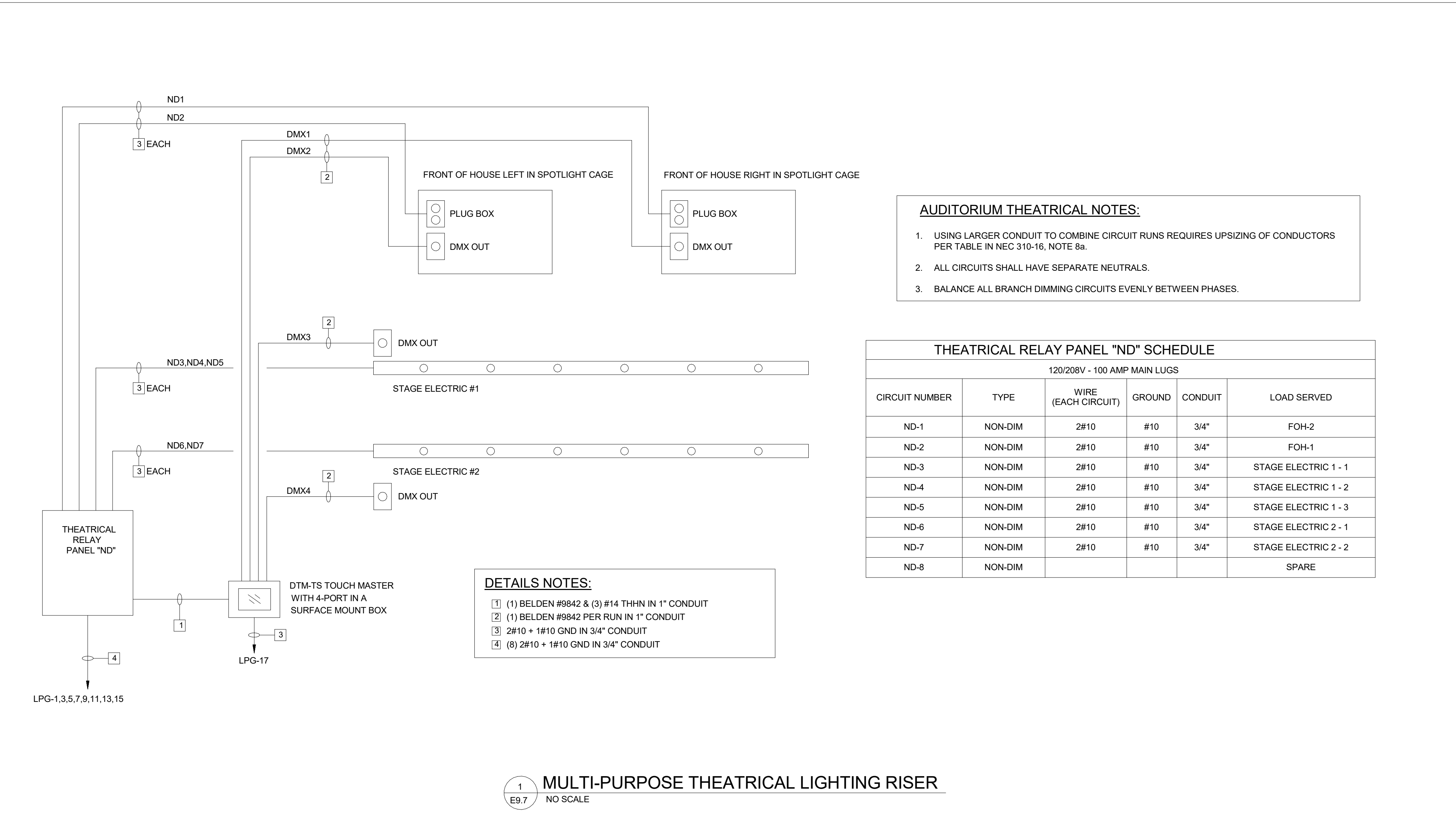
