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BID ADDENDUM #4

Nanuet Union Free School District
103 Church Street
Nanuet, NY 10954

Nanuet Bond Projects Phase 5

Date: February 5th, 2025

NOTICE TO CONTRACTORS

This Addendum issued prior to receipt of Bid shall and does hereby become a part of the Construction Documents for the above project.

All principal Contractors shall be responsible for seeing that their Subcontractors are properly apprised of the contents of this Addendum.

All information contained in this Addendum shall supersede and shall take precedence over any conflicting information in the original Bidding Documents dated January 14, 2025. and all previous addenda.

All Contractors shall acknowledge receipt of this Addendum in the space provided in the Bid Form. Failure to do so may subject Bidder to disqualification.

CLARIFICATIONS:

1. On drawing BM S 101- note – (HSS posts and base plates – galvanized). Should the W10-x26 beams be galvanized or not? Please advise.
Response: Yes, galvanized.

2. On the bid form for the OEC, there are many line items that do not apply to the OEC. However, there is no item for concrete. Please advise.
Response: Concrete is in scope.

3. At HES - There is a 2x2 & a 2x4 ceiling tile indicated on A6/HE-A405 but only a 2x4 indicated on HE-A801. Is the 2x2 the same tile as the 2x4?
Response: Yes, that 2x2 is supposed to be 2x4 (ACT-1) in the Waiting room as well.

4. Maintenance Building - Sheet MB-A101 calls out for a 2x2 'ultima' ceiling tile, however sheet MB-A401 calls out for a Serpentina type ceiling with silver satin grid. Please advise on what type of ceiling grid & tile is needed for 1/MB-A101?
Response: 2x2 ACT is per the legend on MB-A101: Armstrong Ultima Acoustic ceiling tile.

5. Please advise what type of ceiling tile is needed for sheet OEC-A111?
Response: 2x2 ACT

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6. Please advise what type of ceiling is in the current IT Closet room that will have to be patched?
Response: Existing gyp ceiling.

7. On Sheet G041 there is a wood floor type #FT1 but there is no spec on it. Please advise.
Response: FT1 is not called out in this project scope.

8. There is reference to multiple ceiling tile (spec 095123) for example #3257, #565 and formation clouds- however they are not found at the multiple locations- there are other ceiling tiles indicated. Please advise.
Response: No formation clouds in this project scope. Please refer to drawing sheet legends and finish schedule to ceilings specific to each building.

9. There is a spec for bullet resistant fiberglass panels but none are shown on the drawings. Please advise.
Response: Bullet resistant fiberglass panels spec is not relevant to this project scope.

CHANGES TO SPECIFICATIONS:

00 30 02 - EC-01 BID FORM
a. Updated to remove Barr Middle School. See attached specification.
21 05 00 - Common Work Results for Fire Suppression
b. Updated. See attached specifications.
21 13 00 - Fire Suppression Sprinklers
c. Updated. See attached specifications.
23 05 93-Testing, Adjusting, and Balancing for HVAC
d. Updated. See attached specifications.
23 05 53 - Identification for HVAC Piping and Equipment
e. Updated. See attached specifications.
23 05 48 - Vibration Controls for HVAC Piping and Equipment
f. Updated. See attached specifications.
23 05 19 - Meters and Gauges for HVAC Piping
g. Updated. See attached specifications.
23 05 16 - Expansion Fittings and Loops for HVAC Piping
h. Updated. See attached specifications.
23 05 01 - Basic HVAC Materials and Methods
i. Updated. See attached specifications.
22 40 00 - Plumbing Fixtures
j. Updated. See attached specifications.
23 0713 - Duct Insulation
k. Updated. See attached specifications.
23 09 23 - Direct-Digital Control System For HVAC
l. Updated. See attached specifications.
23 21 13 - Hydronic Piping
m. Updated. See attached specifications.
23 21 14 - Hydronic Specialties

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n. Updated. See attached specifications.

23 21 23 - Hydronic Pumps

o. Updated. See attached specifications.

23 23 00 - Refrigerant Piping

p. Updated. See attached specifications.

23 31 00 - HVAC Ducts and Casings

q. Updated. See attached specifications.

23 33 00 - AIR DUCT ACCESSORIES

r. Updated. See attached specifications.

23 34 16 - Centrifugal HVAC Fans

s. Updated. See attached specifications.

23 34 23 - HVAC Power Ventilators

t. Updated. See attached specifications.

23 37 00 - Air Outlets and Inlets

u. Updated. See attached specifications.

23 51 00 - Breechings, Chimneys, and Stacks

v. Updated. See attached specifications.

23 81 26.13 - Small-Capacity Split-System Air Conditioners

w. Updated. See attached specifications.

23 81 26 - MULTI-SPLIT HEAT PUMP SYSTEMS

x. Updated. See attached specifications.

23 81 29 - Variable Refrigerant Flow HVAC Systems

y. Updated. See attached specifications.

238200 - Convection Heating and Cooling Units

z. Updated. See attached specifications.

REVISIONS TO DRAWINGS:

ARCHITECTURAL

None

STRUCTURAL

None

MECHANICAL

1. Sheet HE-FP101 - FIRE PROTECTION PLANS
    a. Revisions noted on sheet.
2. Sheet HE-M002 - SCHEDULES, DETAILS, AND CONTROL DIAGRAMS
    a. Revisions noted on sheet.
3. Sheet HE-M101 - OVERALL LOWER LEVEL PLAN
    a. Revisions noted on sheet.
4. Sheet HE-M102 - OVERALL FIRST FLOOR PLAN
    a. Revisions noted on sheet.
5. HE-M103 - OVERALL SECOND FLOOR PLAN
    a. Revisions noted on sheet.
6. HE-M104 - LOWER LEVEL AND FIRST FLOOR HVAC PLANS
    a. Revisions noted on sheet.
7. HE-M105 - 1ST FLOOR VESTIBULE, 2ND FLOOR, AND ATTIC LEVEL HVAC PLANS

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a. Revisions noted on sheet.

8. HE-M106 - HVAC ROOF PLAN
   a. Revisions noted on sheet.
9. HE-MR101 - LOWER LEVEL AND FIRST FLOOR HVAC REMOVALS
   a. Revisions noted on sheet.
10. HE-MR102 - 1ST FLOOR VESTIBULE, 2NDFLOOR, AND ATTIC HVAC REMOVALS
    a. Revisions noted on sheet.
11. HE-MR103 - HVAC ROOF REMOVALS
    a. Revisions noted on sheet.
12. MB-M101 - FIRST FLOOR PLAN
    a. Revisions noted on sheet.
13. ME-M003 - VRV PIPING AND WIRING DIAGRAMS
    a. Revisions noted on sheet.
14. ME-M004 - VRV WIRING DIAGRAMS
    a. Revisions noted on sheet.
15. ME-M102 - OVERALL ROOF PLAN AND LIBRARY ROOF PLAN & REMOVALS
    a. Revisions noted on sheet.
16. ME-M103 - PARTIAL FIRST FLOOR PLAN - KINDERGARTEN WING
    a. Revisions noted on sheet.
17. ME-M105 - PARTIAL FIRST FLOOR PLAN - 1962 WING
    a. Revisions noted on sheet.
18. ME-M106 - PARTIAL ROOF PLAN - KINDERGARTEN WING
    a. Revisions noted on sheet.
19. ME-M107 - PARTIAL ROOF PLAN - A-WING AND MIDDLE WING
    a. Revisions noted on sheet.
20. ME-M108 - PARTIAL ROOF PLAN - 1962 WING
    a. Revisions noted on sheet.
21. OEC-M001 - SYMBOLS, LEGENDS, ABBREVIATIONS, AND DETAILS
    a. Revisions noted on sheet.
22. OEC-M101 - BASEMENT PLAN
    a. Revisions noted on sheet.
23. OEC-M102 - FIRST FLOOR PLAN
    a. Revisions noted on sheet.
24. OEC-MR101 - BASEMENT REMOVALS
    a. Revisions noted on sheet.

ELECTRICAL

None

PLUMBING

1. HE-P102 - FIRST FLOOR SANITARY AND VENT INSTALLATION PLAN
   b. Revisions noted on sheet.
2. HE-P103 - SECOND FLOOR SANITARY AND VENT INSTALLATION PLAN
   a. Revisions noted on sheet.

END OF BID ADDENDUM No.4

SECTION 233100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

B. Flexible ductwork.

1.2 REFERENCES

A. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 1994.

B. ASTM A 569/A 569M - Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality; 1991a (Reapproved 1993).

C. ASTM A 653/A 653M - Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process; 1995.

D. NFPA 90A - Installation of Air Conditioning and Ventilating Systems; 1993.

E. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems; 1993.

F. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

G. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible;2005.

H. UL 181 - Factory-Made Air Ducts and Connectors; 1994.

1.3 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.4 SUBMITTALS

A. Product Data: Provide data for duct materials.

B. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all ductwork systems.

C. Ductwork Shop Drawings: Provide drawings of ductwork installation, indicating dimensioned locations, equipment, critical dimensions, elevations, sizes, systems, and damper locations. Indicate duct fittings, particulars such as gages, sizes, welds, and configuration.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.1 MATERIALS

A. Galvanized Steel Ducts: ASTM A 653/A 653M galvanized steel sheet, lock-forming quality, with G90/Z275 zinc coating.

B. Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts.

C. Insulated Flexible Ducts:

1. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.

a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.

b. Maximum Velocity: 4000 fpm.

c. Temperature Range: -20 degrees F to 210 degrees F.

D. Hanger Rod: ASTM A 36/A 36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are outlined on the drawings, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.3 SEALING MATERIALS

A. Joint and Seam Sealants, General: The term sealant used here is not limited to materials of adhesive or mastic nature, but also includes combinations of open weave fabric strips and mastics

B. Joint and Seam Tape: 2 inches wide, glass-fiber-fabric reinforced.

C. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with the tape to form a hard, durable, airtight seal.

D. Joint and Seam Sealant:

1. Color: Grey

2. Base: Water

3. Chemical Family: Synthetic Latex

4. Solids Content: 75 ± 2%

5. Viscosity: Approx. 300,000 - 400,000 CPS

6. Application Temperature: 40°F - 110°F

7. Service Temperature: -25°F - 200°F

8. Freeze/Thaw Stability: Through 5 cycles no deterioration (DPTM-20)

9. Flammability: Non-flammable

10. Wet or Dry Flash Point: No flash to boiling

11. Shelf Life: 2 Years (unopened containers)

12. Cure Time: 24 - 72 hours depending on humidity, temperature and application

13. Coverage: Dependent on application thickness, 80-100 sq. ft. at 20-30 wet mils.

14. Packaging: 1/12 gallon tubes, 1 gallon pails, 2 gallon pails, 5 gallon pails, 54 gallon drums

15. Pressure Classes: Meets all SMACNA pressure classes

16. Seal Classes: Meets all SMACNA seal classes

E. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying ASTM C920, Type S, Grade NS Class 25, Use O.

2.4 FIRE STOPPING

A. Provide fire-stopping of penetrations as work of this contract.

2.5 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4 inches thick.

B. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod.

1. Straps and Rod sizes: Conform with Table 4-1 in SMACNA HVAC Duct Construction Standards, 1985 Edition, for sheet steel width and gage and steel rod diameters

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

D. Trapeze and Riser Supports: Steel shapes conforming to ASTM-A36.

1. Where galvanized steel ducts are installed, provide hot-dipped galvanized steel shapes and plates.

E. Rooftop Duct Supports: Dual bases supporting "H" frame strut assembly to support duct.

1. Strut Material: Hot-dip galvanized steel.

2. Stainless steel bases and hot-dip galvanized steel struts.

3. Base Material: Polycarbonate resin, stainless steel or hot-dip galvanized

2.6 RECTANGULAR DUCT FABRICATION

A. General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA "HVAC Duct Construction Standards", Tables 1-3 through 1-19, including their associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals.

1. Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification

2. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains and discolorations.

B. Static Pressure Classifications: Unless otherwise noted, construct all ductwork in this contract to 4 inch water gage static pressure class, for both supply, exhaust and return ductwork.

C. Longitudinal joints shall be Pittsburgh Lock L-1.

D. Transverse joints shall be T-12 Standing S as a minimum, or shall be made using Ductmate, WDCI and Ductlock slide-on connector systems. For ductwork rated at 3" w.g. and above, the transverse joints shall be made with the Ductmate, Ward, or Nexus ductwork connection system. Formed-on connector systems and slip and drive joints (SMACNA Type T-1 through T-14, excluding T-12) shall not be permitted.

E. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with centerline radius equal to 1.5 times associated duct width. Limit angular tapers to 30 degrees for contracting tapers, and 20 degrees for expanding tapers.

F. Fabricate ductwork with accessories installed during fabrication to the greatest extend possible. Refer to Division 23 section "Ductwork Accessories" for accessory requirements.

G. Fabricate plenums of galvanized sheet steel complying with ASTM A527, with G90 zinc coating in accordance with ASTM A525. Gages, construction, reinforcing and bracing shall comply with Section VI of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

H. Provide structural steel channels for support of plenums; provide structural angles and hanger rods.

2.7 RECTANGULAR DUCT FITTINGS

A. Fabricate elbows, transitions, offsets, branch connections and other duct construction in accordance with SMACNA "HVAC Metal Duct Construction Standard," 1985 Edition, Figures 2-1 through 2-10.

B. All branch takesoffs shall be made with 45 degree entry fittings; splitter dampers and extractors shall not be permitted.

2.8 ROUND DUCT FABRICATION

A. Round Ducts: Fabricate round supply ducts with spiral lockseam construction. Comply with SMACNA "HVAC Duct Construction Standards," Table 3 2 for galvanized steel gages.

1. Duct thickness shall be a minimum of 26 gauge.

B. Round Ducts: Fabricate round supply ducts using seam types identified in SMACNA "HVAC Duct Construction Standards," 1985 Edition, Figure 3-1, RL-Standards, " Table 3-2 for galvanized steel gages.

1. Drawband and crimp type transverse joints (RT-3 and RT-5 respectively) shall not be permitted.

2. Pleated, adjustable, and mitered elbows shall not be permitted, and segmented elbows shall be constructed with five segments, minimum.

2.9 ROUND SUPPLY AND RETURN FITTINGS FABRICATION

A. Conical Tees: Fabricate to conform to SMACNA "HVAC Duct Construction Standards", 1985 Edition, Figures 3-4 and 3-5 and with metal thicknesses specified for longitudinal seam straight duct.

B. Elbows: Fabricate in die-formed, gored or pleated construction. Fabricate the bend radius of die-formed, gored and pleated elbows 1.5 times the elbow diameter. Unless elbow construction type is indicated, provide elbows meeting the following requirements:

1. Round Elbows - 8 inches and Smaller: Die-formed elbows for 45- and 90- degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only.

2. Round Elbows - 9 inches through 14 inches: Gored or pleated elbows for 30, 45, 60, and 90 degrees.

3. Round Elbows - Larger Than 14 Inches: Gored elbows

4. Die-Formed Elbows for Sizes Through 8 inches: 20 gage with 2-piece welded construction.

5. Round Gored Elbows Gages: Same as for non-elbow fittings specified above

6. Pleated Elbows Sizes Through 14 inches: 26 gage

C. High Efficiency Round Taps to Rectangular Duct Mains:

1. High-Efficiency Takeoff shall be utilized with a rectangular opening and an approximate 45° slope on the body. A flange shall be turned out on all four sides with each corner being filled. The flange shall also have pre-punched holes for easy installation. There shall be a closed cell neoprene gasket (3/4” X 1/4”) applied to the flange to assure a tight seal. High-Efficiency Takeoffs shall be fabricated from 24 gauge galvanized steel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Duct sizes indicated are inside clear dimensions.

C. Install and seal metal and flexible ducts in accordance with SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible.

D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

E. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

F. Use double nuts and lock washers on threaded rod supports.

G. Connect flexible ducts to metal ducts with adhesive.

H. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

I. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

3.2 CLEANING

A. Clean newly installed duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

3.3 SCHEDULES

A. Ductwork Material:

1. Supply/Return/Relief (interior): Galvanized Steel.

2. General Exhaust: Galvanized Steel.

3. Air Transfer Ductwork: Galvanized Steel.

B. Ductwork Pressure Class:

1. Supply Ductwork: 2 inches

2. Return/Relief Ductwork: 2 inches

3. Transfer Air Ductwork: 1 inch

4. Exhaust air Ductwork: 2 inches

C. Ductwork Leakage Class:

1. Rectangular ductwork: Class 6

2. Round/Oval ductwork: Class 3

3. Air Leakage Testing: All ductwork systems shall be leak tested to the ductwork leakage classes specified. For supply air systems, measured leakage shall not exceed 3% of the total supply fan air volume. For exhaust and return air systems, measured leakage shall not exceed 5% of the total exhaust/return air volume per exhaust/return air fan system. Results of leakage testing shall be submitted to engineer for review.

END OF SECTION

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices.

B. Backdraft dampers - metal.

C. Combination fire and smoke dampers.

D. Duct access doors.

E. Duct test holes.

F. Flexible duct connectors.

G. Thermally broken low leakage motorized dampers.

H. Volume control dampers.

I. Low leakage (Class 1A) control dampers.

1.2 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

C. NFPA 92 - Standard for Smoke Control Systems; 2015.

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

E. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

F. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

C. Manufacturer's Installation Instructions: Provide instructions for combination fire and smoke dampers.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

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

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES

A. Turning Vanes

1. Provide single width airfoil type fabricated turning vanes and vane runners constructed in accordance with SMACNA "HVAC Duct Construction Standards".

B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS - METAL

A. Round:

1. Leakage: Dampers shall have a rating of 4 cfm /sq. ft. @ 1 in wg.

2. Differential Pressure: Dampers shall have a minimum differential pressure rating of 3 in. wg.

3. Velocity: Dampers shall have a minimum velocity rating of 2000 fpm.

4. Construction:

a. Frame and Sleeve: The damper frame and sleeve shall be of one piece design, made with 20 ga. galvanized steel and a groove for added strength.

b. Blades: Aluminum

c. Blade Seals: Closed cell neoprene/EPDM/SBR blend

B. Rectangular:

1. Leakage: Dampers shall have a maximum leakage of 8.9 cfm/ft^2 @ 1 in. wg. with a width or height of 24 in. or greater. Tested in accordance with AMCA standard 500-D.

2. Differential Pressure: Dampers shall have a maximum differential pressure rating of 10 in. wg.

3. Velocity: Dampers shall have a maximum velocity rating of 3500 fpm

4. Construction:

a. Damper frame shall be .125 in. extruded aluminum (6063T5) frame with screwed corners. Blade orientation is horizontal.

b. Blades: Damper blades shall be .070 in. extruded aluminum (6063T5). Blade orientation is horizontal.

c. Blade Edge: Blade seals shall be Vinyl, which are mechanically fastened to each blade.

d. Axles: Aluminum

5. Accessories:

a. Counterbalance weights

2.3 RECTANGULAR COMBINATION FIRE AND SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

B. Provide factory sleeve and collar for each damper.

C. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

D. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

E. Combination fire and smoke dampers shall be provided with Belimo Aircontrols FSAF (133 in-#) actuators or equal. Actuator timing shall meet local codes - 15 seconds.

1. Actuator shall carry a manufacturer's 5-year warranty and be manufactured under ISO 9001 quality control.

2. Actuator shall have microcontroller based motor controller providing:

a. Electronic cut off at full open so that no noise can be generated while holding open. Holding noise level shall be inaudible.

b. Overload protection. Shall be incapable of burning out if stalled before reaching full rotation.

3. Housing shall be steel and gears shall be permanently lubricated.

4. The actuators shall be direct coupled and employ a steel-toothed cold-weld clamp for connecting to damper shafts. Aluminum clamps or set-screw attachment shall not be acceptable.

5. Actuator shall have UL555S Listing by the damper manufacturer for 250°F.

6. Dampers shall be installed straight and true, level in all planes, and square in all dimensions. Dampers shall move freely without undue stress due to twisting, racking, bowing, or other installation error. Do not install in area where moisture can penetrate damper or actuator nor where actuator temperature continuously exceeds 120°F.

F. Provide each combination fire/smoke damper with a position indicator package, which operates as a function of the damper blade position. The position indicator shall allow remote indication of damper blade position with two single pole, double throw switches and provides a positive open or closed signal.

G. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.

H. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.4 ROUND COMBINATION FIRE/SMOKE DAMPERS

A. Ratings:

1. Fire Rating: 1½ hours in accordance with UL-555

2. Smoke Rating: Leakage Class-1 (8 cfm/ft^2 (0.04 m^3/ s/m^2) at 4 in.wg. (1.0 kPa) in accordance with UL-555S.

3. Elevated Temperature Rating: 350ºF (177 ºC)

4. Air Flow Rating: 2000 fpm (15.3 m/s)

5. Differential Pressure Rating: 4 in.wg. (1.0 kPa)

B. Construction:

1. Frame and Sleeve: The damper frame and sleeve shall roll formed from a single piece of 16 inch x 20 gauge (203 x 1.0 mm) galvanized steel with reinforcing beads.

2. Blades: Double skin, minimum 14 gauge equivalent thickness, galvanized steel.

3. Blade Seals: Full perimeter contact, silicone rubber, mechanically secured between blades.

4. Axels: Minimum ½” (13mm) diameter plated steel, mechanically attached to blade.

5. Bearings: Self-lubricating stainless steel, sleeve-type.

6. Fire Closure Device: Resettable

7. Release Temperature: 165 ºF (74 ºC).

8. Mounting: Vertical and/or Horizontal

9. Retaining Plates: Supplied with damper as a standard feature, single-side installation for wood, metal, or masonry walls.

10. Actuator:

    a. Electric 120 V, 60 Hz, two-position, fail close.

    b. Mounting: External Only

11. Accessories:

    a. Two-Temperature Fire Closure Device:

        1) UL classified two-temperature device permits the damper to be re-opened after initial temperature closure allowing the damper to remain operable for smoke management purposes until the high temperature limit is reached.

        2) Manual damper testing is permitted by physically depressing the low temperature thermal disc from the inside of the damper sleeve and resetting the sensor from the exterior side of the damper sleeve.

        3) Dual position blade indicator switch package shall connect directly to the blade axel for positive annunciation (interconnecting arms, wire-forms, or brackets shall not be accepted) and provide full open and full closed blade indication to a remote location.

2.5 DUCT ACCESS DOORS

A. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.

1. Less Than 12 inches Square: Secure with sash locks.

2. Up to 18 inches Square: Provide two hinges and two sash locks.

3. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.

4. Larger Sizes: Provide an additional hinge.

B. Access doors with sheet metal screw fasteners are not acceptable.

2.6 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.7 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.

a. Net Fabric Width: Approximately 2 inches wide.

2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.

2.8 LOW LEAK THERMALLY-BROKEN MOTORIZED DAMPERS

A. General: Provide thermally-broken motorized dampers with insulated blades for all outside air intake dampers as well as exhaust dampers and return air dampers,. Basis of design: Tamco Series 9000.

B. Construction:

1. Frame: Extruded aluminum (6063T5), with thickness of 0.80 inches, 4 inches deep, insulated with styrofoam on four sides. Entire frame shall be thermally broken by means of polyurethane resin pockets complete with thermal cuts

2. Blades: Blades shall be extruded aluminum (6063T5, internally insulated with expanded polyurethane foam and thermally broken. Complete blade shall have an insulating factor of R-2.29 and a temperature index of 55.

3. Seals: Blade and frame seals shall be extruded silicone and secured in an integral slot within the aluminum extrusions.

4. Bearings: Bearings shall be composed of a celcon inner bearing fixed to a 7 /16 inch aluminum hexagon blade pin rotating within a polycarbonate outer bearing inserted in the frame, resulting in no metal-to-metal or metal-to-plastic contact.

5. Normal Position: Closed.

6. Blade Operation: Parallel.

7. Performance: Tested in accordance with AMCA Test Standard 500 D: Leakage: 4.12 CFM/square foot with 4 inches differential pressure, as tested through 48x48 louver.

a. Class 1A leakage rating.

2.9 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Single Blade Dampers:

1. Fabricate for duct sizes up to 6 by 30 inch.

2. Blade: 24 gauge, 0.0239 inch, minimum.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

1. Blade: 18 gauge, 0.0478 inch, minimum.

D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

E. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.

2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, smoke dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 16" x 16" size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

C. Provide duct test holes where indicated and required for testing and balancing purposes.

D. Provide combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

E. Install combination smoke and fire dampers in accordance with NFPA 92.

F. At rooftop air handling units, air handling units, fans and motorized equipment associated with ducts that DON'T include internal fan vibration isolation devices, provide flexible duct connections immediately adjacent to the equipment.

G. Combination Fire/Smoke Dampers:

1. Install dampers at locations indicated on the drawings and in accordance with manufacturer's UL approved installation instructions.

2. Install dampers square and free from racking with blades running horizontally.

3. Do not compress or stretch damper frame into duct or opening.

4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jackshaft.

5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

H. Gravity Backdraft dampers:

1. Install dampers in accordance with manufacturer’s Installation Instructions.

2. Dampers must be accessible to allow inspection, adjustment, and replacement of components. The sheet metal contractor shall furnish any access doors in ductwork or plenums required to provide this access.

3. Install dampers square and free from racking.

4. The installing contractor shall provide and install bracing for multiple section assemblies to support assembly weight and to hold against system pressure.

5. Do not compress or stretch the damper frame into the duct or opening.

6. Attach multiple damper section assemblies together in accordance with manufacturer’s instructions. Install support mullions as reinforcement between assemblies as required.

7. Handle dampers using the frame or sleeve. Do not lift or move dampers using blades, actuator or jackshaft.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

J. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

K. Volume Control Balancing Dampers: Provide multi-blade opposed blade dampers for ductwork 12" high and larger and single blade dampers for ductwork sizes 10" and smaller.

L. Provide balancing dampers on duct take-off to active terminal units, diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 233416 - CENTRIFUGAL HVAC FANS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Square inline centrifugal fans.

B. Bearings and drives.

1.2 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; 1990 (Reapproved 2008).

C. AMCA 99 - Standards Handbook; 2010.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

G. NEMA MG 1 - Motors and Generators; 2014.

H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

I. UL – Underwriters Laboratories.

J. National Electrical Code.

1.3 SUBMITTALS

A. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point plotted, power, rpm, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

B. Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Include complete installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

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

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.6 FIELD CONDITIONS

A. Permanent fans may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.1 DIRECT DRIVE BACKWARD INCLINED SQUARE INLINE CENTRIFUGAL FANS

A. General Description:

1. Base fan performance at standard conditions (density 0.075 Lb/ft3)

2. Normal operating temperature up to 130 Fahrenheit (54.4 Celsius)

3. Applications include: intake, exhaust, return, or make-up air systems

4. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number

B. Wheel:

1. Non-overloading, backward inclined centrifugal wheel

2. Constructed of aluminum

3. Statically and dynamically balanced in accordance to AMCA Standard 204-05

4. The wheel cone and fan inlet shall be matched and shall have precise running tolerances for maximum performance and operating efficiency

5. Single thickness blades shall be securely riveted or welded to a heavy gauge back plate and wheel cone.

C. Motors:

1. Motor shall be NEMA design B with a minimum of class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure.

D. Housing/Cabinet Construction

1. Construction material: Aluminum

2. Square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars

3. Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.

E. Housing Supports and Drive Frame:

1. Housing supports shall be constructed of structural steel with formed flanges

2. Drive frame shall be welded steel which supports the motor

F. Disconnect Switches:

1. NEMA rated: 1

2. Positive electrical shut-off

3. Wired from fan motor to junction box

G. Duct Collars:

1. Square design to provide a large discharge area

2. Inlet and discharge collars shall be provided

H. Access Panel:

1. Two sided access panels, permit easy access to all internal components

2. Located perpendicular to the motor mounting panel

I. Options/Accessories:

1. Insulated Housing

a. Thickness: 1 inch

b. For noise reduction and condensation control

c. Constructed of fiberglass liner

2. Isolation:

a. Type: Restrained Spring Mount

b. Sized to match the weight of each fan

3. Motor Cover:

a. Constructed of galvanized steel

b. Covers motor and drives for safety

4. Pressure Probe:

a. ¼ inch diameter tube in fan venturi that allows hook up to manometer

5. Wiring Pigtail:

a. Direct hook-up to the power supply

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible connections between fan inlet and discharge ductwork; see Section 233300. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

END OF SECTION

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof mounted downblast exhausters.

1.2 REFERENCE STANDARDS

A. AMCA 99 - Standards Handbook; 2010.

B. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.

C. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.

D. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

E. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

G. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Manufacturer's Instructions: Indicate installation instructions.

C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

D. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved: Roof framing and support members relative to duct penetrations.

E. Maintenance Materials: Furnish the following for Nanuet Union Free School District's use in maintenance of project.

1. Extra Fan Belts: One set for each individual belt driven fan.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.5 FIELD CONDITIONS

A. Permanent ventilators may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

B. Provide one set of variable and adjustable pitch sheaves for each belt-driven centrifugal fan selected for midpoint operation at specified performance. Furnish one set of fixed sheaves and matched belts for each belt-driven centrifugal fan, selected following completion of balancing to deliver specified unit airflow. Turn fixed sheaves and matched belts over to balancer upon completion of balancing of variable and adjustable pitched sheaves.

PART 2 PRODUCTS

2.1 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: Comply with AMCA 204.

B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.

C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.

D. Fabrication: Comply with AMCA 99.

E. UL Compliance: UL 705, listed, labeled, designed, manufactured, and tested.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

G. Enclosed Safety Switches: Comply with NEMA 250.

2.2 ROOF MOUNTED DOWNBLAST EXHAUSTERS

A. Acceptable Manufacturers:

1. Loren Cook.

2. Twin City.

3. Greenheck.

B. Fan Unit: Direct drive, with spun aluminum housing and aluminum rub ring; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

C. Roof Curb: 16 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, and factory installed nailer strip.

D. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

E. Backdraft Damper: Motor actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

F. Sheaves (for belt drive fans only): Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

G. Motor (for three phase fans only): Heavy duty type with permanently lubricated sealed ball bearings and furnished at the scheduled voltage and phase.

1. Provide premium efficiency motor, suitable for inverter duty.

H. Motor (FOR single phase DIRECT DRIVE FANS): Motor shall be an electronically commutated motor rated for continuous duty and furnished with unit mounted potentiometer to vary fan speed.

I. Standard Roof curbs: 16 or 18 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, and factory installed nailer strip.

J. Curb Adapters (where called out on drawings and/or schedules):

1. Roof Curb Adapter and Extension:

a. Used to connect a new roof fan to an existing roof curb

b. Roof Products and Systems (RPS) model CA-2 or equal

c. Construction:

1) 18 gauge galvanized steel

2) 1-1/2", 3 LB. density fiberglass insulation

3) Unitized construction

4) Continuous welded corner seams

5) 16 inch height

d. Field measure existing roof curb dimensions as required to provide curb adapter size to match replacement fan inlet dimensions.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

END OF SECTION

SECTION 233700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

1.2 REFERENCE STANDARDS

A. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (R2011).

B. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.3 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

B. Project Record Documents: Record actual locations of air outlets and inlets.

1.4 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 RETURN REGISTERS

A. Approved Manufacturers:

1. Price 530 (basis of design)

2. Titus

3. Nailor

B. Furnish and install steel return registers of the sizes and mounting types indicated on the plans and outlet schedule. Registers shall be 45 degree deflection fixed louver type with blades spaced 3/4 in. on center. The blades shall run parallel to the long dimension of the register. The register shall be finished in B12 White Powder Coat. Paint finish shall pass

500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

2.2 TRANSFER REGISTERS

A. Approved Manufacturers:

1. Price 530 (basis of design)
2. Titus
3. Nailor

B. Furnish and install steel transfer registers of the sizes and mounting types indicated on the plans and outlet schedule. Registers shall be 45 degree deflection fixed louver type with blades spaced 3/4 in. on center. The blades shall run parallel to the long dimension of the register. The register shall be finished in B12 White Powder Coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

2.3 EXHAUST REGISTERS

A. Approved Manufacturers:

1. Price 630 (basis of design)
2. Titus
3. Nailor

B. Furnish and install aluminum exhaust registers of the sizes and mounting types indicated on the plans and outlet schedule. Registers shall be 45 degree deflection fixed louver type with blades spaced 3/4 in. on center. The blades shall run parallel to the long dimension of the register. The register shall be finished in B12 White Powder Coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

2.4 SQUARE CONE DIFFUSERS

A. Approved Manufacturers:

1. Price SCD (basis of design)
2. Titus
3. Nailor

B. Furnish and install ceiling diffusers of sizes and mounting types designated by the plans and air distribution schedule. Diffusers shall consist of a precision formed back cone of one-piece seamless construction that incorporates a round inlet collar of sufficient length for connecting rigid or flexible duct. The diffuser shall integrate with all duct sizes shown

on the plans without affecting the face size and appearance of the unit. An inner cone assembly shall consist of 3 cones (or optional 4 cones) which drop below the ceiling plane to assure optimal VAV air diffusion performance. The inner cone assembly shall be completely removable from the diffuser face to allow for full access to any dampers or other ductwork components located near the diffuser neck. Finish shall be B12 white powder coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

2.5 LOUVERED FACE SUPPLY REGISTERS

A. Approved Manufacturers:

1. Price 510 (basis of design)
2. Titus
3. Nailor

B. Furnish and install steel supply registers of the sizes and mounting types indicated on the plans and outlet schedule. Registers shall be 45 degree deflection fixed louver type with blades spaced 3/4 in. on center. The blades shall run parallel to the (long / short) dimension of the register. The register shall be finished in B12 White Powder Coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

END OF SECTION

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SECTION 235100 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Combustion air inlet for direct vent gas-fired appliances

B. Flue pipe for direct vent gas-fired appliances

1.2 REFERENCE STANDARDS

A. NFPA 54 - National Fuel Gas Code; 2015.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.3 DEFINITIONS

A. Breeching: Vent connector.

B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

C. Smoke Pipe: Round, single wall vent connector.

D. Vent: That portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

E. Vent Connector: That part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.4 SUBMITTALS

A. Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

B. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations where factory built units are used.

C. Manufacturer's Instructions: Include installation instructions, and indicate assembly, support details, and connection requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years documented experience, and approved by manufacturer.

PART 2 PRODUCTS

2.1 BREECHINGS, CHIMNEYS, AND STACKS - GENERAL

A. Regulatory Requirements:

1. Comply with applicable codes for installation of propane burning appliances and equipment.

2.2 COMBUSTION AIR INLET FOR DIRECT VENT GAS-FIRED APPLIANCES

A. PVC Pipe: ASTM D 2665 or ASTM D 3034.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

B. Accessories:

1. Adjustable flashing.

2. Storm collar.

3. Screened inlet.

2.3 FLUE PIPE FOR DIRECT VENT GAS-FIRED APPLIANCES

A. Acceptable Manufacturers:

1. Selkirk Corporation: www.selkirkcommercial.com.

2. Metal-Fab, Inc: www.mtlfab.com.

3. AMPCO: www.ampcostacks.com.

B. Vent shall be factory-built special gas type, single wall, engineered and designed for use on Category IV appliances, or as specified by the equipment manufacturer.

C. Maximum continuous flue gas temperature shall not exceed 1400 degrees Fahrenheit.

D. Vent shall be constructed of AL29-4C® or 29-4 (S44735) superferritic stainless steel with a minimum thickness of .015” for diameters 3”-8” and .020” for diameters 10”-16”.

E. All conduit components shall be manufactured from AL29-4C®, or 29-4 (S44735). The joint closure system shall be a Ring-and-Tab mechanism that is integral to each joint. Joints shall not use screws or fasteners that penetrate the pipe.

F. Vent shall be constructed with a factory installed gasket used to seal the joint. Use of gasket lube, available from the factory, should be used for maximizing gasket life and ease of installation.

G. Joints shall be designed with a male and female overlapping metal-metal connection to maintain condensate on the AL29-4C stainless steel. Proper ¼" per foot pitch shall be maintained at all times and condensate shall flow back toward the appliance to the required number of drains

H. Vent shall be rated for an internal static pressure of 9" w.g.

I. All parts shall be compatible with other single wall and double wall products of the same manufacturer.

J. System shall be sized in accordance with the appliance manufacturer's specifications, NFPA 54-National Fuel Gas Code (ANSI Z223.1), ASHRAE recommendations and other applicable codes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 54

C. Install breechings with minimum of joints. Align accurately at connections, with internal surfaces smooth.

D. Support breechings from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling. Support vertical breechings, chimneys, and stacks at 12 foot spacing, to adjacent structural surfaces, and at floor and roof penetrations. Refer to SMACNA (DCS) for equivalent duct support configuration and size.

E. Clean breechings, chimneys, and stacks during installation, removing dust and debris.

END OF SECTION

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SECTION 238126.13 - SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air cooled condensing units.

B. Indoor air handling (fan and coil) units for ductless systems.

1.2 REFERENCE STANDARDS

A. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment; 2008.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

D. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012, with 2015 amendments.

E. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Ammendments and Errata.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.

1.3 SUBMITTALS

A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

B. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Design Data: Indicate refrigerant pipe sizing.

E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

F. Project Record Documents: Record actual locations of components and connections.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

H. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Nanuet Union Free School District's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience and approved by manufacturer.

1.5 WARRANTY

A. Provide five year manufacturers warranty for condensing units and compressors.

PART 2 PRODUCTS

2.1 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.

1. Cooling: Outdoor electric condensing unit with evaporator located in a unit ventilator .

2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

2.2 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.

1. Comply with AHRI 210/240.

2. Refrigerant: R-32.

3. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

B. Compressor: AHRI 520; scroll, 3600 rpm, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.

C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

1. Condenser Fans: Direct-drive propeller type.

2. Condenser Fan Motor: Enclosed, 1-phase type, permanently lubricated.

D. Coil: Air-cooled, aluminum fins bonded to copper tubes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

3.2 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

B. Install refrigeration systems in accordance with ASHRAE Std 15.

END OF SECTION

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SECTION 238126 - MULTI-SPLIT HEAT PUMP SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air-source heat pumps.

B. Indoor (fan and coil) units.

C. Controls.

1.2 REFERENCE STANDARDS

A. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment; 2008.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

D. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012, with 2015 amendments.

E. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Ammendments and Errata.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.

1.3 SUBMITTALS

A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

B. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Design Data: Indicate refrigerant pipe sizing.

E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

F. Project Record Documents: Record actual locations of components and connections.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

H. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Nanuet Union Free School District's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience and approved by manufacturer.

1.5 WARRANTY

A. Provide five year manufacturers warranty for compressors.

PART 2 PRODUCTS

2.1 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.

1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator.

2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

2.2 INDOOR UNITS

A. General: indoor unit shall be a wall mounted fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation onto a wall within a conditioned space. This compact design shall be furnised with finished white casing. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment. The indoor units sound pressure shall range from 31 dB(A) to 41 dB(A) at low speed measured at 3.3 feet below and from the unit.

B. The indoor unit hall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an

auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing. The discharge angle shall automatically set at the same angle as the previous operation upon restart. The drain pipe can be fitted to from either left or right sides.

C. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.

D. Both refrigerant lines shall be insulated from the outdoor unit.

E. Return air shall be through a resin net mold resistant filter.

F. The indoor units shall be equipped with a condensate pan.

G. The indoor units shall be equipped with a return air thermistor.

H. Unit Cabinet:

1. The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.

2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

I. Fan:

1. The fan shall be a direct-drive cross-flow fan, statically and dynamically balanced impeller with high and low fan speeds available.

2. The fan motor shall be thermally protected.

J. Coil:

1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.

3. The coil shall be a 2-row cross fin copper evaporator coil with 14 fpi design completely factory tested.

4. The refrigerant connections shall be flare connections and the condensate will be 11/16 inch outside diameter PVC.

K. A thermistor will be located on the liquid and gas line.

L. A condensate pan shall be located in the unit.

M. Control:

1. The unit shall have controls provided by unit manufacturer to perform input functions necessary to operate the system.

2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.

3. The unit shall be compatible with a unit manufacturer provided advanced multi-zone controller.

2.3 OUTDOOR UNITS

A. The outdoor units shall be specifically designed to work with the ducted, 4-way cassette, one-way cassette and multi-position air handler indoor units. The outdoor units must have a thermally fused powder coated finish. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.

B. Outdoor unit shall have a sound rating no higher than 55 dB(A). If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.

C. Refrigerant lines from the outdoor unit to the indoor units shall be insulated in accordance with the installation manual.

D. The outdoor unit shall meet performance requirements per schedule and be within piping limitations & acceptable ambient temperature ranges as described in respective manufacturers' published product catalogs. Non-published product capabilities or performance data are not acceptable.

E. The outdoor unit shall be capable of guaranteed operation in heating mode down to -13°F ambient temperatures and cooling mode up to 115°F without additional restrictions on line length & vertical separation beyond those published in respective product catalogs. Models with capacity data for required temperature range published as "for reference only" are not considered capable of guaranteed operation and are not acceptable. If an alternate manufacturer is selected, any additional material, cost, and labor to meet ambient operating range and performance shall be incurred by the contractor.

F. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized snow /hail guard. The snow/hail guard protects the outdoor coil surfaces from hail damage and snow build-up in severe climates.

G. Four-legged outdoor unit mounting systems shall be provided by manufacturer. Stand shall be made from 7 gauge plate steel with thermally fused polyester powder coat finish that meets ASTM D3451-06 standards. Stands shall be provided with galvanized mounting hardware and meets all ASCE 7 overturning safety requirement.

H. Unit Cabinet:

1. The casing shall be fabricated of galvanized steel, bonderized, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for

corrosion protection. Assembly hardware shall be cadmium plated for weather resistance.

2. Cabinet color shall be Munsell 3Y 7.8/1.1.

3. Two (2) mild steel mounting feet, traverse mounted across the cabinet base pan, welded mount, providing four (4) slotted mounting holes shall be furnished. Assembly shall withstand lateral wind gust up to 155 MPH to meet applicable weather codes.The casing(s) shall be fabricated of galvanized steel, bonderized and finished.

I. Fan:

1. The unit shall be furnished with a direct drive propeller type fan.

2. The outdoor unit fan motor shall be a direct current (DC) motor and have permanently lubricated bearings.

3. The fan motor shall be mounted for quiet operation.

4. The fan shall be provided with a raised guard to prevent contact with moving parts.

5. The outdoor unit shall have horizontal discharge airflow.

J. Refrigerant and Refrigerant Piping

1. R410A refrigerant shall be required for systems.

2. Polyolester (POE) oil—widely available and used in conventional domestic systems—shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

3. Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the equipment manufacturer and installed in accordance with manufacturer recommendations.

4. Refrigerant line sizing shall be in accordance with manufacturer specifications.

K. Coil:

1. The outdoor unit coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.

2. The coil fins shall have a factory applied corrosion resistant Blue Fin finish. Uncoated aluminum coils/fins are not allowed.

3. The coil shall be protected with an integral metal guard.

4. Refrigerant flow from the outdoor unit shall be regulated by means of an electronically controlled, precision, linear expansion valve.

5. Outdoor unit shall be pre-charged with sufficient R-410a refrigerant for up to twenty five (25) feet of refrigerant piping for capacities up to 24,000 BTU/h.

6. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements.

7. All refrigerant connections between outdoor and indoor units shall be flare type.

L. Compressor:

1. The compressor shall be a high performance, hermetic, inverter driven, variable speed, dual rotary type manufactured by Mitsubishi Electric Corporation.

2. The compressor motor shall be direct current (DC) type equipped with a factory supplied and installed inverter drive package.

3. The compressor will be equipped with internal thermal overload protection.

4. The outdoor unit must have the ability to operate over the full capacity range with a maximum height difference of 40 feet (12 meters) for 9,000, 12,000, and 15,000 BTU/h models, 50 feet (15 meters) for 18,000 BTU/h models, and 100 feet (30 meters) for 24,000 BTU/h, 30,000 BTU/h and 36,000 BTU/h models; and have refrigerant tubing length of up to 65 feet (20 meters) for 9,000, 12,000, and 15,000 BTU/h models, and 100 feet (30 meters) for 18,000 BTU/h, 24,000 BTU/h, 30,000 BTU/h and 36,000 BTU/h models between the indoor and outdoor units.

5. Filters, sight glasses, and traps shall not be used, and no additional refrigerant oil shall be required.

6. The compressor shall be mounted so as to avoid the transmission of vibration.

M. Basepan Heater:

1. Each outdoor unit module shall be equipped with a basepan heater to protect the coil against ice build-up during prolonged winter operation. Basepan heater shall activate only if compressor is operating in heating mode at an outdoor ambient temperature of 36F or below.

2.4 ACCESSORY EQUIPMENT

A. Controls

1. The control system shall consist of a minimum of one microprocessor on each indoor unit and one in the outdoor unit, communicating via A-Control data over power transmission. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired or wireless controller, providing emergency operation and controlling the outdoor unit. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC.

2. A three (3) conductor 14 gauge AWG wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units.

3. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.

4. The indoor and outdoor unit control system shall be capable of supporting integration with Building Management Systems (BMS) through BACnet Protocol (ANSI/ASHRAE 135-2010) and be Certified by the (BTL) BACnet® Testing Laboratories. The BACnet® interface shall support BACnet Broadcast Management (BBMD).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

3.2 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

B. Install refrigeration systems in accordance with ASHRAE Std 15.

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SECTION 238129 - VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air-source outdoor units.

B. Refrigerant piping.

C. Indoor units.

D. Outdoor unit support systems.

E. Control panels.

F. Control wiring.

1.2 REFERENCE STANDARDS

A. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

B. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2013.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's standard data sheets showing the following for each item of equipment, marked to correlate to equipment item markings indicated in Contract Documents:

1. Outdoor Units:

a. Refrigerant Type and Size of Charge.

b. Output and Input Cooling Capacity: Btu/h.

c. Output and Input Heating Capacity: Btu/h.

d. Operating Temperature Range, Cooling and Heating.

e. Fan Capacity: Flow in cfm with respective fan curves.

f. External Static Pressure (ESP): In-wc.

g. Sound Pressure Level: dB(A).

h. Electrical Data: Complete including motor size.

i. Maximum number of indoor units that can be served.

j. Maximum refrigerant piping run from outdoor unit to indoor unit(s).

k. Maximum height difference between outdoor unit to Indoor unit(s), both above and below.

2. Control Panels: Complete data of controllers, input-output points, and zones.

B. Shop Drawings: Installation drawings custom-made for this project; include as-designed HVAC layouts, locations of equipment items, refrigerant piping sizes and locations, condensate piping sizes and locations, remote sensing devices, control components, electrical connections, control wiring connections. Include:

1. Detailed piping diagrams, with branch balancing devices.

2. Condensate piping routing, size, and pump connections.

3. Detailed power wiring diagrams.

4. Detailed control wiring diagrams.

5. Locations of required access through fixed construction.

6. Drawings required by manufacturer.

C. Operating and Maintenance Data:

1. Manufacturer's complete standard instructions for each unit of equipment and control panel.

2. Custom-prepared system operation, troubleshooting, and maintenance instructions and recommendations.

3. Identification of replaceable parts and local source of supply.

D. Warranty: Executed warranty, made out in Nanuet Union Free School District's name.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Company that has been manufacturing variable refrigerant volume heat pump equipment for at least 5 years.

2. Company that provides system design software to installers.

B. Installer Qualifications: Trained and approved by manufacturer of equipment.

C. The units shall be tested by a National Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.

D. All wiring shall be in accordance with the National Electric Code (NEC).

E. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

F. The condensing units shll be factory charged with R410A.

1.5 WARRANTY

A. Compressors: Provide manufacturer's warranty for ten (10) years from date of installation. During the stated period, should any part fail due to defects in material and workmanship, it shall be repaired or replaced at the discretion of manufacturer according to the manufacturer's terms and conditions. All warranty service work shall be preformed by the manufacturer's factory trained service professional.

B. The equipment manufacturer shall warrant the indoor and outdoor products in this specification section installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the “Products”) will be free from defects in material and workmanship. This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the ‘’installation date’’ which is one of the two dates below:

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: The system design indicated in Contract Documents is based on equipment and system designed by Daikin AC; www.daikinac.com.

B. The variable capacity heat pump air conditioning system shall be a Daikin Variable Refrigerant Volume Series (heat or cool model) system as specified.

C. The systems shall consist of multiple evaporators using PID control, REFNET joints and headers, a two-pipe refrigeration distribution system and Daikin VRV condenser unit.

D. The condensers shall be a direct expansion (DX), air-cooled heat pump, multi-zone air-conditioning system with variable speed inverter driven compressors using R-410A refrigerant.

E. The condensing units may connect an indoor evaporator capacity up to 200% of the condensing unit capacity. All zones are each capable of operating separately with individual temperature control.

F. The Daikin condensing unit shall be interconnected to unit ventilator DX cooling coils in accordance with Daikin’s engineering data book detailing each unit.

G. The fan coil unit DX cooling coils shall be connected to the condensing units utilizing Daikin’s REFNET specified piping joints and headers to ensure correct refrigerant flow and balancing. T style joints are not acceptable for a variable refrigerant system.

H. Operation of the system shall permit either cooling or heating of all of the indoor units simultaneously. Each indoor unit or group of indoor units shall be able to provide set

temperature independently via a local remote controller, the existing Intelligent Manager, or the specified Direct Digital Control (DDC) system interface.

I. Each fan coil unit shall be independently controlled.

J. The condensing unit shall feature a sealed E-box with a minimum of IP55 rating to provide high dust and moisture protection for reliability.

K. Each system shall be able to enlarge from single to dual module or dual to triple module without the need for installed main pipe size changes. The manufacturer shall provide predefined pipe sizes and design rules ensuring reliable system operation and offering design flexibility in phased installation applications.

L. Stable Operation – System shall provide stable inverter operation at varied ambient conditions.

M. No Drain Pan Heater – System shall be capable of heating operation without the need for a drain pan heater. If alternate manufacturer is chosen, an additional drain pan heater shall be provided by the manufacturer.

N. Independent Control - Each indoor unit shall use a dedicated electronic expansion valve with 2000 positions for independent control.

O. VFD Inverter Control and Variable Refrigerant Temperature - Each condensing unit shall use high efficiency, variable speed all “inverter” compressor(s) coupled with inverter fan motors to optimize part load performance. The system capacity and refrigerant temperatures shall be modulated automatically to set suction and condensing pressures while varying the refrigerant volume for the needs of the cooling or heating loads. The control will be automatic and customizable depending on load and weather conditions.

P. Configurator software - Each system shall be available with configurator software package to allow for remote configuration of operational settings and also for assessment of operational data and error codes.

Q. Independent Control - Each fan coil unit DX coil shall use a dedicated electronic expansion valve for independent control.

R. Flexible Design –

1. Systems shall be capable of up to 540ft [623 ft. equivalent] of linear piping between the condensing unit and furthest located indoor unit.

S. Systems shall be capable of up to 3,280ft (1,000m) total “one-way” piping in the piping network.

1. Systems shall have a vertical (height) separation of up to 295ft between the condensing unit and the indoor units.

2. Systems shall be capable of up to 295ft (90m) from the first REFNET / branch point.

3. The condensing unit shall have the ability to connect an indoor unit evaporator capacity of up to 200% of the condensing unit nominal capacity.

4. Systems shall be capable of 361ft vertical separation between indoor units.

5. Oil Return – Each system shall be furnished with a centrifugal oil separator and active oil recovery cycle.

6. Simple wiring – Systems shall use 16/18 AWG, 2 wire, stranded, non-shielded and non-polarized daisy chain control wiring between fan coil units, blower coils and unit ventilators and heat pumps and between fan coil units, blower coils and unit ventilators and remote controllers.

7. Each condensing unit shall include a multi-functional digital display that can provide system operation status such as operating refrigerant temperatures, pressures, outdoor electronic expansion valve opening and compressor operation time.

8. Each condensing unit shall include a service window that can provide easy access to system field settings and operation status without completely removing the condensing unit panel.

9. Systems shall include a self-diagnostic, auto-check function to detect a malfunction and display the type and location.

10. Each condensing unit shall incorporate contacts for electrical demand shedding with optional 3 stage demand control with 12 customizable demand settings.

11. Each system shall be capable of integrating with open protocol BACnet and LonWorks building management systems.

12. Each system shall use indoor and condensing units with quiet operation as low as 27 dB(A).

13. Each system shall include a built-in data recorder that can store up to 40 minutes of operational data which can help identify the issue in case of a product failure

14. Heating during Defrost and Oil Return. Reverse cycle (cooling mode) in these modes shall not be permitted due to the potential reduction in space temperature.

15. Low Ambient Cooling - Each system shall be capable of low ambient cooling operation to -4°FDB (-20°CDB).

16. The condensing unit shall have configurable settings for intermittent fan operation to help minimize snow accumulation on fan blades when the system is off.

17. The condensing unit shall be factory equipped with a Schrader valve for connection to a pressure relief kit.

18. Substitutions: Systems manufactured by other manufacturers will not be considered.

2.2 VARIABLE REFRIGERANT FLOW SYSTEM

A. Cooling Operation:

1. The operating range in cooling shall be 23°F DB ~ 122°F DB (-5°CDB ~ 50°CDB).

2. Cooling mode indoor room temperature range shall be 57-77°FWB (13.8 - 25°CWB).

B. Heating Operation:

1. The operating range in heating shall be -13°F WB – 61°F WB.

2. Heating mode indoor room temperature range shall be 59°FDB - 80°F DB (15°CDB – 26.7°CDB).

C. WIRING:

1. The control voltage between the indoor and condensing unit, and between the indoor unit and associated remote controller, shall be 16VDC non-shielded, stranded 2 conductor cable.

2. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one condensing unit with one 2-cable wire, thus simplifying the wiring installation.

D. REFRIGERANT PIPING:

1. REFNET piping joints and headers shall be used to ensure proper refrigerant balance and flow for optimum system capacity and performance.

a. T style joints shall not be acceptable as this will negatively impact proper refrigerant balance and flow for optimum system capacity and performance.

2.3 AIR-SOURCE OUTDOOR UNITS

A. GENERAL:

1. The condensing unit shall be designed specifically for use with VRV series components.

2. The refrigeration circuit of the condensing unit shall consist of Daikin inverter scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant accumulator.

3. Liquid and suction lines shall be individually insulated between the condensing and indoor units.

4. The condensing unit can be wired and piped with access from the left, right, rear or bottom.

5. The connection ratio of indoor units to condensing unit shall be permitted up to 200% of nominal capacity.

6. Each condensing system shall be able to support the connection of up to 64 indoor units dependent on the model of the condensing unit.

7. The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit. The condensing unit shall be capable of operating automatically at further reduced noise during night time or via an external input.

8. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.

9. The condensing unit shall be modular in design and should allow for side-by-side installation with minimum spacing.

10. The following safety devices shall be included on the condensing unit; high pressure sensor and switch, low pressure switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.

11. To ensure the liquid refrigerant does not flash when supplying to the various indoor units, the circuit shall be provided with a sub-cooling feature.

12. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.

13. The condensing unit shall be capable of heating operation at -13°F (-25°C) wet bulb ambient temperature without additional low ambient controls or an auxiliary heat source.

B. UNIT CABINET:

1. The condensing unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed galvanized steel panels coated with a baked enamel finish.

2. Each condensing unit shall have a three-segment panel design which allows for direct access to outdoor fans, critical mechanical and electrical components separately for ease of installation and service.

3. Each outdoor unit shall have separate knock-outs for both refrigerant piping and wiring on the bottom panel.

C. FAN:

1. The condensing unit shall consist of one or more propeller type, direct-drive fan motors that have multiple speed operation via a DC (digitally commutating) inverter.

2. The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type, and be of high external static pressure and shall be factory set as standard at 0.12 in. WG. A field setting switch to a maximum 0.32 in. WG pressure is available to accommodate field applied duct for indoor mounting of condensing units.

3. The condensing unit shall have configurable settings for intermittent fan operation to help minimize snow accumulation on fan blades when the system is off.

4. The fan shall be a vertical discharge configuration with a nominal airflow maximum range of 6,200 CFM to 14,505 CFM dependent on model specified.

5. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.

6. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

D. CONDENSER COIL:

1. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.

2. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.

3. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.

4. The fins shall be coated with an anti-corrosion hydrophilic blue coating as standard from factory with a salt spray test rating of 1000hr per ASTM test standards.

5. The condensing unit shall be factory equipped with condenser coil guards on all sides.

E. COMPRESSOR:

1. The Daikin inverter scroll compressors shall be variable speed (PVM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit.

    a. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency) shall be controlled to eliminate deviation from target value.

        1) Non –inverter-driven compressors, which may cause starting motor current to exceed the nominal motor current (RLA) and require larger wire sizing, shall not be allowed.

2. The inverter driven compressors in the condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll “G-type” or “J-type”.

3. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type.

a. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.

4. The capacity control range shall be as low as 1% to 100%.

5. The compressor's motor shall have a cooling system using discharge gas, to avoid sudden changes in temperature resulting in significant stresses on winding and bearings.

6. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.

7. Oil separators shall be standard with the equipment together with an intelligent oil management system.

8. The compressor shall be mounted on vibration dampening rubber grommets to minimize the transmission of vibration, eliminating the standard need for external spring isolation.

9. In the event of compressor failure, the remaining compressors shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be manually activated to specifically address this condition for single module and manifolded systems.

10. In the case of multiple condenser modules, conjoined operation hours of the compressors shall be balanced by means of the Duty Cycling Function, ensuring sequential starting of each module at each start/stop cycle, completion of oil return, completion of defrost or every 8 hours. When connected to a central control system sequential start is activated for all system on each DIII network.

F. Roof Curbs:

1. Roof Curbs: 18 ga. galvanized steel, unitized construction with attn integral base plate, continuous welded corner seams, pressure treated wood nailer, counterflashing with location screws. Internally re-inforced to conform with load bearing factors.

a. 24" overall height, length based on heat pump unit length.

2.4 INDOOR UNITS

A. 4 WAY CEILING SUSPENDED CASSETTE UNIT

1. General: Daikin indoor unit model FXUQ shall be a ceiling suspended cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation onto a ceiling within a conditioned space. It shall be available in capacities from 18,000 Btu/h to 36,000 Btu/h. It shall be a four-way air distribution type, fresh white, impact resistant with a washable panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 60°. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The indoor units sound pressure

shall range from 36 dB(A) to 40 dB(A) at low speed measured at 5 feet below the unit.

2. Indoor Unit:

    a. The Daikin unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.

3. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.

    a. Both refrigerant lines shall be insulated from the outdoor unit.

    b. The 4-way supply air flow can be field modified to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.

    c. Return air shall be through the concentric panel, which includes a resin net mold resistant filter.

    d. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 23-5/8” of lift and has a built in safety shutoff and alarm.

    e. The indoor units shall be equipped with a return air thermistor.

    f. All electrical components are reached through the decoration panel, which reduces the required side service access.

    g. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.

    h. The voltage range will be 253 volts maximum and 187 volts minimum.

4. Unit Cabinet:

    a. The cabinet shall be space saving and shall be located into the ceiling.

    b. Three auto-swing positions shall be available to choose, which include standard, draft prevention and ceiling stain prevention.

    c. The airflow of the unit shall have the ability to shut down outlets with multiple patterns allowing for simpler installation in irregular spaces.

    d. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

5. Fan:

    a. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with three fan speeds available.

b. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.06 to 0.14 HP.

c. The airflow rate shall be available in three settings.

d. The fan motor shall be thermally protected.

6. Filter:

   a. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

7. Coil:

   a. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

   b. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.

   c. The coil shall be a 3-row cross fin copper evaporator coil with 21 FPI design completely factory tested.

   d. The refrigerant connections shall be flare connections and the condensate will be 1 inch outside diameter PVC.

   e. A condensate pan with antibacterial treatment shall be located under the coil.

   f. A condensate pump with a 23-5/8 inch lift shall be located below the coil in the condensate pan with a built-in safety alarm.

   g. A thermistor will be located on the liquid and gas line.

8. Electrical:

   a. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.

   b. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).

   c. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

9. Control:

   a. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.

   b. The unit shall be compatible with interfacing with a BMS system via BACnet gateways.

c. The unit shall be compatible with the existing Daikin Intelligent Touch Manager advanced multi-zone controller.

B. 1-Way Ceiling-Recessed Cassette, Indoor Units:

1. General: Daikin indoor unit model FXEQ shall be a ceiling suspended cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation onto a ceiling within a conditioned space. It shall be a one-way air distribution type, fresh white, impact resistant with a washable panel. The supply air is distributed via motorized vertical and horizontal louvers which can be adjusted from 0° to 45° and 20° to 70° respectively. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E73. The indoor units sound pressure shall range from 26 dB(A) to 38 dB(A) at low speed measured at 3.3 feet below the unit.

2. The Daikin indoor unit FXEQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate lift pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.

3. The indoor unit shall be able to process up to 15% fresh air

4. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.

5. Both refrigerant lines shall be insulated from the outdoor unit.

6. Return air shall be through the flat back panel, which includes a white resin net mold resistant filter.

7. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 33-716” of lift and has a built in safety shutoff and alarm.

8. The indoor units shall be equipped with a return air thermistor.

9. Motor and some of the electrical components shall be reachable through the decoration panel.

10. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.

11. The voltage range will be 253 volts maximum and 187 volts minimum.

12. Unit Cabinet:

    a. The cabinet shall be space saving and shall be located into the ceiling.

    b. The cabinet shall have a built in 4” knock-out to connect fresh air intake

c. The cabinet shall be constructed with sound absorbing foamed polyurethane noise insulation.

d. The cabinet shall be equipped with foamed polystyrene and foamed polyethylene heat insulation.

13. Fan:

a. The fan shall be direct-drive Sirocco fan type with statically and dynamically balanced impeller with five selectable fan speeds available.

b. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.11 to 0.15 HP.

c. The airflow rate shall be available in five settings.

d. The fan motor shall be thermally protected.

14. Filter:

a. The return air shall be filtered by means of a mold resistant Resin net filter.

b. The filter shall be accessible from the decoration panel

15. Coil:

a. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

b. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.

c. The coils for units up to 1 ton shall be a 2-row cross fin copper evaporator coil with 20.5 FPI design completely factory tested for the

d. The coils for units from 1.25 ton to 2.0 ton shall be 2-row cross fin copper evaporator coil with 20.5 FPI and an additional row with 15.9 FPI.

e. The refrigerant connections shall be flare connections and the condensate will be 1-1/32 inch outside diameter PVC.

f. A condensate pan with antibacterial treatment shall be located under the coil.

g. A condensate pump with a 25 inch lift shall be located below the coil in the condensate pan with a built-in safety alarm.

h. A thermistor will be located on the liquid and gas line.

16. Electrical:

a. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.

b. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).

c. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

17. Control:

a. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.

b. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.

c. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

C. One Way Blow Ceiling Suspended Indoor Unit

1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. The unit shall have an auto-swing function for the horizontal vane. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

2. The casing shall have a white finish.

3. Fan:

a. The indoor unit fan shall be an assembly with two, three, or four Sirocco fan(s) direct driven by a single motor.

b. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.

c. The indoor fan shall consist of four (4) speeds, Low, Mid1, Mid2, and High, and Auto fan function.

4. Return air shall be filtered by means of an easily removable, washable filter.

5. Coil:

a. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos- copper or silver alloy.

b. The coils shall be pressure tested at the factory.

6. Controls:

a. Units shall have the ability to control supplemental heat via connector CN24 and a 12 VDC output.

b. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.

c. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.

d. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

e. Manufacturer to provide drain pan level sensor powered by a 20-year life lithium battery. Sensor shall require no external power for operation and shall have an audible indication of low battery condition.

f. The drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

D. Wall Mounted, Indoor Units:

1. General: Daikin indoor unit FXAQ shall be a wall mounted fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation onto a wall within a conditioned space. This compact design shall be furnised with finished white casing. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment. The indoor units sound pressure shall range from 31 dB(A) to 41 dB(A) at low speed measured at 3.3 feet below and from the unit.

2. The Daikin indoor unit FXAQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing. The discharge angle shall automatically set at the same angle as the previous operation upon restart. The drain pipe can be fitted to from either left or right sides.

3. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.

4. Both refrigerant lines shall be insulated from the outdoor unit.
5. Return air shall be through a resin net mold resistant filter.
6. The indoor units shall be equipped with a condensate pan.
7. The indoor units shall be equipped with a return air thermistor.
8. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
9. The voltage range will be 253 volts maximum and 187 volts minimum.
10. Unit Cabinet:
    a. The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.
    b. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
11. Fan:
    a. The fan shall be a direct-drive cross-flow fan, statically and dynamically balanced impeller with high and low fan speeds available.
    b. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.054 to 0.058 HP.
    c. The airflow rate shall be available in high and low settings.
    d. The fan motor shall be thermally protected.
12. Coil:
    a. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
    b. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
    c. The coil shall be a 2-row cross fin copper evaporator coil with 14 fpi design completely factory tested.
    d. The refrigerant connections shall be flare connections and the condensate will be 11/16 inch outside diameter PVC.
    e. A thermistor will be located on the liquid and gas line.
    f. A condensate pan shall be located in the unit.
13. Electrical:
    a. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.

b. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).

c. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

14. Control:

a. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.

b. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.

c. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install refrigerant piping in accordance with equipment manufacturer's instructions.

C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).

D. Coordinate with installers of systems and equipment connecting to this system.

3.2 SYSTEM STARTUP

A. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.

B. Adjust equipment for proper operation within manufacturer's published tolerances.

END OF SECTION

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SECTION **00 30 02 - EC BID FORM**

CONTRACT 2 – ELECTRICAL CONSTRUCTION PROPOSAL (EC-01):

CLOSING: (signature)_____

DATE: _____

BY: _____

TITLE: _____

FIRM: _____

ADDRESS: _____

TELEPHONE NUMBER: _____

FAX NUMBER: _____

CONTACT PERSON: _____

E-MAIL: _____

BID TO (Owner): Attention: Purchasing Agent
Nanuet Union Free School District
101 Church Street
Nanuet, New York 10954

SED Project Control No.	Highview Elementary School	SED#50-01-08-03-0-002-020
	Outdoor Education Center	SED#50-01-08-03-7-012-004
	Maintenance Building Renovations	SED#50-01-08-03-7-007-002

1. **Representations**: By making this Bid, the Bidder represents that:

The Bidder (identified above) hereby certifies that they have examined and fully understands the requirements and intent of the Bidding and Contract Documents, including Drawings, Project Manuals, and Addenda; and proposes to provide all labor, material, and equipment necessary to complete the Work on, or before, the dates specified in the Agreement.

To The Board of Education,

The undersigned hereby proposes to furnish all labor, materials, devices, appliances, supplies, equipment, services and other facilities necessary to complete all of the work of the above referenced Contract for the Nanuet Union Free School District, Nanuet, New York, as required by, and in accordance with, the provisions of the Instructions to Bidders, the Supplementary Instructions to Bidders, the Conditions of the Contract, the Drawings and Specifications, all as prepared by KSQ Design designated as Nanuet Union Free School District Phase 5 Projects, dated **January 14, 2025** and that, if this Proposal is accepted, the Undersigned agrees to enter into an Agreement with the owner to perform this work for the lump sum of:

Total Base Bid (All Schools):_____($_____)

Highview Elementary School:_____($_____)

Outdoor Education Center:_____($_____)

Maintenance Building Renovations:_____($_____)

(Words) (Figures)

ALLOWANCES:

The undersigned Contractor has included the Allowance(s) as specified in Section 01 2100 in their Base Bid.

UNIT PRICE:

A. **Unit Price EC-#1:** $_____ Dollars $ No Cents

ALTERNATES:

Add Alternate EC-01 Alt #1: $_____ Dollar $ No Cents

ADDENDA:

The undersigned acknowledges the receipt of the following addenda:

Addendum Number	Date	Addendum Number	Date
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The Undersigned understands that the Owner reserves the right to accept or reject any or all proposals, but that if notice of the acceptance of the above Proposal is sent via United States Postal Service or any other overnight carrier, with signature required, to the Undersigned within sixty (60) days after the formal opening of Bids or anytime thereafter before this Proposal is withdrawn, the Undersigned will enter into, execute, and deliver a Contract within five (5) days after the date of said notification.

1. Time of Commencement and Completion:

The Undersigned agrees in the Base Bid to complete the work as per the Milestone Schedule provided in the Specifications.

2. Rejection of Bids:

The Bidder acknowledges that the Owner reserves the right to waive any informality in, or to reject any or all Bids.

3. Attachments:

Obtain and attach the following documents to each individual Bid.

a. Corporate Resolutions
b. Non-Collusive Bid Certification
c. Iran Divestment Act Affidavit

d. Bid Security

e. Subcontractor List

f. Substitution List

g. NYSDOL Certificate of Registration (See Notice to Bidders for more information)

4. Work Cost Breakdown:

This form shall be filled out in its entirety and submitted by the Contractor. The grand total must equal the TOTAL BASE BID under Section I (A) "THE BID". UNIT PRICES are required for the items listed in the Unit Prices section of the work cost breakdown. Unit prices will be provided for use if the required quantities are more or less than the quantities indicated in the plans and specifications. Failure to complete the work cost breakdown may result in the disqualification of the bid. As itemized in the "Instructions to Bidders" for a complete Bid Form include the following which must be filled out completely, failure to comply with any listed below bid will be a rejected bid:

a. Bid Form, all costs must be shown in each CSI section and totaled, failure to breakdown these costs will be subject to disqualification of bid.

b. Unit costs

Highview Elementary School

Contract Number: Contract No. 02 – Electrical Construction (EC-01)

Contract Titles: As noted in the Notec to Bidders 00 03 00

Date:

* Refer to specification Section 012900 Payment Procedures for additional information

Description	QTY	Unit	Total
General Requirements (Submittals, Punchlist, etc.)			
012100 Allowances - Unforeseen Conditions	1	NA	$12,000.00
078413 Penetration Firestopping (Labor)			
078413 Penetration Firestopping (Material)			
078446 Fire-Resistive Joint Systems (Labor)			
078446 Fire-Resistive Joint Systems (Material)			
079200 Joint Sealant (Labor)			
079200 Joint Sealant (Material)			
260505 selective demolition for electrical (Labor)			
260505 selective demolition for electrical (Material)			
260519 low-voltage electrical power conductors and cables (Labor)			
260519 low-voltage electrical power conductors and cables (Material)			
260526 Grounding and bonding for electrical systems (Labor)			

260526 Grounding and bonding for electrical systems (Material)			
260529 hangers and supports for electrical systems (Labor)			
260529 hangers and supports for electrical systems (Material)			
260533.13 conduit for electrical systems (Labor)			
260533.13 conduit for electrical systems (Material)			
260533.16 boxes for electrical systems (Labor)			
260533.16 boxes for electrical systems (Material)			
260533.23 surface raceways for electrical systems (Labor)			
260533.23 surface raceways for electrical systems (Material)			
260553 Identification for electrical systems (Labor)			
260553 Identification for electrical systems (Material)			
260923 lighting control devices (Labor)			
260923 lighting control devices (Material)			
262416 panelboards (Labor)			
262416 panelboards (Material)			
262421 circuit breakers for existing panelboard (Labor)			
262421 circuit breakers for existing panelboard (Material)			
262726 wiring devices (Labor)			
262726 wiring devices (Material)			
262816.16 enclosed switches (Labor)			
262816.16 enclosed switches (Material)			
265100 interior lighting (Labor)			
265100 interior lighting (Material)			
271000 structured cabling-voice and data- inside (Labor)			
271000 structured cabling-voice and data- inside (Material)			
284600 fire detection and alarm (Labor)			
284600 fire detection and alarm (Material)			

079200 Joint Sealant (Material)			
260505 selective demolition for electrical (Labor)			
260505 selective demolition for electrical (Material)			
260519 low-voltage electrical power conductors and cables (Labor)			

260519 low-voltage electrical power conductors and cables (Material)			
260526 Grounding and bonding for electrical systems (Labor)			
260526 Grounding and bonding for electrical systems (Material)			
260529 hangers and supports for electrical systems (Labor)			
260529 hangers and supports for electrical systems (Material)			
260533.13 conduit for electrical systems (Labor)			
260533.13 conduit for electrical systems (Material)			
260533.16 boxes for electrical systems (Labor)			
260533.16 boxes for electrical systems (Material)			
260553 Identification for electrical systems (Labor)			
260553 Identification for electrical systems (Material)			
260923 lighting control devices (Labor)			
260923 lighting control devices (Material)			
262416 panelboards (Labor)			
262416 panelboards (Material)			
262421 circuit breakers for existing panelboard (Labor)			
262421 circuit breakers for existing panelboard (Material)			
262726 wiring devices (Labor)			
262726 wiring devices (Material)			
262816.16 enclosed switches (Labor)			
262816.16 enclosed switches (Material)			
265100 interior lighting (Labor)			
265100 interior lighting (Material)			
284600 fire detection and alarm (Labor)			
284600 fire detection and alarm (Material)			

Submit Bid Form in duplicate.

END OF SECTION 00 30 01

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SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.

1.2 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

D. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.

E. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2013.

F. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2012.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

H. ASME B16.25 - Buttwelding Ends; 2012.

I. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

J. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

K. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

M. FM (AG) - FM Approval Guide; current edition.

N. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

O. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Shop Drawings:

1. Plans: Installation layouts; indicate pipe materials, sizes and internal diameters, and valve locations and sizes.

2. Details and Schedules: Indicate the following:

a. Jointing methods and piping connections.

b. Floor and wall penetration seals.

c. Mounting and support details, including data on supported weights.

3. Submit shop drawings to Fire Marshall for approval. Submit proof of approval to Engineer.

D. Project Record Documents: Record actual locations of components and tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section.

1. Minimum three years experience.

C. Welder Qualifications: Certify in accordance with AWS D1.1/D1.1M.

1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

D. Conform to FM (AG) and UL (DIR) requirements.

1.5 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 ABOVE GROUND PIPING FOR WET PIPE SYSTEMS

A. Steel Pipe (for pressures up to 300 psig):

1. Welded or roll grooved:

a. Up to and including 5 inches: Schedule 10 ASTM A 795 for fire protection, ASTM A 53 or ASTM A 135 black iron or hot-dip zinc-coated (galvanized).

2. Threaded or cut groove fittings:

a. Up to and including 6 inches: Schedule 40 ASTM A 795 for fire protection, ASTM A 53 or ASTM A 135 black iron or hot-dip zinc-coated (galvanized).

3. Steel Fittings: ASME B16.9 wrought steel, buttwelded, ASTM A234/A234M wrought carbon steel or alloy steel, or ASME B16.5 steel flanges and fittings.

4. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.

5. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.

6. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

7. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

8. Welders and/or welding machine operators shall, upon completion of each weld, stamp an imprint of their identification into the side of the pipe adjacent to each weld.

2.2 ESCUTCHEONS

A. Material:

1. Grade TP304, seamless tube, ASTM A269/A269M stainless steel.

2. Metals and Finish: Comply with ASME A112.18.1.

B. Construction:

1. One-piece for mounting on chrome-plated pipe and one-piece or split-pattern type elsewhere.

2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.3 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

C. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

D. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

E. Vertical Support: Steel riser clamp.

F. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Inserts:

1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

E. Provide auxiliary drains for all trapped sections of sprinkler piping created by any vertical pipe offsets.

1. Less then 5 gallons of trapped water: Use a valve that's at least 1/2 in (15 mm) with a plug or nipple and cap

2. 5-50 Gallons of trapped water: Use a valve that's at least 3/4 in (19 mm) with a plug or nipple and cap

3. Greater then 50-gallons of trapped water: Use a valve that's at least 1 in (25 mm)

4. Auxiliary drains shall be accessible

5. Systems with low-point drains shall have a sign indicating the number and locations of the drains

3.2 CLEANING

A. Upon completion of work, clean all parts of the installation.

END OF SECTION

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SECTION 211300 - FIRE SUPPRESSION SPRINKLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. System design, installation, and certification.

1.2 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; current edition.

B. FM (AG) - FM Approval Guide; current edition.

C. FM (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.

D. ITS (DIR) - Directory of Listed Products; current edition.

E. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

F. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.3 SUBMITTALS

A. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

B. Shop Drawings:

1. Plans: Installation layouts; indicate pipe materials, sizes and internal diameters, and valve locations and sizes.

2. Elevations: Riser diagrams; indicate pipe materials and sizes, and valve locations and sizes.

3. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.

4. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls. Provide hydraulic calculations and design bearing the PE stamp of the engineer under whose supervision the work was designed.

5. Details and Schedules: Indicate the following:

a. Jointing methods and piping connections.

b. Floor and wall penetration seals.

c. Mounting and support details, including data on supported weights.

6. Submit shop drawings to authority having jurisdiction for approval. Submit proof of approval to Engineer.

7. Provide NFPA 13 “Contractor’s Material and Test Certificate for Aboveground Piping”.

8. Provide New York State Fire Code required Statement of Compliance for the fire protection system.

C. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

E. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

F. Maintenance Materials: Furnish the following for Nanuet Union Free School District's use in maintenance of project.

1. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.

2. Sprinkler Wrenches: For each sprinkler type.

3. Provide spare list in compliance with NFPA 13 (2007) 6.2.9.7:

a. The list shall include the following:

1) Sprinkler Identification Number (SIN) if equipped; or the manufacturer, model, orifice, deflector type, thermal sensitivity, and pressure rating

2) General description

3) Quantity of each type to be contained in the cabinet

4) Issue or revision date of the list

b. Verify spares match installation, as-builts and NFPA 13 certifications.

1.4 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to UL (DIR) requirements.

C. Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in New York. Provide shop drawing submittals bearing the PE stamp of the engineer under whose supervision the work was designed.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience and approved by manufacturer.

F. Equipment and Components: Provide products that bear FM (AG) label or marking.

G. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for building areas noted. Refer to drawings for occupancy hazard classifications.

B. Storage Cabinet for Spare Sprinklers and Tools: Steel, located in boiler room adjacent to water service entrance area.

2.2 SPRINKLERS

A. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.

1. Response Type: Quick.
2. Coverage Type: Extended.
3. Finish: Brass.
4. Escutcheon Plate Finish: Enamel, color as selected.
5. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Firestop all joints, penetrations within rated construction in compliance with the specification section 078413.

D. Place pipe runs to minimize obstruction to other work.

E. Place piping in concealed spaces above finished ceilings.

F. Hydrostatically test entire system.

G. Locate sprinklers minimum distances from heat sources for compliance with NFPA 13, as applicable.

3.2 SCHEDULES

A. System Hazard Areas:

1. Highview Elementary Ground Floor Toilet Rooms: Light Hazard

END OF SECTION

SECTION 221005 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building.

B. Sanitary waste piping, above grade.

C. Pipe, pipe fittings, specialties, and connections for piping systems.

1. Domestic water.

2. Flanges, unions, and couplings.

3. Pipe hangers and supports.

4. Ball valves.

D. Backfill Materials.

1.2 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

D. ASME B31.1 - Power Piping; 2014.

E. ASME B31.9 - Building Services Piping; 2014.

F. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2015.

G. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

I. ASTM B68/B68M - Standard Specification for Seamless Copper Tube, Bright Annealed; 2011.

J. ASTM B 68M - Standard Specification for Seamless Copper Tube, Bright Annealed (Metric); 2011.

K. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2011.

L. ASTM B 75M - Standard Specification for Seamless Copper Tube (Metric); 1999 (Reapproved 2005).

M. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

N. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

O. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2010.

P. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2002 (Reapproved 2010).

Q. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

R. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

S. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

T. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

U. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2015.

V. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

W. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011.

X. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2012.

Y. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2012.

Z. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.

AA. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2013.

BB. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

CC. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

DD. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

EE. NSF 372 - Drinking Water System Components - Lead Content; 2011.

FF. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe; 2013.

GG. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

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

B. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

C. Piping Schedule: Provide schedule of piping applications and materials, indicating piping and fittings.

D. Piping Shop Drawings: Provide drawings of piping installation, indicating dimensioned locations, equipment, critical dimensions, elevations, sizes, systems, and valve locations.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with New York State Building Code.

B. Perform work in accordance with New York State Plumbing Code.

C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.6 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.

1. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed by NSF International.

2. Fittings: Cast iron.

3. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C 564 neoprene gaskets.

B. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed by NSF International.

2. Fittings: Cast iron.

3. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. PVC Pipe: ASTM D2729.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.4 PLUMBING VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed by NSF International.

2. Fittings: Cast iron.

3. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. PVC Pipe: ASTM D 2665.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.5 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube for piping 4" and smaller: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2. Hydraulic Press Fitting for Copper Tubing.

a. Acceptable Fittings:

1) ProPress by Viega, 301 N. Main, Wichita, KS 67202, (877) 843-4262, www.viega.com. NO SUBSTITUTIONS SHALL BE PERMITTED.

b. Operating Conditions:

1) Maximum Operating Pressure: 200 psi.

2) Operating Temperature Range: 0-250 degrees F.

3) Maximum Test Pressure: 600 psi.

4) Maximum Vacuum: 29.2 inches hg @ 68 degrees F.

c. Features:

1) Fittings: Copper and copper alloy conforming to material requirements of ASME B16.18 or ASME B16.22.

(a) Stainless Steel Grip Ring: Adds strength to the joint without collapsing the interior passageway.

2) No flame for soldering required for installation of fittings and valves.

3) Unpressed connections identified during pressure testing when water flows past sealing element.

4) Sealing Elements: Factory installed, EPDM.

5) Fittings that have been pressed can be rotated. If rotated more than 5 degrees, the fitting must be repressed to restore its resistance to rotational movement.

6) Extended fitting end lead allows for twice the retention grip surface, and assists with proper tube alignment.

7) Soldered adapter fittings are not allowed.

B. All materials used for installation related to the domestic water piping system shall be lead-free, including pipes, pipe fittings, plumbing fittings, and plumbing fixtures and conform to NSF/ANSI Standard 61, NSF/ANSI Standard 61 - Annex G, and NSF/ANSI Standard 372.

2.6 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Ferrous Pipe: Class 150 malleable iron threaded unions.

2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:

1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

2.7 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.

3. Trapeze Hangers: Welded steel channel frames attached to structure.

4. Vertical Pipe Support: Steel riser clamp.

5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.

B. Plumbing Piping - Drain, Waste, and Vent:

1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

2. Hangers for all pipe sizes: Carbon steel, adjustable, clevis.

3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

5. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

6. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:

1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

3. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.

4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

5. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

6. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

7. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.

8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.8 BALL VALVES

A. 4-inch and smaller: 2-piece, full port, bronze:

1. Body: Zero Lead Bronze C87700.

2. Ball/Stem: 316 Stainless steel.

3. Seat Ring: Reinforced TFE.

4. Packing: TFE.

5. Ends: Soldered or hydraulic press.

6. Maximum operating pressure: 250 psi

B. All materials used for installation related to the domestic water piping system shall be lead-free, including pipes, pipe fittings, plumbing fittings, and plumbing fixtures and conform to NSF/ANSI Standard 61, NSF/ANSI Standard 61 - Annex G, and NSF/ANSI Standard 372.

2.9 CALIBRATED BALANCE VALVES

A. Size 1/2 inch to 3 inch:

1. Bronze body with brass ball construction with glass and carbon filled TFE seat rings. Valves shall have differential pressure read-out ports across valve seat area. Read-out ports shall be fitted with internal EPT insert and check valve. Valve bodies shall have 1/4 inch NPT tapped drain/purge port. Valves shall have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves shall have calibrated nameplate to assure specific valve setting. Valves shall be leak-tight at full rated working pressure.

2. Design Pressure/Temperature:

   a. 1/2" to 3" NPT connections: 300 psi at 250 degrees F.

   b. 1/2" to 2" sweat connections: 200 psi at 250 degrees F.

B. Design Pressure/Temperature: 175 psi at 250 degrees F.

C. Acceptable Manufacturers:

1. Red-White Valve Corp.

2. Bell and Gossett

3. Flow Design, Inc.

D. All materials used for installation related to the domestic water piping system shall be lead-free, including pipes, pipe fittings, plumbing fittings, and plumbing fixtures and conform to NSF/ANSI Standard 61, NSF/ANSI Standard 61 - Annex G, and NSF/ANSI Standard 372.

2.10 BACKFILL MATERIALS

A. Select Fill:

1. Select fill shall be crushed stone, crushed gravel, or run of bank gravel that is free of clay, organics, snow, ice and friable or deleterious particles and meet the requirements of NYSDOT Standard Specifications, Select Fill, Item 203.06, having the following gradation requirements:

   a. Sieve Size:

      1) 4": 100 percent finer by weight.

      2) No. 40: 0-70 percent finer by weight.

      3) No; 200: 0-15 percent finer by weight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Remove scale and dirt, on inside and outside, before assembly.

B. Prepare piping connections to equipment with flanges or unions.

3.3 EARTH EXCAVATION

A. All excavation work shall be executed to the lines and grades shown on the Drawings or as required to install the services as indicated on the drawings, unless directed otherwise by the Owner's Representative. All excavation shall be performed in such a manner as to minimize disturbance and maintain stability of subgrade soils and slopes. Special care shall be taken not to disturb the bottom of excavations and proposed bearing elevations and surfaces. Excavation to the final subgrade levels must be done by methods that minimize traffic on or disturbance to the subgrade.

B. The excavation equipment must be of such size and capacity sufficient to excavate the materials encountered and to the specified depths as shown.

C. The Contractor shall be responsible at all times for safe and prudent excavation operations so as to protect the workmen, utilities, structures, and adjacent property. The Contractor shall perform all excavation in accordance with OSHA standards. The Contractor shall observe all applicable local, state and federal requirements and acquire all necessary permits.

D. The Contractor shall bench or cut back excavated slopes, dewater and sheet, as necessary for stability, safety and protection of adjacent utilities, structures, and properties.

E. Subgrades and slopes which have been damaged or degraded as a result of Contractor's activities, or failure of the Contractor to properly protect them shall be repaired at the Contractor's expense as directed by the Owner's Representative.

F. Subgrades in which soft or unsuitable materials are encountered which are not a result of Contractor's operations or failure to protect subgrades shall be undercut and backfilled with appropriate fill as directed by the Owner's Representative.

G. All subgrades will be monitored and tested as determined necessary by the Owner's Representative. The Contractor, at the direction of the Owner's Representative, shall be required to proof roll subgrades. All proof rolling, if required, shall be done in the presence of the Owner's Representative.

H. No materials or fill shall be placed by the Contractor until the subgrades are observed and tested by the Owner's Representative.

3.4 FILLING AND BACKFILLING

A. The Contractor shall not place fill or backfill until underlying subgrades have been observed and tested as required by the Owner's Representative.

B. Materials shall be placed at the locations shown on the Drawings, and as directed by the Owner's Representative

C. Delivery and compaction of materials shall be made during the presence of the Owner's Representative and shall be subject to its review. This inspection by no means absolves the Contractor from responsibility to properly compact and test as specified.