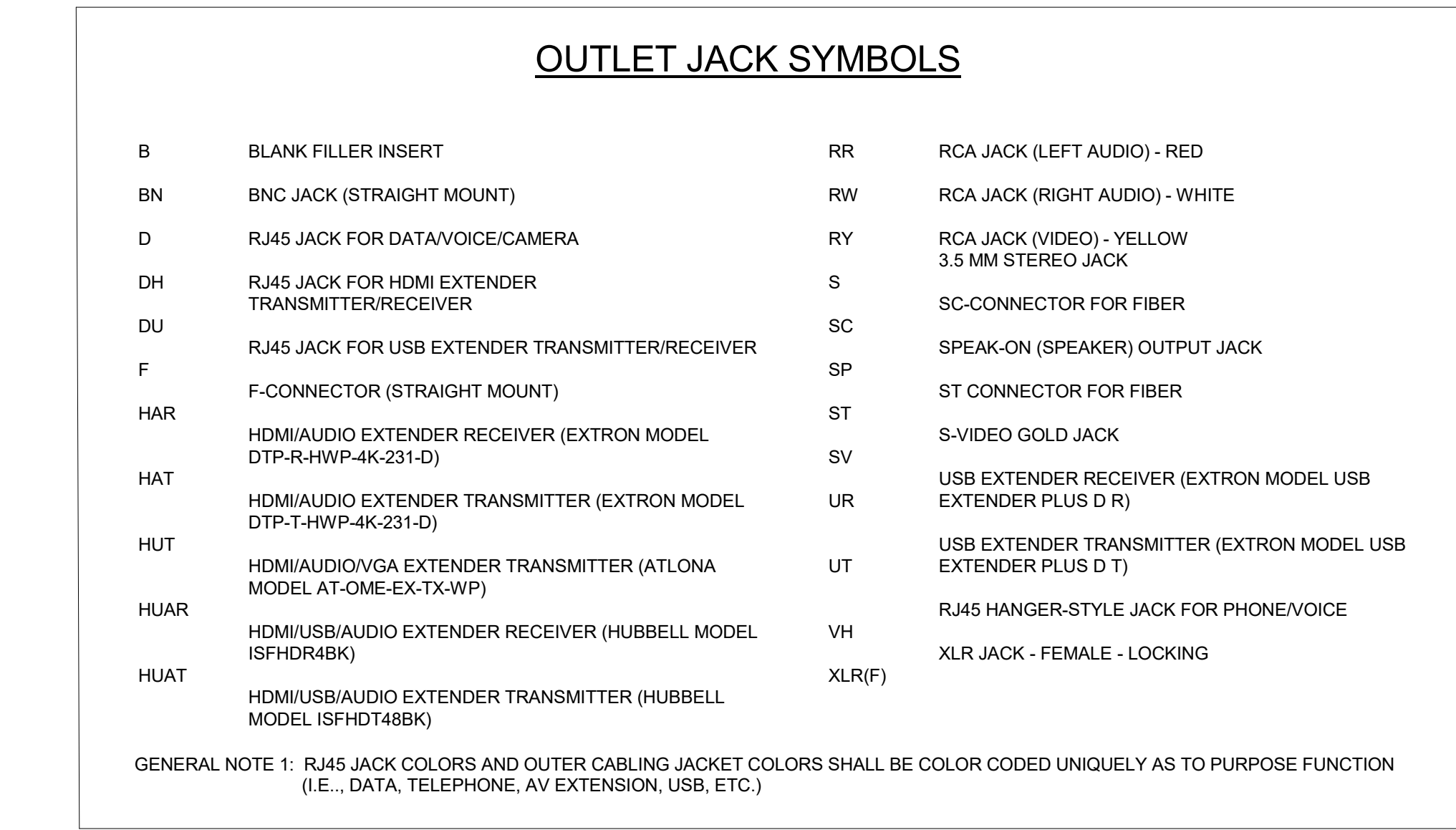
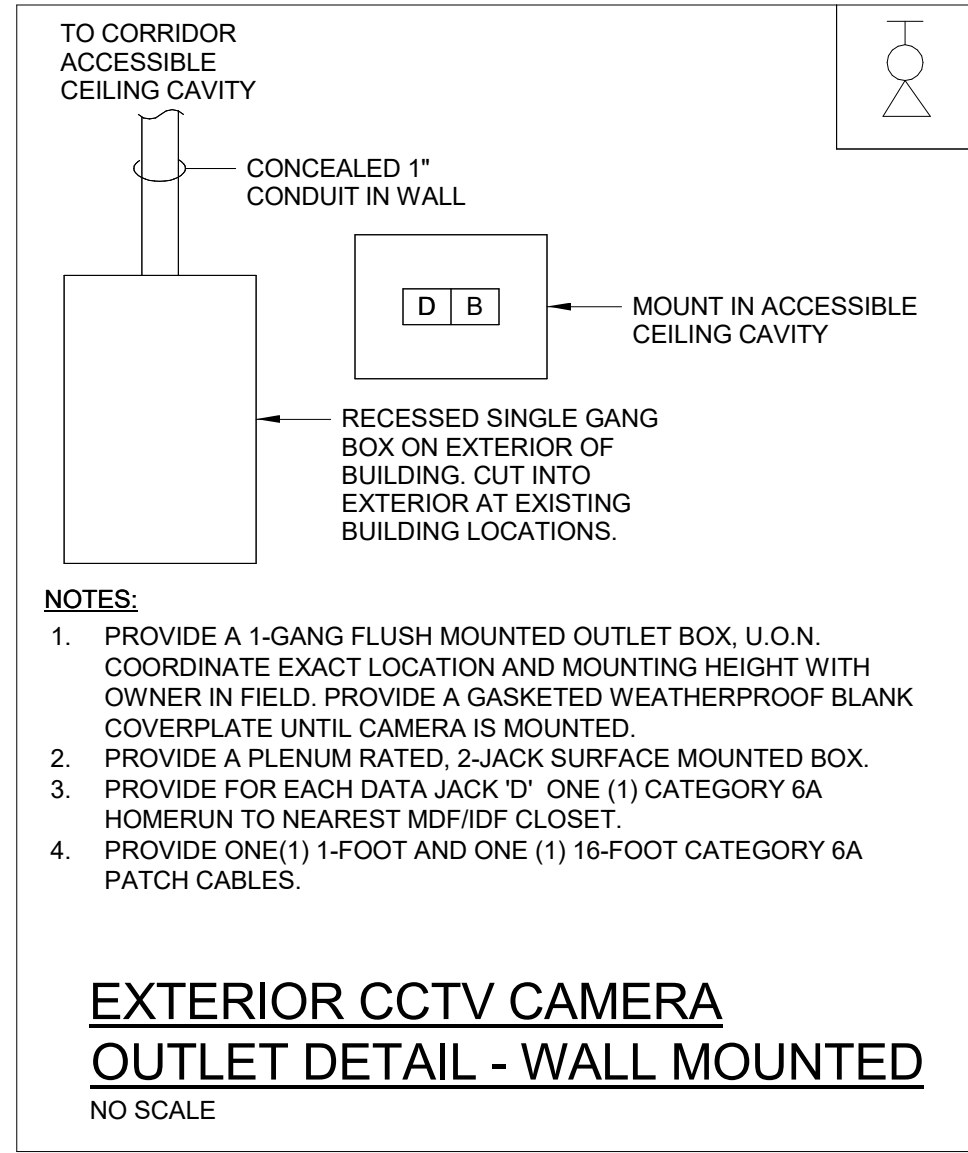