D. Acceptance and/or rejection of materials placed and compacted shall be based upon in-place density test result requirements and other requirements as stated in these specifications.

E. Placement and Compaction:

1. Select fill shall be placed in maximum loose lift thicknesses of 9-inches. Select fill shall be compacted to a minimum of 95 percent of the maximum Modified Proctor density as determined by ASTM D1557.

2. Equipment used to compact select fill must be compatible with the material type, lift thickness, and constraints posed by size and configuration of excavated area being filled.

3.5 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not exposed.

H. Install bell and spigot pipe with bell end upstream.

I. Provide rigid sway bracing at changes in direction greater than 45 degrees for pipe sizes 4 inches and larger.

J. Provide cleanouts at base of all vertical storm and sanitary risers.

K. Install valves with stems upright or horizontal, not inverted. See Section 220523.

L. Install water piping to ASME B31.9.

M. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

N. PVC and CPVC Pipe: Make solvent-welded joints in accordance with ASTM D 2855.

O. Sleeve pipes passing through partitions, walls, and floors.

P. Inserts:

1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

Q. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.

2. Support horizontal piping as indicated.

3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

4. Place hangers within 12 inches of each horizontal elbow.

5. Provide hanger below each P-trap on storm and sanitary piping systems.

6. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

7. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

8. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

9. Provide copper plated hangers and supports for copper piping.

R. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.6 EXCAVATING

A. Excavate to accommodate construction operations.

B. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

D. Do not interfere with 45 degree bearing splay of foundations.

E. Cut utility trenches wide enough to allow inspection of installed utilities.

F. Hand trim excavations. Remove loose matter.

G. Correct areas that are over-excavated and load-bearing surfaces that are disturbed.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation.

I. Remove excavated material that is unsuitable for re-use from site.

J. Stockpile excavated material to be re-used in area designated on site .

K. Remove excess excavated material from site.

3.7 FILLING

A. Fill to contours and elevations indicated or required using unfrozen materials.

B. Fill up to finish grade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Soil Fill: Place and compact material in equal continuous layers not exceeding 12 inches compacted depth.

G. Correct areas that are over-excavated.

1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

H. Reshape and re-compact fills subjected to vehicular traffic.

3.8 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.9 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope for 3 inch and larger, 1/4 inch per foot slope for sizes smaller than 3 inch.

3.10 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.11 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.12 FLUSHING AND DISINFECTING POTABLE WATER SYSTEMS

A. Flushing: The water service piping and distribution piping to all fixtures and outlets shall be flushed until the water runs clear and free of debris or particles. Faucet aerators or screens shall be removed during the flushing operations.

B. Disinfecting:

1. The water service piping and the hot and cold water distribution piping shall be disinfected after flushing and prior to use. The procedure used shall be as follows, or an approved equivalent:

a. All water outlets shall be posted to warn against use during disinfecting operations.

b. Disinfecting shall be performed by persons experienced in such work.

c. The water supply to the piping system or parts thereof being disinfected shall be valved-off from the normal water source to prevent the introduction of disinfecting agents into the well storage tank or portions of a system that are not being disinfected.

d. The piping shall be disinfected with a water-chlorine solution. During the injection of the disinfecting agent into the piping, each outlet shall be fully opened several times until a concentration of not less than 50 parts per million chlorine is present at every outlet. The solution shall be allowed to stand in the piping for at least 24 hours.

e. An acceptable alternate to the 50 ppm/24 hour procedure described above shall be to maintain a level of not less than 200 parts per million chlorine for not less than three hours. If this alternate procedure is used, the heavily concentrated chlorine shall not be allowed to stand in the piping system for more than 6 hours. Also, special procedures shall be used to dispose of the heavily concentrated chlorine in an environmentally acceptable and approved manner.

f. At the end of the required retention time, the residual level of chlorine at every outlet shall be not less than five parts per million. If the residual is less than five parts per million, the disinfecting procedure shall be repeated until the required minimum chlorine residual is obtained at every outlet.

g. After the required residual chlorine level is obtained at every outlet, the system shall be flushed to remove the disinfecting agent. Flushing shall continue until the chlorine level at every outlet is reduced to that of the incoming water supply.

h. Any faucet aerators or screens that were removed shall be reinstalled.

i. A certification of performance and laboratory test report showing the absence of coliform organisms shall be submitted to the Authority Having Jurisdiction upon satisfactory completion of the disinfecting operations.

2. The disinfecting procedures shall meet or exceed the requirements set forth in the American Water Works Association Standard C651-92, Disinfection of Water Mains.

3.13 TESTING OF DOMESTIC WATER PIPING

A. Preparation for Testing: Prepare piping as follows:

1. Leave joints uninsulated and exposed for examination during the test.

2. Flush system with clean water. Clean strainers.

3. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve.

4. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.

B. Testing: Test domestic water piping as follows:

1. Leave joints uninsulated and exposed for examination during the test.

2. Test piping in accordance with New York State Building Code.

3. Test water service pipes and rough piping installations prior to covering or concealment.

4. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for the workmen and compatible with the piping system components.

5. Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at low points in the system for complete removal of the test liquid.

6. Examine system to ensure that equipment and components that cannot withstand test pressures are properly isolated. Examine test equipment to ensure tight connection and that low pressure filling lines have been disconnected.

7. Upon completion of a section of or the entire water supply system, the system, or portion completed, shall be tested and proved tight under a water pressure not less than the working pressure of the system; or by an air test of not less than 50 psi (344 kPa). The water utilized for tests shall be obtained from a potable source of supply. Isolate the system expansion tank from the tested system for the hydrostatic system test. Isolate building plumbing fixtures from the tested system for the hydrostatic system test.

8. After the test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.

C. Testing: Test all Domestic Water connected Plumbing Fixtures as follows:

1. Prior to construction closeout, a lead test shall be done to the domestic water plumbing fixtures in accordance with the New York State Department of Health Codes, Rules and Regulations chapter 10 volume A-1a, subchapter G, Part 67. Draw samples shall be collected from all outlets, as defined in Subpart 67-4. Draw sample volume shall be 250 milliliters (mL), collected from each cold water outlet before any water is used. The water shall be motionless in the pipes for a minimum of 8 hours, but not more than 18 hours, before sample collection.

2. All draw samples shall be analyzed by a laboratory approved to perform such analyses by the New York State Department’s Environmental Laboratory Approval Program (ELAP). A copy of the results shall be handed over the school’s representative as well as included in any closeout documentation to the New York State Education Department.

3.14 TESTING DRAINAGE, WASTE AND VENT PIPING

A. Provide testing of the drainage, waste and vent piping of either air or water testing, as described below.

B. Preparation for Testing: Prepare piping as follows:

1. Leave joints uninsulated and exposed for examination during the test.

C. Test drainage, waste and vent piping as follows:

1. Test piping with either a water test in accordance with New York State Building Code, and as follows:

a. A water test shall be applied to the drainage system either in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system shall be filled with water to point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 10-foot (3048 mm) head of water. In testing successive sections, at least the upper 10 feet (3048 mm) of the next preceding section shall be tested so that no joint or pipe in the building, except the uppermost 10 feet (3048 mm) of the system, shall have been submitted to a test of less than a 10-foot (3048 mm) head of water. The water shall be kept in the system, or in the portion under test, for at least 15 minutes before inspection starts. The system shall then be tight at all points.

D. Completed sanitary drainage and vent systems:

1. After all plumbing fixtures have been installed and all traps have been filed with water, every part of the sanitary drainage and vent systems within the building walls shall be subjected to a final test as prescribed herein. For the duration of testing, flow of water in the system shall be halted and the building drain shall be sealed adjacent to its point of entry inside the building. If requested by the authority of jurisdiction, remove any cleanout plugs to ascertain that the testing is effective in all parts of the system.

2. The final test of the completed drainage and vent system shall be visual and in sufficient detail to determine compliance with the provisions of this code except that the plumbing shall be subjected to a smoke test where necessary for cause. Where the smoke test is utilized, it shall be made by filling all traps with water and then introducing into the entire system a pungent, thick smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1-inch water column (248.8 Pa) shall be maintained for 15 minutes before inspection starts.

3.15 TESTING OF DRAINAGE AND VENT SYSTEMS

A. Rough Plumbing:

1. Except for outside leaders and perforated or open jointed drain tile, the piping of plumbing drainage and venting systems shall be tested upon completion of the rough piping installation by water or air and proved watertight. The Authority Having Jurisdiction may require the removal of any cleanout plugs to ascertain if the pressure has reached all parts of the system. The following test method shall be used:

a. The water test shall be applied to the drainage system either in its entirety or in sections after rough piping has been installed. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system filled with water to point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest opening of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 10-foot head of water. In testing successive sections at least the upper 10 feet of the next preceding section shall be tested, so that no joint or pipe in the building (except the uppermost 10 feet of the system) shall have been submitted to a test of less than 10-foot head of water. The water shall be kept in the system or in the portion under test for at least 15 minutes before inspection starts; the system shall then be tight at all points.

B. Finished Plumbing

1. When the rough plumbing has been tested in accordance with the paragraphs above, a final test of the finished plumbing system may be required to insure that the final fixture connections to the drainage system are gas-tight.

2. After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and watertight. A final smoke or peppermint test shall b required, except in the case of a previous or site-inspected water or air tested system. If a smoke or peppermint test is required, the following test methods shall be employed:

a. A smoke test shall be made by filling all traps with water and then re introducing into the entire system a pungent, thick smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, they shall be closed and a pressure equivalent to a one-inch water column shall be developed and maintained for the period of the inspection.

b. Where the Authority Having Jurisdiction, due to practical difficulties or hardships, finds that a smoke test cannot be performed, a peppermint test shall be substituted in lieu thereof. Such peppermint test shall be conducted by the introduction of two ounces of oil of peppermint into the roof terminal of every line or stack to be tested. The oil of peppermint shall be followed at once by ten quarts of hot (140 degrees F) water whereupon all roof vent terminals shall be sealed. A positive test, which reveals leakage, shall be the detection of the odor of peppermint at any trap or other point on the system. Oil of peppermint or person or clothes have come in contact with oil of peppermint shall be excluded from the test area.

3.16 VALVE INSTALLATIONS

A. General Application: Use ball valves for shut-off duty; ball for throttling duty. Refer to piping system specification sections for specific valve applications and arrangements.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves and unions for each item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.

D. Install valves in horizontal piping with stem at or above the center of the pipe.

E. Install valves in a position to allow full stem movement.

3.17 SOLDER CONNECTIONS

A. Cut tube square and to exact lengths.

B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket in the same manner.

C. Apply a proper soldering flux in an even coat to inside of valve socket and outside of tube.

D. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate valve or tube slightly to ensure even distribution of the flux.

E. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around the tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

3.18 THREADED CONNECTIONS

A. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.19 PRESS FITTING CONNECTIONS FOR DOMESTIC WATER PIPING

A. Press connections: Copper and copper alloy press connections shall be made in accordance with the manufacturer’s installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.

3.20 FLANGED CONNECTIONS

A. Align flange surfaces parallel.

B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

3.21 SCHEDULES

A. Pipe Hanger Spacing:

1. Cast Iron Piping: 5 feet maximum horizontal spacing, 15 feet maximum vertical spacing. Where 10 foot lengths of cast iron piping are installed, maximum horizontal spacing may be increased to 10 feet. All cast iron joints shall be supported.

2. Copper Piping:

a. 1-1/4 inch diameter and smaller: 6 feet maximum horizontal spacing, 10 feet maximum vertical spacing.

b. 1-1/2 inch diameter and larger: 10 feet maximum horizontal spacing, 10 feet maximum vertical spacing.

3. PVC Pipe or Tubing: 4 feet maximum horizontal spacing, 10 feet maximum vertical spacing.

END OF SECTION

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SECTION 224000 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Dual flush water closets.

B. Urinals.

C. Lavatories.

D. Fixture Sealant.

1.2 REFERENCE STANDARDS

A. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration.; 2008.

B. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2002).

C. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

D. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2013.

E. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.

F. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; 1994 (R2004).

G. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2011.

H. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2004.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

J. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

K. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.3 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

C. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Nanuet Union Free School District's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with the following:

1. A weighted average lead content of not more than 0.25 percent as determined by NSF/ANSI 372.

2. NSF/ANSI 61.

C. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks emonstrating third party certification with these requirements.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 DUAL FLUSH WATER CLOSETS

A. WC-1/WC-2:

1. Dual Flush, wall mounted, back outlet Vitreous china with antimicrobial ceramic glaze

2. Elongated front rim

3. 2-1/8" fully glazed trapway

4. High efficiency siphon jet flush action

5. Shipping Weight: 40 lbs.

6. Flushometer:

a. Flush volume: 1.6/1.1 gpf

b. Power type: hard wired

c. Activation: Employs an infrared sensor with multiple-focused, lobular sensing fields for high and low target detection

d. Valve: Diaphragm

e. Fixture Connection: Top spud

f. Automatically initiates a 1.1 gpf or 1.6 gpf flush based on how long the user remains in sensor range

g. Buttons on top of the flush valve enable manual flushing with a full or reduced flush in case of power outage or at restroom visitor's discretion

h. Three-second flush delay High copper, low zinc brass castings for dezincification resistance Fixed metering bypass and no external volume adjustment to ensure water conservation

i. Valve body, Cover, Tailpiece and Control Stop shall be in compliance with ASTM Alloy Classification for Semi-Red Brass

j. Valve shall be in compliance to the applicable sections of ASSE 1037.

B. WC-4:

1. Vitreous China, 1.1 gpf [4.2 Lpf] or greater high efficiency floor mounted bottom outlet toilet with siphon jet flushing action, elongated front rim with 1-1/2" [39 mm] top spud. The bowl shall be designed to perform to industry standards with flush volumes of 1.1 gallons per flush.

2.

C. Water Closet Carriers:

1. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2. Narrow Wall horizontal siphon jet water closet carrier system, with high performance Dura-coated cast iron main fitting with hydro-mechanically optimized sweep, 4" no-hub connections, and extended 2" vent. Corrosion resistant, adjustable 3" dia. X 6" coupling with integral test cap, designed to increase flow velocity and line carry, and labor saving "Neo-Seal" bonded gasket optimizes flow performance while reducing installation steps. Complete system includes an adjustable, gasketed faceplate; floor mounted foot supports; fixture bolts, trim, and stud protectors. Narrow wall system shall comply with all applicable requirements of ASME A112.6.1M up to a 500 lbs maximum static load.

2.3 WALL HUNG URINALS (UR-1)

A. 0.125 gpf (gallons per flush)

1. Vitreous china

2. Siphon Jet Action
3. 4 1/8” Back Outlet Rough-in
4. 3/4” top spud
5. 2” I.P.S. outlet flange and rubber gasket with integral trap

B. Shipping Weight: 39 lbs

C. Flush Valve:

1. Power type: hardwired
2. Valve: Diaphragm
3. Finish: Polished chrome
4. Courtesy Flush Override button
5. Includes 18” electrical cable
6. Flex Tube Diaphragm designed for improved life and reduced maintenance
7. Rubber Diaphragm with twin linear filtered bypass and vortex cleansing action
8. Employs an infrared sensor with multiple-focused, lobular sensing fields for high and low target detection
9. Latching Solenoid Operator
10. High copper, low zinc brass castings for dezincification resistance
11. Engineered Metal Cover with replaceable Lens Window
12. High Back Pressure Vacuum Breaker Flush Connection with One-piece Bottom Hex Coupling Nut
13. ADA Compliant Electronic Infrared Sensor for automatic “No Hands” operation
14. Adjustable Tailpiece
15. Line Powered with 6 VAC Step Down Transformer
16. 3/4” I.P.S. Screwdriver Angle Stop
17. Initial Set-up Range Indicator Light (first 10 minutes)
18. Sweat Solder Adapter with Cover Tube and Cast Wall Flange with Set Screw
19. Infrared Sensor with Multiple-focused, Lobular Sensing Fields for high and low target detection
20. High Copper, Low Zinc Brass Castings for Dezincification Resistance

21. Spud Coupling and Flange for 3/4” Top Spud Free Spinning, Vandal Resistant Stop Cap

22. Fixed metering bypass and no external volume adjustment to ensure water conservation

23. Valve body, Cover, Tailpiece and Control Stop shall be in compliance with ASTM Alloy Classification for Semi-Red Brass

24. Valve shall be in compliance to the applicable sections of ASSE 1037

D. Carriers:

1. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.4 LAVATORIES

A. LAV-1/LAV-2:

1. Constructed of vitreous china

2. 21-1/4"L x 18-1/8"W

3. Wall-mount installation

4. Includes wall hanger

5. Drilled for concealed arm carrier

6. Faucet:

a. 0.5 GPM flow rate, aerated spray type, polished chrome finish, hardwired powered deck.

b. Modular One-piece Construction with all Concealed Components above deck

c. Automatic Self-adapting Sensor Technology

d. Magnetic Solenoid Valve

e. Water Supply Connection with Flexible High-pressure Hose and Strainer

f. Appropriate Mounting Hardware included

g. 6 Volt DC Plug-in Adapter

h. Power supply: hardwired

2.5 FIXTURE SEALANT

A. Bathtub/Tile Sealant: White silicone; ASTM C 920, Uses M and A; single component, mildew resistant.

1. Applications: Use for: Joints between plumbing fixtures and floor and wall surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Seal fixtures to wall and floor surfaces with sealant, color to match fixture.

F. Install handicap accessible fixtures at elevations required by ADA.

G. Install non-handicap accessible fixtures at elevations recommended by the manufacturer. Coordinate with Nanuet School District for height of fixtures to be utilized by students.

H. Seal fixtures to wall and floor surfaces with one-part, mildew resistant silicone sealant; Dow Corning 786, Dow Corning Tub and Ceramic, Pecora 898 Sanitary Silicone, General Electric Sanitary SCS1700, or Bostik Silicone Rubber Bathroom Caulk.

I. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 230501 - BASIC HVAC MATERIALS AND METHODS

PART 1 GENERAL

1.1 SUMMARY

A. This section includes the following basic mechanical materials and methods to complement other Division 23 Sections.

1. Concrete equipment base construction requirements.
2. Field-fabricated metal and wood equipment supports.
3. Water soluble flux.
4. Plumbing solder.
5. Installation requirements common to equipment specifications.
6. Firestopping (refer to specification section 078400).
7. Cutting and patching.
8. Touchup painting and finishing.
9. Demolition.
10. Mechanical System Commissioning
11. Mechanical Equipment Instruction

B. Pipe and pipe fitting materials are specified in piping system Sections.

1.2 DEFINITIONS

A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces and tunnels.

C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. General: Submit the following according to the conditions of the Contract and Division 1 Specification Sections.

1. Product Data: Provide product data for piping specialties.

2. Shop Drawings: Detailing fabrication and installation for metal and wood supports, and anchorage for mechanical materials and equipment.

3. Identification materials and devices.

4. Certificates: Welder certificates signed by the Contractor certifying that welders meet or exceed the requirements specified under the "Quality Assurance" Article.

5. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Nanuet Union Free School District's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with the Building Code of New York State.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

D. Qualify welding processes and operators for structural steel according to AWS D1.1 "Structural Welding Code--Steel."

E. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

F. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work.

E. Coordinate connection of electrical services.

F. Coordinate connection of mechanical systems with utilities and services. Comply with requirements of governing regulations, landlord, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 CONCRETE FOR EQUIPMENT PADS

A. Reinforcement

1. Welded Steel Wire Fabric: ASTM A 185, plain type.

a. Flat Sheets.

b. Mesh Size: 6 x 12.

2. Reinforcing Steel: ASTM A 615/A 615M Grade 40 (300).

a. Galvanized in accordance with ASTM A 767/A 767M, Class I.

3. Reinforcement Accessories:

a. Tie Wire: Annealed, minimum 16 gage.

B. Concrete Materials

1. Cement: ASTM C 150, Type I - Normal or Type II - Moderate Portland type.

2. Fine and Coarse Aggregates: ASTM C 33.

3. Fly Ash: ASTM C 618, Class F.

4. Air Entraining: ASTM C 260.

5. Water: Clean and not detrimental to concrete.

6. Prohibited Admixtures: Calcium chloride, thiocyanates, and admixtures containing more than 0.05 percent water soluble chloride ions by weight of cement for more than 0.3 percent thiocyanates by weight of cement are not permitted.

C. Concrete Accessories

1. Bonding Agent: ASTM C 1059, Type II acrylic non-redispersable type.

2. Epoxy Bonding System: ASTM C 881, type as required by project conditions.

3. Vapor Retarder: 6 mil thick clear polyethylene film, type recommended for below grade application.

4. Non-Shrink Grout: ASTM C 1107; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

a. Minimum Compressive Strength at 48 Hours: 2,400 psi.

5. Moisture-Retaining Cover: ASTM C 171; regular curing paper, white curing paper, clear polyethylene, white polyethylene, or white burlap-polyethylene sheet.

D. Joint Devices and Materials

1. Waterstops: Rubber type, COE CRD-C 513.

2. Joint Filler: Nonextruding, resilient asphalt impregnated fiberboard or felt, complying with ASTM D 1751, 1/4 inch thick and 4 inches deep ; tongue and groove profile.

2.2 WATER SOLUBLE FLUX

A. Water Soluble Flux: Taramet Sterling(R) lead-free water soluble flux, conforming to ASTM B 813.

2.3 PLUMBING SOLDER

A. Plumbing Solder: Sterling® solder, ASTM B 32, Alloy Grade TC; 95 percent tin, 4.85 percent copper, 0.15 percent selenium.

1. Certified to comply with NSF 61.

2. Melting Temperature: 410 degrees F..

3. Tensile Strength: 7,130 psi.

4. Shear Strength: 5,979 psi.

5. Elongation Percent: 19.1.

6. Brinell Hardness: 15.1.

7. Burst Strength: 5,800 psi.

8. Pressure/Temperature Test Data on Copper Tube Assemblies comprised of 3 inch, 2 inch, 1 inch, 3/4 inch, and 1/2 inch Tubing with a Reducing Tee:

   a. No leaks at 180 degrees F., 200 psi, held for 2 minutes.

2.4 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type where required to conceal protruding fittings and sleeves.

1. Inside Diameter: Closely fit around pipe, tube and insulation.

2. Outside Diameter: Completely cover opening.

3. Stamped Steel: One-piece, with set-screw and chrome-plated finish.

4. Cast-Iron Floor Plate: One-piece casting.

B. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.

2. Insulating Material: Suitable for system fluid, pressure and temperature.

3. Dielectric Unions: Factory-fabricated, union assembly for 250-psig minimum working pressure at a 180 deg. F temperature.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction protect open ends with temporary plugs or caps.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Sleeve pipe passing through partitions, walls, and floors.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Inserts:

1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location

E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.4 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish

3.5 CONCRETE BASES

A. Construct concrete equipment bases of dimensions indicated, but not less than 4 inches (100 mm) larger than supported unit in both directions. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations.

B. Concrete materials, reinforcement, forms, and earth which will be in contact with fresh concrete shall be free from frost at the time of concrete placement

C. Bonding To Existing Concrete Slabs

1. Where more than one pad is required for a single piece of equipment, install 2 dowels in existing slab for each pad. Drill existing slab as required to install dowels 3 inches into the existing concrete. Grout dowels in the drilled holes.

2. Prior to placing concrete, thoroughly roughen and clean existing concrete slab. Saturate existing concrete surface with clean water. Immediately prior to depositing concrete for pad, apply a coat of cement grout over the existing damp concrete or allow existing concrete to dry and apply bonding agent (adhesive) over the existing concrete in accordance with manufacturer's printed instructions.

D. Installing Anchor Bolts and Sleeves

1. Install anchor bolts (with sleeves) for all bolt holes in equipment supports.

2. Accurately position and securely support anchor bolts and sleeves prior to placing concrete. Support head of bolt 1 inch above bottom of pad. Temporarily close open end of sleeves to prevent entry of concrete.

3. Grout anchor bolts in sleeves with cement grout or approved shrink-resistant grout after final positioning.

E. Reinforcing

1. Except where other reinforcement is shown on the Drawings, install welded wire fabric at mid-depth of each pad, extending to 1 inch from perimeter of pad.

F. Finishes

1. Formed Surfaces: Provide a smooth rubbed finish, with rounded or chamfered external corners, on all concrete surfaces exposed to view.

2. Unformed Surfaces: Provide a troweled finish on top surface of pads.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1 "Structural Welding Code--Steel."

3.7 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.8 MECHANICAL EQUIPMENT COMMISSIONING

A. Provide startup and commissioning services by factory-trained representatives of the equipment manufacturer for the following equipment:

1. Variable Refrigerant Volume Heat Pump Systems.

2. Controls.

B. Commissioning shall include the following:

1. Provide commissioning services for the equipment included in the contract, in accordance with SMACNA HVAC Systems Commissioning Manual; 1994.

2. Start-up the equipment specified and provide all manufacturer-recommended tests for startup of new installations.

3. Verify equipment operation under normal operating conditions through a complete range of equipment conditions from minimum through maximum equipment capacity.

4. Check operating condition and capacity of all required maintenance items, including, but not limited to oil, refrigerant or other consumables.

3.9 MECHANICAL EQUIPMENT INSTRUCTION

A. Provide instruction of the Owner's representatives for the duration specified below in operation and maintenance of the following equipment:

1. Pumps (minimum 2 hours).

2. Air Cooled Condensing Units (minimum 2 hours).

3. Cabinet Unit Heaters (minimum 1 hour).

4. Hydronic Radiant Panels (minimum 2 hours).

5. Variable Refrigerant Volume heat pump and fan coil unit systems (minimum 4 hours).

6. Controls (minimum 8 hours).

7. Exhaust Fans (minimum 2 hours).

3.10 GROUTING

A. Install nonmetallic, nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean all surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout to completely fill equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure grout in place according to manufacturer's printed instructions.

3.11 DEMOLITION

A. Disconnect, demolish, and remove work specified under Division 23 and as indicated.

B. Where pipe, breeching, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and breeching in its entirety.

D. Removal: Remove indicated equipment from the project site.

E. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational, equipment indicated for relocation.

END OF SECTION

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SECTION 230516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion Loops.

1.2 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

B. EJMA (STDS) - EJMA Standards; Tenth Edition.

C. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.3 SUBMITTALS

A. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

2. Expansion Joints/Loops: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

B. Design Data: Indicate selection calculations.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

D. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Corrugated stainless steel hose with single layer of stainless steel exterior braiding or bronze hose and braid, minimum 12" Live Length for piping 2-1/2" and less, minimum 18" Live Length for 3" and 4" piping and minimum 24" of Live Length for piping 5" and over; for maximum working pressure of 500 psi.

B. Flexible metal braided connectors shall be installed in a straight line without offsets or twists. Support pipe without any load on flexible connectors.

C. Connectors for pipe sizes 2" and below shall have threaded ends, and connectors for pipe sizes 2-1/2" and larger shall be flanged. Connectors for copper piping shall have copper tube ends. Connectors shall be constructed of annular corrugations and butt-welded seams. Utilize connectors of 300 series stainless steel corrugated hose and braid and carbon steel welded-on end fittings for connection to steel piping. Connectors to be installed on copper piping shall be constructed of bronze hose and braid with copper end connections.

2.2 REFRIGERANT PIPING EXPANSION LOOPS

A. General

1. Provide flexible hose expansion loop(s) as indicated on the contract drawings to accommodate any thermal expansion or contraction.

2. Flexible hose expansion loops shall be manufactured complete with two parallel sections of corrugated metal house, compatible braid, 180º return bend, with inlet and outlet connections. Field fabricated loops shall not be acceptable.

3. Flexible hose expansion loops shall impart no thrust loads to system support, anchors or building structure.

B. Products

1. Flexible hose expansion loops to be "**VRFMetraloop**" as manufactured by The Metraflex Company, Chicago, IL. OR EQUAL.

2. Corrugated Hose shall be Type 321 stainless Steel.

3. Braid shall be double layer of type 304 Stainless Steel.

4. Fittings shall be Sch 40 Schedule Type 304 Stainless in accordance with ASTM A240.

5. Copper pipe systems, the VRF Metraloop shall be equipped with a stainless-steel to copper conversion fitting with XHP copper stub ends.

6. Flexible hose expansion loops shall have a factory supplied; hanger / support lug located at the bottom of the 180º return.

7. UL 207 LISTED.

C. Execution

1. Install and guide per manufacturers' installation instructions and Mechanical Contractors Association of America "Guidelines for Quality Piping Installations".

2. Flexible hose expansion loop return fitting shall be supported to allow movement.

2.3 ACCESSORIES

A. Pipe Alignment Guides:

1. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for insulation thickness required, minimum 2 inches travel.

B. Anchor Clamps:

1. Carbon steel, light weight anchor that clamps to pipe and shall be either bolted or welded to the structure.

2. Approximate spring force (in pounds) required for anchors by pipe size:

3. Pipe size ranges:

1) 3/4" pipe size and less: 41 pounds.

2) 1" pipe size: 46 pounds.

3) 1-1/8"/1-1/4" pipe size: 65 pounds.

4) 1-1/2" pipe size: 68 pounds.

5) 2" pipe size: 82 pounds.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

END OF SECTION

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SECTION 230519 - METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

1.2 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014.

D. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

1.3 QUALITY ASSURANCE

A. Provide meters and gages that are rated by the manufacturer for both the temperature and pressure of the duty for the intended systems.

1.4 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

B. Project Record Documents: Record actual locations of components and instrumentation.

PART 2 PRODUCTS

2.1 PRESSURE GAUGES

A. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.

2. Size: 6 inch diameter.

3. Mid-Scale Accuracy: One percent.

4. Scale: Psi.

2.2 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

2.3 STEM TYPE THERMOMETERS

A. Thermometer: ASTM E 1, adjustable angle, mercury free, blue spirit fill, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.

1. Size: 9 inch scale.

2. Window: Clear Lexan.

3. Stem: 3/4 inch NPT brass.

4. Accuracy: 2 percent per ASTM E77.

5. Calibration: Degrees F.

2.4 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.5 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

C. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Extend nipples to allow clearance from insulation.

D. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

E. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 SCHEDULE

A. Pressure Gauges, Location and Scale Range:

1. Pumps, 0 to 100 psi.

2. New Boiler Inlet and Outlet, 0 to 125 psi.

B. Pressure Gauge Tappings, Location:

1. Control valves 3/4 inch & larger - inlets and outlets.

C. Stem Type Thermometers, Location and Scale Range:

1. New Boiler - inlets and outlets, 30 to 240 degrees F.

D. Thermometer Sockets, Location:

1. Control valves 1 inch & larger - inlets and outlets.

END OF SECTION

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SECTION 230548 - VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vibration isolators.

1.2 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2015.

1.3 SUBMITTALS

A. Product Data:

1. Provide manufacturer's product literature documenting compliance with PART 2 PRODUCTS.

B. Shop Drawings:

1. Provide schedule of vibration isolator type with location and load on each.

C. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.4 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Perform design and installation in accordance with applicable codes.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years of documented experience.

1. Member of Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Kinetics Noise Control, Inc: www.kineticsnoise.com.

B. Mason Industries: www.mason-ind.com.

C. Vibration Eliminator Company, Inc: www.veco-nyc.com.

2.2 PERFORMANCE REQUIREMENTS

A. General:

1. All vibration isolators to conform to all uniform deflection and stability requirements under all operating loads.

2. Steel springs to function without undue stress or overloading.

3. Lateral to vertical stiffness ratio to not exceed 0.08 with spring deflection at minimum 75 percent of specified deflection.

2.3 VIBRATION ISOLATORS

A. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.

B. Non-Seismic Type:

1. Rubber Mount or Hanger: Molded rubber designed for 0.4 inch deflection with threaded insert.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:

1. Isolator Hangers:

a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.

b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.

2. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.

3. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.

4. Adjust isolators to be free of isolation short circuits during normal operation.

5. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.2 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

C. Support piping connections to equipment mounted on isolators using isolators or resilient hangers as follows:

1. Up to 4 Inches Pipe Size: First three points of support.

2. 5 to 8 Inches Pipe Size: First four points of support.

3.3 SCHEDULE

A. Equipment Isolation Schedule.

1. Cabinet Unit Heaters: Rubber in shear hangers, minimum 1/4 inches static deflection.

END OF SECTION

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SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

1.3 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Boilers: Nameplates.

B. Exhaust Fans: Nameplates.

C. Heat Pumps: Nameplates.

D. Ductwork: Stencilled painting.

E. Piping: Pipe markers.

F. Pumps: Nameplates.

2.2 NAMEPLATES

A. Letter Color: White.

B. Letter Height: 1/4 inch.

C. Background Color: Black.

D. Plastic: Comply with ASTM D709.

2.3 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. Ductwork and Equipment: 2-1/2 inch high letters.

2.5 PIPE MARKERS

A. Color: Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.

2. Install in clear view and align with axis of piping.

3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

F. Install ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Commissioning activities.

1.2 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; 2005, Seventh Edition.

1.3 SUBMITTALS

A. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. Certification: All reports submitted, whether progress reports or final reports shall be certified and shall bear the seal of the certification agency.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Engineer.

2. Submit to the Commissioning Authority, Construction Manager, and HVAC controls contractor.

3. Submit six weeks prior to starting the testing, adjusting, and balancing work.

4. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Engineer and other installers to sufficiently understand the design intent for each system.

5. Include at least the following in the plan:

a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

c. Identification and types of measurement instruments to be used and their most recent calibration date.

d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

e. Final test report forms to be used.

f. Detailed step-by-step procedures for TAB work for each system and issue, including:

1) Diffuser proportioning.

2) Total flow calculations.

3) Rechecking.

g. Expected problems and solutions, etc.

h. Details of how TOTAL flow will be determined; for example:

1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.

2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.

i. Proposed selection points for sound measurements and sound measurement methods.

j. Methods for making coil or other system plant capacity measurements, if specified.

k. Time schedule for TAB work to be done in phases (by floor, etc.).

l. Time schedule for deferred or seasonal TAB work, if specified.

m. False loading of systems to complete TAB work, if specified.

n. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).

o. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least twice a week to the Commissioning Authority.

E. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Submit to the the Commissioning Authority, Construction Manager, and HVAC controls contractor within two weeks after completion of testing, adjusting, and balancing.

2. Revise TAB plan to reflect actual procedures and submit as part of final report.

3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.

4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

6. Units of Measure: Report data in I-P (inch-pound) units only.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.

2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

2. Having minimum of three years documented experience.

3. Certified by the following:

a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.

b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire, smoke, combination fire/smoke and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Engineer to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 5 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.

2. Discrepancies, deficient or uncompleted work by others.

3. Contract interpretation requests.

4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Nanuet Union Free School District.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.7 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.8 COMMISSIONING

A. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

B. In the presence of the Commissioning Authority, verify that:

1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.

2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.

3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open.

3.9 SCOPE

A. Test, adjust, and balance the following:

1. HVAC Pumps.

2. Boilers

3. Air Cooled Condensing Units.

4. Variable Refrigerant Volume Heat Pump Systems.

5. Fan Coil Units.

6. Terminal Heat Transfer Units.

7. Fans.

8. Air Filters.

9. Air Inlets and Outlets.

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.

2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. Pumps:

1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

C. Combustion Equipment:

1. Boiler manufacturer.
2. Model number.
3. Serial number.
4. Firing rate.
5. Overfire draft.
6. Gas meter timing dial size.
7. Gas meter time per revolution.

8. Gas pressure at meter outlet.
9. Heat input.
10. Burner manifold gas pressure.
11. Percent carbon monoxide (CO).
12. Percent carbon dioxide (CO2).
13. Percent oxygen (O2).
14. Percent excess air.
15. Flue gas temperature at outlet.
16. Ambient temperature.
17. Net stack temperature.
18. Percent stack loss.
19. Percent combustion efficiency.
20. Heat output.

D. Heat Pumps:

1. Identification/number.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Entering DB air temperature, design and actual.
7. Leaving DB air temperature, design and actual.
8. Number of compressors.

E. Cooling Coils:

1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.

6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Saturated suction temperature, design and actual.
11. Air pressure drop, design and actual.

F. Heating Coils:

1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

G. Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.

9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Fan RPM.

H. Exhaust Fans:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Fan RPM.

I. Duct Traverses:

1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

J. Duct Leak Tests:

1. Description of ductwork under test.
2. Duct design operating pressure.

3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
    a. Blower.
    b. Orifice, tube size.
    c. Orifice size.
    d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

K. Air Distribution Tests:

1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION

SECTION 230713 - DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

1.2 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.

E. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2008.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of experience and approved by manufacturer.

C. Code Compliance: All insulation products provided on the contract shall be fully in compliance with all material and installation requirements of the New York State Energy Conservation Construction Code, latest addition with all amendments. Insulation products shall meet all "k" values and thicknesses as described in the Code.

1.5 REGULATORY REQUIREMENTS

A. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E 84.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Knauf Insulation: www.knaufinsulation.com.

2. Johns Manville: www.jm.com.

3. Owens Corning Corporation: www.ocbuildingspec.com.

4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.

2. Maximum Service Temperature: 450 degrees F.

3. Maximum Water Vapor Absorption: 5.0 percent by weight.

4. Density: 1.50 pounds per cubic foot.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E96/E96M.

3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:

1. Provide insulation with vapor barrier jackets.

2. Finish with tape and vapor barrier jacket.

3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.

2. Secure insulation without vapor barrier with staples, tape, or wires.

3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.

4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.3 SCHEDULES

A. Supply air ductwork (interior, concealed): 2" thick fiberglass flexible duct wrap insulation.

END OF SECTION

SECTION 230923 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SCOPE OF WORK

A. General:

1. The existing School District's DDC is manufactured by Siemens Industry, Inc, which is the building's certified temperature control system. The products, control equipment, software, hardware, programming, graphics, wiring and conduit specified in this section shall be provided by Siemens Industry, Inc. All control system requirements specified in this section shall connect to the existing Siemens Industries, Inc. network system that exists on the Nanuet Union Free School District campus. The Board of Education of the Nanuet Free Union School District has decided to purchase controls components, engineering, programming and project management labor from Siemens Industry, Indc. All work specified within specification section 230923, and all temperature control work outlined on the drawings shall be manufactured by Siemens.

2. The work of this section shall include the furnishing and installing of a complete Building Management System (BMS). The BMS shall be an extension of the existing Siemens V6.0 of the Desigo CC Graphical Software at Nanuet Schools. Building Operating Personnel shall utilize existing Desigo workstation software to schedule and control the HVAC equipment. All controllers, sensors, and end devices shall match existing site DDC equipment as furnished by Siemens Industry, Inc..

3. Provide and Install all new graphics on DESIGO server

4. Verify operation of all new DESIGO graphics

5. The contractor shall include tuition for (2) multi-day training classes for up to (1) student per class delivered a Siemens Training Center.

6. The entire system shall be computer driven and shall employ Direct Digital Control (DDC) processes for energy management, equipment monitoring and control, utilizing open communications capabilities as herein specified.

7. The Building Automation System (BAS) manufacturer’s local corporate branch office shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems with open communications capabilities as herein specified. To ensure the highest quality of long-term service, the use of an independent distributor, non-corporate branch office is not permissible.

8. Actuators for valves and dampers shall be electric.

9. Analog Outputs: All analog outputs referenced in the specifications or on the drawings shall be true modulating control signals activating devices with spring return features so that the end device fails into the normal position as described or indicated. Floating point type control accomplished by power-open and power-close signals using multiple digital outputs or pulse width modulation shall not be acceptable except for devices in which the sequences or the drawings specifically identify floating point operation. All devices indicated with normally open (NO) or normally closed (NC) positions shall feature spring return to the normal position upon loss of power or failure of signal.

10. Provide operator training to the Nanuet Union Free School District as described in Section 3.

11. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.2 DDC SYSTEM DESCRIPTION

A. The entire Energy Management and Control System (EMCS) shall be comprised of a network of interoperable, stand-alone digital controllers communicating on an open protocol communication network. All information from the EMCS shall be available to local computers within the building via local Intranet and to remote computers or from multiple facilities via the Internet. The EMCS shall be capable of communicating to third party systems such as HVAC, lighting, energy metering, power management, clock displays, security, access control, fire-life safety systems and other building management related devices with open, interoperable communication capabilities.

B. All labor, material, equipment and software not specifically referred to herein or on the plans, that are required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

C. The intent of this specification is to provide open protocol field mounted Direct Digital controls. Open protocol, fully programmable, DDC controllers for each piece of mechanical equipment being controlled are mandatory. Controls that are “packaged” and supplied by the manufacturer are not acceptable. All systems as described in the sequence of operation shall be shown via dynamic Web based graphics with all pertinent system alarms for proper operation and maintenance.

D. Provide DDC controllers and all required field devices, sensors, and actuators, as specified herein, required for a complete and operating extension to the existing Apogee DDC System for the following equipment:

1. Integration to Fan Coil Variable Refrigerant Volume (VRV) manufacturers furnished BACnet MS/TP compatible controls

2. Controls for hydronic radiators/convectors, VRV heat pump system fan coil units, exhaust fans.

3. Representative Siemens zone temperature sensors as shown on the drawings

4. Integration into existing Insight Graphical Operators Workstation

E. To ensure installation of a product of the highest quality, the BAS manufacturer must be UL registered and ISO 9001:2000 registered under Automatic Controls for Regulating Commercial Environments and Appliances for The Design and Manufacture of Environmental Controls and Energy Management Products and ISO 14001:1996 Registered as an Energy Management System. Proof of ISO 9001:2000 and ISO 14001:1996 registration must be submitted prior to bid. Quality Management System Manual detailing the BAS manufacturer's ISO registered Quality Management System must be submitted with the manufacturer's submittal.

F. The installation of the control system shall be performed by the controls manufacturer's corporate branch office with the shop drawings, flow diagrams, bill of materials, component designation or identification number and sequence of operation all bearing the name of the manufacturer.

G. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specially for this project. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.

H. BAS manufacturer shall be responsible for all BAS and Temperature Control wiring for a complete and operable system. All wiring shall be done in accordance with all local and national codes. Systems shall be complete in all respects including thermostats, valves, dampers, relays, wiring, conduit, etc. to provide the functions described, regardless of whether or not thermostats, relays, etc., are specifically mentioned.

I. System Architecture:

1. Provide a twisted pair for DDC system communication with BACNet protocol between intelligent devices and controllers. All communications wiring shall be plenum rated.

2. Provide programming for graphical display of all contract control systems on the new DESIGO head end system.

1.3 CONTROL DIAGRAMS AND POINT SCHEDULES

A. The performance sequences described are provided to supplement the temperature control diagrams and point schedules as shown on the contract drawings. Where individual points are described in the diagrams and/or point schedules but are not required to meet the sequences specified, the points shall be included in the system as indicated on the drawings. All points shown on the drawings shall be provided whether or not they are required for the sequences. Additionally, provide all points which are required to meet the specified sequences, whether or not they are specifically identified on either the diagrams or the point schedules. The diagrams and point schedules are provided to enhance document clarity, and are not to be utilized to limit the hardware utilized in engineering the temperature control.

1.4 MANUFACTURER'S RECOMMENDATIONS

A. Where this specification does not describe installation procedures, or other equipment required to be in accordance with the recommendations of the manufacturer of the

control system, provide those procedures and equipment without additional cost to the Owner as if it was explicitly specified in this contract. The contractor shall provide a complete and operable system which meets the recommendations of the equipment manufacturers.

1.5 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2005.