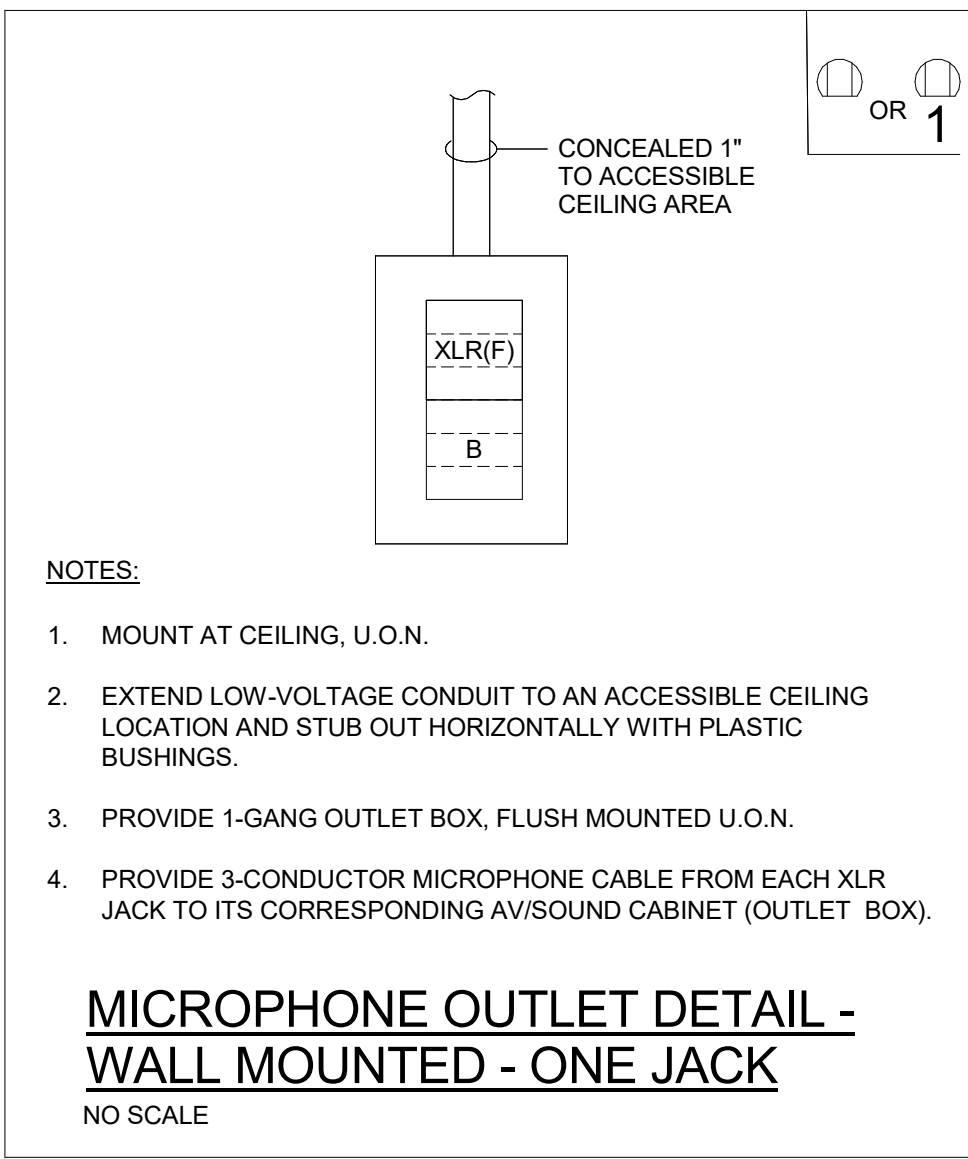
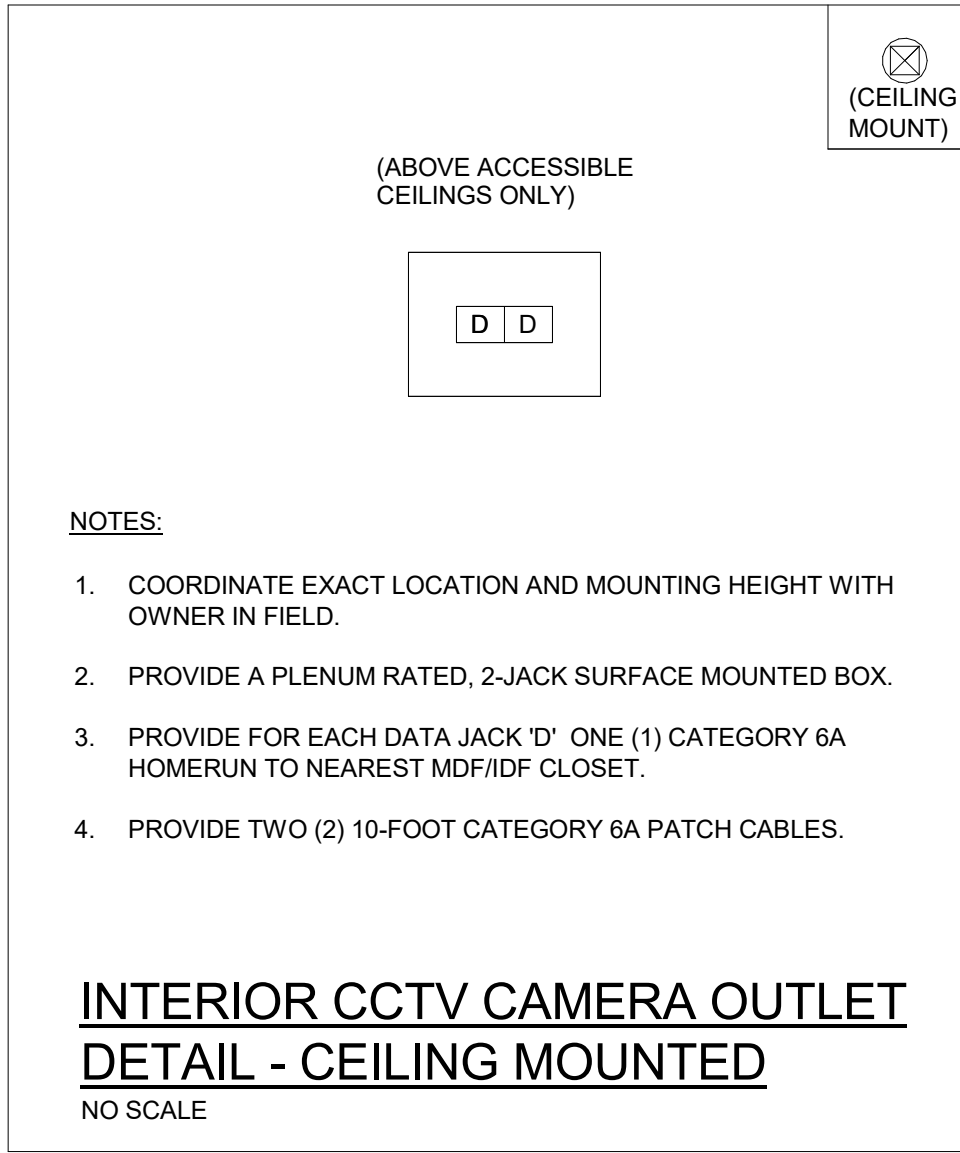
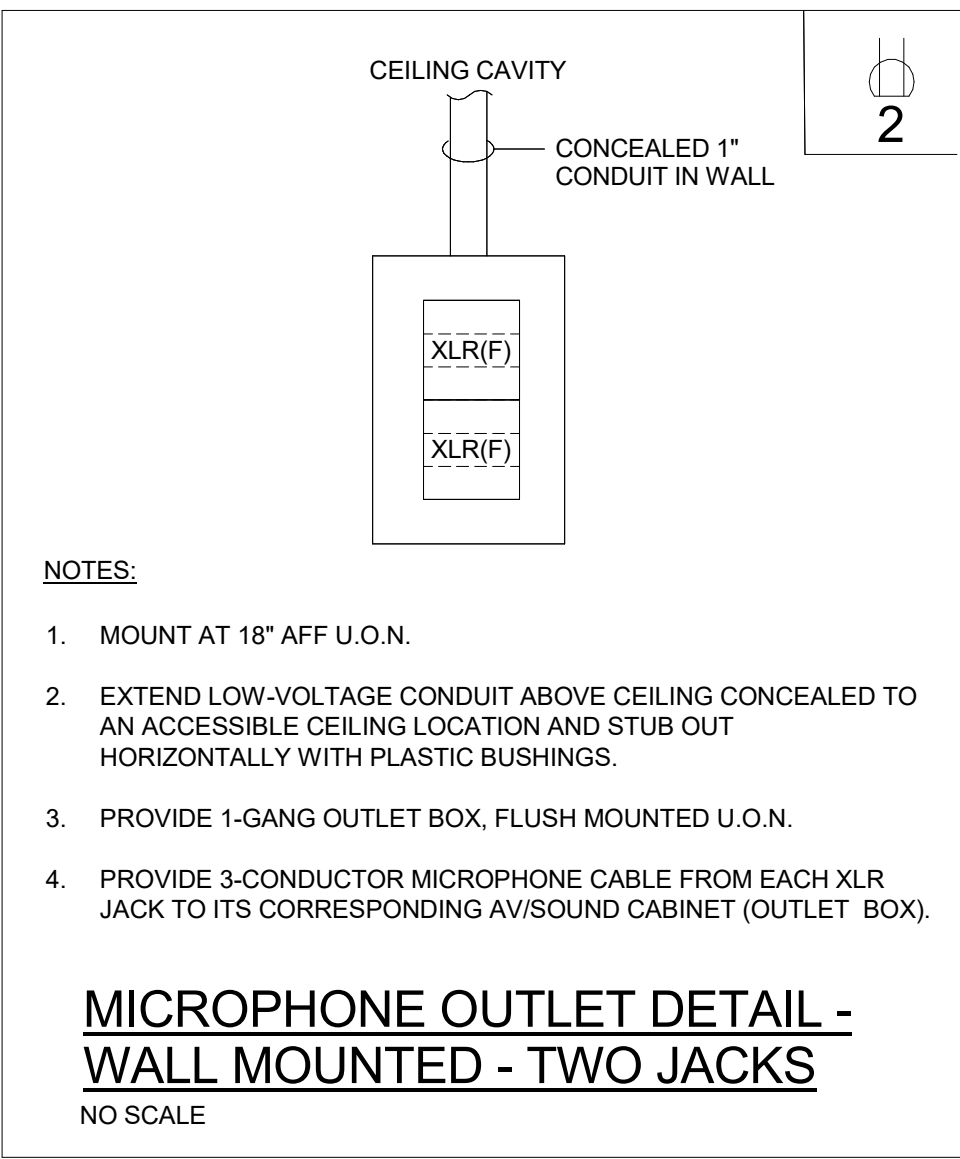