B. UL-916 Energy Management Systems

C. ULC, UL Canadian Standards Association

D. FCC, Part 15, Subpart J, Class A Computing Devices

1.6 SUBMITTALS

A. Product Data: Provide data for each system component and software module.

B. Shop Drawings:

1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.

2. List connected data points, including connected control unit and input device.

3. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.

4. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

5. Indicate description and sequence of operation of operating, user, and application software.

6. Provide a complete point schedule demonstrating compliance with the point schedules included in the contract documents. Schedule format shall be such as to easily confirm that all the scheduled points are being provided.

7. Provide a copy of all proposed system graphics.

8. Schematics, sequences and flow diagrams.

9. Revised BAS architecture diagram indicating the new equipment.

10. Equipment data cut sheets

11. System schematics, including:

a. sequence of operations

b. point names

c. point addresses

d. interface wiring diagrams

e. panel layouts

f. system riser diagrams

12. Points schedule for each real point in the BAS, including: Tag, Point Type, System Name and Display Units.

13. Samples of Graphic Display screen types and associated menu penetrations to show hierarchy and functional interrelationships.

14. Detailed Bill of Material list for each Node, identifying quantity, part number, description, and optional features.

15. Control Damper Schedule including a separate line for each damper and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Blade Type, Bearing Type, Seals, Duct Size, Damper Size, Mounting, and Actuator Type.

16. Control Valve Schedules including a separate line for each valve and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Calculated CV, Design Pressure, Actual Pressure, and Actuator Type.

17. Details of all BAS interfaces and connections to the work of other trades.

18. Product data sheets for all products including software.

19. Training provided, including outlines for each session.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

D. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.

2. Include submittals data in final "Record Documents" form.

E. Operation and Maintenance Data:

1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.

2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.

3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

1.7 QUALITY ASSURANCE

A. Single Source Responsibility: The contractor shall be fully responsible for the proper operation of all control systems, including, but not limited to sensors and controls, and peripheral devices. After the installation, the contractor shall be responsible for the calibration of the system. The control system manufacturer shall be fully responsible for providing and loading the specified software packages, to include the loading of all necessary operational parameters. Any debugging of software problems shall be performed solely by the control system manufacturer.

B. Electrical Work and Safety Requirements:

1. Electrical work shall be in strict accordance with applicable NFPA, ANSI and UL requirements. Fully enclose or properly guard electrical wiring, terminal blocks and other high voltage contacts and mark to prevent accidental injury to personnel.

2. All wiring associated with and required by the control system (including power circuits as indicated on the drawings) shall be the responsibility of the contractor.

3. Comply with all the latest federal, state and local rules, regulations, ordinances having jurisdiction over this work, including OSHA requirements. These codes and standards shall supersede the specifications and drawings. All work under this contract shall be in accordance with the latest editions of the National Electrical Code (NEC) and the electric codes in the locale in which the work is being performed.

4. The term "wiring" shall be construed to include furnishing of wire, conduit, miscellaneous materials and labor as required for mounting and connecting electrical control devices, and providing electrical interlocks between equipment. Low voltage sensor wiring shall be installed per NEC and local codes.

C. Perform work in accordance with NFPA 70 and NFPA 90A.

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

E. The BAS system components shall match existing system components.

F. The BAS system shall be designed and installed, commissioned and serviced by manufacturer employed, factory trained personnel. Manufacturer shall have an in-place support facility within 30 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment. Distributors or licensed installing contractors are not acceptable.

G. The manufacturer shall provide on site, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the B.M.S.

H. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and

shall be manufacturer's latest standard design that complies with the specification requirements.

I. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX; Standard ULC C100, category UUKL7; and under Standard UL 864, categories UUKL, UDTZ, and QVAX. and be so listed at the time of bid. All floor level controllers shall comply, at a minimum, with UL Standard UL 91 6category PAZX; Standard UL 864, categories UDTZ, and QVAX. and be so listed at the time of Bid.

J. DDC peer-to-peer controllers shall be compliant with the European EMC Directive, Standards EN 50081-2 and EN 50082-2, at the Industrial Levels. Additionally the equipment shall be compliant with the European LVD Directive and bear the CE mark in order to show compliance to both Directives.

K. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

L. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

M. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network.

N. Compatibility shall be defined as the ability for any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers or protocol converters.

1.8 SYSTEM PERFORMANCE

A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).

1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.

2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.

3. Multiple Alarm Annunciations. Each workstation on the network shall receive alarms within 5 sec of other workstations.

B. Coordination:

1. Coordinate location of temperature sensors, humidity sensors and other exposed control sensors with plans and room details before installation.

2. Coordinate installation of control dampers, taps, control valves, airflow stations, etc. with the mechanical contractor.

3. Coordinate BMS equipment with all relevant divisions including, but not limited to, Fire Alarm to achieve compatibility with equipment that interfaces with that system.

4. Coordinate BMS equipment to achieve compatibility with motor starters and annunciation devices.

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

6. Coordinate routing of network communication cabling with associated trades.

    a. Coordinate routing of network communication cabling with associated trades.

7. Controller shall support BACnet MS/TP or BACnet/IP.

C. The Application Specific Controller shall provide for control of each piece of equipment, including, but not limited to the following:

1. Hydronic radiators

2. Cabinet unit heaters

D. Each Application Specific Controller shall, at a minimum, be provided with:

1. Appropriate NEMA rated enclosure

2. Power supplies as required for all associated modules, sensors, actuators, etc.

3. Each controller measuring air volume shall include a differential pressure transducer

4. Approvals and standards: UL916 PAZX; CUL; FCC

E. Each Application Specific Controller shall continuously perform self-diagnostics on all hardware and secondary network communications. The Application Specific Controller shall provide both local and remote annunciation of any detected component failures or repeated failure to establish communication to the system.

F. Power Supply. The Application Specific controller shall be powered from a 24 VAC source and shall function normally under an operating range of -15% / +20%.

G. All controller configuration settings and programs shall be stored in non volatile memory. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration.

H. Environment. The controllers shall function normally under ambient conditions of 23 to 122°F (-5 to 50°C) and 5% to 95% RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the circuit board assembly.

1.9 ALARM PROCESSING

A. Alarms shall be classified by their alarm type. The facility shall be provided for enabling and disabling each individual alarm on the system.

B. Once generated, the alarm shall be processed by its associated alarm type as defined in the I/O Point Schedules. The alarm types shall be as follows:

1. General Mismatch
2. Critical Mismatch
3. General Binary
4. Critical Binary
5. General Analog
6. Critical Analog
7. Alarm Inhibition

C. Consequential alarm suppression algorithms shall be provided to limit the alarms annunciated on the DDC System to those associated with the source of the initial alarm condition e.g. fire alarms shall not initiate mismatch alarms, restoration of power following a power failure shall not initiate mismatch alarms etc.

1.10 CONFIGURATION

A. Configuration data shall be stored in the DDC Controllers or the Terminal Unit Controllers. Configuration data shall include but not be limited to the following:

1. The unit applicable (deg F, GPM's, inches, etc.).
2. The point identifier (minimum of 12 characters).
3. The point alarm message if applicable (minimum of 80 characters).
4. The point descriptor (minimum of 32 characters).

1.11 DDC STANDARD PROGRAMS

A. The device schedules included in this Specification provide details of inputs monitored and outputs controlled by the DDC System. All point types are described under Controllers elsewhere in this Specification. The DDC System shall allow for the following point functionality and standard programs to be available:

1. Point Override
2. Manual Start/Stop
3. Fixed Time Program
4. Optimum Start/Stop

5. Control Loops
6. Rotational Point
7. Run Time Totalization
8. KWH calculations
9. Anti-Short Cycling
10. Staggered Start
11. User Definable Software
12. General Control Requirements

1.12 INTEGRATIONS

A. The BMS shall utilize and be compatible with industry-standard integration protocols (BACnet and Modbus) for subsystem integration. Coordinate integration protocols with subsystem manufacturer.

B. In addition to the above, the BMS shall be integrated with all pump and fan VFDs via BACnet MS/TP or IP. All up to (20) software points shall be made available at the BMS for monitoring.

1.13 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.14 WARRANTY

A. Warranty the direct digital control system to be free from defects in workmanship and material for a period of one (1) year from completion of final commissioning. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of twelve (12) months from completion of system demonstration.

B. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be twenty-four (24) hours.

1.15 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

1. BAS Building Automation System
2. EMCS Energy Management and Control System
3. DDC Direct Digital Control

4. NAC Network Area Controller
5. IBCI nteroperable BACNet Controller
6. ASC Application Specific Controller
7. FUI Full User Interface
8. BUI Browser User Interface
9. POT Portable Operator's Terminal
10. PMI Power Measurement Interface
11. LAN Local Area Network
12. WAN Wide Area Network
13. OOT Object Oriented Technology
14. PICS Product Interoperability Compliance Statement

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The BMS shall be an extension of the existing Siemens BAS. The existing Siemens INSIGHT operator software shall be upgraded to DESIGO as part of this project.

B. Basis of Design

1. Siemens Desigo CC

a. Siemens Industry, Inc., local NY/NJ Factory Branch Office

b. Contact: Bert Vecchiarelli

1) Email: bert.vecchiarelli@siemens.com

2) Phone: (201) 454-3842

2.2 MATERIALS

A. All products used in this project installation shall be new and currently manufactured and shall have been applied in similar installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner or Owner's representative. Spare parts shall be available for at least five years after completion of this contract.

2.3 DDC CONTROLLER FLOOR LEVEL NETWORK

A. This level communication shall support a family of application specific controllers and shall communicate with the peer to peer network through DDC Controllers for transmission of global data.

2.4 TIE-IN TO EXISTING SIEMENS BMS

A. Provide a SEAMLESS tie-in to the existing Siemens BMS. The tie-in shall include Direct Digital Control (DDC), historical data collection, archiving and alarm, energy and information management for all control points specified herein.

B. Tie-in to existing site BMS of all DDC equipment and points as specified in this section and as required in all other referenced sections and as required to complete the sequences of operation outlined herein. Tie-in shall be made via an extension of the existing BMS.

C. Provide new color graphics for all new systems specified in this contract.

D. Revisions to all existing BMS workstations as required to incorporate the additional control components provided under this section. Revisions shall include, but are not limited to, revised graphics, update of additional firmware and/or software as required to accommodate new points.

2.5 SYSTEM FUNCTIONS AND PERFORMANCE

A. The BMS shall be capable of accepting inputs (analog, digital, pulsed digital, thermistor, and RTD) from field devices, and of producing analog and digital outputs (4 - 20 mA DC, pulse width modulation, and 0-10 VDC) for control and monitoring functions in order to:

1. Adjust control parameters for process-controlled variables.

2. Initiate, define and acknowledge audible alarms.

3. Start/stop motors and position valves and dampers.

4. Initiate shutdowns due to activation of safety devices.

5. Communicate with the servers and workstations.

2.6 SYSTEM ARCHITECTURE

A. The system architecture shall consist of a network of independent, standalone BACnet IP, BACnet MS/TP or Siemens P2/P1 based primary and unitary controllers. Each controller shall perform all specified control and monitoring functions independently. Failure of one (1) control unit shall have no effect upon any other unit in the network.

B. The system architecture shall be based on a modular PC network, utilizing industry standard operating systems, networks and protocols.

C. The system shall allow the distribution of system functions such as monitoring and control and graphical user interface etc. across the network to achieve maximum flexibility and performance.

D. Data communications protocol shall be BACnet and shall comply with ASHRAE 135.

E. Each DDC, unitary controller, server, and workstation shall communicate via TCP/IP or Siemens P1/P2.

F. Use fiber optic cabling for all Ethernet runs longer than 300 ft.

2.7 BUILDING AUTOMATION SYSTEM NETWORK - UTILIZE EXISTING SIEMENS BAS NETWORK.

A. The design of the BMS shall network the BMS server, operator workstations, primary control panels and secondary control panels. The network architecture shall consist of multiple network levels. Provide a peer-to-peer Primary Network to connect the existing server, operator workstation(s) and all primary control panels in the building for global system operation. Provide secondary networks to connect from each primary control panel to the secondary control panels of associated terminal equipment.

B. All networked control products provided for this project shall be comprised of an industry standard open protocol internetwork. Communication involving control components (i.e. all types of controllers and operator interfaces) shall conform to the ASHRAE 135 - BACnet standard. Networks and protocols proprietary to one company or distributed by one company are prohibited.

C. Controllers and software shall be BTL listed at the time of installation.

D. Primary control panels may be connected to the primary network via routers if this follows the standard architecture of a specified manufacturer. Provide additional controllers if required according to manufacturer's standard architecture layout to achieve network functionality. Quantity and locations of routers, network controllers, and supervisory controllers to be coordinated with Engineer.

E. Access to system data shall not be restricted by the hardware configuration of the BMS. The hardware configuration of the BMS network shall be totally transparent to the user when accessing data or developing control programs.

F. The BMS design shall allow the co-existence of current and future primary control panels and personal computer operator workstations on the same primary network.

G. The BMS contractor shall provide new supervisory controllers/routers as required to connect to all new controllers being installed as part of this project, while still keeping with all requirements such as spare capacity requirements, etc.

2.8 BUILDING MANAGEMENT SYSTEM SOFTWARE – DESIGO CC

A. Provide software which includes the following capabilities.

1. Scheduling and override of building operations.

2. Collection and analysis of historical data.

3. Editing, programming, storage and downloading of controller databases, programs and parameters.

4. The latest version Microsoft Windows environment that allows the user to run several applications simultaneously. Other Windows applications shall run simultaneously with the BMS software including, but not limited to, Word, Excel, Access, etc.

5. Provide a user interface that shall minimize the use of a typewriter style keyboard through the use of a mouse or similar pointing device and "point and click" approach to menu selection.

6. The operator shall be able to drag and drop information between applications (e.g., click on a point in the alarm screen and drag it into the dynamic trend graph screen to initiate a dynamic trend).

7. Operator specific password access protection shall allow the user to limit workstation control, display and data base manipulation capabilities for each object in the system. An object shall be defined as any input or output point, setpoint, system program, etc. The operator privileges shall “follow” the operator to any workstation or primary control panel that the operator logs on to. Provide a minimum of 1000 passwords.

8. Operators will be able to perform only those commands on the objects available based on their respective passwords. Menu selections displayed shall be limited to only those items defined for the access level of the password used to log-on.

9. An audit trail report to track system object changes that shall record operator-initiated actions. These actions shall include, but not be limited to, changes made by a particular person, changes made to a specific piece of equipment and/or changes made during a designated time frame. The changes shall be printed and archived for future reference either on command or automatically, at the operator’s option. The operator activity tracking data shall be stored in a tamper proof buffer.

10. Software shall allow the operator to perform commands including, but not limited to:

    a. Start up and shutdown of equipment.

    b. Setpoint adjustment.

    c. Add/modify/delete time programming.

    d. Enable/disable process execution.

    e. Lock/unlock alarm reporting.

    f. Enable/disable totalization and/or trending.

    g. Override PID loop setpoints.

    h. Enter temporary override schedules.

    i. Define holiday schedules.

    j. Change time/date.

    k. Automatic daylight savings time adjustments.

    l. Enter/modify analog warning and alarm limits.

B. Reporting.

1. Reports shall be generated and directed to displays, printers or disk. As a minimum, the system shall allow the user to easily obtain the following types of reports:

    a. A general listing of all points in the network.

    b. List of all points currently in alarm.

    c. List of all points currently in override status.

    d. List of all disabled points.

    e. List of all points currently locked out.

    f. DDC Controller trend overflow warning.

    g. List all weekly schedules.

C. Scheduling.

1. Provide a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Provide schedules for 365 days in advance.

2. Weekly schedules shall be provided for each building zone or piece of equipment with a specific occupancy schedule. Temporary overrides and associated times may be inserted into blocks for modified operating schedules. After overrides have been executed, the original schedule will automatically be restored.

3. Zone schedules shall be provided for each building zone as previously described. Each schedule shall include all points that can be commanded residing within the zone. Each point may have a unique schedule of operation relative to the zone's occupancy schedule, allowing for sequential starting and control of equipment within the zone. Scheduling and rescheduling of points may be accomplished easily via the zone schedule graphic.

D. Password. New user passwords and access levels will need to be established.

1. Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display, and database manipulation capabilities as he or she deems appropriate for each user, based on an assigned password.

2. Each user shall have the following: a user name (12 characters minimum); a password (12 characters minimum), and an access level (from 1 - 5).The system shall allow each user to change his or her password at will.

3. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.

4. A minimum of five levels of access shall be supported as follows.

    a. Level 1 = Data Access and Display

b. Level 2 = Level 1 and Operator Overrides

c. Level 3 = Level 2 and Database Modification

d. Level 4 = Level 3 and Database Generation

e. Level 5 = All privileges, including Password Add/Modify

5. A minimum of 100 unique passwords, including user initials, shall be supported.

6. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.

7. The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.

8. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving the operator workstation logged on.

E. Collection and Analysis of Historical Data.

1. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals or changes of value, both of which shall be user-definable. Trend data shall be stored on hard disk for future diagnostics and reporting.

2. Trend data report graphics shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or pre-defined groups of at least 6 points. Provide additional functionality to allow any trended data to be transferred directly to an off-the-shelf spreadsheet package such as Excel. This shall allow the user to perform custom calculations such as energy usage, equipment efficiency and energy costs and shall allow for generation of these reports on high-quality plots, graphs and charts.

3. Provide additional functionality that allows the user to view trended data on trend graph displays. Displays shall be actual plots of both historical and/or real-time dynamic point data. A minimum of 10 points shall be viewed simultaneously on a single graph. The user may pause the graph and take "snapshots" of screens to be stored on the hard disk for future recall and analysis. Displays shall include an 'X' axis indicating elapsed time and a 'Y' axis indicating a range scale in engineering units for each point. The 'Y' axis shall have the ability to be manually or automatically scaled at the user's option. Different ranges for each point may be used with minimum and maximum values listed at the bottom and top of the 'Y' axis. All 'Y' axis data shall be color-coded to match the line color for the corresponding point.

4. Static graphs shall represent actual point data that has been trended and stored on disk. Exact point values may be viewed on a data window by pointing or scrolling to the place of interest along the graph. Provide capability to print any graph on the system printer for use as a building management and diagnostics tool.

5. Dynamic graphs shall represent real-time point data. Any point or group of points may be graphed, regardless of whether they have been predefined for trending. The graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any point. In addition, the user may pause the graph and take "snapshots" of screens to be stored on the workstation disk for future recall and analysis. As with static graphs, exact point values may be viewed and the graphs may be printed.

F. Dynamic Color Graphic Displays. Approximately (80) system graphics are included. In addition - each terminal unit with a networked Siemens controller (Unit vent, fan-coil unit, etc.) shall have a dedicated graphic.

1. All workstation(s) shall be provided with color graphics. All workstation(s) software shall include a graphical viewing and control environment and definition and construction of dynamic color graphic displays.

2. Provide system color graphics for each HVAC system and for each electrical, plumbing and/or piping system that is monitored and/or controlled by the BMS. Provide scaled floor plans indicating equipment location, service and system data as required.

3. Provide color graphic floor plan displays and system schematics for each piece of mechanical equipment, including but not limited to air handling units, and hot water systems to optimize system performance analysis and speed alarm recognition.

4. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands.

5. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.

6. The windowing environment of the PC operator workstation(s) shall allow the user to simultaneously view several graphics at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

7. Graphic generation software shall be provided to allow the user to add, modify, or delete system graphic displays via an off the shelf graphics package.

8. Provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g., fans, cooling coils, filters, dampers, etc.), complete mechanical systems (e.g., constant volume-terminal reheat, VAV, etc.) and electrical symbols.

9. Graphical displays can be created to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout, or any other logical grouping of points that aids the operator in the analysis of the facility.

10. Graphical displays shall contain animation to assist the operator in determining status of the equipment being displayed (e.g., a fan that is energized shall rotate).

11. Provide an automatically updated, dynamic display of the site-specific BMS architecture indicating the status of primary and secondary controllers, PC workstation(s) and networks.

12. Provide a separate dynamic display page of each HVAC (AHU, RTU, heat pump, unit ventilator, blower coil, etc.), electrical and/or plumbing system connected to the BMS.

13. Provide a separate dynamic display page of each piece of terminal equipment (VAV box, fan coil unit, etc.) connected to the BMS.

14. Provide a separate dynamic display page for each floor, roof and zone of each building within the school district. At a minimum, each page shall display the associated space temperature readings and links to equipment located on the floor or in the zone.

15. Graphics shall incorporate all system integration points communicated via hardware or software gateways and/or interfaces. Origin of information shall be transparent to the operator and shall be controlled, displayed, trended, etc. as if the points were hardwired to the BMS.

G. System Configuration and Definition

1. All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.

2. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently add, delete or modify any system object including primary control panel(s), operator workstations(s), secondary control panels, reporting definitions, control loops, energy management applications, time and calendar-based programming, totalization, historical data trending, custom control processes, graphic displays, operator passwords, alarm messages, etc.

3. Definition of operator device characteristics for individual points, applications and control sequences shall be performed using instructive prompting software.

4. Programming shall be performed with the BMS system online and shall not interfere with BMS system operation.

5. Inputs and outputs for any process shall not be restricted to a single primary control panel, but shall be able to include data from any and all other network panels to allow the development of network-wide control strategies. Processes shall also allow

the operator to use the results of 1 process as the input to any number of other processes (cascading).

6. Provide the capability to backup and store all system databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation(s) are on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate primary control panel. Similarly, changes made at the primary control panels shall be automatically uploaded to the workstation, ensuring system continuity. The user shall also have the option to selectively download changes as desired.

7. Provide context-sensitive help menus to provide instructions appropriate with operations and applications currently being performed.

H. External Data Access

1. The software shall provide the ability to expose configuration properties and real-time values through CSV files, OPC DA, OPC UA, or REST-based Web Services.

2. The software shall provide the ability for external applications to change configuration and real-time values through OPC DA, OPC UA, or REST-based Web Services.

3. The software shall provide the ability for external applications to access historical Trend data through CSV files or REST-based Web Services.

4. External data access must be secured using the level of permissions configured for users and operator workstations.

5. Web service interfaces must allow for exchanging data (object's values, events and trend series) between workstation and external applications such as facility management systems, enterprise applications, mobile applications or other value-added services.

6. Documentation describing web services interfaces must be included to allow external developers to write applications that leverage the data exchange.

I. Data Security

1. The BAS software must allow that all communication paths between clients and the server are encrypted and protected against replay attacks as well as data manipulation.

2. Any runtime data transfer between the system server and Web Server (IIS) must be allowed to be encrypted by Desigo CC.

3. Communication between any Web Server (IIS) and the Web Clients must be allowed to be encrypted.

4. Passwords must be handled with encrypted storage and transmission

5. The software must support the use of public domain algorithms for cryptographic functions, including AES, DiffieHellmann, RSA, and SHA-2. No self-coded algorithms shall be allowed.

6. All symmetrical encryption must use 256 bit AES or stronger.

7. All asymmetrical encryption must use 2048 bit or stronger.

8. The software must support the use of commercial certificates for securing client-server communications.

9. The software must support the use of self-signed certificates to allow local deployments without the overhead of obtaining commercial certificates.

10. When using self-signed certificates, the owner of the Desigo CC system is responsible for maintaining their validity status, and for manually adding them to and removing them from the list of trusted certificates.

11. The BAS software shall be compatible with the following Virus Scanners:

    a. Kaspersky

    b. Avira

    c. McAfee

    d. Bitdefender

    e. TrendMicro Office Scan

2.9 BUILDING CONTROLLER HARDWARE (B-BC)

A. If available, existing P2/P1 or BACnet building controllers may be utilized. For new controllers, utilize the below specification requirements.

B. Provide all necessary hardware for a complete operating system as required. The Building Controller shall be able to operate as a standalone panel and shall not be dependent upon any higher-level computer or another controller for operation.

C. Basis of Design: Siemens PXC Series.

D. This controller shall have the BTL listing and meet the BACnet device profile of a Building Controller (B-BC).

    1. Controller shall support BACnet MS/TP and BACnet/IP.

E. This level of controller shall be used for the following types of systems:

    1. Hot water systems.

    2. Air handling units.

    3. Rooftop Unit systems.

4. Heat Pump systems.

F. Computing power and memory minimum:

1. A stand-alone, multi-tasking, multi-user, real-time 1.2GHz digital control microprocessor module.

2. Inputs shall be 16-bit minimum analog-to-digital resolution

3. Outputs shall be 10-bit minimum digital-to-analog resolution

4. Memory module (2GB, minimum) to accommodate all Primary Control Panel software requirements, including but not limited to, its own operating system and databases (see Controllers Software section), including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, operator I/O, dial-up communications.

5. Real time clock and battery

6. Data collection/ Data Trend module sized for 10,000 data samples.

7. Flash Memory Firmware: Each Building Level Control Panel shall support firmware upgrades without the need to replace hardware.

G. Communication

1. 2-Port Ethernet switch cabling compatible with star, bus or daisy chain topology.

2. WLAN connection for service, commissioning and firmware upgrade.

3. Web user interface is accessible over HTTP or securely over HTTPS.

4. Individual 3rd Ethernet port for local service/tools connection.

H. Input and Output Points Hardware

1. Input/output point expansion modules shall be installed as required to include 20% spare capacity of points.

2. Input/output point modules shall have removable terminal blocks.

3. Monitoring of the status of all hand-off-auto switches.

4. Monitoring of all industry standard types of analog and digital inputs and outputs, without the addition of equipment to the primary control panel.

5. Local status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Each primary control panel shall perform diagnostics on all inputs and outputs and a failure of any input or output shall be indicated both locally and at the operator workstation.

6. Graduated intensity LEDs or analog indication of value for each analog output.

7. Optional HOA (hand-off-auto module) with software configurability and LED status indicators.

I. Code compliance

1. Approvals and standards: UL916; CE; FCC

2. Provide UL864-UUKL where called for in the sequences of operations.

J. Accessories:

1. Appropriate NEMA rated metal enclosure.

2. Power supplies as required for all associated modules, sensors, actuators, etc.

K. The operator shall have the ability to manually override automatic or centrally executed commands at the primary control panels via local, point discrete, on-board hand/off/auto operator override switches. If on board switches are not available, provide separate control panels with HOA switches. Mount panel adjacent to primary control panel. Provide hand/off/auto switch for each digital output, including spares.

L. Panel setup, point definitions and sequencing diagrams shall be backed up on EEPROM memory.

M. Power loss. In the event of the loss of power, there shall be an orderly shutdown of all Building Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 30 days.

N. Building Level Controllers shall have the capability to serve as a gateway between Modus subnetworks and BACnet objects. Provide software, drives and programming.

O. Spare Capacity: Provide enough inputs and outputs to handle the equipment shown to be “future” on drawings and 20% more of each point type. Provide all hardware modules, software modules, processors, power supplies, communication controllers, etc. required to ensure adding a point to the spare point location only requires the addition of the appropriate sensor/actuator and field wiring/tubing.

P. Environment:

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

2. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).

3. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).

4. Controller hardware shall be optionally suitable for rooftop environments.

2.10 BACNET APPLICATION SPECIFIC CONTROLLERS (B-ASC)

A. Each Application Specific Controller shall operate as a stand alone controller capable of performing its user selectable control routines independently of any other controller in the system. Each Application Specific Controller shall provide standard applications and programmability to provide both reliability and flexibility. Each application specific controller shall be a microprocessor based, multi tasking, digital control processor.

B. Basis of Design: Siemens DXR.

C. Configurable control applications. Each Application Specific Controller model must have a set of pre-loaded, selectable and field-adjustable control applications appropriate for the secondary HVAC equipment that the controller model is intended to control. Specific applications must be configurable to meet the user's control strategy requirements, allowing for additional system flexibility.

D. Programmability: Application Specific Controllers shall be programmable. Program language shall be graphical.

E. The Application Specific Controller shall include all point inputs and outputs necessary to perform the specified HVAC control sequences. The controller shall accept input and provide output signals that comply with industry standards. Controllers utilizing proprietary control output signals shall not be acceptable. Controllers shall provide outputs utilized either for two-state, modulating floating, or proportional control, allowing for additional system flexibility.

1. Analog inputs shall be software configurable to accept sensors using 0-10v (such as RH or CO2 sensors), NTC3k, NTC10k, NTC100k, Ni1000, PT1K 385, and resistance sensors of 1000Ω, 2500 Ω, 10K Ω, and 100k Ω . 24vDC power to drive active sensors shall be an option available from the controller.

2. Digital input

3. Analog Outputs shall support 0-10v HVAC control signals.

4. Digital outputs shall be AC 24V high-side switching triacs, able to switch loads of 250 mA / 6 VA per output.

5. Every installed Application Specific Controller shall be prepared for the addition of occupancy, CO2 and humidity sensors

6. Additional sensors and output modules for occupancy, lighting and shade control within the same space as the HVAC control shall be connected as needed via a sub-network connection on each Application Specific Controller

7. The Application Specific Controller shall be compatible with a Siemens Room Unit which combines a display with CO2, temperature and humidity sensing in 1 wall device.

8. The Application Specific Controller shall be compatible with a Siemens Room Unit which combines a display with temperature sensing and configurable switches for lighting, shade and scene control in 1 wall device.

F. Application Specific Controller communication

1. Communication over floor level network shall be BACnet MS/TP or BACnet IP over Ethernet unless otherwise required by the application.

2. Each controller that uses BACnet IP shall provide at least two Ethernet ports allowing the controllers to be wired in a daisy-chain configuration of up to at least 20 controllers per chain, utilizing standard Ethernet cables of up to 300ft in length between each controller.

G. The Application Specific Controller shall have the BTL listing and meet the BACnet device profile of an Application Specific Controller (B-ASC) as specified in ANSI/ASHRAE 135.

1. Controller shall support BACnet MS/TP or BACnet/IP.

H. The Application Specific Controller shall provide for control of each piece of equipment, including, but not limited to the following:

1. Baseboard radiator

2. Chilled/heated ceiling panels

I. Each Application Specific Controller shall, at a minimum, be provided with:

1. Appropriate NEMA rated enclosure

2. Power supplies as required for all associated modules, sensors, actuators, etc.

3. Each controller measuring air volume shall include a differential pressure transducer

4. Approvals and standards: UL916 PAZX; CUL; FCC

J. Each Application Specific Controller shall continuously perform self-diagnostics on all hardware and secondary network communications. The Application Specific Controller shall provide both local and remote annunciation of any detected component failures or repeated failure to establish communication to the system.

K. Power Supply. The Application Specific controller shall be powered from a 24 VAC source and shall function normally under an operating range of -15% / +20%.

L. All controller configuration settings and programs shall be stored in non volatile memory. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration.

M. Environment. The controllers shall function normally under ambient conditions of 23 to 122°F (-5 to 50°C) and 5% to 95% RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the circuit board assembly.

2.11 ALARM PROCESSING

A. Alarms shall be classified by their alarm type. The facility shall be provided for enabling and disabling each individual alarm on the system.

B. Once generated, the alarm shall be processed by its associated alarm type as defined in the I/O Point Schedules. The alarm types shall be as follows:

1. General Mismatch
2. Critical Mismatch
3. General Binary
4. Critical Binary
5. General Analog
6. Critical Analog
7. Alarm Inhibition

C. Consequential alarm suppression algorithms shall be provided to limit the alarms annunciated on the DDC System to those associated with the source of the initial alarm condition e.g. fire alarms shall not initiate mismatch alarms, restoration of power following a power failure shall not initiate mismatch alarms etc.

2.12 CONFIGURATION

A. Configuration data shall be stored in the DDC Controllers or the Terminal Unit Controllers. Configuration data shall include but not be limited to the following:

1. The unit applicable (deg F, GPM's, inches, etc.).
2. The point identifier (minimum of 12 characters).
3. The point alarm message if applicable (minimum of 80 characters).
4. The point descriptor (minimum of 32 characters).

2.13 DDC STANDARD PROGRAMS

A. The device schedules included in this Specification provide details of inputs monitored and outputs controlled by the DDC System. All point types are described under Controllers elsewhere in this Specification. The DDC System shall allow for the following point functionality and standard programs to be available:

1. Point Override
2. Manual Start/Stop
3. Fixed Time Program
4. Optimum Start/Stop

5. Control Loops
6. Rotational Point
7. Run Time Totalization
8. KWH calculations
9. Anti-Short Cycling
10. Staggered Start
11. User Definable Software
12. General Control Requirements

2.14 INTEGRATIONS

A. The BMS shall utilize and be compatible with industry-standard integration protocols (BACnet and Modbus) for subsystem integration. Coordinate integration protocols with subsystem manufacturer.

B. In addition to the above, the BMS shall be integrated with all pump and fan VFDs via BACnet MS/TP or IP. All up to (20) software points shall be made available at the BMS for monitoring.

2.15 CONTROL PANELS

A. Fully enclosed, steel-rack-type cabinet with locking doors or locking removable backs.

B. Field equipment panels located indoors shall be NEMA 1. Field equipment panels located outdoors or subject to outdoor air conditions shall be minimum of NEMA 3R, provided with internal electric heater and cooling fan.

C. Coordinate installation of the control panels with the engineer/architect.

D. Coordinate power for the panels with the electrical contractor.

E. All control panels shall be provided with DIN Rail mounted screw terminal blocks. Field wiring shall be connected to the screw terminal blocks. It is not acceptable to terminate any field wiring directly to the DDC controller or any panel devices such as relay and transducers. The screw terminal blocks located/attached to the DDC controller alone does not comply with this requirement.

F. All control devices such as relays, transformers, transducers, power supplies, associated I/O devices, etc. shall be installed inside the panel, not at the starter or electrical junction box.

2.16 SENSORS

A. Input/output sensors and devices shall be closely matched to the requirements of the DDC for accurate, responsive, noise-free signal input/output. Control input response shall

be high sensitivity and matched to the loop gain requirements for precise and responsive control. Thermistors are acceptable for VAV terminal applications.

B. Temperature Sensors

1. Provide the following instrumentation as required by the monitoring, control, and optimization functions. All temperature sensors shall use platinum RTD elements only, nickel or silicon RTD's and thermistors are not acceptable.

2. Temperature Transmitter Assembly – Airstream averaging type

   a. The assembly shall consist of a capillary type 1000-ohm platinum RTD housed in a flexible sheath contained in housing suitable for duct mounting.

3. Temperature Transmitter Assembly – Airstream non-averaging type

   a. The assembly shall consist of an insertion type 1000-ohm platinum RTD mounted on a 12-inch probe (or duct diameter) contained in a housing suitable for duct mounting.

4. Temperature Transmitter – Space

   a. The assembly shall consist of a 1000-ohm platinum RTD contained in a decorative ventilated enclosure similar in appearance to room thermostats.

   b. Temperature transmitters for terminal unit applications (such as VAVs, FCUs, etc.) may utilize industry-standard KNX protocol.

   c. Cover type (i.e. indicating, adjustable, blank), colors, and final installation locations shall be as reviewed approved by the architect, owner, and engineer. In general, occupied spaces (i.e. offices, conference rooms, etc.) shall be provided with indicating temperature display (LCD) and setpoint adjustment (±3°F); transient spaces (i.e. open office area, hallways, etc.) shall be provided with blank non-indicating and non-adjustable sensors. Note: All adjustable sensors are subject to ADA requirements.

5. Temperature Transmitter – Liquid Immersion

6. Sensing element RTD

   a. Temperature range Suitable for application

   b. Output signal 4-20 mA

   c. Accuracy ±0.15°F

   d. Provide Type 304 stainless steel thermowell for each liquid immersion temperature sensing element.

   e. Siemens Q series Sensors

C. Current-Sensing Relays

1. Relay shall be field-adjustable for detecting AC current levels in equipment served. Relay shall be non-latching and shall have no time delay. Nominal input voltage and current-sensing range shall be selected based on electrical characteristics of equipment served. Relay shall be installed on one (1) lead of the load side of motor feed. Relay contacts shall be Form C-rated for 5A at 120 VAC.

2.17 FIELD DEVICES

A. General

1. Specified in this section are the following hard-wired input/output devices connected to the Networked Primary DDC Controller or ASC.

a. Automatic Control Valves

b. Binary Temperature Devices

c. Temperature Sensors

d. Differential Pressure Switches

e. Relays

f. Current Switches

B. ELECTRIC DAMPER ACTUATORS

1. General

a. The actuator shall have mechanical or electronic stall protection to prevent damage to the actuator throughout the rotation of the actuator.

b. Where shown, for power-failure/safety applications, an internal mechanical, spring-return mechanism shall be built into the actuator housing. Alternatively, an uninterruptible power supply (UPS) may be provided.

c. Proportional actuators shall accept a 0 to 10 VDC or 4 to 20 mA control signal.

d. All 24 VAC/VDC actuators shall operate on Class 2 wiring

e. All actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring-return actuators with more than 7 Nm (60 in.-lb) torque capacity shall have a manual crank for this purpose.

C. AUTOMATIC CONTROL VALVES.

1. General:

a. Control valves shall be two-way or three-way type single seated globe type for two-position or modulating service as shown. Valves shall meet ANSI Class IV leakage rating.

b. Body pressure rating and connection type construction shall conform to pipe, fitting and valve schedules. Where pressure and flow combinations exceed ratings for commercial valves and operators, industrial class valves and operators shall be provided.

c. Valve operators shall be of electric type.

d. The valves shall be quiet in operation and fail-safe in either normally open or normally closed position in the event of power failure.

e. Provide valves 2" and smaller with screwed end bronze bodies and stainless-steel trim. Provide valves 2-1/2" and larger with flanged ends, cast iron body and stainless-steel trim.

f. Valves shall have sufficient stuffing box protection to ensure against leakage at hydrostatic head involved. Control valve operators shall be sized to close against differential pressure equal to the design pump head plus 10 percent. Valve leakage shall meet or exceed ANSI Class IV leakage (0.01% of rated valve capacity).

g. Two-way Modulating Control Valves – 2-1/2” and larger

1) Two-way modulating control valves shall be globe-style with equal percentage flow characteristic for water service and linear flow characteristic for steam service.

(a) Performance:

(1)	Pressure Rating	ANSI 125 or 250
(2)	Close-off Pressure	Pump head plus 10%
(3)	Leakage	ANSI Class IV
(4)	Temperature Range	34 to 250°F
(5)	Rangeability	100:1

(b) Material construction:

(1)	Body	Cast Iron
(2)	End Connection	ANSI Flanged
(3)	Trim	Bronze
(4)	Stem	Stainless Steel

(c) Input power voltage shall be 24VAC.

(d) Control signal to valves shall be via hardwired analog output (0-10 VDC).

(e) Valves shall be Siemens Flanged Iron Two-Way Globe Valves, or approved equal.

h. Three-way Modulating Control Valves – 2-1/2" and larger

1) Three-way modulating control valves shall be globe-style with equal percentage flow characteristic.

(a) Performance:

(1) Pressure Rating ANSI 125 or 250

(2) Close-off Pressure Pump head plus 10%

(b) Leakage ANSI Class IV

(1) Temperature Range 34 to 250°F

(2) Rangeability 100:1

(c) Material construction:

(1) Body Cast Iron

(2) End Connection ANSI Flanged

(3) Trim Bronze

(4) Stem Stainless Steel

(d) Input power voltage shall be 24VAC.

(e) Control signal to valves shall be via hardwired analog output (0-10 VDC).

(f) Valves shall be Siemens Flanged Iron Three-Way Globe Valves, or approved equal.

i. Motorized Isolation Valves – Up to 2"

1) Valve shall be suitable for hot water service. Isolation valve shall be line-sized, full-port ball valve.

2) Performance:

(a) Pressure Rating 360 psig

(b) Close-off pressure 200 psi

(c) Temperature Range 35 to 250°F

3) Valves shall meet the following material construction specifications:

(a) Body Forged brass

(b) End Connection NPT female

(c) Ball Stainless steel

(d) Stem Stainless steel

(e) Ball Seats Teflon PTFE

(f) Stem Seal EPDM O-rings

(g) Input power voltage shall be 24VAC.

4) Valves shall be two-position (on/off) and provided with open and closed endswitches.

5) Valves shall be as manufactured by Belimo, Siemens, or approved equal.

j. High Performance Motorized Butterfly Valves for Isolation – 2-1/2" and larger

1) Valve shall be suitable for chilled and hot water service. Valve shall be line-sized.

2) Performance:

(a) Pressure Rating ANSI Class 200, 740 psig

(b) Close-off pressure Suitable for application

3) Temperature Range -62 to 500°F

4) Valves shall meet the following material construction specifications:

(a) Body Carbon steel

(b) End Connection Lugged

(c) Disc Stainless steel

5) Stem Stainless steel

(a) Seat PTFE

6) Valve Actuator

(a) Input Power 120 VAC or 24 VAC

(b) Signal Two position (on/off)

(c) Enclosure Rating NEMA 4 or greater

(d) Limit Switches Integral opened and closed

(e) Torque Suitable for application close-off

(f) Manual Override Handwheel

(g) Valve and actuator shall be as manufactured by Siemens, Bray, or approved equal.

D. RELAYS.

1. Control relays shall be UL listed plug-in type with dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.

2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable ±200% (minimum) from set point shown on plans. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

E. CURRENT SWITCHES.

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.2 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation.

C. For all thermostats and temperature sensors shown to be installed on outside walls, provide insulated backs.

D. Install all thermostats, sensors and other wall mounted end device input control equipment at elevations in conformance with ADA requirements.

E. PROJECT MANAGEMENT

1. Provide a designated project manager who will be responsible for the following:

a. Construct and maintain project schedule

b. On-site coordination with all applicable trades, subcontractors, and other integration vendors

c. Authorized to accept and execute orders or instructions from owner/architect

d. Attend project meetings as necessary to avoid conflicts and delays

e. Make necessary field decisions relating to this scope of work

f. Coordination/Single point of contact

3.3 ELECTRICAL WIRING AND MATERIALS

A. Install, connect and wire the items included under this Section. This work includes providing required conduit, wire, fittings, and related wiring accessories.

B. Provide wiring between thermostats, aqua-stats, and unit heater/cabinet unit heater motors.

C. 120 Volt power provided to BMS Panels and Local Transformer Panels shall be included by BAS contractor.

D. Provide status function conduit and wiring for equipment covered under this Section.

E. Low voltage wiring exposed to view shall be installed in conduit. Low voltage wiring exposed to view within Mechanical rooms shall be installed in conduit. Open plenum rated cable is acceptable in concealed for low voltage wiring only. All wiring to be compliant to local building code and the NEC.

F. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.

G. Install exposed cable in EMT raceways.

H. Install concealed cable in enclosed vertical chases and within furred walls as open plenum rated cable.

I. Install outdoor cabling in water-tight EMT or galvanized rigid conduit.

J. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.

K. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

L. Plenum Rated Cable to be used in accessible locations above ceilings (i.e. open ceilings and drop-ceilings).

M. Install, connect and wire the items included under this Section. This work includes providing required conduit, wire, fittings, and related wiring accessories.

1. Provide wiring for thermostats, aquastats, and all control and alarm devices for all Sections of the Specifications and wiring for all break-glass stations furnished under this Section.

2. Power for each direct digital control unit, field equipment panel, workstation, server, controller, shall be taken from dedicated power circuits as indicated on the electrical drawings. Power type (normal, emergency, life-safety, etc.) shall be determined on Electrical Drawings. If no guidance is included on the electrical drawings all power wiring shall be 'normal' power or match that of the associated mechanical equipment. Wiring and conduit between the electrical junction boxes and all direct digital control units, field equipment cabinets, workstation, server and unitary controllers, etc., shall be furnished and installed by this Section of the Specifications.

3. Provide conduit and control wiring for devices specified in this Section.

4. Provide control and signal wiring between the DDC system and equipment provided by other Sections such as pumps, variable frequency drives, etc.

5. Provide all control wiring for variable air volume and constant air volume terminal units.

N. All wiring in Mechanical Equipment Rooms, communications or electrical closets shall be in approved raceways (cable tray, conduit, EMT, etc.). Open wiring strung above accessible ceilings shall be plenum-rated cable, bundled together and protected from mechanical damage. Wiring shall be independently supported from the building structure with bridal rings and clips. The supporting of wiring from mechanical ductwork or piping shall not be acceptable. Provide individual supports for conduit. Where conduit is required, this Contractor shall be responsible for providing all conduit serving DDC system. DDC system wiring (i.e. power, control, communication, sensor or interlock) shall not be installed in conduits, provided under another section of the specification unless noted otherwise. DDC system wiring shall not "share" conduits with any other system unless noted otherwise.

O. 120 VAC circuits used for control and instrumentation shall be taken from panelboards provided under the Electrical Section. The electrical section shall provide junction boxes local to the BMS devices and equipment. Final connection between junction box and BMS devices shall be furnished by this Contractor.

P. RS-485 Cabling

1. RS-485 cabling shall be used for BACnet MS/TP networks.

2. RS-485 shall use low capacitance, 20-24 gauge, twisted shielded pair.

3. The shields shall be tied together at each device.

4. The shield shall be grounded at one end only and capped at the other end.

5. Provide end of line (EOL) termination devices at each end of the RS-485 network or subnetwork run, to match the impedance of the cable, 100 to 120 Ohm.

Q. Ethernet Cabling

1. Ethernet shall not be run with any Class 1 or low voltage Class 2 wiring.

2. CAT6, unshielded twisted pair (UTP) cable shall be used for BAS Ethernet.

3. Solid wire shall be used for long runs, between mechanical rooms and between floors. Stranded cable can be used for patch cables and between panels in the same mechanical room up to 50 feet away.

4. When the BAS Ethernet connects to an Owner's network switch, document the port number on the BAS As-builts.

R. Fiber-Optic Cabling

1. All fiber optic cabling shall be 50/125-micrometer, laser-optimized (multi-mode OM3/OM4), duplex (2-strand) fiber, optical fiber cable with plenum-rated jackets. Minimum bend radius shall be 7.5mm. Industry standard LC style connectors shall be usedFiber optic cabling shall be manufactured by Corning.

2. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.

3. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.

4. All terminations shall be made into a patch panel, designed for such use. Free air terminations with patch panels are prohibited.

3.4 INSTALLATION OF SENSORS

A. General:

1. Install sensors in accordance with the manufacturer's recommendations.

2. Mount sensors rigidly and adequately for the environment within which the sensor operates.

3. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.

4. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

5. Sensors used in mixing plenums shall be of the averaging type.

6. All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

B. Room Instrument Mounting

1. Room instruments, including but not limited to wall mounted thermostats and sensors located in occupied spaces shall be mounted 48 inches above the finished floor unless otherwise shown.

C. Instrumentation Installed in Piping Systems

1. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

2. Gauges in piping systems subject to pulsation shall have snubbers.

D. Duct Smoke Detectors

1. Duct smoke detectors will be provided by the Fire Alarm System Contractor in supply and return air ducts in accordance with Division 26

2. Contractor shall connect the DDC System to the auxiliary contacts provided on the Smoke Detector as required for system safeties and to provide alarms to the DDC system.

E. Temperature Limit Switch

1. A temperature limit switch (Low Temperature Detector) shall be provided to sense the temperature.

2. A sufficient number of temperature limit switches shall be installed to provide complete coverage of the duct section.

3. Manual reset limit switches shall be installed in approved, accessible locations where they can be reset easily.

4. The temperature limit switch sensing element shall be installed in a serpentine pattern and in accordance with the manufacturer's installation instructions.

5. Each bend shall be supported with a capillary clip. Provide 3 m of sensing element for each 1 m2 (1 ft of sensing element for each 1 ft2) of coil area.

F. Averaging Temperature Sensing Elements

1. Sensing elements shall be installed in a serpentine pattern.

2. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.

3.5 ACTUATORS

A. Mount and link control damper actuators according to manufacturer's instructions.

1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.

2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

3. Provide all mounting hardware and linkages for actuator installation.

B. Electric/Electronic

1. Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations.

2. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

3.6 WARNING LABELS AND IDENTIFICATION TAGS

A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the DDC system.

1. Labels shall use white lettering (12-point type or larger) on a red background.

2. Warning labels shall read as follows: “C A U T I O N This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to “Off” position before servicing.”

B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.

1. Labels shall use white lettering (12-point type or larger) on a red background.

2. Warning labels shall read as follows: “C A U T I O N This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.”

C. Equipment and Device labeling:

1. Labels and tags shall be keyed to the unique identifiers shown on the As-Built drawings.

2. All Enclosures and DDC Hardware shall be labeled.

3. All sensors and actuators not in occupied areas shall be tagged.

4. Airflow measurement arrays shall be tagged to show flow rate range for signal output range, duct size, and pitot tube AFMS flow coefficient.

5. Duct static pressure taps shall be tagged at the location of the pressure tap.

6. Tags shall be plastic or metal and shall be mechanically attached directly to each device or attached by a metal chain or wire.

7. Labels exterior to protective enclosures shall be engraved plastic and mechanically attached to the enclosure or DDC Hardware.

8. Labels inside protective enclosures may be attached using adhesive, but shall not be hand written.

9. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.

10. Identify room sensors relating to unit ventilator or valves with nameplates.

11. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.

D. Identification of Tubing and Wiring

1. All wiring and cabling including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with the DDC address or termination number.

2. Permanently label or code each point of field terminal strips to show the instrument or item served.

3. All pneumatic tubing shall be labeled at each end within 5 cm (2 in.) of termination with a descriptive identifier.

3.7 IDENTIFICATION OF HARDWARE AND WIRING

A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with the DDC address or termination number.

B. All pneumatic tubing shall be labeled at each end within 5 cm (2 in.) of termination with a descriptive identifier.

C. Permanently label or code each point of field terminal strips to show the instrument or item served.

D. Identify control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.

E. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.

F. Identify room sensors relating to terminal box or valves with nameplates.

G. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.

H. Identifiers shall match record documents.

I. Control Equipment and Device labeling:

1. Labels and tags shall match the unique identifiers shown on the as-built drawings.

2. All Enclosures shall be labeled to match the as-built drawing by either control panel name or the names of the DDC controllers inside.

3. All sensors and actuators not in occupied areas shall be tagged.

4. Each device inside enclosures shall be tagged.

5. Terminal equipment need only have a tag for the unique terminal number, not for each device. Match the unique number on:

    a. First, the design drawings, or

    b. Second, the control as-builts, or

    c. Third, the DDC addressing scheme

6. Tags shall be mechanically printed on permanent adhesive backed labeling strips, 12 point height minimum.

7. Identification of Wires

    a. Tag each wire with a common identifier on each end of the wire

    b. Tag each network wire with a common identifier on each end.

    c. Tag each 120V power source with the panel and breaker number it is fed by.

3.8 FIELD QUALITY CONTROL

A. After completion of the installation of work in this section, test, regulate and adjust system equipment, controllers, alarms, sensors, transmitters, switches, relays, automatic control valves, automatic damper motors and related system accessories, and the entire automation system, including interconnections with the building life safety, plumbing, fire protection and electrical systems, and place these items in complete and satisfactory operating condition. Submit data showing set points and final adjustments of controls.

B. This Contractor shall provide assistance to the Air and Water Balancer for access to all set point adjustments and calibration requirements. At the completion of the balancing process all air and water set points shall be hardcoded into the default set points for each system.

3.9 COMMISSIONING

A. The BMS contractor shall submit point to point verification of all hard-wired control points and Terminal unit control functions verification documentation for terminal units controllers showing all control systems have been tested, startup complete, final PID adjustments complete, dynamic graphics installed on workstation as per owners requirements etc. prior to scheduled commissioning.

B. The BMS contractor shall notify the authorized representative that the BMS is 100% ready for demonstration and commissioning. The BMS contractor shall demonstrate to the authorized representative typical operating functional control loops for 50% of control points and functions. If any failure occurs the test would stop and the BMS contractor shall be responsible to demonstrate all control points.

3.10 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.

2. The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the “Control System Checkout and Testing” article in Part 3 of this specification. The engineer will be present to observe and review these tests. The engineer shall be notified at least 10 days in advance of the start of the testing procedures.

3. The demonstration process shall follow that approved in Part 1, “Submittals.” The approved checklists and forms shall be completed for all systems as part of the demonstration.

4. The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.

5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.

6. Demonstrate compliance with Part 1, “System Performance.”

7. Demonstrate compliance with sequences of operation through all modes of operation.

8. Demonstrate complete operation of operator interface.

9. Additionally, the following items shall be demonstrated:

    a. DDC control loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC control loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.

    b. Optimum start/stop. The contractor shall supply a trend data output showing the capability of the algorithm. The change-of value or change-of-state trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.

c. Interface to the building fire alarm system.

d. Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and electronic formats.

10. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance

1. All tests described in this specification shall have been performed to the satisfaction of both the engineer and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the engineer. Such tests shall then be performed as part of the warranty.

2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1, “Submittals.”

3.11 CLEANING

A. The contractor shall clean up all debris resulting from their activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.12 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

3.13 TEMPERATURE CONTROL SEQUENCES

A. MILLER ELEMENTARY SCHOOL

1. NON-DUCTED VRV FAN COIL UNITS:

a. Occupied Mode - For spaces with existing floor mounted unit ventilators providing ventilation and heating, the space temperature sensor serving the unit

ventilator shall be set to 68 degrees F heating setpoint and 75 degrees F cooling setpoint. The VRF fan coil unit controller heating setpoint shall be set to 70 degrees F heating setpoint and 75 degrees F cooling setpoint. In heating mode, the heat pump and fan coil unit shall provide heating to satisfy the 70 F setpoint. The unit ventilator shall utilize the heating water control valve to maintain a constant leaving air temperature matching the unit ventilator sensor setpoint (68 degrees F). Should the fan coil unit be unable to maintain the setpoint and the space temperature falls below 68 degrees F on the unit ventilator sensor, the unit ventilator operation shall be overridden and the DDC system shall modulate the heating water control valve to provide leaving air temperature as required to maintain the 68 F lower level heating setpoint. In cooling mode, if economizer cooling is available the fan coil unit shall be locked out of mechanical cooling at the DDC system and the unit ventilator shall operate in economizer mode to maintain the space sensor setpoint. Should economizer cooling be unavailable, the fan coil unit and its associated heat pump shall operate as required to maintain the controller's cooling setpoint. During building occupied times (in NON-Economizer mode) the unit ventilator shall remain on in minimum ventilation mode with the fan on.

2. The DDC shall integrate into the VRV system's master controller through BACnet connectivity and allow the DDC system to set the minimum cooling setpoint and maximum heating setpoint of the VRF fan coil remote controllers and lock the remote controllers from allowing manual changes from HEAT MODE/COOL MODE/OFF and lock the remote controllers from allowing manual changes to the room temperature setpoint.

3. The DDC system shall integrate into the VRV system's master controller through BACnet connectivity and allow the DDC system to monitor all points available through the master controller at the DDC front end. Error codes generated by the indoor units, outdoor units, and remote controllers shall be displayed on the BACnet building management system in the event of system abnormality/error with a two digit error code as specified by VRV system manufacturer. All alarms for the outdoor unit shall be displayed through the indoor units.

4. Economizer Lock-out: The DDC shall integrate into the VRF system's master controller through BACnet connectivity and allow the DDC system to lock-out mechanical cooling through the fan coils from each space that is ventilated via unit ventilators when the outside air temperature is 62 degrees F or below (adjustable). At all outside air temperatures above 62 degrees F, the mechanical cooling through the VRF systems shall be allowed.

5. Fan coil unit supply fans shall only operate on a call for cooling or heating and be OFF when controller temperature setpoint is satisfied.

B. HIGHVIEW ELEMENTARY SCHOOL:

1. Cabinet Unit Heaters:

a. Cycle fan operation and valve position to maintain space temperature at setpoint conditions through space temperature sensor. Provide a two-position, normally-open, spring return control valve on the hot water return line.

2. Exhaust Fans EF-HE-1, EF-HE-2, EF-HE-3:

a. Fans shall be OFF during building unoccupied periods with associated motorized damper closed.

b. Fans shall be ON during building occupied periods with associated motorized damper opened.

3. Floor Radiation/Fin Tube Radiation:

a. Modulate normally-open 2-WAY modulating contol valve to maintain room at setpoint in occupied mode of 70 degrees F (adjustable) as well as unoccupied reduced temperature setpoint conditions of 62 degrees F (adjustable).

3.14 TRAINING

A. Provide sixteen (8) hours of on-site training for up-to four (4) building operators from competent factory authorized personnel. Intent is to provide instruction to operation and maintenance personnel concerning the location, operation and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Construction Manager and owner after submission and approval of formal training plans. Training on BAS systems other than Siemens shall be (40) Hours.

B. Additional training of (16) hours shall be provided for DESIGO software

C. (2) multi-day remote site classroom training sessions shall be included for up to (1) person for DESIGO software.

D. Training shall include but not limited to:

1. Explanation of drawings and operations and maintenance manuals.

2. Walk thru of the job to locate control components.

3. Operator workstation and peripherals.

4. Operator control functions including graphic generation and field panel programming.

5. Explanation of adjustment, calibration and replacement procedures.

END OF SECTION

SECTION 232113 - HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Cooling coil condensate piping.

D. Equipment Drain and overflow piping.

E. Natural Gas piping, above grade.

F. Pipe hangers and supports.

G. Unions, flanges, mechanical couplings, and dielectric connections.

1.2 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

E. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008.

F. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2014.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

I. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

J. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

L. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2013.

M. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

N. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

O. ASTM F 708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

P. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.3 SUBMITTALS

A. Piping Schedule: Provide schedule of piping applications and materials, indicating piping and fittings.

B. Piping Shop Drawings: Provide drawings of piping installation, indicating dimensioned locations, equipment, critical dimensions, elevations, sizes, systems, and valve locations.

C. Product Data:

1. Include data on pipe materials, pipe fittings, valves, and accessories.

2. Provide manufacturers catalog information.

3. Indicate valve data and ratings.

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

E. Project Record Documents: Record actual locations of valves.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this sectionwith minimum three years of experience.

C. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.

2. Use non-conducting dielectric connections whenever jointing dissimilar metals.

3. Grooved mechanical joints are not permitted in any location.

4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges or unions to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:

1. Provide drain valves where indicated, and if not indicated provide at least at main and main branch shut-offs locations, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch ball valves with cap.

2. For throttling, bypass, or manual flow control services, use ball or butterfly valves.

3. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

2.2 HEATING WATER AND GLYCOL PIPING

A. Steel Pipe for sizes 2-1/2" and above: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.

2. Threaded Joints: ASME B16.3, malleable iron fittings.

3. Fittings: ASTM B 16.3, malleable iron or ASTM A 234/A 234M, forged steel welding type fittings.

B. Copper Tube for piping sizes 3" and below: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.

a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.

2. Hydraulic Press Fitting for Copper Tubing.

a. Acceptable Fittings:

1) ProPress by Viega, 301 N. Main, Wichita, KS 67202, (877) 843-4262, www.viega.com.

b. Operating Conditions:

1) Maximum Operating Pressure: 200 psi.

2) Operating Temperature Range: 0-250 degrees F.

3) Maximum Test Pressure: 600 psi.

4) Maximum Vacuum: 29.2 inches hg @ 68 degrees F.

c. Features:

1) Fittings: Copper and copper alloy conforming to material requirements of ASME B16.18 or ASME B16.22.

(a) Stainless Steel Grip Ring: Adds strength to the joint without collapsing the interior passageway.

2) No flame for soldering required for installation of fittings and valves.

3) Unpressed connections identified during pressure testing when water flows past sealing element.

4) Sealing Elements: Factory installed, EPDM.

5) Fittings that have been pressed can be rotated. If rotated more than 5 degrees, the fitting must be repressed to restore its resistance to rotational movement.

6) Extended fitting end lead allows for twice the retention grip surface, and assists with proper tube alignment.

7) Soldered adapter fittings are not allowed.

3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

2.3 COOLING COIL CONDENSATE PIPING SYSTEM

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), hard drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.

2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

3. Joints: Solder, lead free, ASTM B 32, HB alloy (95-5 tin-antimony), or tin and silver.

B. PVC Pipe: ASTM D 1785, Schedule 40, or ASTM D 2241, SDR 21 or 26.

1. Fittings: ASTM D 2466 or D2467, PVC.

2. Joints: Solvent welded.

2.4 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings:

a. ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.

b. Cold Press Mechanical Joint Fittings shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria of IAPMO PS117. Sealing elements for press fittings shall be FKM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press ends shall have Smart Connect technology design. MegaPress fittings with the Smart Connect technology assure leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. The function of this technology is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.

2. Joints:

a. NFPA 54, threaded or welded to ASME B31.1 or cold press mechanical joint fittings.

2.5 **EQUIPMENT DRAINS AND OVERFLOWS**

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:

1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.

2.6 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

C. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.

D. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.

E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

F. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

G. Wall Support for Pipe Sizes 4 Inches and Greater: Welded steel bracket and wrought steel clamp.

H. Vertical Support: Steel riser clamp.

I. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

J. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

K. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

L. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

M. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

N. Rooftop Supports for Low-Slope Roofs and Exterior Pipe supports at grade level: Steel pedestals with bases that rest on top of roofing membrane or on grade, not requiring any attachment to the roof structure or exterior grade and not penetrating the roofing assembly or exterior grading, with support fixtures as specified; and as follows:

1. Bases: High-density polypropylene.

2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly or exterior grading.

3. Steel Components: Stainless steel or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion-resistant material.

5. Height: Provide minimum clearance of 6 inches under pipe to grade level or to top of roofing .

2.7 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe of 2 Inches and Less:

1. Ferrous Piping: 150 psi brass or malleable iron, threaded.

2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:

1. Ferrous Piping: 150 psig forged steel, slip-on.

2. Copper Piping: Bronze.

3. Gaskets: 1/16 inch thick, preformed neoprene.

C. Dielectric Connections:

1. Waterways:

a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.

b. Dry insulation barrier able to withstand 600-volt breakdown test.

c. Construct of galvanized steel with threaded end connections to match connecting piping.

d. Suitable for the required operating pressures and temperatures.

2. Flanges:

a. Dielectric flanges with same pressure ratings as standard flanges.

b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.

c. Dry insulation barrier able to withstand 600-volt breakdown test.

d. Construct of galvanized steel with threaded end connections to match connecting piping.

e. Suitable for the required operating pressures and temperatures.

2.8 GAS COCKS

A. Full port, brass ball valves with bottom-loaded blowout proof stem, virgin PTFE seats, thrust washer and adjustable stem packing gland, stem packing nut, chrome plated breass ball, brass adapter and steel handle.

B. 1/4" to 3/8": 1/2 psig, ASME B16.33.

C. 1/2" to 2": 1/2 psig, ASME B16.33.

2.9 BALL VALVES

A. 3-inch and smaller: 2-piece, full port:

1. Class: 150 psi saturated steam, 600 psi wog.
2. Body: ASTM B-584 Alloy 844 bronze.
3. Body End Piece: ASTM B-584 Alloy 844 bronze.
4. Ball: ASTM B-584 Alloy 844 bronze with hard chrome plate.
5. Seat Ring: Reinforced TFE.
6. Threaded Packing Gland: ASTM B-16 Alloy 360 brass.
7. Stem: 316 stainless steel.
8. Ends: Soldered or Press Fittings.

B. Acceptable Manufacturers:

1. Nibco.
2. Apollo.
3. Stockham.

2.10 ZERO LEAKAGE TRIPLE OFFSET HIGH-PERFORMANCE BUTTERFLY VALVES

A. 2-1/2 inch and larger: Triple offset rotary valve, carbon steel, bi-directional, double flange body (wafer or lug-style not acceptable), zero leakage.

1. Class: ANSI 300.
2. Body: Carbon steel.
3. Disc: Nickel plated carbon steel.
4. Shaft: ASTM A-564 Type 630 (17-4PH) stainless steel.
5. Seat: Welded Stellite GR.21, integral with valve body.
6. Seat Ring: Dublex, stainless steel, laminated, field replaceable.
7. Locator Bearing: ASTM A-743 Grade CG8M Type 317 stainless steel.
8. Thrust Bearing: Type 317 stainless steel with PTFE woven fabric.
9. Packing: Graphite.
10. Packing Gland: ASTM A-743 Grade CF8M Type 316 stainless steel.

11. Disc Pins: ASTM A-276 Type stainless steel.

12. Operator: Self-locking, manual gear operator.

13. Leakage class. Zero leakage as defined by API 598, 7th edition.

B. Acceptable Manufacturers:

1. Tyco Vanessa Series 30,000.

2. Crane Flowseal MS.

3. Adams Valve MAK.

2.11 CHECK VALVES

A. Swing Check: 2-Inch and smaller:

1. Class: 125

2. Body: ASTM B-62 bronze.

3. Disc: ASTM B-62 bronze.

4. Hinge : ASTM B-62 bronze.

5. Hinge Pin: ASTM B-16 brass.

6. Cap: ASTM B-62 bronze.

7. Ends: Threaded or soldered.

8. Acceptable Manufacturers:

a. Stockham

b. Nibco

c. Milwaukee

2.12 CALIBRATED BALANCE VALVES

A. Size 1/2 inch to 3 inch:

1. Bronze body with brass ball construction with glass and carbon filled TFE seat rings. Valves shall have differential pressure read-out ports across valve seat area. Read-out ports shall be fitted with internal EPT insert and check valve. Valve bodies shall have 1/4 inch NPT tapped drain/purge port. Valves shall have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves shall have calibrated nameplate to assure specific valve setting. Valves shall be leak-tight at full rated working pressure.

2. Design Pressure/Temperature:

a. 1/2" to 3" NPT connections: 300 psi at 250 degrees F.

b. 1/2" to 2" sweat connections: 200 psi at 250 degrees F.

B. Size 2-1/2" to 8"

1. Valves shall be of heavy-duty cast iron construction with ANSI flanged connections suitable up to 175 psi working pressure. Valves 2-1/2" to 3" pipe shall have a brass ball with glass and carbon filled TFE seat rings. Valves 4" to 8" shall be fitted with a bronze seat, replaceable bronze disc with EPDM seal insert, and stainless steel stem. Valves shall have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves shall have calibrated nameplate to assure specific valve setting. Valves shall be leak-tight at full rated working pressure.

C. Design Pressure/Temperature: 175 psi at 250 degrees F.

D. Acceptable Manufacturers:

1. Red-White Valve Corp.

2. Bell and Gossett

3. Flow Design, Inc.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. See Section 232500 for additional requirements.

3.2 CALIBRATED BALANCE VALVE SELECTION

A. The contractor shall be responsible for selection of the appropriate size of all calibrated balance valves. Select valve size such that optimal accurace is achieved when balanced to the flow rate as indicated on contract documents. Provide all required increasers and reducers to mate the installed calibrated balance valves to the adjacent piping and equpment.

B. Balance Valve Sizing:

GPM	Balance Valve Size

Up to 2.5	1/2"
2.6 to 4.5	3/4"
4.6 to 9.0	1"
9.1 to 22.0	1-1/4"
22.1 to 35.0	1-1/2"
35.1 to 78.0	2"
78.1 to 120.0	2-1/2"
120.1 to 200.0	3"
200.1 to 400.0	4"
400.1 to 500.0	5"

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install heating water piping to ASME B31.9 requirements.

C. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

D. Install cooling coil condensate drains from all cooling coils to locations shown on drawings. Provide trap sized for required depth as determined by maximum static pressure of the cooling coil supply fan.

E. Route piping in orderly manner, parallel to building structure, and maintain gradient.

F. Install piping to conserve building space and to avoid interference with use of space.

G. Group piping whenever practical at common elevations.

H. Sleeve pipe passing through partitions, walls, and floors.

I. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

J. Slope piping and arrange to drain at low points.

K. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 230516.

L. Inserts:

1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

M. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.

2. Support horizontal piping as scheduled.

3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.

4. Place hangers within 12 inches of each horizontal elbow.

5. Use hangers with 1-1/2 inches minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

8. Provide copper plated hangers and supports for copper piping.

N. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 230719.

3.4 FIELD QUALITY CONTROL

A. Preparation for Testing: Prepare hydronic piping in accordance with ASME B 31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during the test.

2. Flush system with clean water. Clean strainers.

3. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.

4. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.

B. Testing: Test hydronic piping as follows:

1. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for the workmen and compatible with the piping system components.

2. Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at low points in the system for complete removal of the test liquid.

3. Examine system to ensure that equipment and components that cannot withstand test pressures are properly isolated. Examine test equipment to ensure tight connection and that low pressure filling lines have been disconnected.

4. Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the system design pressure, but not less than 100 psi. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under testing. Make a check to verify that the stress due to pressure at the bottom of vertical runs does not exceed either 90% of specified yield strength, or 1.7 times the "SE" value in Appendix A of ASME B31.9, Code for Pressure Piping, Building Service Piping.

5. After the hydrostatic test pressure has been applied for at least 15 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.

3.5 VALVE ENDS SELECTION

A. Select valves with the following ends or types of pipe/tube connections:

1. Copper Tube Size, 3-inch and Smaller: Press or threaded ends for heating hot water.

2. Steel Pipe Sizes, 2-inch and Smaller: threaded end.

3. Steel Pipe Sizes 2-1/2 inch and Larger: flanged end.

3.6 VALVE INSTALLATIONS

A. General Application: Use ball, and butterfly valves for shut-off duty; ball globe, and butterfly for throttling duty. Refer to piping system specification sections for specific valve applications and arrangements.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves and unions for each item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.

D. Install valves in horizontal piping with stem at or above the center of the pipe.

E. Install valves in a position to allow full stem movement.

F. Installation of Check Valves: Install for proper direction of flow as follows:

3.7 SOLDER CONNECTIONS

A. Cut tube square and to exact lengths.

B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket in the same manner.

C. Apply a proper soldering flux in an even coat to inside of valve socket and outside of tube.

D. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate valve or tube slightly to ensure even distribution of the flux.

E. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around the tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

3.8 THREADED CONNECTIONS

A. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.9 FLANGED CONNECTIONS

A. Align flange surfaces parallel.

B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

3.10 PRESS FITTING CONNECTIONS (NON-NATURAL GAS PIPING)

A. Press connections: Copper and copper alloy press connections shall be made in accordance with the manufacturer’s installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.

3.11 PRESS FITTING CONNECTIONS FOR NATURAL GAS PIPING

A. Cold press mechanical joint fittings shall be installed in accordance with the manufacturer’s installation instructions. The protective corrosion coating shall be removed from the outside of the pipe end. The pipe shall be fully inserted into the fitting and the pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the pipe to assure the pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.

B. Air Testing: The piping system shall be air tested for joint tightness. The piping system shall be pressurized with air to the maximum pressure of the system or to the code or standard required minimum for the required length of time. The system shall have no leaks at the rated pressure.

3.12 INSPECTION, TESTING AND PURGING OF NATURAL GAS PIPING

A. General: Prior to acceptance and initial operation, all piping installations shall be inspected and pressure tested to determine that the materials, design, fabrication, and installation practices comply with the requirements of authority having jurisdiction.

1. Inspections: Inspection shall consist of visual examination, during or after manufacture, fabrication, assembly, or pressure tests as appropriate. Supplementary types of nondestructive inspection techniques, such as magnetic-particle, radiographic, ultrasonic, etc., shall not be required unless specifically listed herein or in the engineering design.

2. Repairs and additions: In the event repairs or additions are made following the pressure test, the affected piping shall be tested.

a. EXCEPTION: Minor repairs or additions, provided the work is inspected and connections are tested with a noncorrosive leak-detecting fluid.

B. Section testing: A piping system shall be permitted to be tested as a complete unit or in sections. Under no circumstances shall a valve in a line be used as a bulkhead between gas in one section of the piping system and test medium in an adjacent section, unless two valves are installed in series with a valved "telltale" located between these valves. A valve shall not be subjected to the test pressure unless it can be determined that the valve, including the valve closing mechanism, is designed to safely withstand the test pressure.

C. Regulators and valve assemblies. Regulator and valve assemblies fabricated independently of the piping system in which they are to be installed shall be permitted to be tested with inert gas or air at the time of fabrication.

D. Test medium: The test medium shall be air or an inert gas. Oxygen shall not be used.

E. Test preparation: Pipe joints, including welds, shall be left exposed for examination during the test. If the pipe end joints have been previously tested in accordance with this section, they shall be permitted to be covered or concealed.

1. Expansion joints: Expansion joints shall be provided with temporary restraints, if required, for the additional thrust load under test.

2. Equipment isolation: Equipment that is not to be included in the test shall be either disconnected from the piping or isolated by blanks, blind flanges, or caps. Flanged joints at which blinds are inserted to blank off other equipment during the test shall not be required to be tested.

3. Equipment disconnection: Where the piping system is connected to equipment or components designed for operating pressures of less than the test pressure, such

equipment or equipment components shall be isolated from the piping system by disconnecting them and capping the outlet(s).

4. Valve isolation: Where the piping system is connected to equipment or components designed for operating pressures equal to or greater than the test pressure, such equipment shall be isolated from the piping system by closing the individual equipment shutoff valve(s).

5. Testing precautions: All testing of piping systems shall be done with due regard for the safety of employees and the public during the test. Bulkheads, anchorage, and bracing suitably designed to resist test pressures shall be installed if necessary. Prior to testing, the interior of the pipe shall be cleared of all foreign material.

F. Test Pressure measurement: Test pressure shall be measured with a manometer or with a pressure measuring device designed and calibrated to read, record, or indicate a pressure loss due to leakage during the pressure test period. The source of pressure shall be isolated before the pressure tests are made.

1. Test pressure: The test pressure to be used shall be no less than 1-1/2 times the proposed maximum working pressure, but not less than 3 psig (20 kPa gauge), irrespective of design pressure. Where the test pressure exceeds 125 psig (862 kPa gauge), the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe.

2. Test duration: Test duration shall be not less than 1/2 hour for each 500 cubic feet (14 m3) of pipe volume or fraction thereof. When testing a system having a volume less than 10 cubic feet (0.28 m3) or a system in a single-family dwelling, the test duration shall be permitted to be reduced to 10 minutes. For piping systems having a volume of more than 24,000 cubic feet (680 m3), the duration of the test shall not be required to exceed 24 hours.

G. Detection of leaks and defects: The piping system shall withstand the test pressure specified without showing any evidence of leakage or other defects. Any reduction of test pressures as indicated by pressure gages shall be deemed to indicate the presence of a leak unless such reduction can be readily attributed to some other cause.

1. Detection methods: The leakage shall be located by means of an approved combustible gas detector, a noncorrosive leak detection fluid, or an equivalent nonflammable solution. Matches, candles, open flames, or other methods that could provide a source of ignition shall not be used.

2. Corrections: Where leakage or other defects are located, the affected portion of the piping system shall be repaired or replaced and retested.

H. System and equipment leakage test: Leakage testing of systems and equipment shall be in accordance with the following:

1. Test gases: Fuel gas shall be permitted to be used for leak checks in piping systems that have been tested in accordance with requirements of this section.

2. Before turning gas on: Before gas is introduced into a system of new gas piping, the entire system shall be inspected to determine that there are no open fittings or ends and that all manual valves at outlets on equipment are closed and all unused valves at outlets are closed and plugged or capped.

3. Test for leakage: Immediately after the gas is turned on into a new system or into a system that has been initially restored after an interruption of service, the piping system shall be tested for leakage. If leakage is indicated, the gas supply shall be shut off until the necessary repairs have been made.

4. Placing equipment in operation: Gas utilization equipment shall be permitted to be placed in operation after the piping system has been tested and determined to be free of leakage and purged in accordance with the following table:

Nominal Pipe Size(inches)	Length of Piping Requiring Purging
3	> 30 feet
4	> 15 feet
6	> 10 feet
8 or larger	Any length

I. Purging: Purging of piping shall comply with the following:

1. Removal from service: Where gas piping is to be opened for servicing, addition, or modification, the section to be worked on shall be turned off from the gas supply at the nearest convenient point, and the line pressure vented to the outdoors, or to ventilated areas of sufficient size to prevent accumulation of flammable mixtures.

2. The remaining gas in this section of pipe shall be displaced with an inert gas as required by the following table:

Nominal Pipe Size (inches)	Length of Piping Requiring Purging
2-1/2	> 50 feet
3	> 30 feet
4	> 15 feet
6	> 10 feet
8 or larger	Any length

3. Placing in operation: Where piping full of air is placed in operation, the air in the piping shall be displaced with fuel gas, provided the piping does not exceed the length shown in the table below. The air can be safely displaced with fuel gas provided that a moderately rapid and continuous flow of fuel gas is introduced at one end of the line and air is vented out at the other end. The fuel gas flow shall be continued without interruption until the vented gas is free of air. The point of discharge shall not be left unattended during purging. After purging, the vent shall then be closed. Where required by the table below, the air in the piping shall first be displaced with an inert gas, and the inert gas shall then be displaced with fuel gas:

Nominal Pipe Size(inches)	Length of Piping Requiring Purging
3	> 30 feet
4	>15 feet

6	>10 feet
8 or larger	Any length

4. Discharge of purged gases: The open end of piping systems being purged shall not discharge into confined spaces or areas where there are sources of ignition unless precautions are taken to perform this operation in a safe manner by ventilation of the space, control of purging rate, and elimination of all hazardous conditions.

5. Placing equipment in operation: After the piping has been placed in operation, all equipment shall be purged and then placed in operation, as necessary.

3.13 SCHEDULES

A. Pipe Hanger Spacing:

1. Copper Piping:

a. 1-1/4 inch diameter and smaller: 6 feet maximum horizontal spacing, 10 feet maximum vertical spacing.

b. 1-1/2 inch diameter and larger: 10 feet maximum horizontal spacing, 10 feet maximum vertical spacing.

2. PVC Pipe or Tubing: 4 feet maximum horizontal spacing, 10 feet maximum vertical spacing.

3. Steel Pipe: 12 feet maximum horizontal spacing, 15 feet maximum vertical spacing.

END OF SECTION

SECTION 232114 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air vents.

B. Strainers.

1.2 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.

1.3 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

B. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 AIR VENTS

A. Manual Air Vent: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

B. Float Air Vent:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

C. Maximum Fluid Pressure: 150 psi.

D. Maximum Fluid Temperature: 250 degrees F.

2.2 STRAINERS

A. Size 2 inch and Under:

1. Provide threaded, grooved, or sweat brass or iron body for up to 175 psi working pressure, Y-pattern strainer with 1/32 inch stainless steel perforated screen.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

C. Provide valved drain and hose connection on strainer blowdown connection.

END OF SECTION

SECTION 232123 - HYDRONIC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. In-line circulators with electrically commutated motors.

B. Coil Condensate Pumps

1.2 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; 2014.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

C. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

B. Provide motors in compliance with the requirements of the New York State Energy Conservation Construction Code, tested in accordance with IEEE Standard 112, test method B.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Taco: www.taco-hvac.com.

B. Armstrong Pumps Inc: www.armstrongpumps.com.

C. Bell & Gossett, a Xylem Inc. brand: www.bellgossett.com.

2.2 GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Minimum Quality Standard: UL 778.

C. Electrical Requirements:

1. Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2. Enclosures: Provide unspecified product(s) required to fit motor:

2.3 ELECTRICAL COMMUTATED MOTOR IN-LINE CIRCULATORS

A. Maximum operating pressure: 145 psi.

B. Water Temperature range: 14 - 230 degrees F.

C. Casing: Cast iron cataphoresis coated.

D. Impeller: Engineered polymer.

E. Shaft: Stainless Steel.

F. Bearing: Metal impregnated carbon.

G. Electrical Specifications:

1. Motor: Electrically Commutated

2. Power consumption: 10 - 180 watts, 1/4 Horsepower

3. Rated Current: 0.1 A to 1.5 A a 115 volt, single phase

4. Continuous Duty

5. Built-In start-up circuit.

H. Standards and Protection:

1. Insulation: Class F, 230 V; Class H, 115V

2. Enclosure: Class 2, IP44

3. Integrated Motor Protection (electronically protected).

4. UL 778

I. Communication Module (Provide pump with communication module):

1. Ethernet communication

2. Modbus RTU communication

3. Analog Control input 0 - 10 V

4. 3 analog inputs/outputs

5. 1 relay output

6. Set pump to operate at fixed speed equal to scheduled flow rate.

2.4 COIL CONDENSATE PUMPS

A. Refer to condensate pump schedule for pump requirements.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

END OF SECTION

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SECTION 232300 - REFRIGERANT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Filter-driers.

F. Expansion valves.

G. Flexible connections.

1.2 REFERENCE STANDARDS

A. AHRI 710 - Performance Rating of Liquid-Line Driers; 2009.

B. AHRI 730 (I-P) - Flow Capacity Rating of Suction-Line Filters and Suction-Line Filter-Driers; 2013.

C. AHRI 750 - Standard for Thermostatic Refrigerant Expansion Valves; 2007.

D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

E. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2013.

F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

G. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2013.

H. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2013.

I. ASME B31.9 - Building Services Piping; 2014.

J. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

L. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

M. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2013.

N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

O. ICC (IMC)-2018 - International Mechanical Code; 2018.

P. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

Q. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:

1. Use line size liquid indicators in main liquid line leaving condenser.

D. Valves:

1. Use service valves on suction and discharge of compressors.

E. Filter-Driers:

1. Use a filter-drier on suction line just ahead of compressor.

F. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.4 SUBMITTALS

A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

B. Piping Schedule: Provide schedule of piping applications and materials, indicating piping and fittings.

C. Piping Shop Drawings: Provide drawings of piping installation, indicating dimensioned locations, equipment, critical dimensions, elevations, sizes, systems, and valve locations.

D. Manufacturer Piping Sizing: Provide documentation from the manufacturer of the refrigeration equipment connected to the refrigerant piping and accessories establishing the required sizing of piping.

E. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

F. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

G. Test Reports: Indicate results of leak test, acid test.

H. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

I. Installer's qualification statement.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of documented experience.

B. The manufacturer of the refrigeration equipment connected to the refrigerant piping and accessories shall review and provide final sizing of piping and accessories.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.

1. Fittings: ASME B16.22 wrought copper.

2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

3. Mechanical Press Sealed Fittings: Double pressed type complying with UL 207 and ICC (IMC)-2018.

B. Pipe Supports and Anchors:

1. Provide hangers and supports that comply with MSS SP-58.

a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.

3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

5. Vertical Support: Steel riser clamp.

6. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

8. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

9. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

10. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:

    a. Bases: High density, UV tolerant, polypropylene or reinforced PVC.

    b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

    c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

    d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.

    e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

2.2 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.3 VALVES

A. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.4 FILTER-DRIERS

A. Performance:

1. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.

2. Design Working Pressure: 350 psi, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.

1. Connections: As specified for applicable pipe type.

2.5 EXPANSION VALVES

A. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.

B. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.6 FLEXIBLE CONNECTORS

A. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Inserts:

1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

4. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

G. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.5.

2. Support horizontal piping as indicated.

3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

4. Place hangers within 12 inches of each horizontal elbow.

5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

7. Provide copper plated hangers and supports for copper piping.

H. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access to concealed valves and fittings.

K. Flood piping system with nitrogen when brazing.

L. Insulate piping; refer to Section and Section 230716.

M. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

N. Provide replaceable cartridge filter-driers, with isolation valves.

O. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

P. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

Q. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

R. Fully charge completed system with refrigerant after testing.

3.3 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

3.4 SCHEDULES

A. Pipe Hanger Spacing:

1. Copper Piping:

a. 1-1/4 inch diameter and smaller: 6 feet maximum horizontal spacing, 10 feet maximum vertical spacing.

b. 1-1/2 inch diameter and larger: 10 feet maximum horizontal spacing, 10 feet maximum vertical spacing.