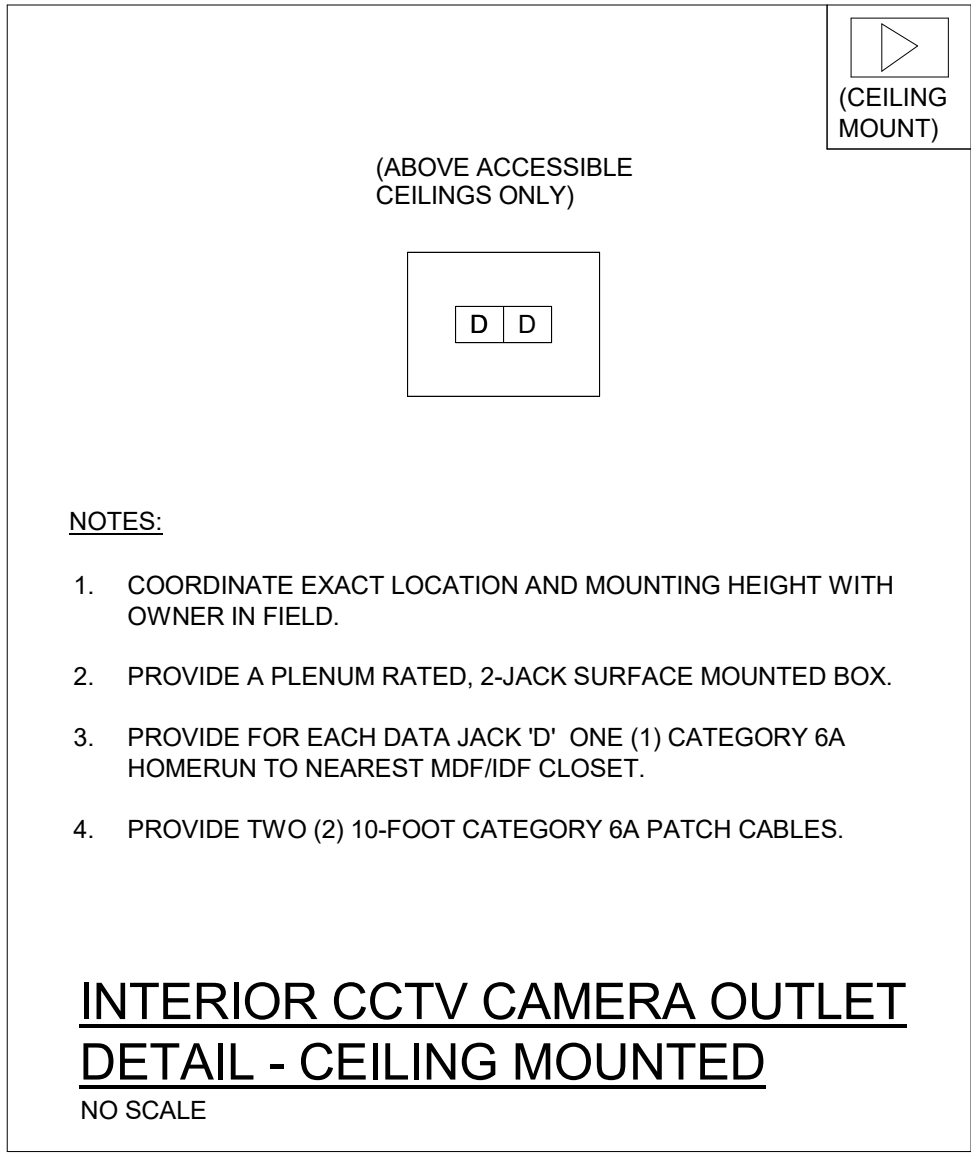