END OF SECTION

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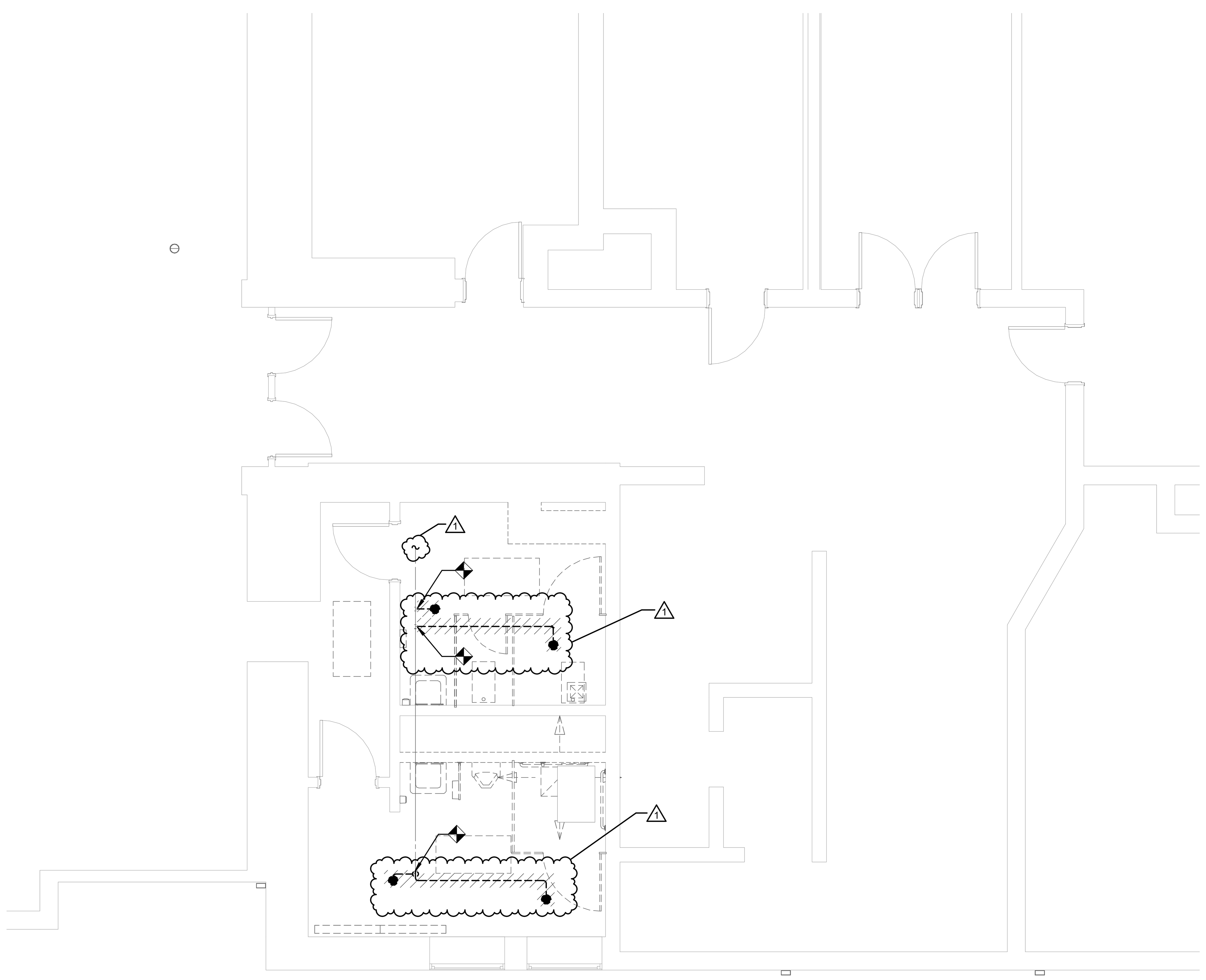
FIRE PROTECTION LEGEND

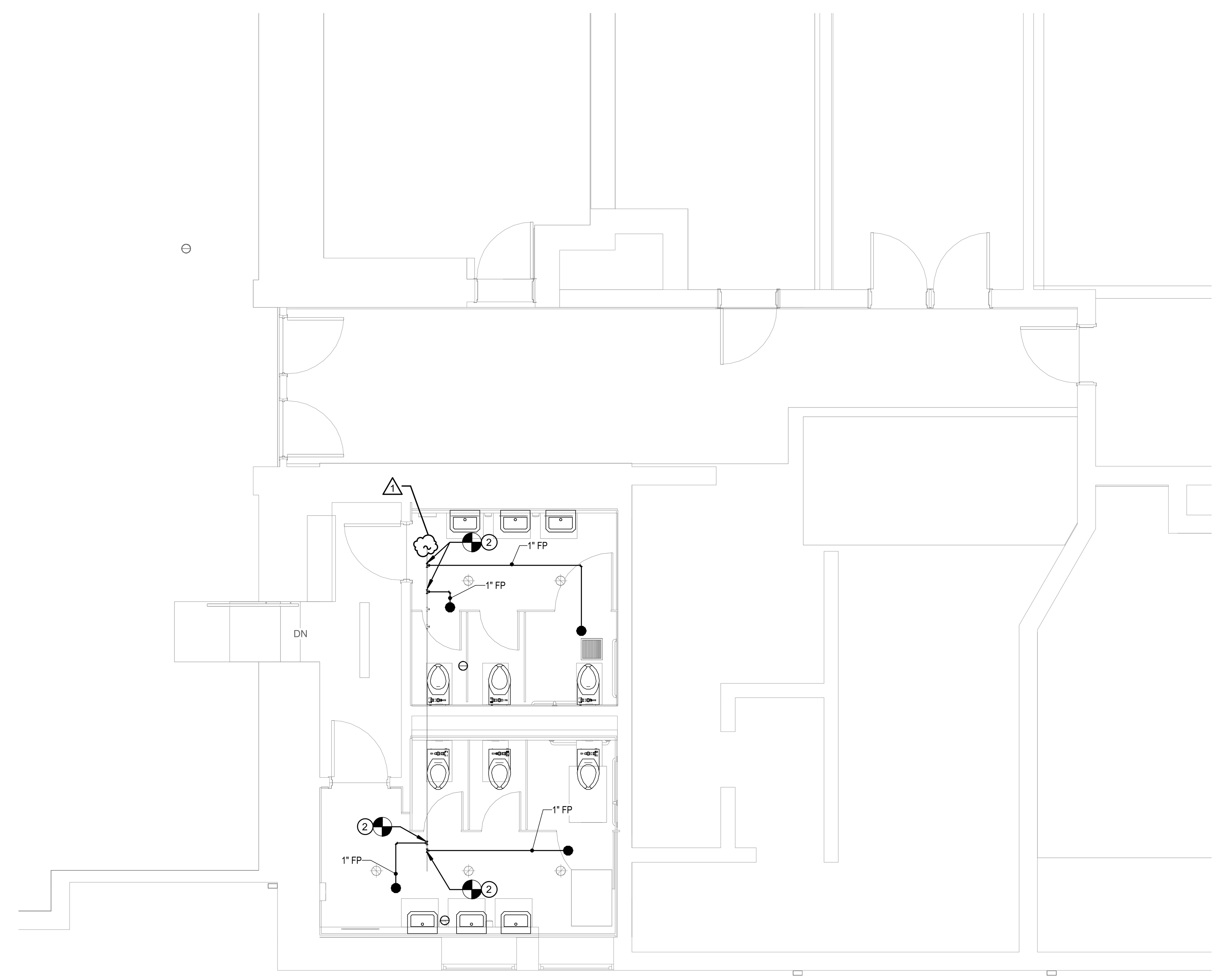
- —FP— WET SPRINKLER PIPING - FP
- 90 DEGREE PIPE ELBOW DOWN
- PIPE RISER UP SYMBOL
- PIPING/EQUIPMENT REMOVALS
- CHECK VALVE
- GATE VALVE
- PIPE REDUCER
- POINT OF REMOVAL
- POINT OF CONNECTION
- (X) KEYED NOTED DESIGNATION
- PENDANT MOUNTED SPRINKLER HEAD
- UPRIGHT SPRINKLER HEAD

KEYED NOTES:

1. DISCONNECT AND REMOVE SPRINKLER PIPING AND ASSOCIATED PENDENT SPRINKLER HEADS BACK TO DISCONNECTION POINT SHOWN.
2. CONNECT TO EXISTING SPRINKLER PIPING AT LOCATIONS SHOWN AND ROUTE SPRINKLER PIPING TO PENDENT SPRINKLER HEADS.



A18 GROUND FLOOR FIRE PROTECTION REMOVALS
1/4" = 1'-0"



A9 GROUND FLOOR FIRE PROTECTION PLAN
1/4" = 1'-0"

ARCHITECT

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REGISTRATION EXPIRES: 11/30/2026

NANUET

NUFSD BOND PROJECT PHASE 5 - HIGHVIEW

- ■ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- ☐ SED#50-01-08-03-7-007-002 (Maintenance)
- ☐ SED#50-01-08-03-7-012-004 (OEC)
- ☐ SED#50-01-08-03-0-001-026 (MILLER ES)
- ☐ SED#50-01-08-03-0-004-022 (BARR MS)

Highview Elementary School
24 Highview Ave
Nanuet, NY 10954

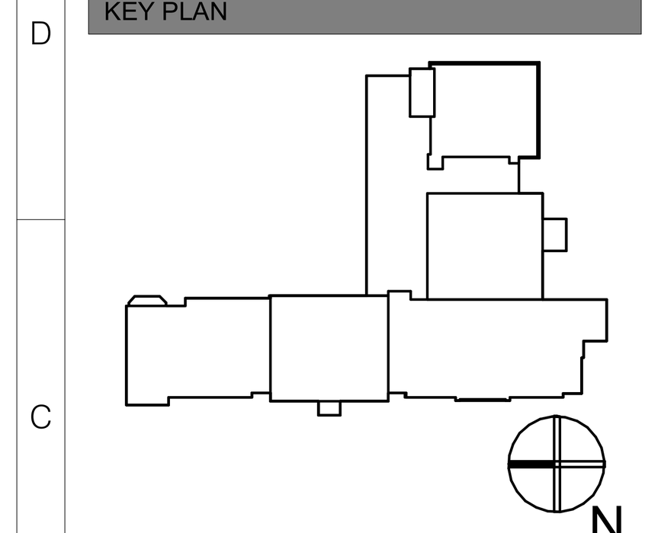
OEC Building
135 Convent Rd
Nanuet, NY 10954

Maintenance Building
103 Church St.
Nanuet, NY 10954

Miller Elementary School
50 Blauvelt Rd Unit1
Nanuet, NY 10954

A MacArthur Barr Middle School
143 Church St
Nanuet, NY 10954

KEY PLAN



REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

SCALE: As indicated

SHEET NAME:
FIRE PROTECTION PLANS

SHEET NUMBER:
HE-FP101

ISSUE FOR BID SET

2/4/2025 9:06:54 AM

CABINET UNIT HEATER SCHEDULE

1. PROVIDE WITH ECM MOTOR WITH CONTROL BOARD, 3 SPEED SWITCH AND SERVICE SWITCH, DPST SERVICE SWITCH, AND ALUMINUM GRILLES

Mark	LOCATION	CFM	FAN MOTORS RPM	FAN MOTORS VOLTS	FAN MOTORS PH	AMPS	HP	CAPACITY (MBH)	TEMP EWT	TEMP LWT	WPD (FT)	GPM	TYPE	BASIS OF DESIGN MANUFACTURER AND MODEL	REMARKS
CUH-HE-1	LOWER LEVEL BOYS TOILET	230	1,050	120	1	0.45 A	1/15	14.0	180 °F	160 °F	0.06	0.84	RECESSED CEILING	STERLING RC-1200-02	1

HEATING WATER RADIATION SCHEDULE

1. PROVIDE WITH SAME END SERIES PIPING CONNECTIONS (SUPPLY AND RETURN CONNECTIONS ON SAME SIDE OF RADIATOR).
2. PROVIDE WITH OPPOSITE END SERIES PIPING CONNECTIONS (SUPPLY AND RETURN CONNECTIONS ON OPPOSITE SIDES OF RADIATOR).
3. PROVIDE WITH HIGH PRESSURE RATED RADIATORS.
4. PROVIDE WITH POST MOUNTS AS REQUIRED FOR FLOOR MOUNTING RADIATORS.
5. PROVIDE WITH APPROPRIATE WALL MOUNTING BRACKETS FOR WALL MOUNTING OF RADIATOR.

Mark	CAPACITY (BTU/HR PER LINEAL FOOT)	AVERAGE WATER TEMP.	EAT	HEIGHT	SIZE DEPTH	FLOW RATE (GPM)	SIZE LENGTH	WATER PRESSURE DROP	FINS PER FOOT	BASIS OF DESIGN MFG. AND MODEL	REMARKS
R-HE-1	1,141	175.0 °F	65 °F	14.38 in	2.38 in	0.680	3' - 0"	0.08 Feet	32	RUNTAL UFLT-5	2,3,5
R-HE-2	1,141	175.0 °F	65 °F	14.38 in	2.38 in	0.680	3' - 0"	0.08 Feet	32	RUNTAL UFLT-5	1,3,5

1

FAN SCHEDULE

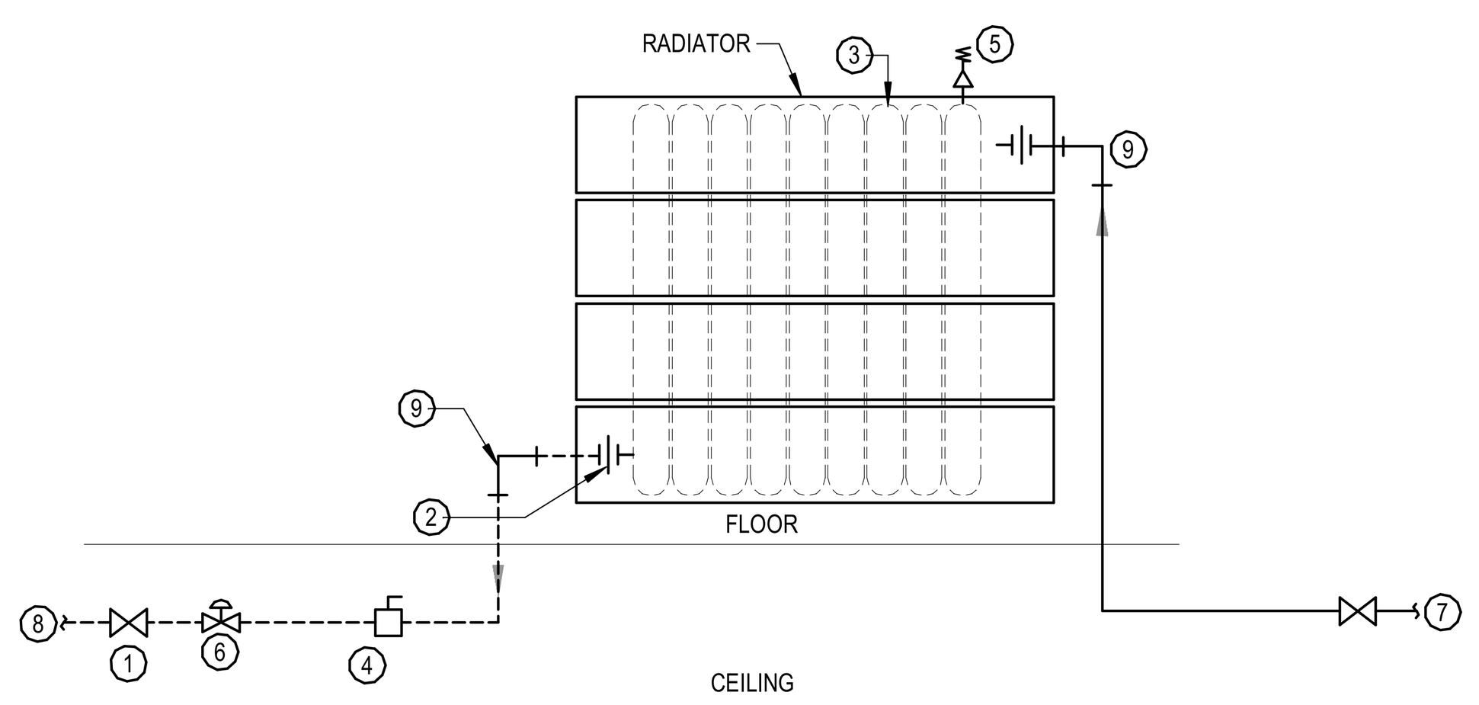
1. PROVIDE WITH UNIT MOUNTED DISCONNECT, 24-VOLT MOTORIZED BACKDRAFT DAMPER, AND ELECTRICALLY COMMUTATED FAN MOTOR THAT INCLUDES A DIAL FAN MOUNTED SPEED CONTROLLER.
2. PROVIDE FAN WITH 16" HIGH ROOF CURB ADAPTER MOUNTED TO TOP OF EXISTING ROOF CURB.
3. PROVIDE FAN WITH 18" HIGH INSULATED ROOF CURB.
4. PROVIDE WITH UNIT MOUNTED DISCONNECT SWITH AND ELECTRICALLY COMMUTATED FAN MOTOR WITH FAN MOIUNTED DIAL SPEED CONTROLLER.

Mark	LOCATION	SERVICE	TYPE	DRIVE	CFM	STATIC PRESSURE (IN WC)	MINIMUM IMPELLER DIAMETER	ELECTRICAL DATA RPM	BHP	HP	WATTS	VOLTS	PH	VFD SPEED SETTING	MIN FAN STATIC EFFICIENCY	FAN EFFICIENCY INDEX	MAXIMUM SOUND LEVEL (dBA)	TOTAL SYSTEM WEIGHT	BASIS OF DESIGN MFG. AND MODEL	REMARKS
EF-HE-1	NORTH ROOF	TOILET ROOMS	DOWNBLAST CENTRIFUGAL ROOF EXHAUST FAN	DIRECT	1,960	1.10	15.0 in	1,379	0.565	5/8		115	1		60%		66	115 lb	COOK ACE-D 150C17D (VF)	1,2
EF-HE-2	SOUTH ROOF	TOILET ROOMS	DOWNBLAST CENTRIFUGAL ROOF EXHAUST FAN	DIRECT	900	1.10	12.0 in	1,829	0.439	1/2		115	1		36%		67	20 lb	COOK 120 ACED OR91	1,3
EF-HE-3	LOWER LEVEL BOYS TOILET	LOWER LEVEL TOILET ROOMS	INLINE CENTRIFUGAL	DIRECT	555	0.80	10.0 in	1,984	0.210	1/3		115	1		33%		63	52 lb	COOK 100 SQN-D OR80	4

DIFFUSER, REGISTER AND GRILLE SCHEDULE

1. PROVIDE WITH ALUMINUM OPPOSED BLADE DAMPER

Mark	DESCRIPTION/PATTERN	OVERALL SIZE	DUCT CONNECTION SIZE	MOUNTING	MATERIAL	BASIS OF DESIGN MANUFACTURER AND MODEL	REMARKS
ER-HE-1	LOUVERED REGISTER, 3/4" BLADE SPACING, 45 DEGREE DEFLECTION	13-3/4"x13-3/4"	12"x12"	SURFACE	ALUMINUM	PRICE 630	1
ER-HE-2	LOUVERED REGISTER, 3/4" BLADE SPACING, 45 DEGREE DEFLECTION	7-3/4"x7-3/4"	6"x6"	SURFACE	ALUMINUM	PRICE 630	1
SD-HE-1	SQUARE CONE SA DIFFUSER, 360 DEGREE RADIAL AIR PATTERN	24"x24"	6"ø	LAY-IN	STEEL	PRICE SCD	
TG-HE-1	LOUVERED REGISTER, 3/4" BLADE SPACING, 45 DEGREE DEFLECTION	35-3/4"x55-3/4"	34"x54"	SURFACE	STEEL	PRICE 530	
TG-HE-2	LOUVERED REGISTER, 3/4" BLADE SPACING, 45 DEGREE DOUBLE DEFLECTION	35-3/4"x55-3/4"	34"x54"	SURFACE	STEEL	PRICE 510	



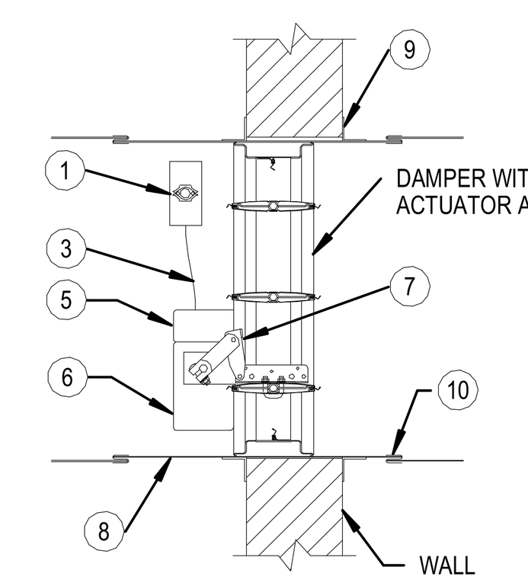
1. SHUT-OFF VALVE (TYP)
2. UNION (TYP)
3. FIN ELEMENT
4. BALANCE VALVE
5. AIR VENT
6. 2-WAY MODULATING CONTROL VALVE
7. HWS
8. HWR
9. EXPANSION COMPENSATOR

NOTE:

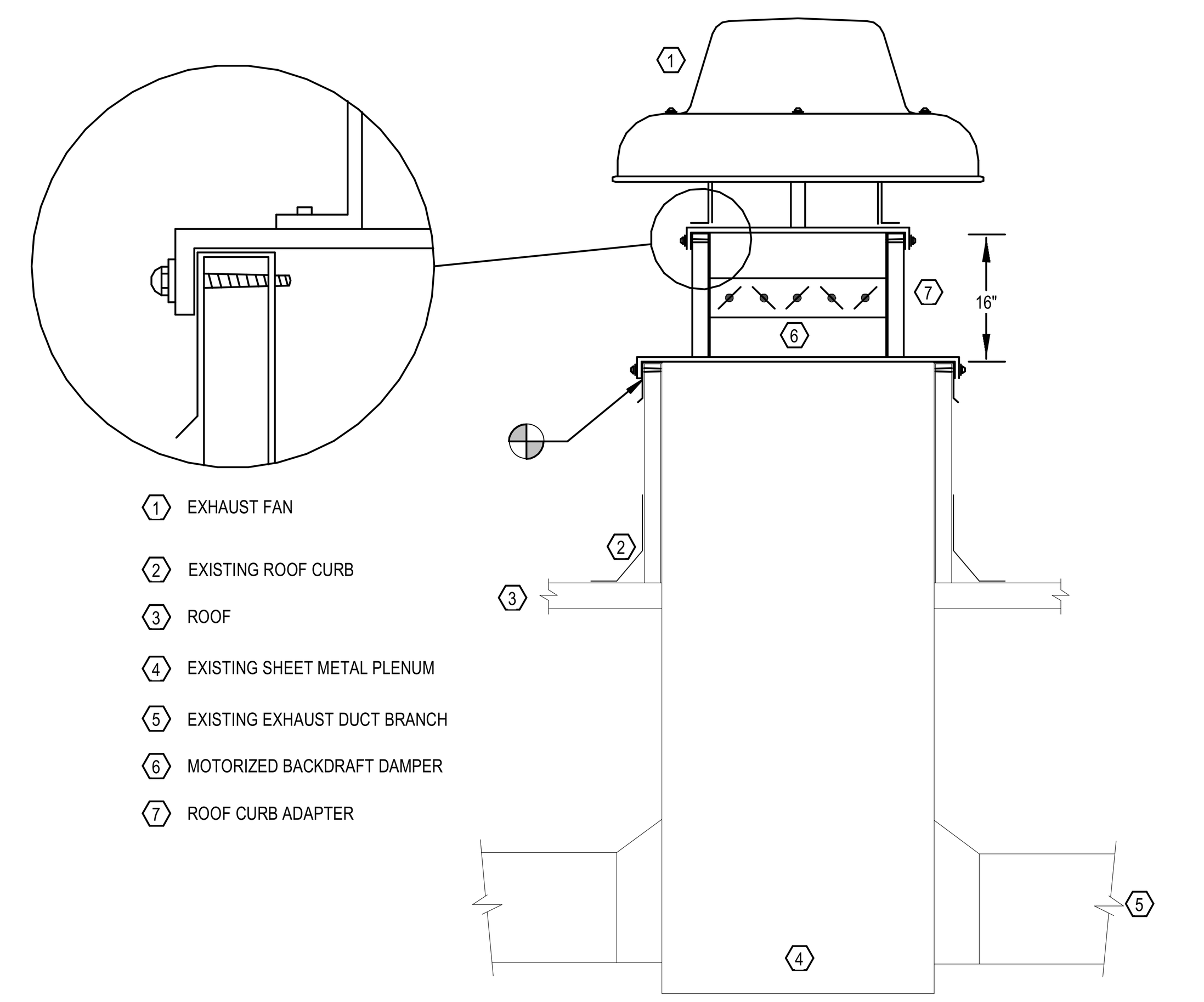
1. DETAIL FOR PIPING TO RADIATION PIPED FROM BELOW TO OPPOSITE END CONNECTIONS ON RADIATOR.

G18 HOT WATER FLOOR RADIATION DETAIL
NOT TO SCALE

ITEM.	DESCRIPTION
1.	EFL ELECTRIC RESET LINK
2.	CONTROL SWITCH (OPTIONAL)
3.	FLEX CONDUIT
4.	DAMPER FRAME
5.	JUNCTION BOX
6.	ACTUATOR
7.	OVER CENTER LINK
8.	SLEEVE
9.	PFMA OR CONVENTIONAL MOUNTING ANGLES
10.	SLEEVE TO DUCT CONNECTION (BY OTHERS)

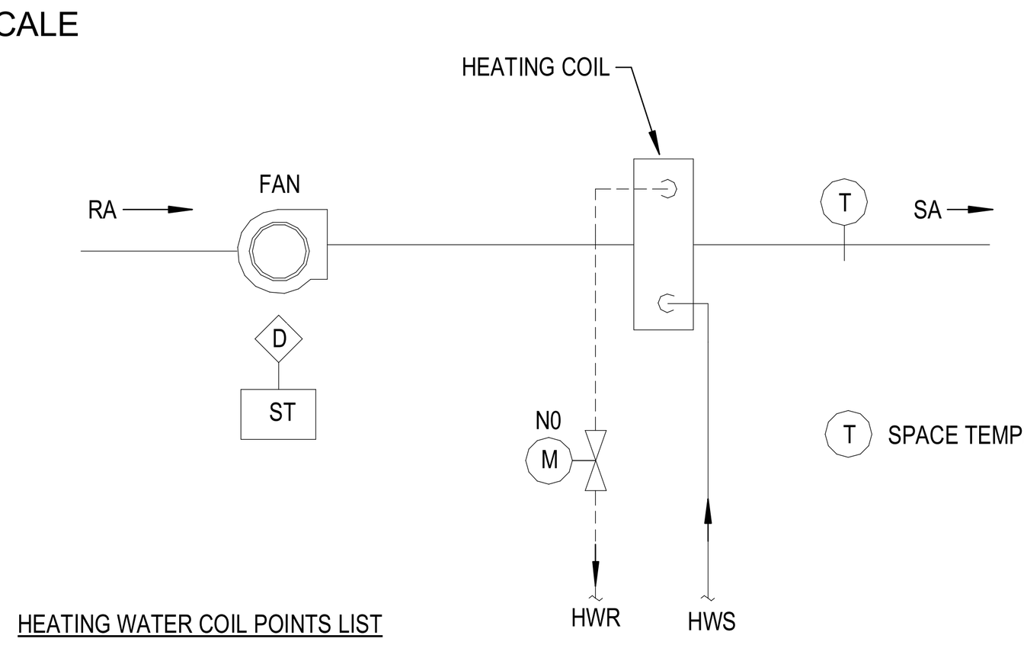


G13 ROUND COMBINATION FIRE/SMOKE DAMPER DETAIL
NOT TO SCALE



1. EXHAUST FAN
2. EXISTING ROOF CURB
3. ROOF
4. EXISTING SHEET METAL PLENUM
5. EXISTING EXHAUST DUCT BRANCH
6. MOTORIZED BACKDRAFT DAMPER
7. ROOF CURB ADAPTER

E8 NON-GREASE APPLICATION EXHAUST FAN DETAIL - EXISTING ROOF PENETRATION
NOT TO SCALE

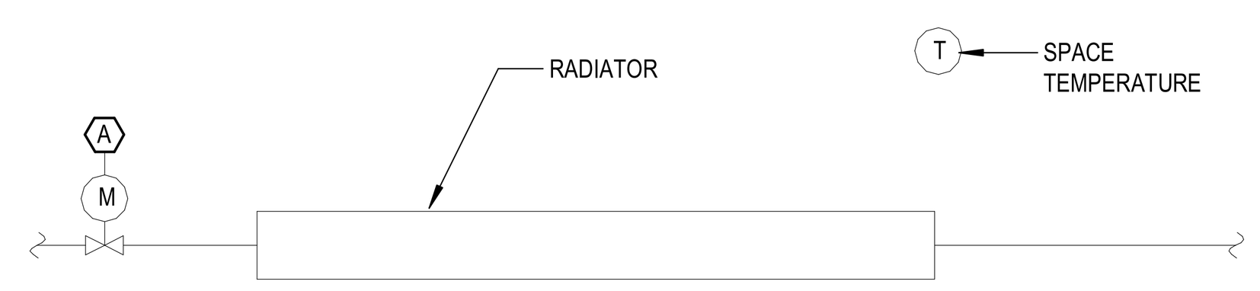


T SPACE TEMPERATURE

HEATING WATER COIL POINTS LIST

ITEM	DIGITAL INPUT	DIGITAL OUTPUT	ANALOG INPUT	ANALOG OUTPUT	LOCAL INTERLOCK	NOTES
2-WAY MODULATING HEATING CONTROL VALVE				X		T
SPACE TEMPERATURE			X			T, A
FAN START/STOP		X				RT, T

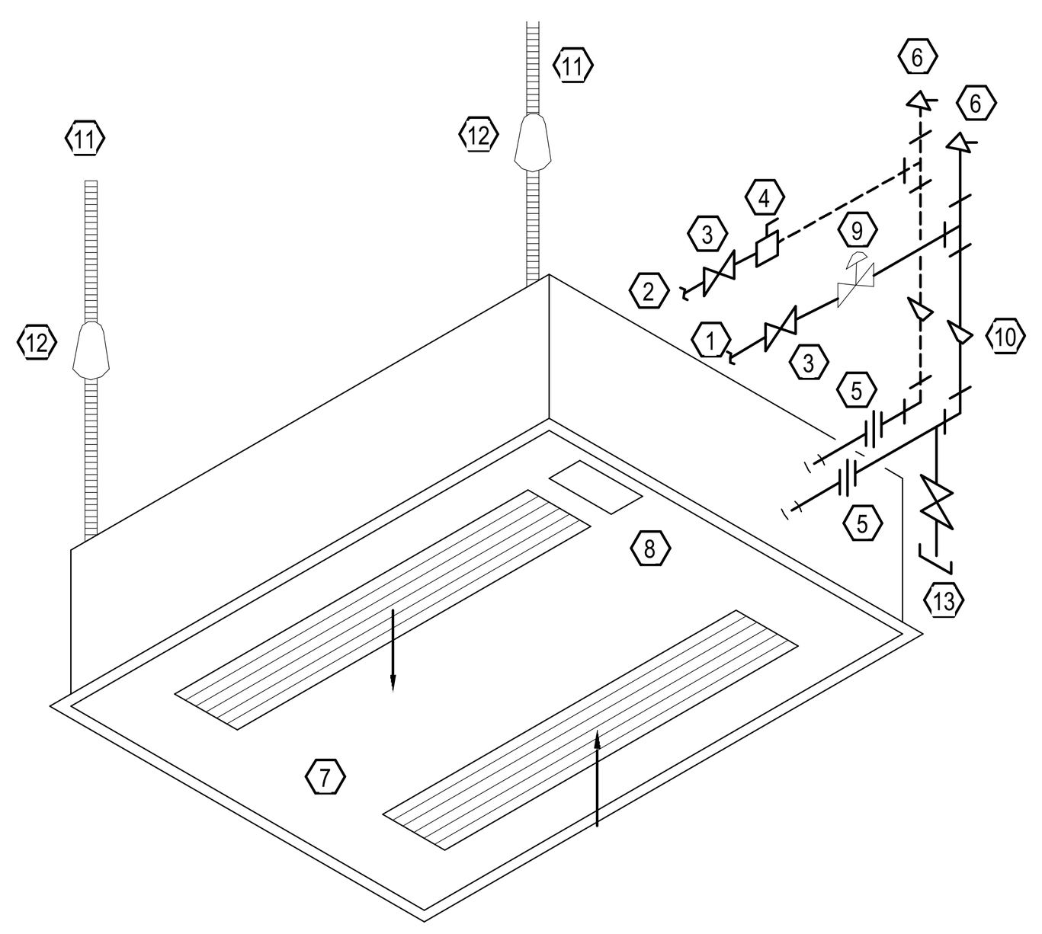
D18 CABINET UNIT HEATER CONTROL DIAGRAM
NOT TO SCALE



FIN TUBE RADIATION/WALL RADIATOR POINTS LIST

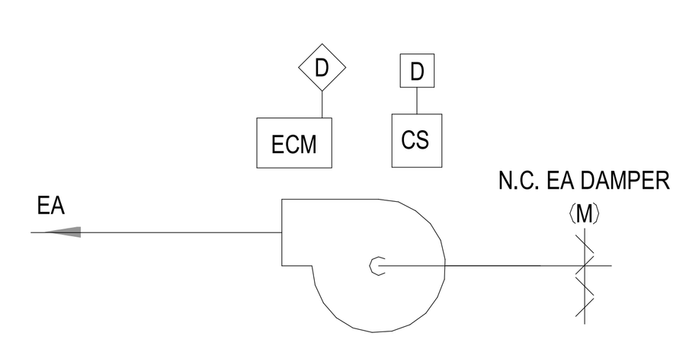
ITEM	DIGITAL INPUT	DIGITAL OUTPUT	ANALOG INPUT	ANALOG OUTPUT	NOTES
HEATING CONTROL VALVE				X	T
SPACE TEMPERATURE			X		T, A

D9 FLOOR HEATING RADIATION CONTROL DIAGRAM
NOT TO SCALE



1. HWS
2. HWR
3. SHUT-OFF VALVE
4. BALANCING VALVE
5. UNION
6. MANUAL AIR VENT
7. HINGED FRONT PANEL
8. LOCKED ACCESS DOOR
9. 2-WAY CONTROL VALVE
10. INCREASER/REDUCER (TYP)
11. HANGER RODS TO STRUCTURE ABOVE
12. VIBRATION ISOLATORS
13. DRAIN VALVE W/ HOSE END AND CAP

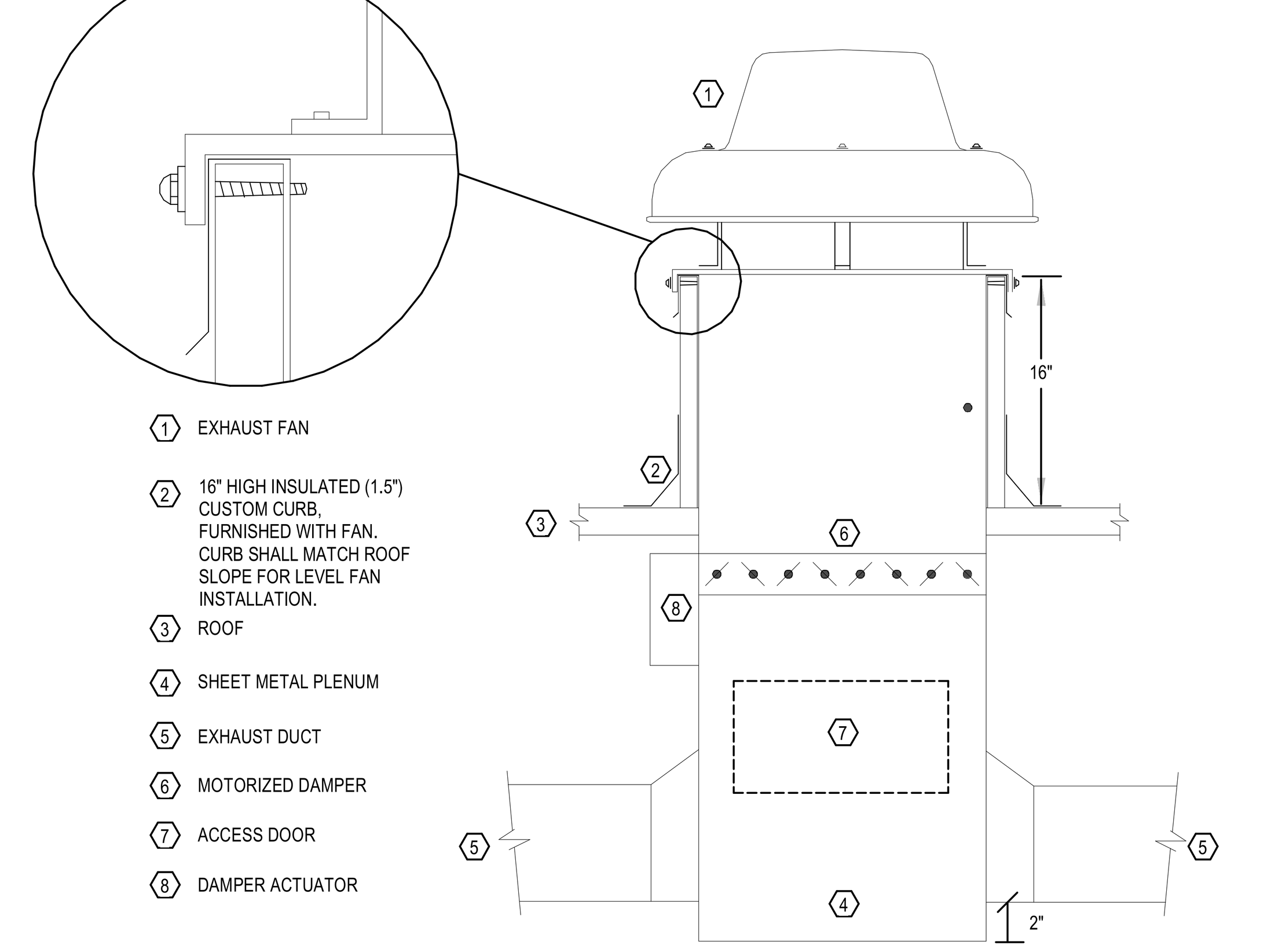
A18 CEILING CABINET UNIT HEATER INSTALLATION DETAIL
NOT TO SCALE



KITCHEN GENERAL EXHAUST FAN F-HS-1 POINTS LIST

ITEM	DIGITAL INPUT	DIGITAL OUTPUT	ANALOG INPUT	ANALOG OUTPUT	LOCAL INTERLOCK	NOTES
FAN START/STOP		X				RT, T
FAN STATUS	X					A
EXHAUST AIR DAMPER		X				T

A13 EXHAUST FAN CONTROL DIAGRAM
NOT TO SCALE



1. EXHAUST FAN
2. 18" HIGH INSULATED (1.5") CUSTOM CURB, FURNISHED WITH FAN. CURB SHALL MATCH ROOF SLOPE FOR LEVEL FAN INSTALLATION.
3. ROOF
4. SHEET METAL PLENUM
5. EXHAUST DUCT
6. MOTORIZED DAMPER
7. ACCESS DOOR
8. DAMPER ACTUATOR

A8 NON-GREASE APPLICATION EXHAUST FAN DETAIL - NEW SINGLE ROOF PENETRATION
NOT TO SCALE

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NUFSD BOND PROJECT PHASE 5 - HIGHVIEW

- ■ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- ☐ SED#50-01-08-03-7-007-002 (Maintenance)
- ☐ SED#50-01-08-03-7-012-004 (OEC)
- ☐ SED#50-01-08-03-0-001-026 (MILLER ES)
- ☐ SED#50-01-08-03-0-004-022 (BARR MS)

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Miller Elementary School
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A MacArthur Barr Middle School
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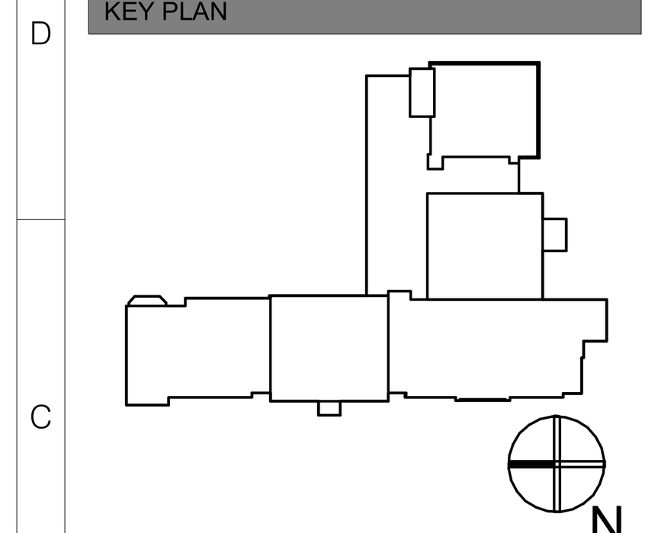
Nanuet, NY 10954

KEY PLAN

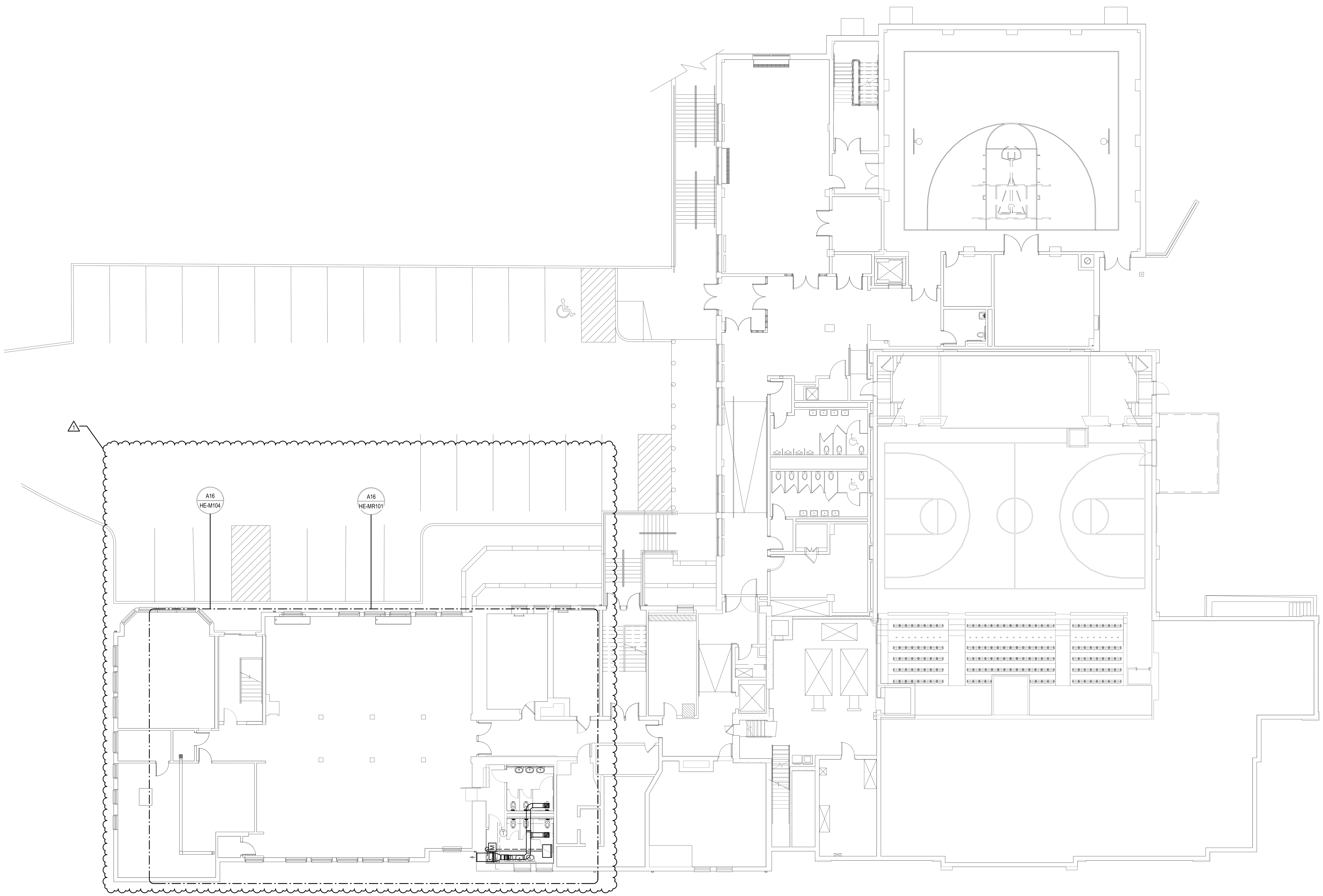


REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET
DATE: 06/21/2024
SCALE: As indicated
SHEET NAME: SCHEDULES, DETAILS, AND CONTROL DIAGRAMS
SHEET NUMBER: HE-M002

ISSUE FOR BID SET



A17 OVERALL LOWER LEVEL PLAN
3/32" = 1'-0"

ARCHITECT

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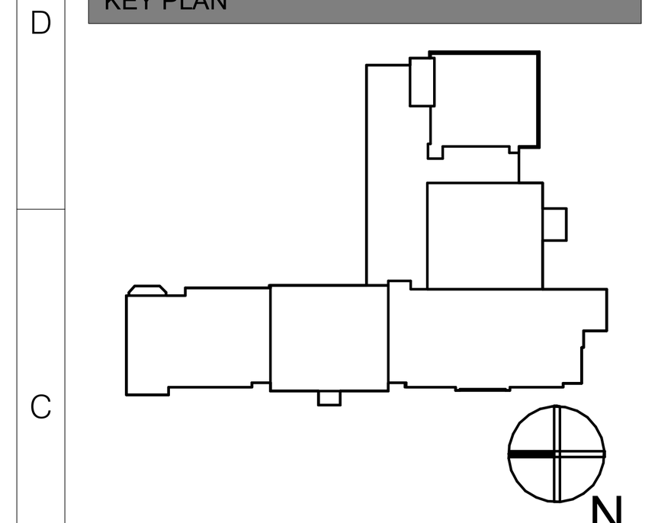
KEY PLAN



REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

SCALE: 3/32" = 1'-0"