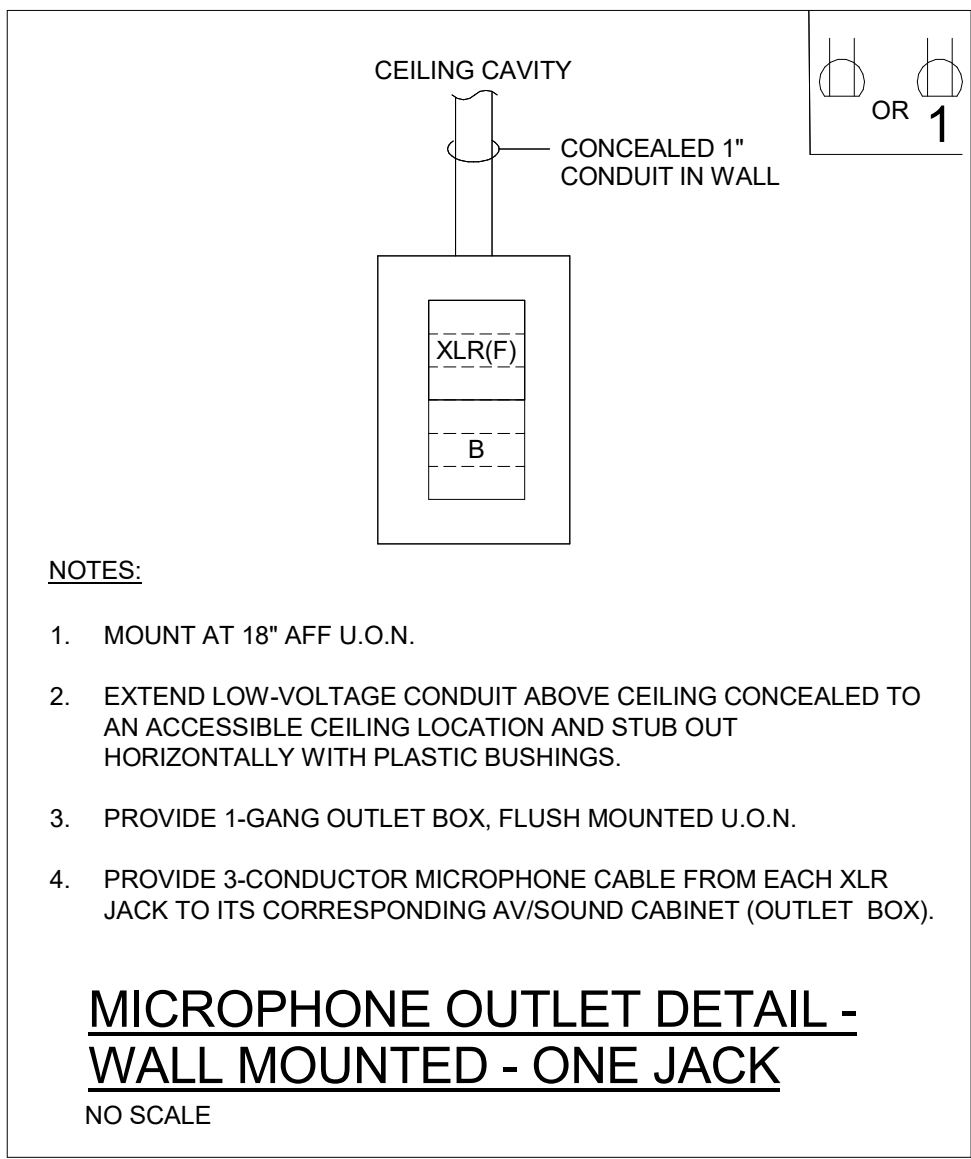
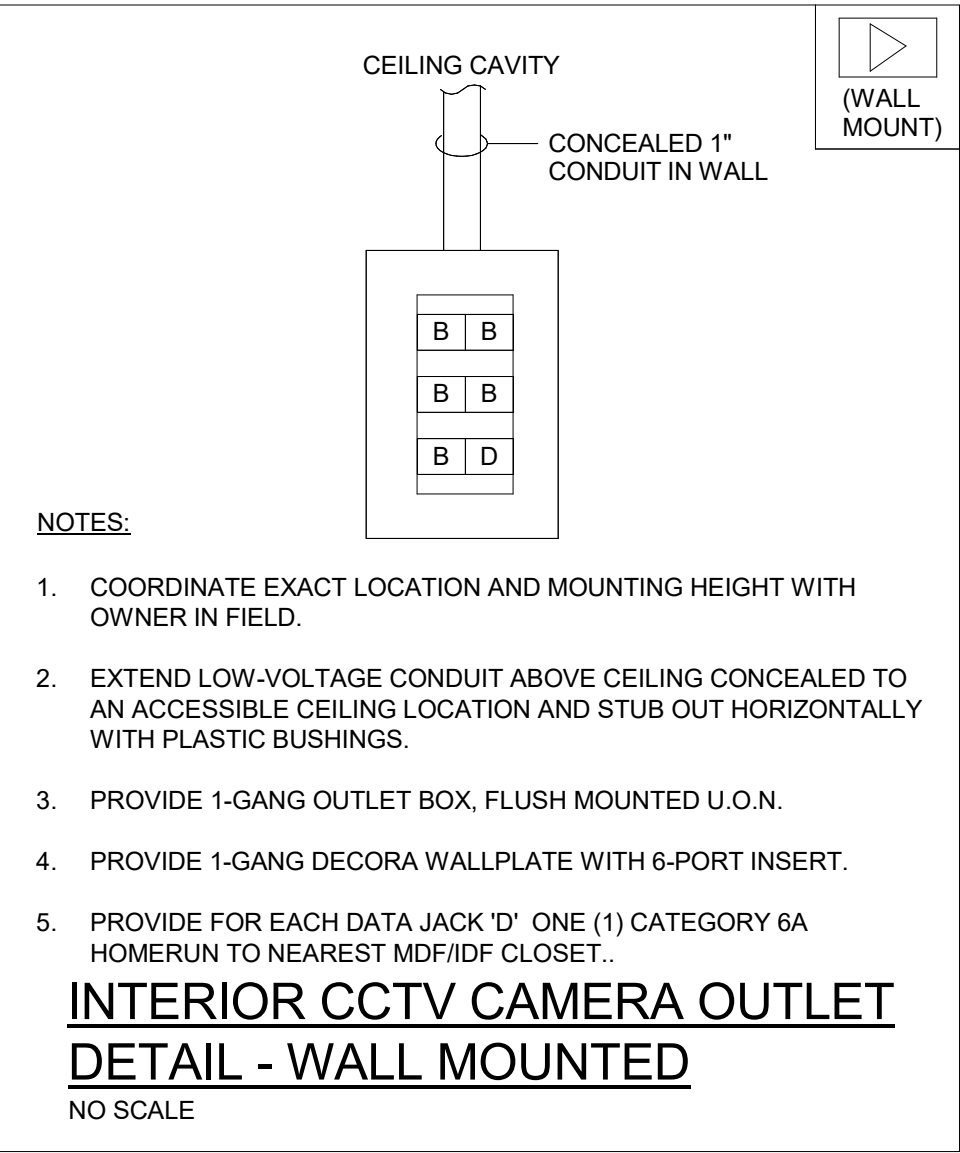