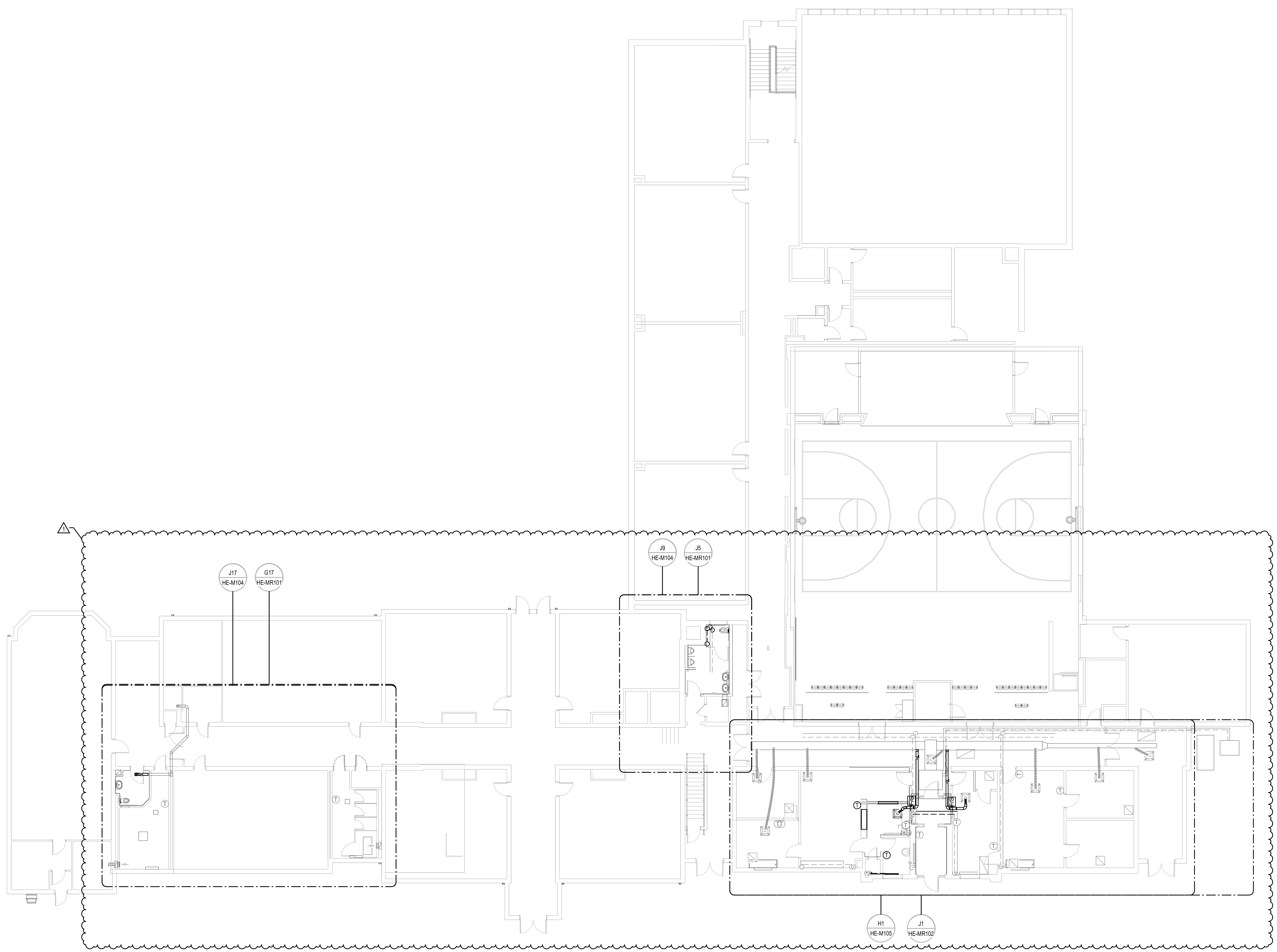
SHEET NAME:
OVERALL LOWER LEVEL PLAN

SHEET NUMBER:
HE-M101

ISSUE FOR BID SET

PROJECT NUMBER: 00000.00

2/4/2025 8:41:56 AM



A17 OVERALL 1ST FLOOR PLAN
3/32" = 1'-0"

ARCHITECT

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- ■ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- □ SED#50-01-08-03-7-007-002 (Maintenance)
- □ SED#50-01-08-03-7-012-004 (OEC)
- □ SED#50-01-08-03-0-001-026 (MILLER ES)
- □ SED#50-01-08-03-0-004-022 (BARR MS)

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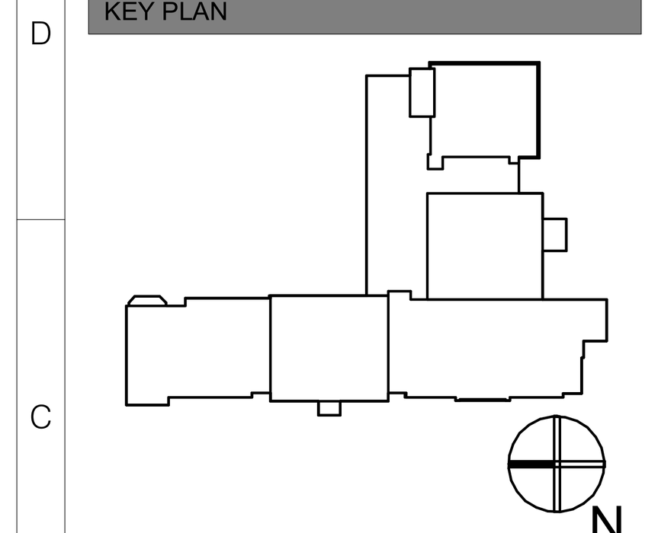
KEY PLAN



REVISIONS

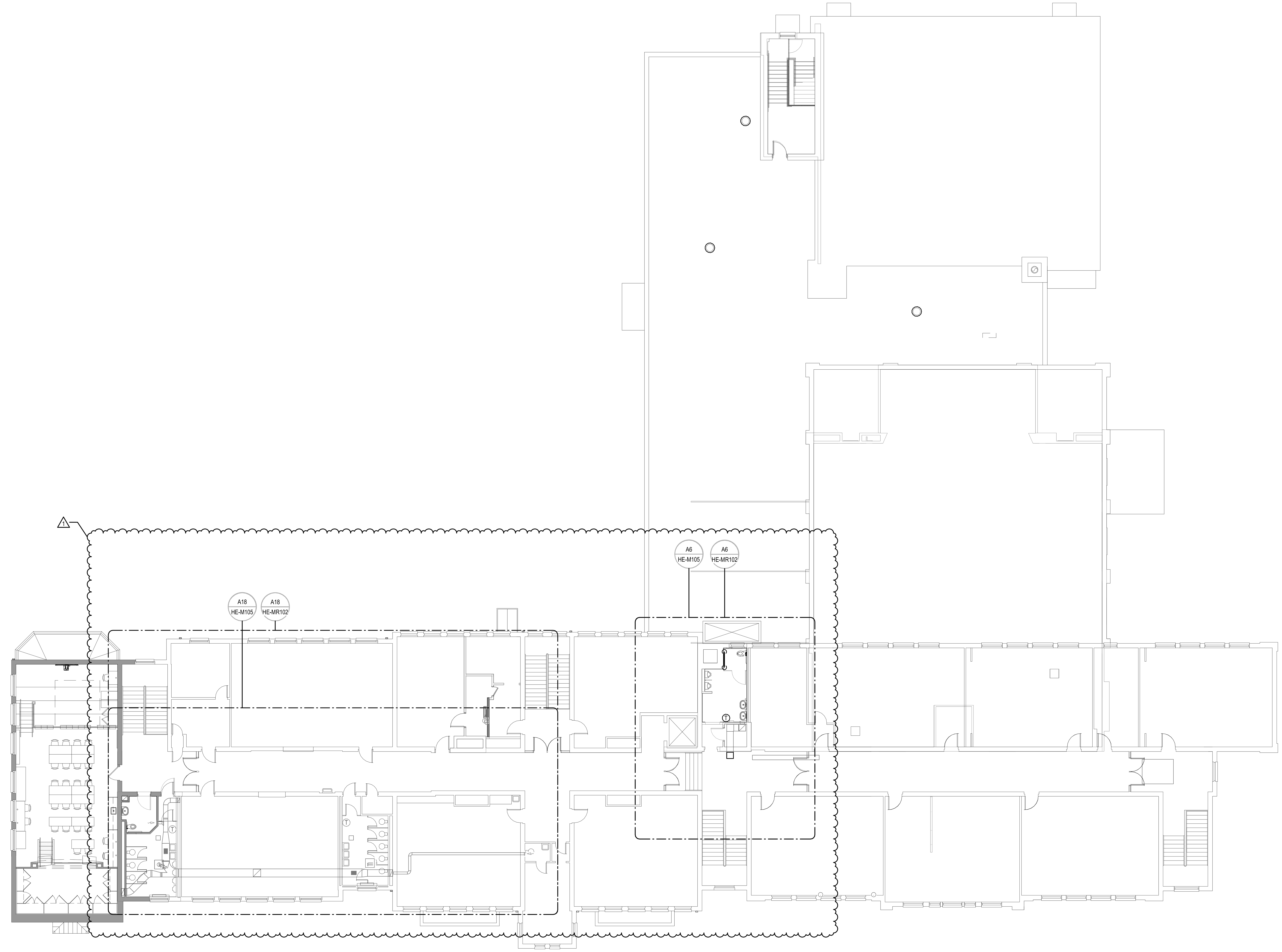
No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET
DATE: 06/21/2024
SCALE: 3/32" = 1'-0"
SHEET NAME:
OVERALL FIRST FLOOR PLAN
SHEET NUMBER:
HE-M102

ISSUE FOR BID SET

PROJECT NUMBER: 00000.00

2/4/2025 8:42:00 AM



A17 OVERALL SECOND FLOOR PLAN
3/32" = 1'-0"

ARCHITECT

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083994

NUFSD BOND PROJECT PHASE 5 - HIGHVIEW

■ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
☐ SED#50-01-08-03-7-007-002 (Maintenance)
☐ SED#50-01-08-03-7-012-004 (OEC)
☐ SED#50-01-08-03-0-001-026 (MILLER ES)
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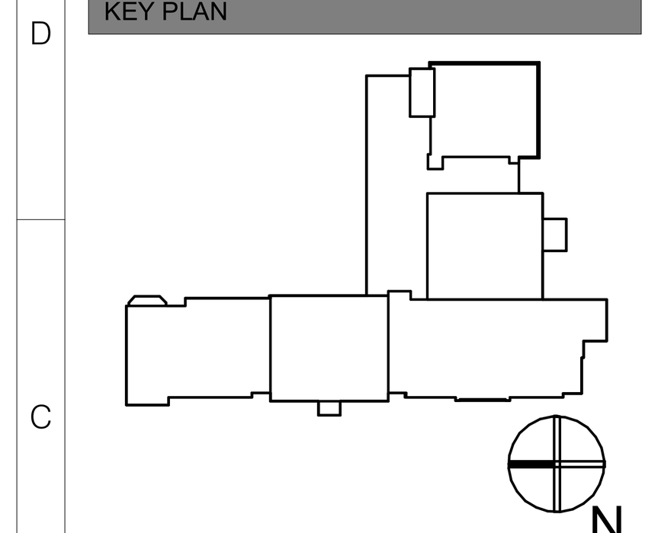
KEY PLAN



REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

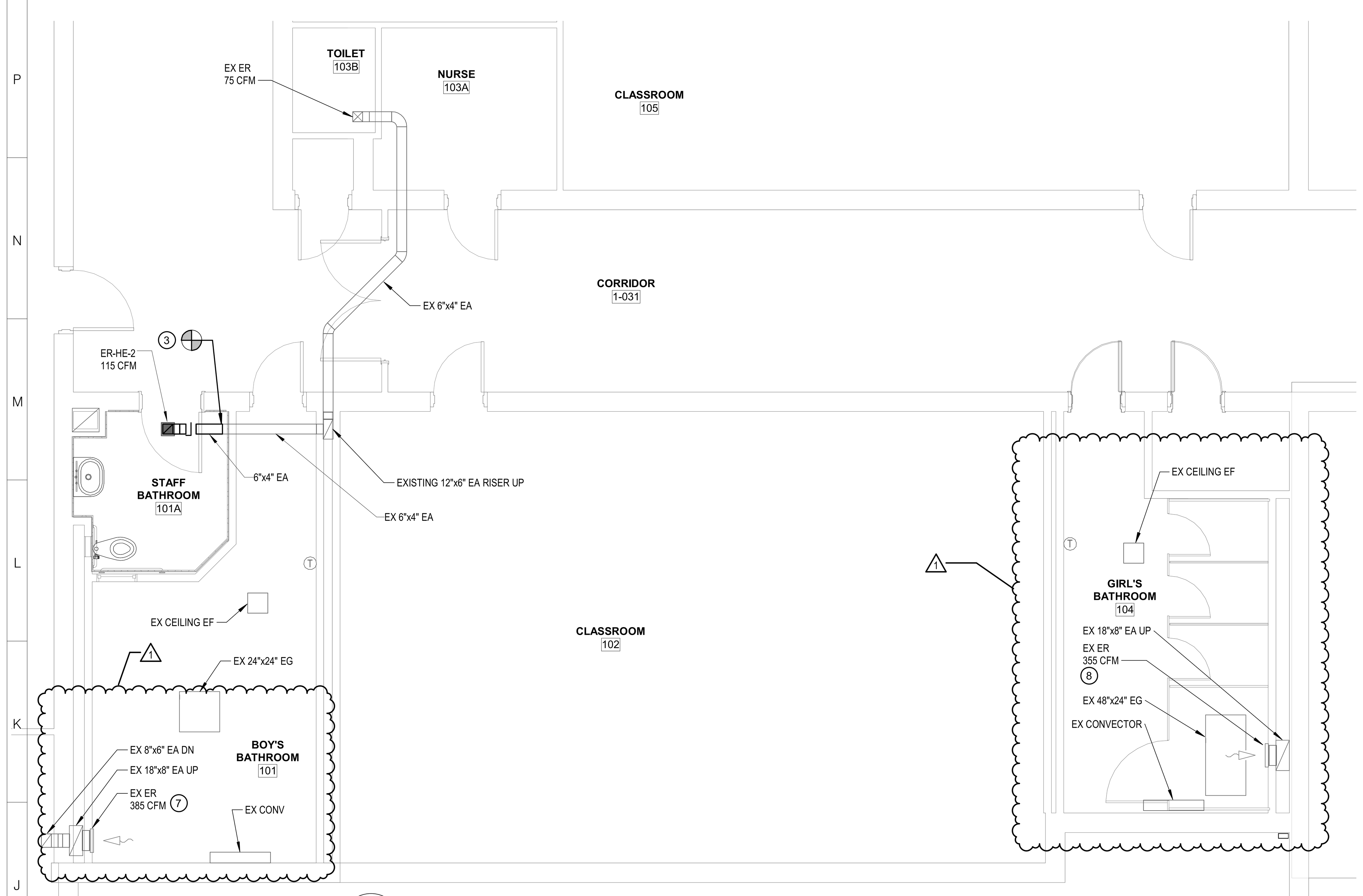
SCALE: 3/32" = 1'-0"

SHEET NAME:
OVERALL SECOND FLOOR PLAN

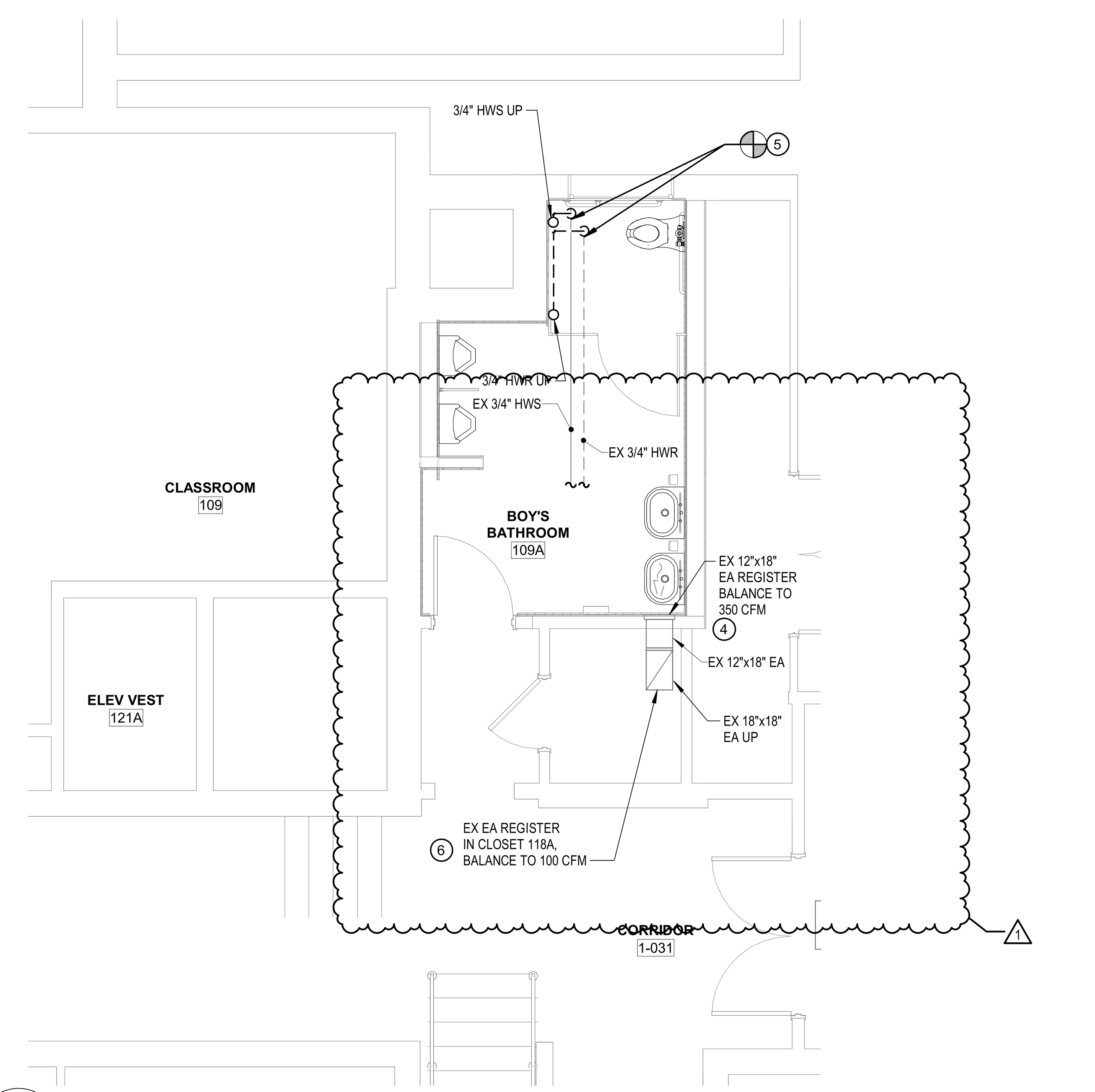
SHEET NUMBER:
HE-M103

ISSUE FOR BID SET

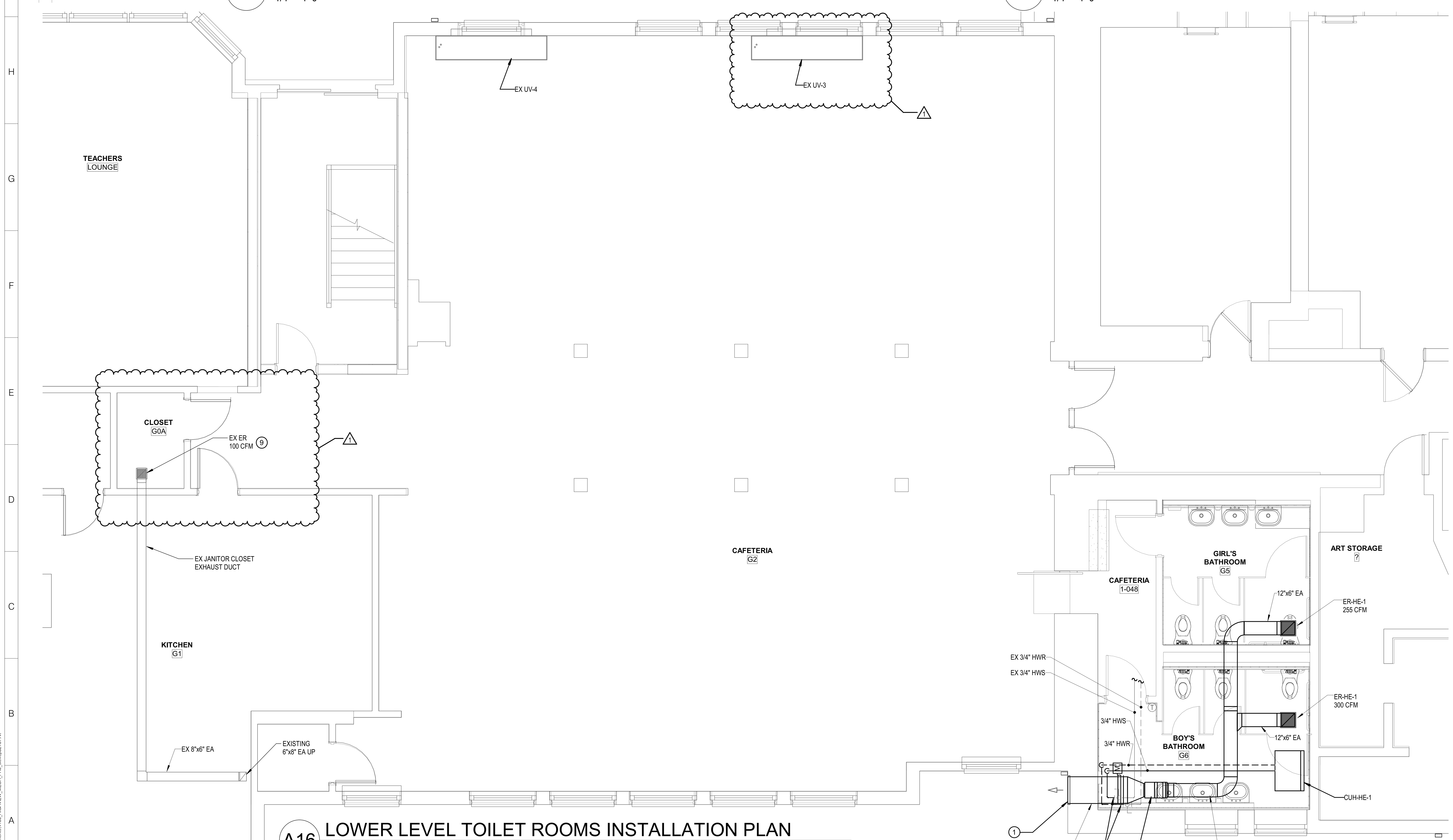
PROJECT NUMBER: 00000.00



J17 1ST FLOOR NORTH TOILET ROOMS INSTALLATION PLAN
1/4" = 1'-0"



J9 1ST FLOOR CENTER TOILET ROOM INSTALLATION PLAN
1/4" = 1'-0"



A16 LOWER LEVEL TOILET ROOMS INSTALLATION PLAN
1/4" = 1'-0"

KEYED NOTES:

1. PROVIDE 24" WIDE x 7.75" HIGH GREENHECK MODEL BVE, EXTRUDED ALUMINUM BRICK VENT LOUVER. PROVIDE WITH INSECT SCREEN AND 0.06", 18" LONG ALUMINUM DUCT SLEEVE. PROVIDE MOTORIZED DAMPER AT OUTLET OF INLINE EXHAUST FAN EF-HE-3 AS SHOWN.
2. CONNECT TO EXISTING 3/4" HWS/R PIPING AT LOCATION SHOWN DOWNSTREAM OF EXISTING BALL SHUT-OFF VALVES AND ROUTE 3/4" HWS/R TO RECESSED CEILING CABINET UNIT HEATER AT LOCATION SHOWN. REUSE EXISTING SPACE TEMPERATURE SENSOR AND ROUTE CONTROL WIRING FROM SENSOR TO CABINET HEATER AS REQUIRED.
3. CONNECT TO EXISTING EA BRANCH AT LOCATION SHOWN AND ROUTE EA DOWN TO SURFACE MOUNTED EA REGISTER AT LOCATION SHOWN.
4. BALANCE AIRFLOW THROUGH EXISTING EA REGISTER LOCATED APPROXIMATELY 6" ABOVE FLOOR LEVEL TO 350 CFM WITH EF-HE-2 OPERATING AT SCHEDULED AIRFLOW RATE.
5. CONNECT TO EXISTING HWS/R BRANCH PIPING ABOVE CEILING SYSTEM AND ROUTE 3/4" HWS/R UP TO WALL MOUNTED RADIATOR ON SECOND FLOOR.
6. BALANCE AIRFLOW THROUGH EXISTING DUCTED MOUNTED EA REGISTER TO 100 CFM WITH EF-HE-2 OPERATING AT SCHEDULED AIRFLOW RATE.
7. BALANCE AIRFLOW THROUGH EXISTING WALL MOUNTED EA REGISTER LEVEL TO 385 CFM WITH EF-HE-1 OPERATING AT SCHEDULED AIRFLOW RATE.
8. BALANCE AIRFLOW THROUGH EXISTING WALL MOUNTED EA REGISTER LEVEL TO 355 CFM WITH EF-HE-1 OPERATING AT SCHEDULED AIRFLOW RATE.
9. BALANCE AIRFLOW THROUGH EXISTING CEILING MOUNTED EA REGISTER LEVEL TO 100 CFM WITH EF-HE-1 OPERATING AT SCHEDULED AIRFLOW RATE.

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NUFSD BOND PROJECT PHASE 5 - HIGHVIEW

■ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
☐ SED#50-01-08-03-7-007-002 (Maintenance)
☐ SED#50-01-08-03-7-012-004 (OEC)
☐ SED#50-01-08-03-0-001-026 (MILLER ES)
☐ SED#50-01-08-03-0-004-022 (BARR MS)

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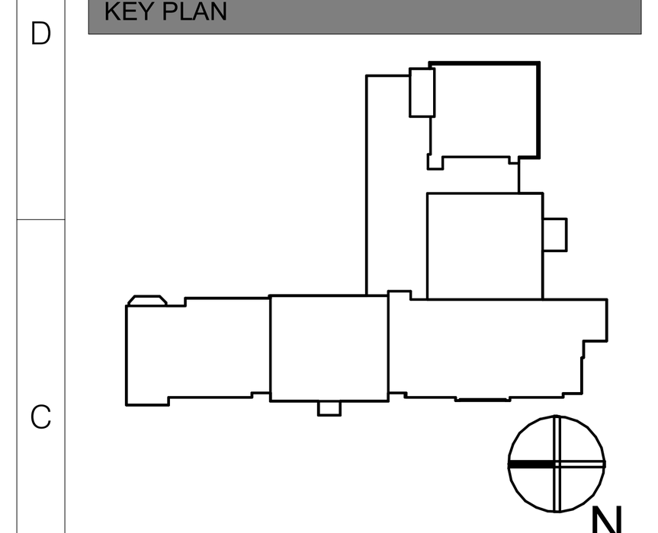
KEY PLAN



REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET
DATE: 06/21/2024
SCALE: 1/4" = 1'-0"
SHEET NAME:
LOWER LEVEL AND FIRST FLOOR HVAC PLANS
SHEET NUMBER:
HE-M104

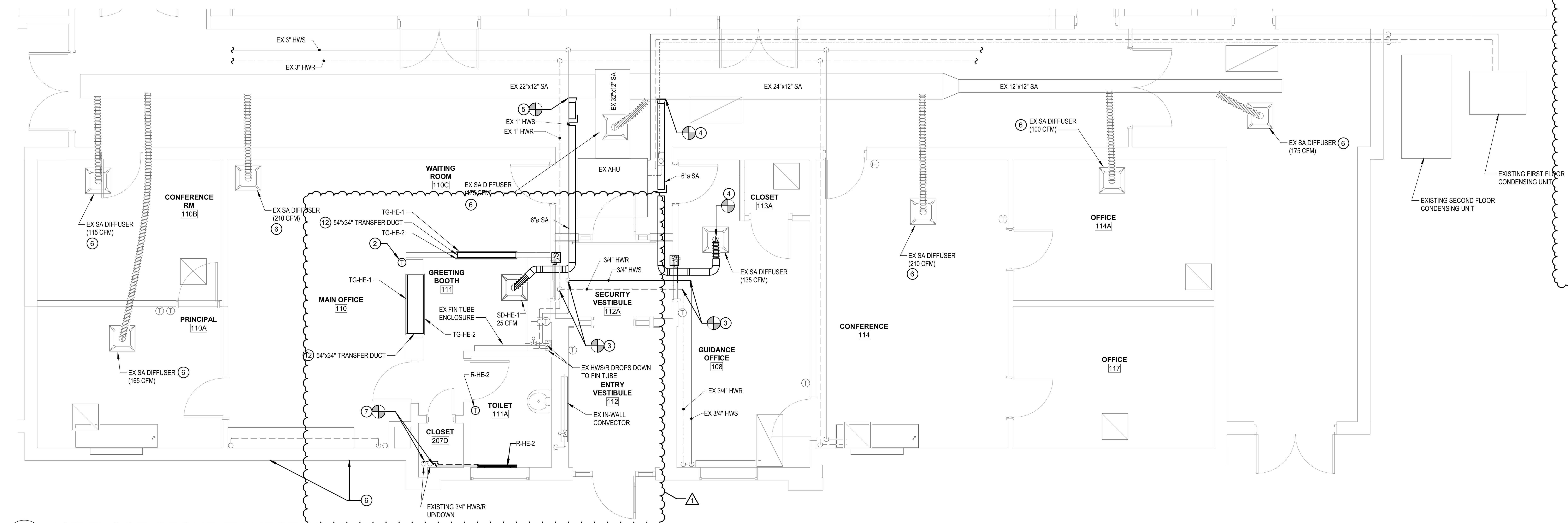
ISSUE FOR BID SET

2/4/2025 8:42:06 AM

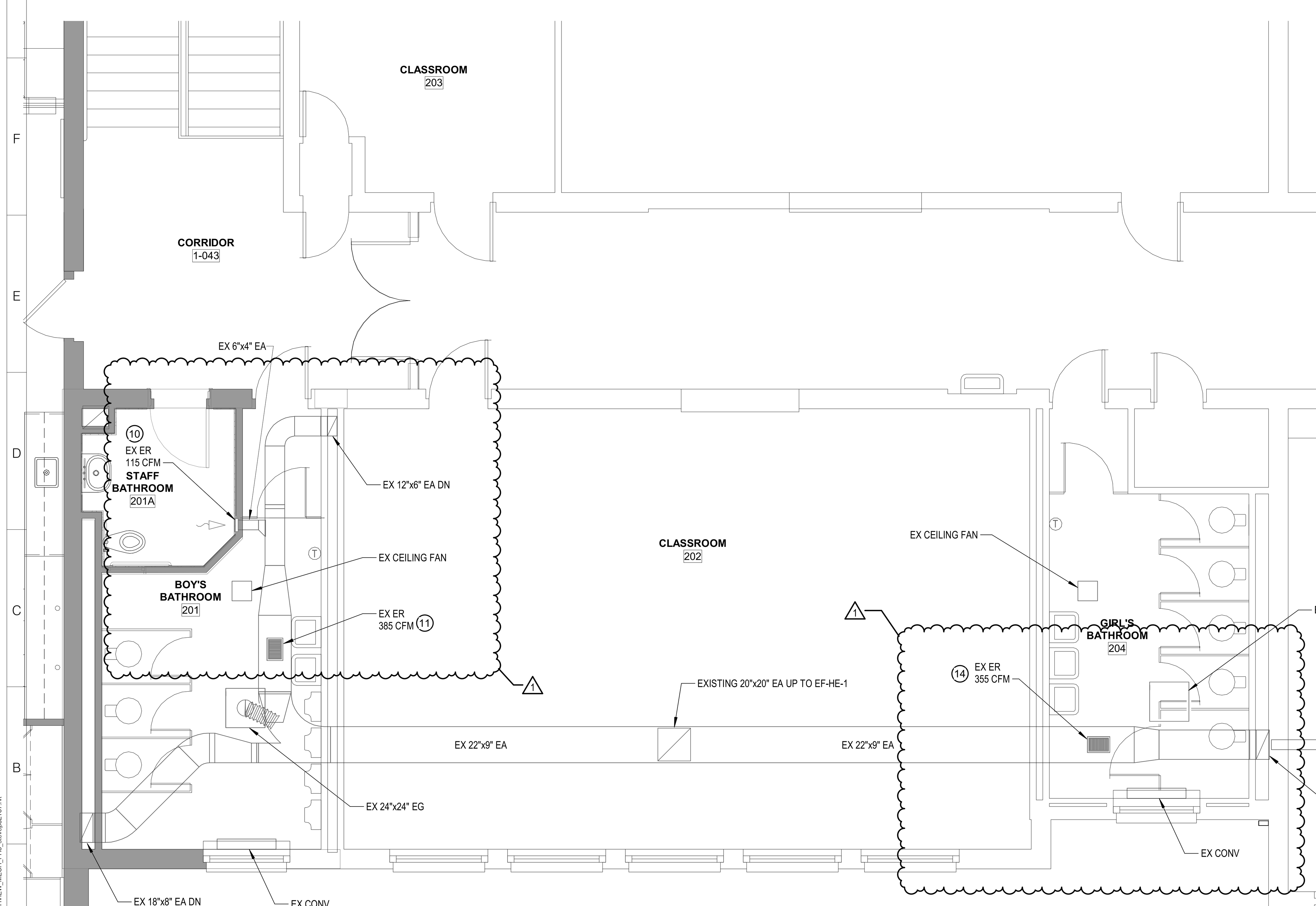
PROJECT NUMBER: 00000.00

KEYED NOTES:

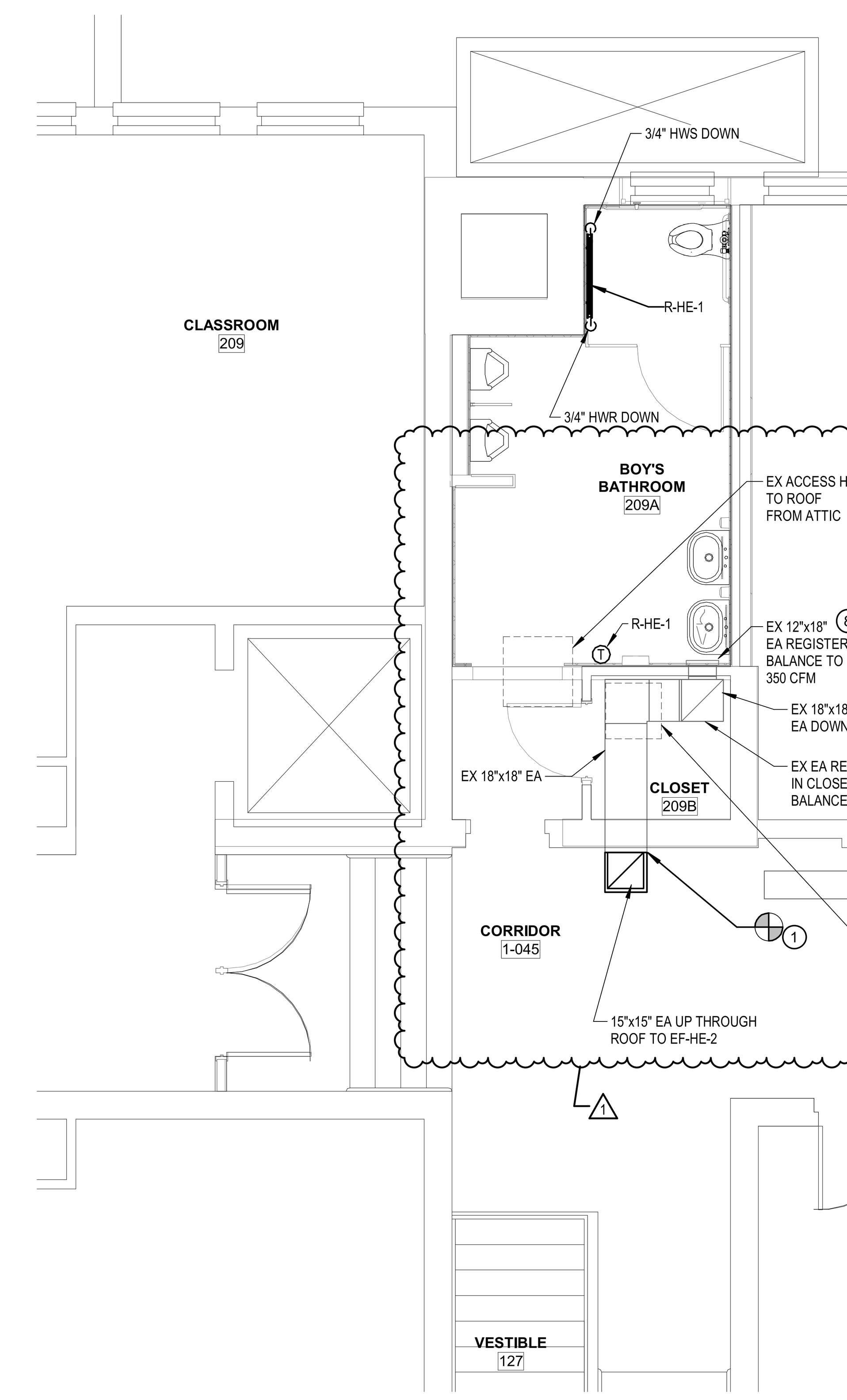
1. CONNECT TO EXISTING, HORIZONTAL 18"x18" EA DUCT LOCATED IN ATTIC SPACE ABOVE SECOND FLOOR AND EXTEND THE HORIZONTAL DUCT AS SHOWN, THEN PROVIDE A 15"x15" TAP OFF THE TOP OF THE HORIZONTAL 18"x18" EA DUCT AND ROUTE THE 15"x15" EA RISER UP THROUGH ROOF TO EF-HE-2.
2. REINSTALL SALVAGED TEMPERATURE SENSOR AT LOCATION SHOWN. EXTEND CONTROL WIRING FROM ORIGINAL SENSOR LOCATION TO REINSTALLED LOCATION.
3. CONNECT TO EXISTING 3/4" HWS/R PIPING BETWEEN CONNECTION POINTS SHOWN AND RECONNECT HWS/R PIPING FOLLOWING WALL INSTALLATION WORK.
4. CONNECT TO SA MAIN AT LOCATION SHOWN AND ROUTE 6" ROUND SA DUCTWORK AS SHOWN. PROVIDE FLEXIBLE DUCTWORK CONNECTION TO EXISTING SA DIFFUSER AND REBALANCE SUPPLY AIRFLOW THROUGH EXISTING, REUSED SA DIFFUSER TO AIRFLOW AMOUNT SHOWN WITH EXISTING AHU SUPPLY FAN OPERATING.
5. CONNECT TO SA MAIN AT LOCATION SHOWN AND ROUTE 6" ROUND SA DUCTWORK AS SHOWN. PROVIDE FLEXIBLE DUCTWORK CONNECTION TO SA DIFFUSER AND BALANCE SUPPLY AIRFLOW THROUGH SA DIFFUSER TO AIRFLOW AMOUNT SHOWN WITH EXISTING AHU SUPPLY FAN OPERATING.
6. UTILIZE THE TWO (2) EXISTING 4'-0" WIDE x 8'-0" HIGH HALF-OPENABLE WINDOWS FOR NATURAL VENTILATION, TOTAL OF 32 SQUARE FEET OPENABLE AREA, TO PROVIDE NATURAL VENTILATON TO MAIN OFFICE 110 AND GREETING BOOTH 111 PER NYS MECHANICAL CODE 402.1. ALSO, UTILIZE NYS MECHANICAL CODE PART 402.3, NATURAL VENTILATION TO ADJOINING SPACES, TO PROVIDE NATURAL VENTILATION TO THE GREETH BOOTH 111 UTILIZING THE TRANSFER DUCTS SHOWN BETWEEN THE OFFICE AND THE GREETING BOOTH.
7. CONNECT TO EXISTING, EXPOSED HWS/R RISERS WITHIN CLOSET 207D AT FLOOR LEVEL AND ROUTE 1/2" HWS/R PIPING TO RADIATOR R-HE-2 WITHIN TOILET 111A AS REQUIRED.
8. BALANCE AIRFLOW THROUGH EXISTING EA REGISTER LOCATED APPROXIMATELY 6" ABOVE FLOOR LEVEL TO 350 CFM WITH EF-HE-2 OPERATING AT SCHEDULED AIRFLOW RATE.
9. BALANCE AIRFLOW THROUGH EXISTING DUCT MOUNTED EA REGISTER TO 100 CFM WITH EF-HE-2 OPERATING AT SCHEDULED AIRFLOW RATE.
10. BALANCE AIRFLOW THROUGH EXISTING WALL MOUNTED EA REGISTER LEVEL TO 115 CFM WITH EF-HE-1 OPERATING AT SCHEDULED AIRFLOW RATE.
11. BALANCE AIRFLOW THROUGH EXISTING CEILING MOUNTED EA REGISTER LEVEL TO 385 CFM WITH EF-HE-1 OPERATING AT SCHEDULED AIRFLOW RATE.
12. MOUNT TRANSFER DUCT AND ASSOCIATED TRANSFER REGISTERS APPROXIMATELY 6'-6" FROM FINISHED FLOOR LEVEL TO BOTTOM OF TRANSFER DUCT.
13. BALANCE AIRFLOW THROUGH EXISTING WALL MOUNTED EA REGISTER LEVEL TO 75 CFM WITH EF-HE-1 OPERATING AT SCHEDULED AIRFLOW RATE.
14. BALANCE AIRFLOW THROUGH EXISTING CEILING MOUNTED EA REGISTER LEVEL TO 355 CFM WITH EF-HE-1 OPERATING AT SCHEDULED AIRFLOW RATE.