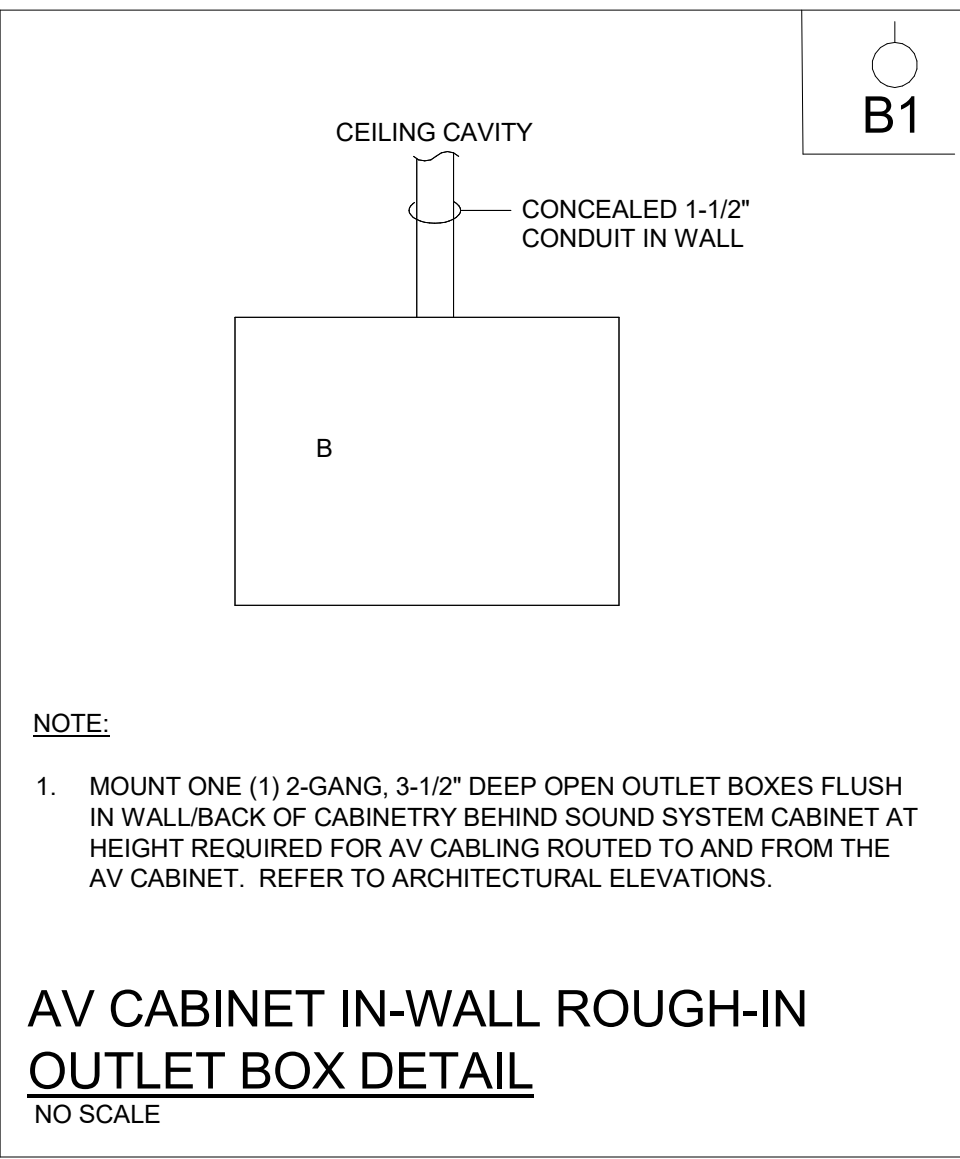
DATE:

MARCH 10, 2025

**PROJECT**  
3758

**E9.2**





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ELECTRICAL DETAILS

PROJECT  
3758

FILENAME  
24066

DATE  
MARCH 10, 2025

E9.7

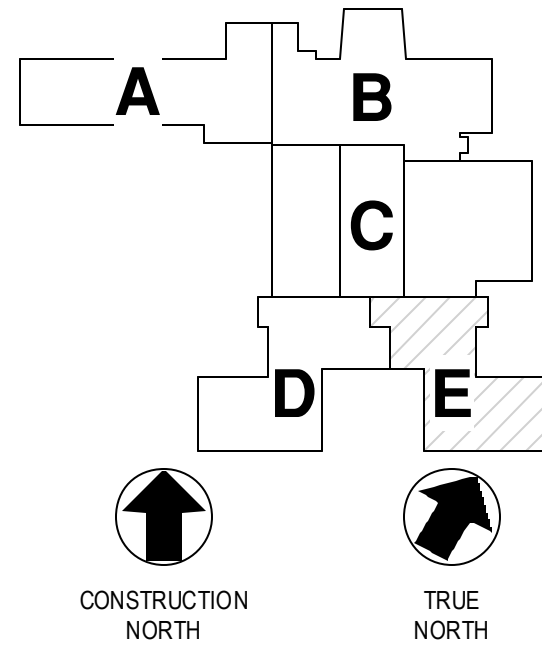
LIGHTING CONTROLS SEQUENCE OF OPERATIONS FOR SECTION 260940		
ROOM/SPACE NAME	ROOM/SPACE OPERATION	ROOM BUTTON STATIONS
CLASSROOMS INTERVENTION READING SUPPORT CI/PT SPEECH LEARNING SUPPORT KINDERGARTEN AUTISTIC SUPPORT INSTRUMENTAL OPEN CLASSROOM SPECIAL EDUCATION  SIMILAR SPACES	'ON': MANUAL BY WALL STATION 'OFF': OCCUPANCY SENSOR  - ROOM PEAK LEVEL TO BE SET AT 80% OF MAX LEVEL. - OCCUPANCY SENSORS SHALL TURN ALL LOADS OFF AFTER THE SPACE IS VACATED FOR 20 MINUTES. - WHERE APPLICABLE, DAYLIGHT SENSOR SHALL LOWER THE DIMMING ZONE LUMNAIRES TO THE PRESET LEVEL.	2R ☒ BUTTON ONE - 80% ENTIRE ROOM
LOBBY VESTIBULE	'ON': OCCUPANCY SENSOR 'OFF': OCCUPANCY SENSOR  - ROOM PEAK LEVEL TO BE SET AT 80% OF MAX LEVEL. - OCCUPANCY SENSORS SHALL TURN ALL LOADS OFF AFTER THE SPACE IS VACATED FOR 20 MINUTES. - WHERE APPLICABLE, DAYLIGHT SENSOR SHALL LOWER THE DIMMING ZONE LUMNAIRES TO THE PRESET LEVEL.	
GIRLS TOILET BOYS TOILET	'ON': OCCUPANCY SENSOR 'OFF': OCCUPANCY SENSOR  - ROOM PEAK LEVEL TO BE SET AT 80% OF MAX LEVEL. - OCCUPANCY SENSORS SHALL TURN ALL LOADS OFF AFTER THE SPACE IS VACATED FOR 20 MINUTES.	1 ☒ BUTTON - 80% ENTIRE ROOM
RECEPTION WORKROOM NURSE	'ON': MANUAL BY WALL STATION 'OFF': OCCUPANCY SENSOR  - ROOM PEAK LEVEL TO BE SET AT 80% OF MAX LEVEL. - OCCUPANCY SENSORS SHALL TURN ALL LOADS OFF AFTER THE SPACE IS VACATED FOR 20 MINUTES.	1 ☒ BUTTON ONE - 80% ENTIRE ROOM
STORAGE FIRE PUMP PLUMBING STORAGE RECEIVING	'ON': MANUAL BY WALL STATION 'OFF': OCCUPANCY SENSOR  - ROOM PEAK LEVEL TO BE SET AT 80% OF MAX LEVEL. - ROOM LIGHTING SHALL TURN ALL LOADS OFF AT 11:00PM AFTER A BLINK WARN.	1 ☒ BUTTON - 80% ENTIRE ROOM
KITCHEN	'ON': MANUAL BY WALL STATION 'OFF': MANUAL BY WALL STATION  - ROOM PEAK LEVEL TO BE SET AT 80% OF MAX LEVEL. - ROOM LIGHTING SHALL TURN ALL LOADS OFF AT 11:00PM AFTER A BLINK WARN.	1 ☒ BUTTON - 80% ENTIRE ROOM 3 ☒ BUTTON ONE - 80% ZONE ☒ BUTTON TWO - 50% ZONE BUTTON THREE - ALL OFF
CAFETERIA	'ON': MANUAL BY WALL STATION 'OFF': OCCUPANCY SENSOR  - ROOM PEAK LEVEL TO BE SET AT 80% OF MAX LEVEL. - OCCUPANCY SENSORS SHALL TURN ALL LOADS OFF AFTER THE SPACE IS VACATED FOR 20 MINUTES.	3R BUTTON ONE - 80% ENTIRE ROOM ☒ BUTTON TWO - RAISE/LOWER ZONE BUTTON THREE - RAISE/LOWER ZONE
MEDIA CENTER	'ON': MANUAL BY WALL STATION 'OFF': OCCUPANCY SENSOR  - ROOM PEAK LEVEL TO BE SET AT 80% OF MAX LEVEL. - OCCUPANCY SENSORS SHALL TURN ALL LOADS OFF AFTER THE SPACE IS VACATED FOR 20 MINUTES.	5R BUTTON ONE - 80% ENTIRE ROOM ☒ BUTTON TWO - RAISE/LOWER ZONE BUTTON THREE - RAISE/LOWER ZONE BUTTON FOUR - RAISE/LOWER ZONE BUTTON FIVE - RAISE/LOWER ZONE
GYMNASIUM	'ON': MANUAL BY WALL STATION 'OFF': OCCUPANCY SENSOR  - ROOM PEAK LEVEL TO BE SET AT 80% OF MAX LEVEL. - OCCUPANCY SENSORS SHALL TURN ALL LOADS OFF AFTER THE SPACE IS VACATED FOR 20 MINUTES.	4 BUTTON ONE - 80% ENTIRE ROOM BUTTON TWO - 50% ENTIRE ROOM ☒ BUTTON THREE - b 30% OR cd ZONES 60% BUTTON FOUR - ALL OFF
BUILDING LIGHTING	'ON': PHOTOCELL 'OFF': PHOTOCELL	
SITE LIGHTING - SECURITY	'ON': PHOTOCELL 'OFF': PHOTOCELL	



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KEY PLAN



REVISIONS

NO.	REVISED BY	NAME	DESCRIPTION OF CHANGES
2	3/28/2025		ADDENDUM 2

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ELECTRICAL DETAILS

PLOTS/SCALE

FILENAME

DATE

MARCH 10, 2025

PROJECT

3758

E9.8