H1 1ST FLOOR SECURITY VESTIBULE PLAN
1/4" = 1'-0"



A18 2ND FLOOR NORTH TOILET ROOMS INSTALLATION PLAN
1/4" = 1'-0"



A6 2ND FLOOR CENTER TOILET ROOM INSTALLATION PLAN
1/4" = 1'-0"

ARCHITECT

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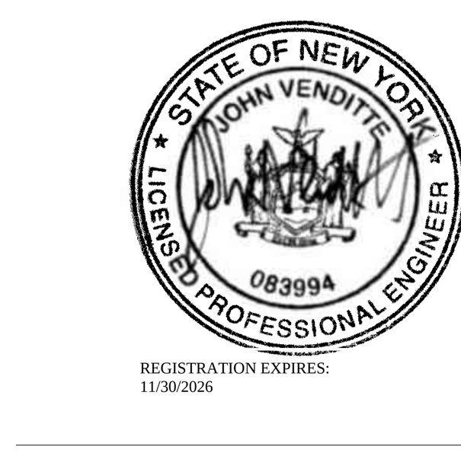

NUFSD BOND PROJECT PHASE 5 - HIGHVIEW

- ■ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- ☐ SED#50-01-08-03-7-007-002 (Maintenance)
- ☐ SED#50-01-08-03-7-012-004 (OEC)
- ☐ SED#50-01-08-03-0-001-026 (MILLER ES)
- ☐ SED#50-01-08-03-0-004-022 (BARR MS)

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Miller Elementary School
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A MacArthur Barr Middle School
143 Church St
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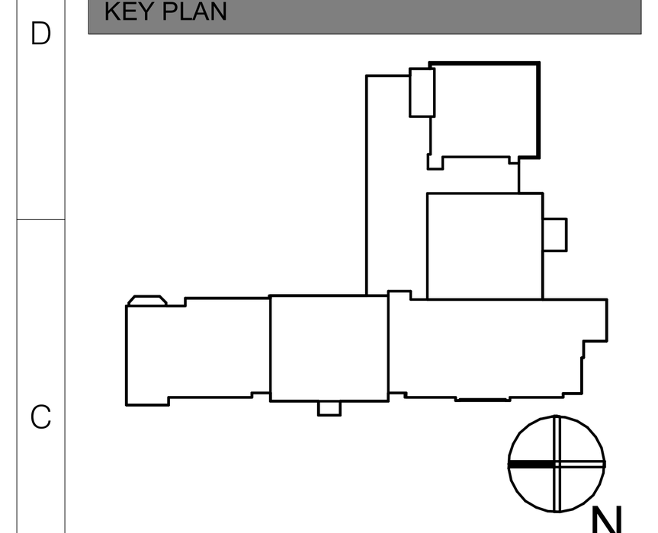
KEY PLAN



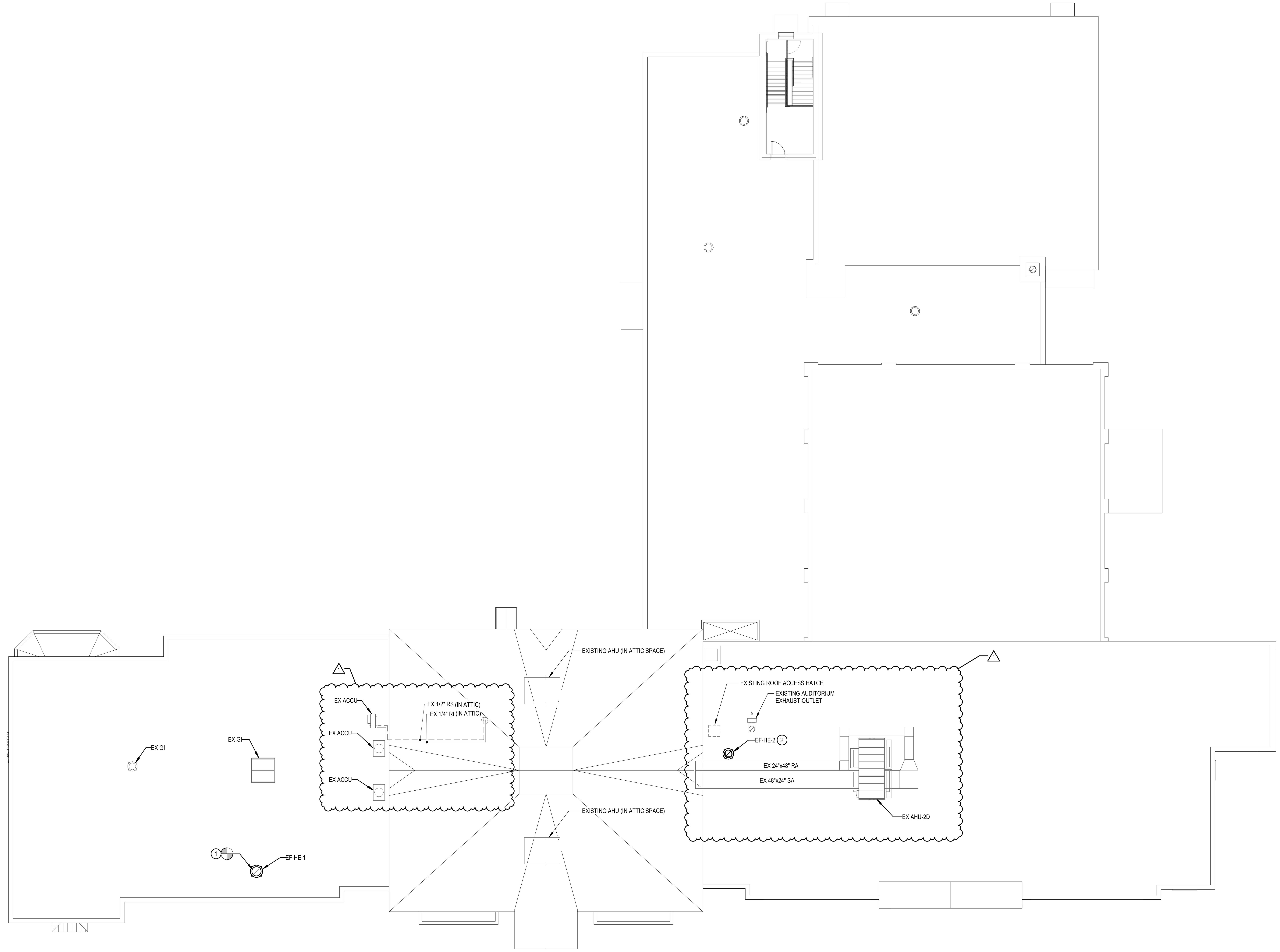
REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET
DATE: 06/21/2024
SCALE: 1/4" = 1'-0"
SHEET NAME: 1ST FLOOR VESTIBULE, 2ND FLOOR, AND ATTIC LEVEL HVAC PLANS
SHEET NUMBER: HE-M105

ISSUE FOR BID SET

PROJECT NUMBER: 00000.00



KEYED NOTES:

1. PROVIDE EXHAUST FAN AND ROOF CURB ADAPTER AT LOCATION OF REMOVED EXHAUST FAN AS SHOWN. USE THE EXISTING DUCT PENETRATION THROUGH ROOF. EXTEND EXISTING EXHAUST AIR DUCT RISER UP TO ROOF FAN DUCT CONNECTION AS REQUIRED FROM TEMPORARY CAP. PROVIDE MOTORIZED DAMPER WITHIN RISER UP TO FAN CONNECTION. PROVIDE ROOF CURB ADAPTER ON TOP OF EXISTING ROOF CURB.
2. PROVIDE NEW, ROOFTOP EXHAUST FAN WITH ASSOCIATED ROOF CURB, MOTORIZED DAMPER AND CONTROL WIRING AT LOCATION REMOVED 18" ROUND EA VERTICAL DUCT PENETRATION THROUGH ROOF.

1

A17 HVAC ROOF PLAN
3/32" = 1'-0"

ARCHITECT

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- ☐ SED#50-01-08-03-7-007-002 (Maintenance)
- ☐ SED#50-01-08-03-7-012-004 (OEC)
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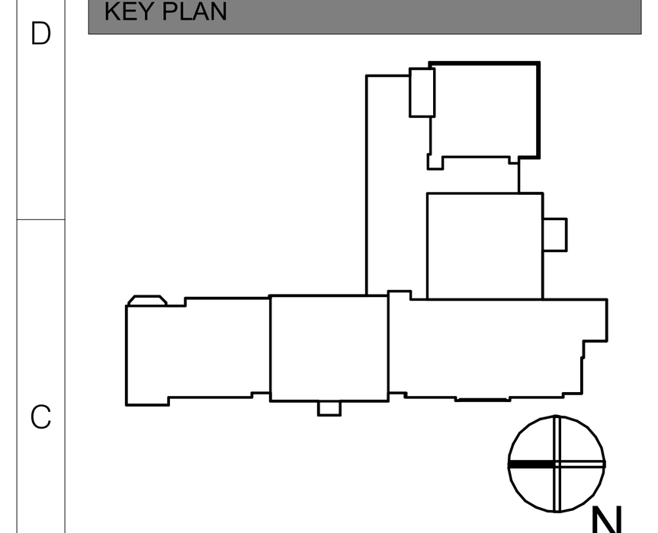
KEY PLAN



REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

SCALE: 3/32" = 1'-0"

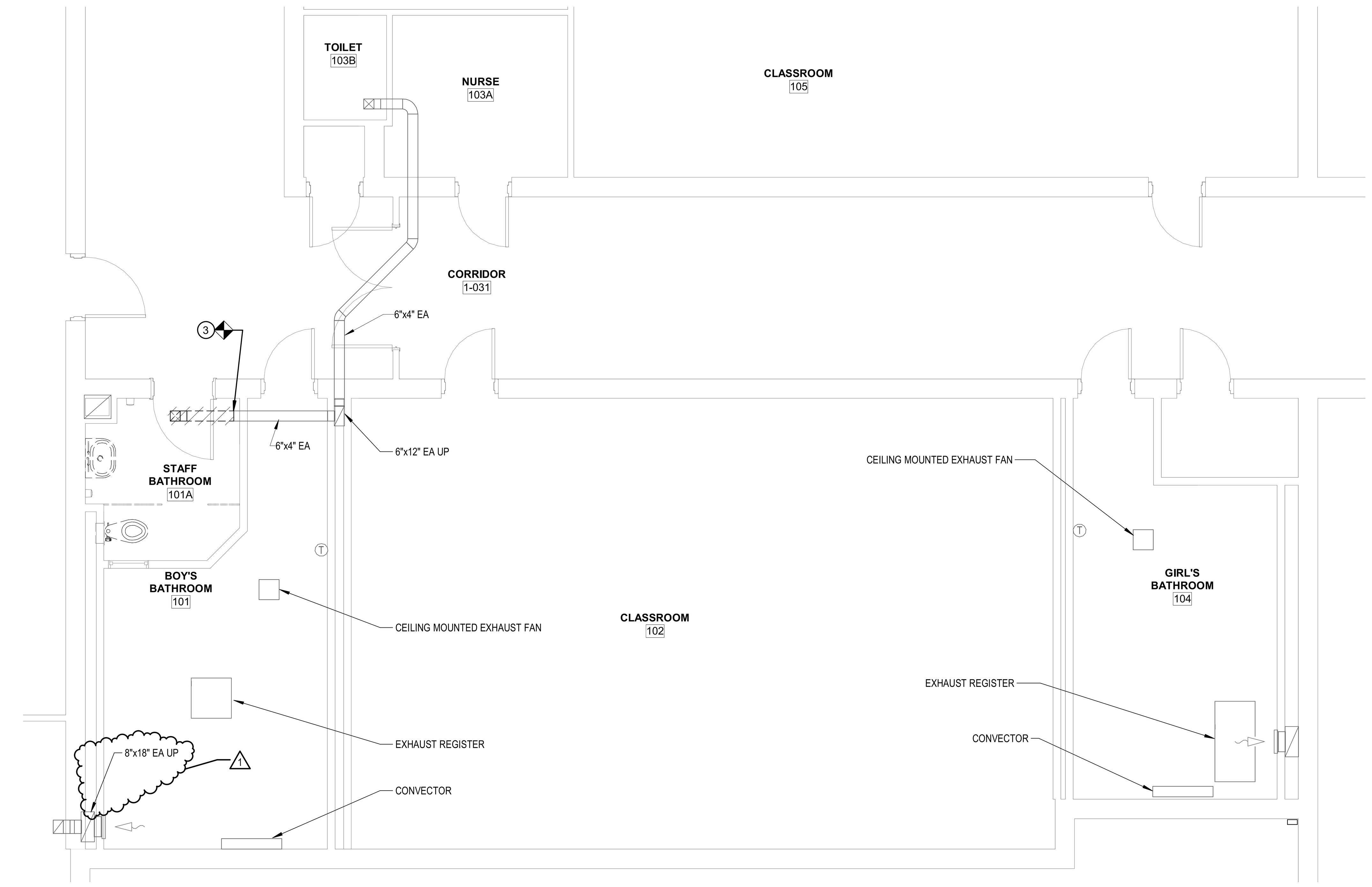
SHEET NAME:
HVAC ROOF PLAN

SHEET NUMBER:
HE-M106

ISSUE FOR BID SET

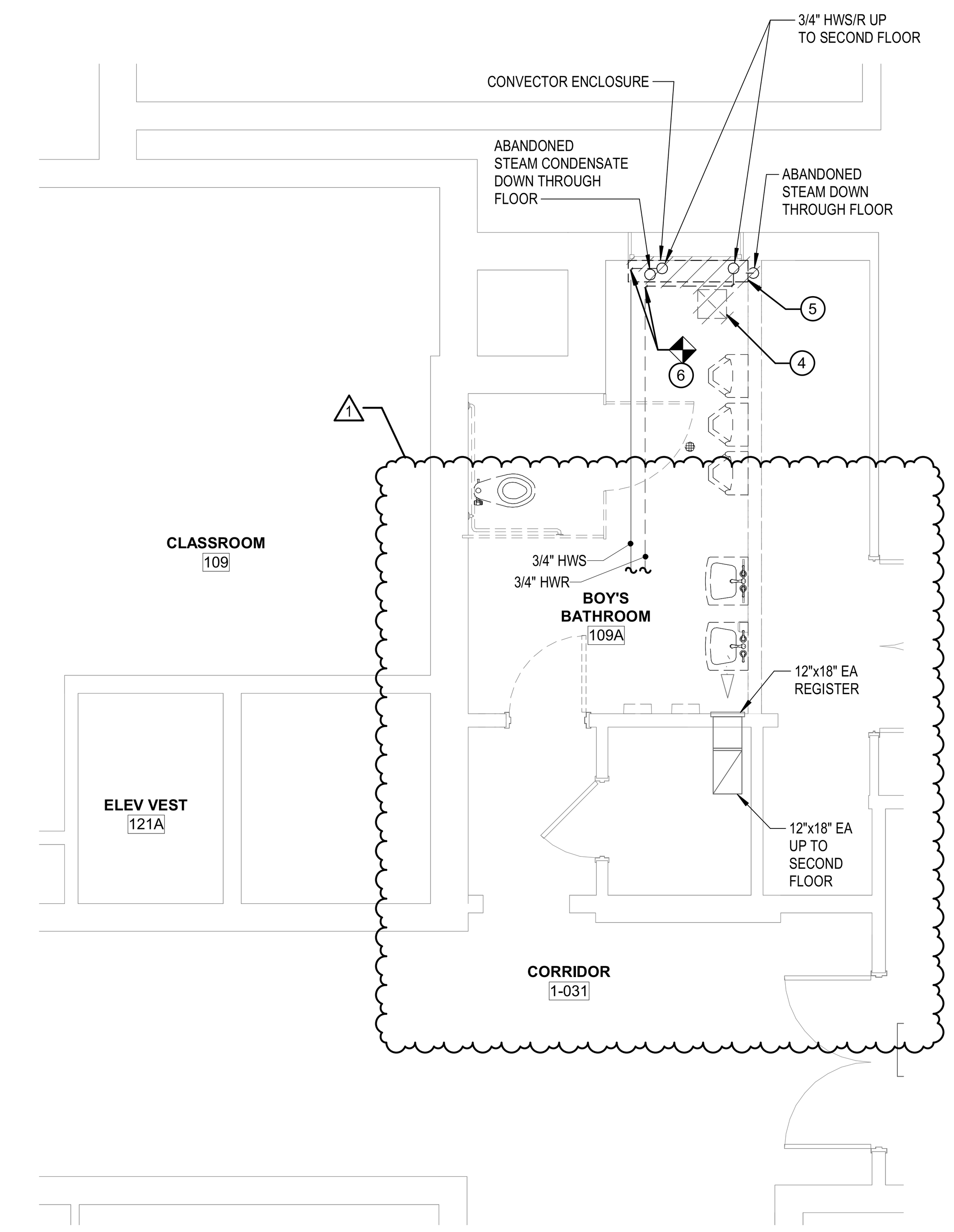
PROJECT NUMBER: 00000.00

2/4/2025 8:42:09 AM



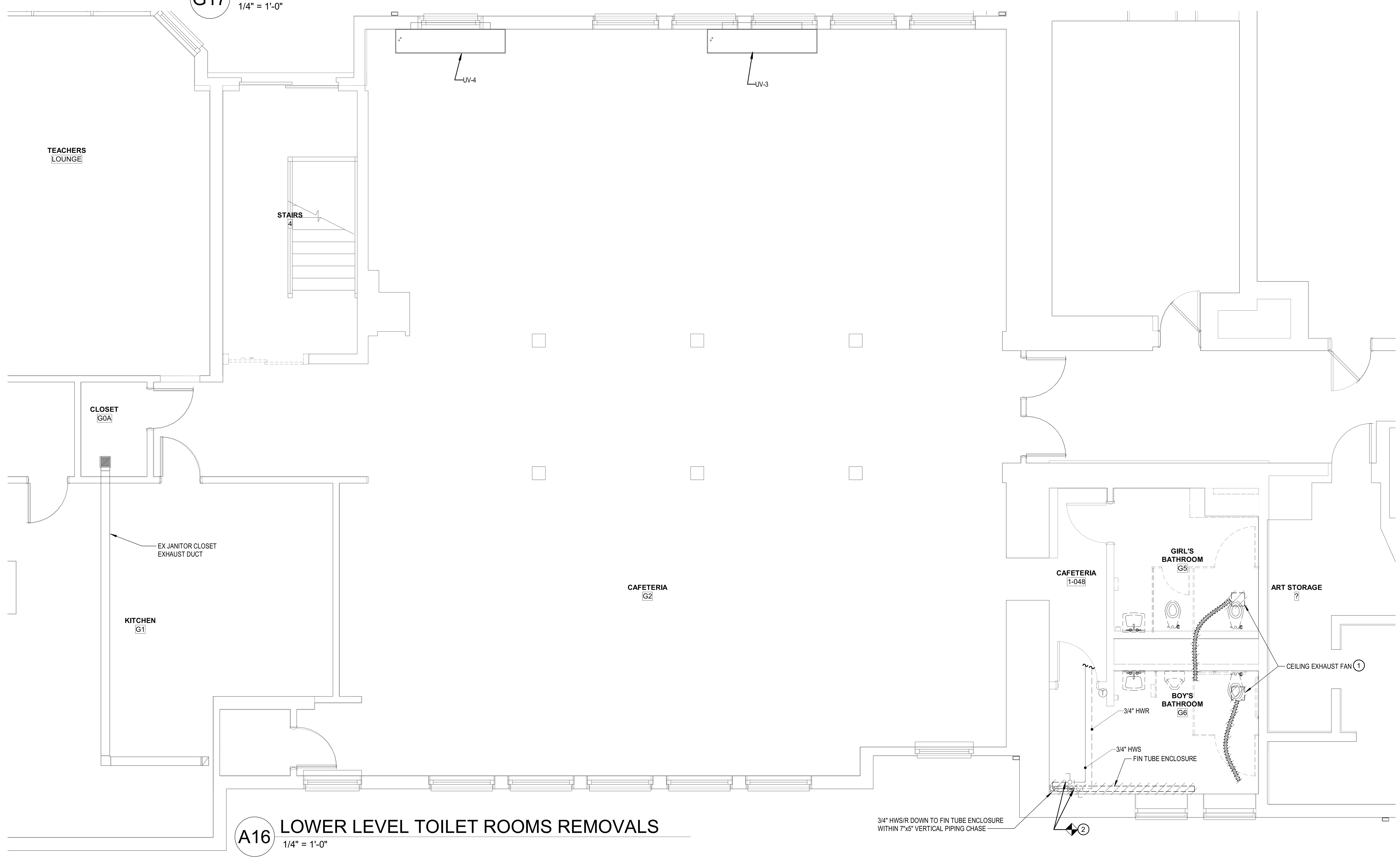
G17 1ST FLOOR NORTH TOILET ROOMS REMOVALS

1/4" = 1'-0"



J5 1ST FLOOR CENTER TOILET ROOM REMOVALS

1/4" = 1'-0"



A16 LOWER LEVEL TOILET ROOMS REMOVALS

1/4" = 1'-0"

KEYED NOTES:

1. DISCONNECT AND REMOVE CEILING EXHAUST FANS INCLUDING ASSOCIATED 4" ROUND FLEXIBLE DUCTWORK TERMINATED OPEN-ENDED ABOVE TOILET ROOM CEILING.
2. DISCONNECT AND REMOVE 3/4" HWS/R DROPS DOWN TO FIN TUBE RADIATION BACK TO SHUT-OFF VALVES AT DISCONNECTION POINTS SHOWN. DISCONNECT AND REMOVE ASSOCIATED VERTICAL PIPING ENCLOSURE, HORIZONTAL FIN TUBE ENCLOSURE, AND 2-WAY CONTROL VALVE. MAINTAIN SPACE TEMPERATURE SENSOR AT LOCATION SHOWN FOR REUSE.
3. DISCONNECT AND REMOVE EA DUCTWORK AND ASSOCIATED SURFACE MOUNTED EA REGISTER BACK TO DISCONNECTION POINT SHOWN.
4. DISCONNECT AND REMOVE UN-DUCTED CEILING MOUNTED REGISTER OPEN TO CEILING PLENUM.
5. DISCONNECT AND REMOVE ABANDONED FLOOR MOUNTED ENCLOSURE AND ASSOCIATED, ABANDONED STEAM CONDENSATE PIPING DOWN THROUGH FLOOR TO BOILER ROOM BELOW AND ABANDONED STEAM PIPING ROUTED THROUGH TOILET ROOM WALL, THEN DOWN THROUGH FLOOR TO BOILER ROOM BELOW.
6. DISCONNECT AND REMOVE 3/4" HWS/R PIPING BACK TO DISCONNECTION POINTS SHOWN INCLUDING ASSOCIATED HWS/R RISERS UP TO REMOVED CONVECTOR ON SECOND FLOOR.

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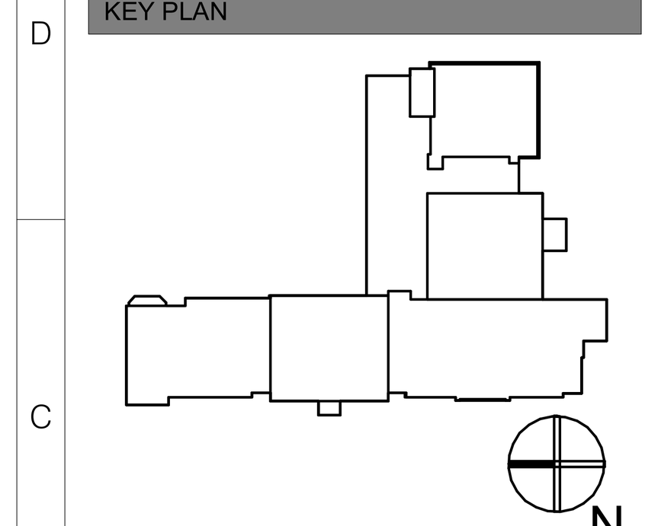
KEY PLAN



REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

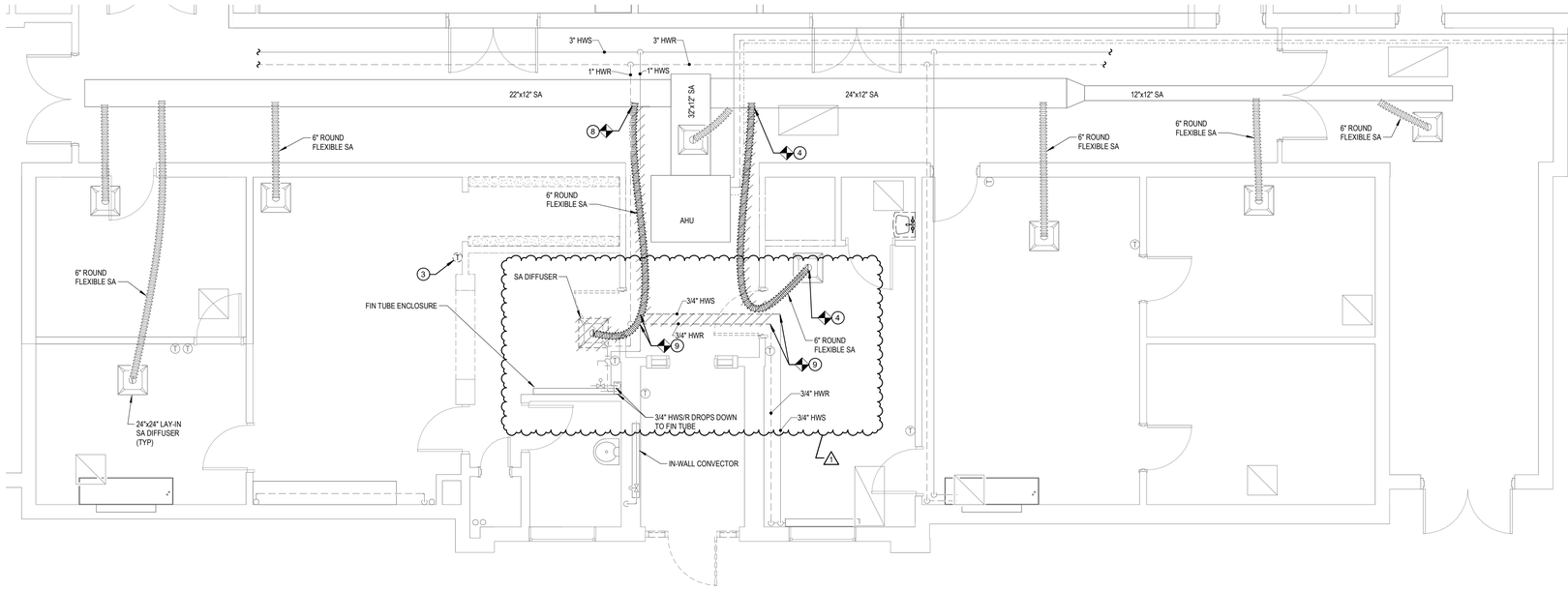
DATE: 06/21/2024

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

SHEET NAME: LOWER LEVEL AND FIRST FLOOR HVAC REMOVALS

SHEET NUMBER: HE-MR101

ISSUE FOR BID SET

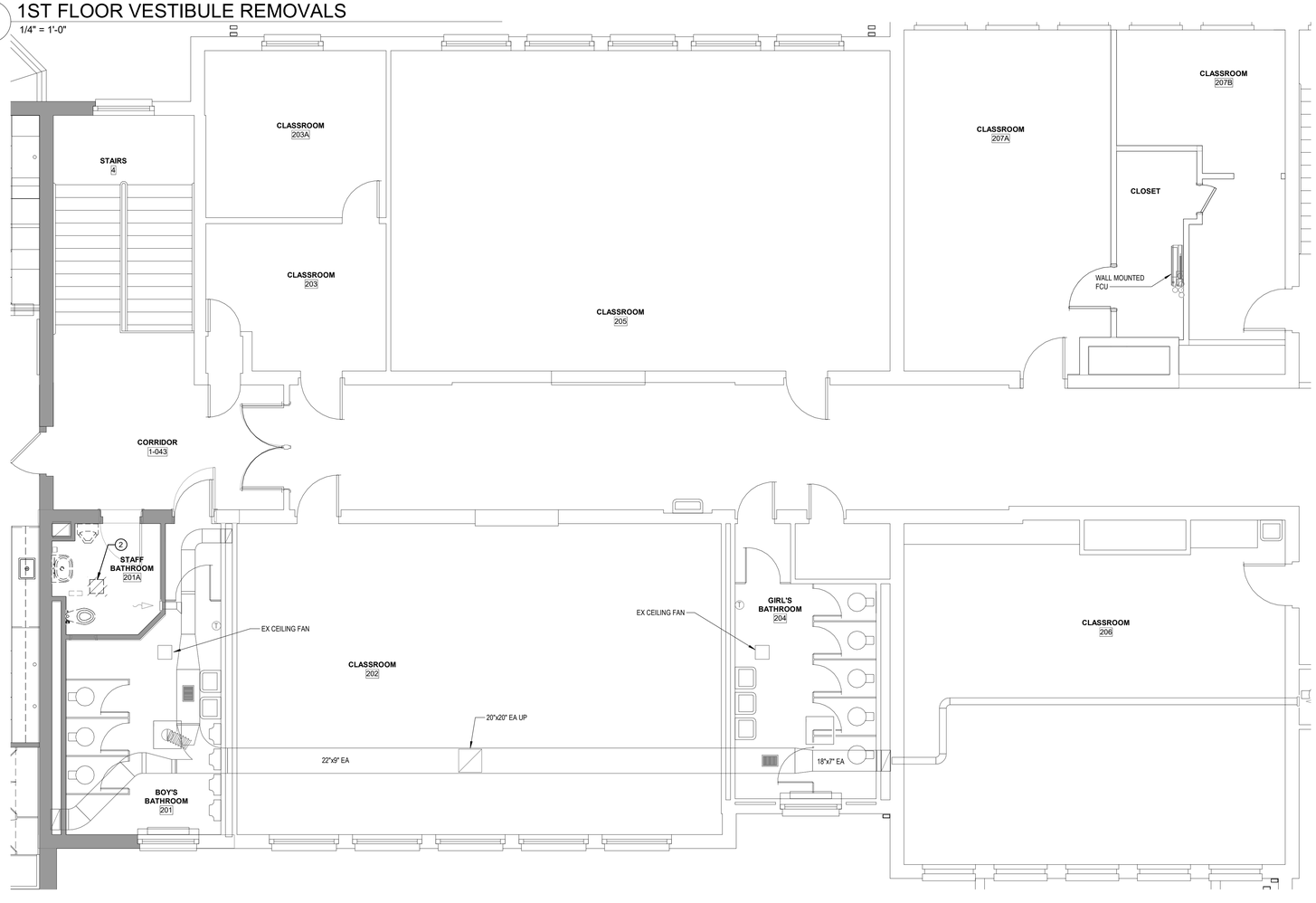


KEYED NOTES:

1. DISCONNECT AND REMOVE UTILITY EXHAUST FAN LOCATED WITHIN ATTIC ABOVE SECOND FLOOR. DISCONNECT AND REMOVE EA INLET DUCTWORK AT DISCONNECTION POINT. DISCONNECT AND REMOVE EA OUTLET DUCTWORK UP THROUGH ROOF PENETRATION.
2. DISCONNECT AND REMOVE CEILING MOUNTED EXHAUST FAN INCLUDING ASSOCIATED EA DUCTWORK ABOVE CEILING.
3. DISCONNECT, REMOVE, AND SALVAGE TEMPERATURE SENSOR AT LOCATION TO ACCOMMODATE ARCHITECTURAL RENOVATIONS. REFER TO INSTALLATION PLAN FOR RELOCATION.
4. DISCONNECT AND REMOVE FLEXIBLE DUCTWORK BETWEEN CONNECTION POINTS SHOWN. CAP DUCTWORK AT SA MAIN AND REMOVE FLEXIBLE DUCTWORK CONNECTED TO SA DIFFUSER. MAINTAIN SA DIFFUSER AT LOCATION SHOWN FOR REUSE.
5. DISCONNECT AND REMOVE CEILING EXHAUST AIR REGISTER INCLUDING ASSOCIATED FLEXIBLE DUCTWORK TO DISCONNECTION POINT SHOWN ON THE 12"x12" EA MAIN WITHIN THE CEILING OF CORRIDOR 1-045.
6. DISCONNECT AND REMOVE UN-DUCTED CEILING EA REGISTER OPEN TO CEILING PLENUM ABOVE CEILING SYSTEM.
7. DISCONNECT AND REMOVE CONVECTOR ELEMENT, CONVECTOR ENCLOSURE, HWS/R PIPING DOWN TO FIRST FLOOR CEILING AND ASSOCIATED TEMPERATURE SENSOR. DISCONNECT AND REMOVE CONTROL WIRING.
8. DISCONNECT AND REMOVE FLEXIBLE DUCTWORK BACK TO DISCONNECTION POINT SHOWN ON THE SA MAIN AND CAP. DISCONNECT AND REMOVE ASSOCIATED SA DIFFUSER.
9. DISCONNECT AND REMOVE 3/4" HWS/R PIPING BETWEEN DISCONNECTION POINTS TO ACCOMMODATE WALL REMOVAL WORK.

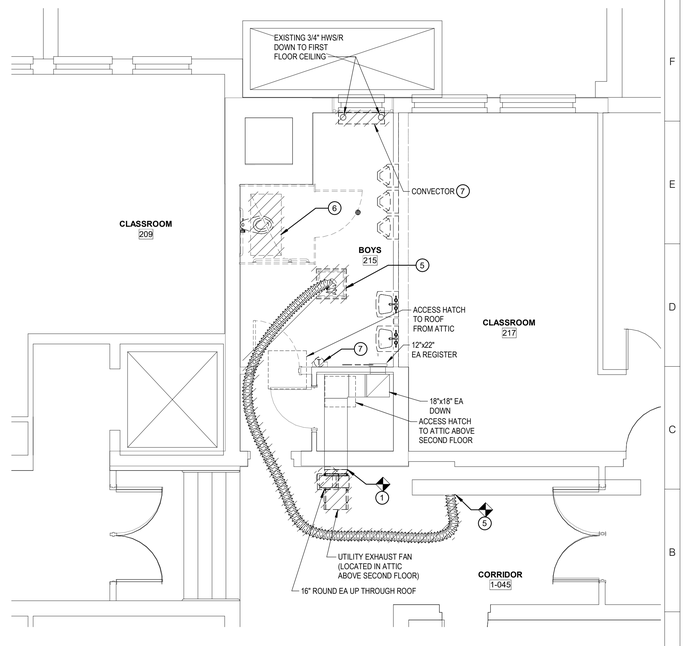
J1 1ST FLOOR VESTIBULE REMOVALS

1/4" = 1'-0"



A18 2ND FLOOR NORTH TOILET ROOMS REMOVALS

1/4" = 1'-0"



A6 2ND FLOOR CENTER TOILET ROOM REMOVALS

1/4" = 1'-0"

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NUFSD BOND PROJECT PHASE 5 - HIGHVIEW

- ■ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- □ SED#50-01-08-03-7-007-002 (Maintenance)
- □ SED#50-01-08-03-7-012-004 (OEC)
- □ SED#50-01-08-03-0-001-026 (MILLER ES)
- □ SED#50-01-08-03-0-004-022 (BARR MS)

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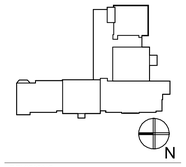
KEY PLAN



REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

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

SHEET NAME:
1ST FLOOR VESTIBULE, 2NDFLOOR, AND ATTIC HVAC REMOVALS

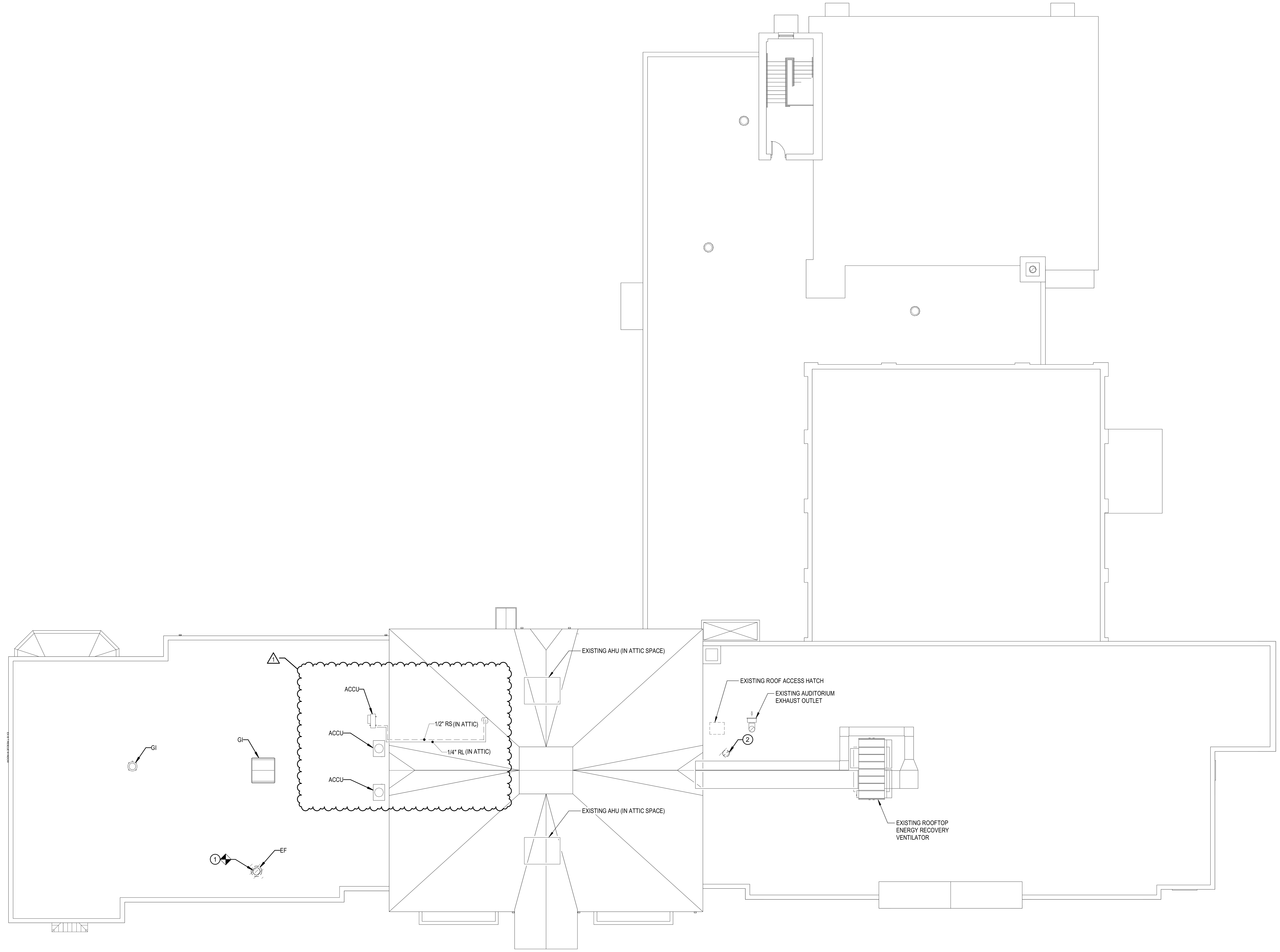
SHEET NUMBER:

HE-MR102

ISSUE FOR BID SET

KEYED NOTES:

1. DISCONNECT AND REMOVE EXHAUST FAN, INCLUDING ASSOCIATED MOTORIZED DAMPER AND ALL ASSOCIATED CONTROL WIRING. FAN ROOF CURB TO REMAIN IN PLACE. DISCONNECT EXHAUST AIR DUCT RISER FROM EXHAUST FAN WITHIN ROOF CURB AND PROVIDE TEMPORARY CAP OVER THE EXHAUST AIR DUCT RISER.
2. DISCONNECT AND REMOVE 16" ROUND EA ROOF PENETRATION AND ASSOCIATED TERMINATION CAP.



A17 HVAC ROOF REMOVALS
3/32" = 1'-0"

ARCHITECT

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- ☐ SED#50-01-08-03-7-012-004 (OEC)
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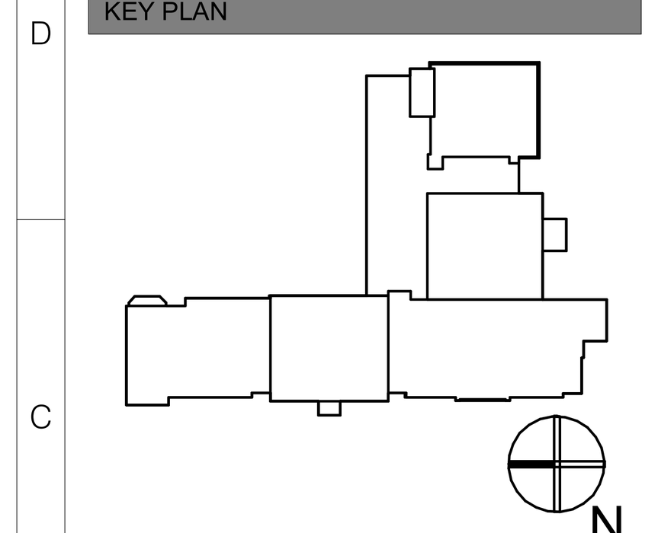
KEY PLAN



REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

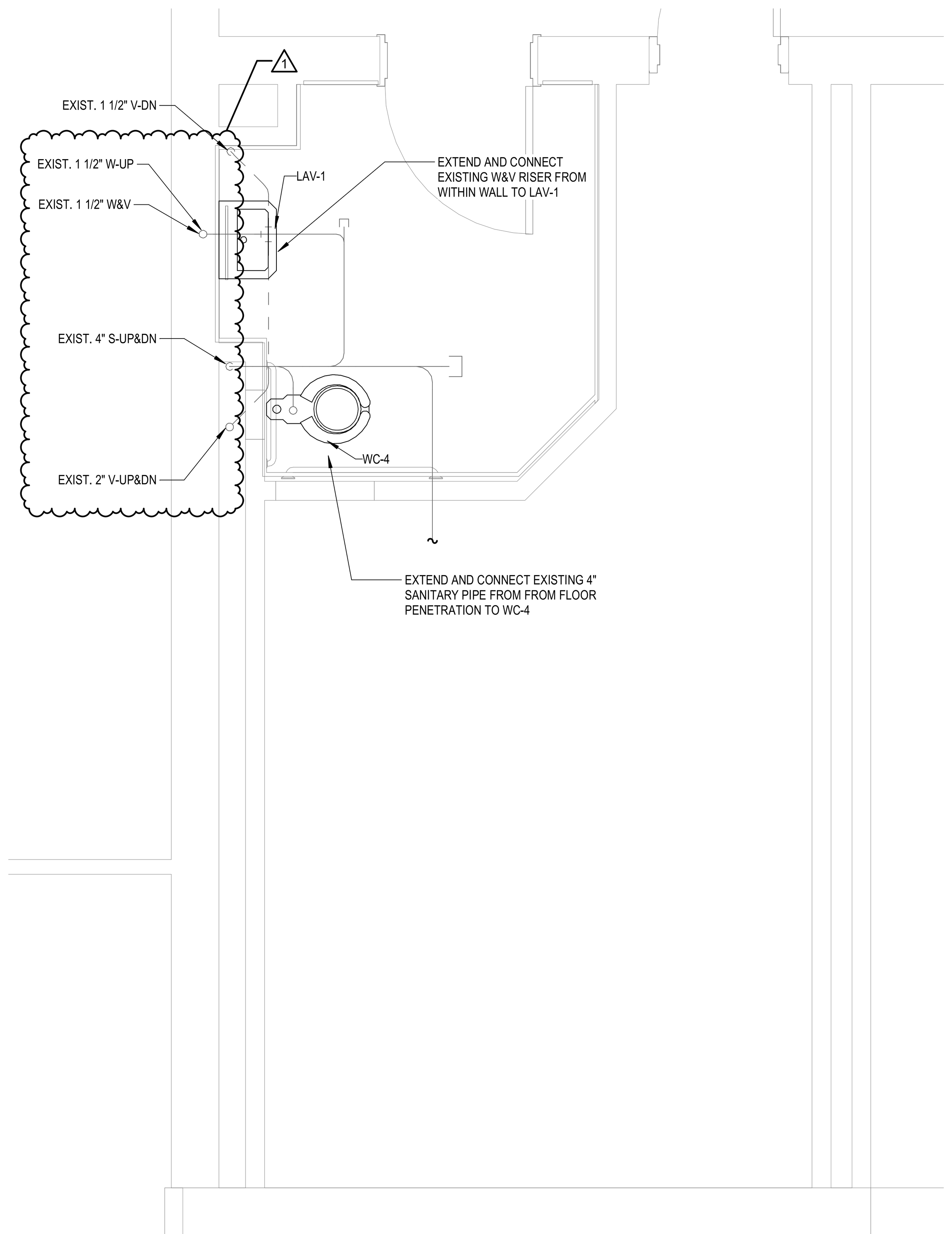
DATE: 06/21/2024

SCALE: 3/32" = 1'-0"

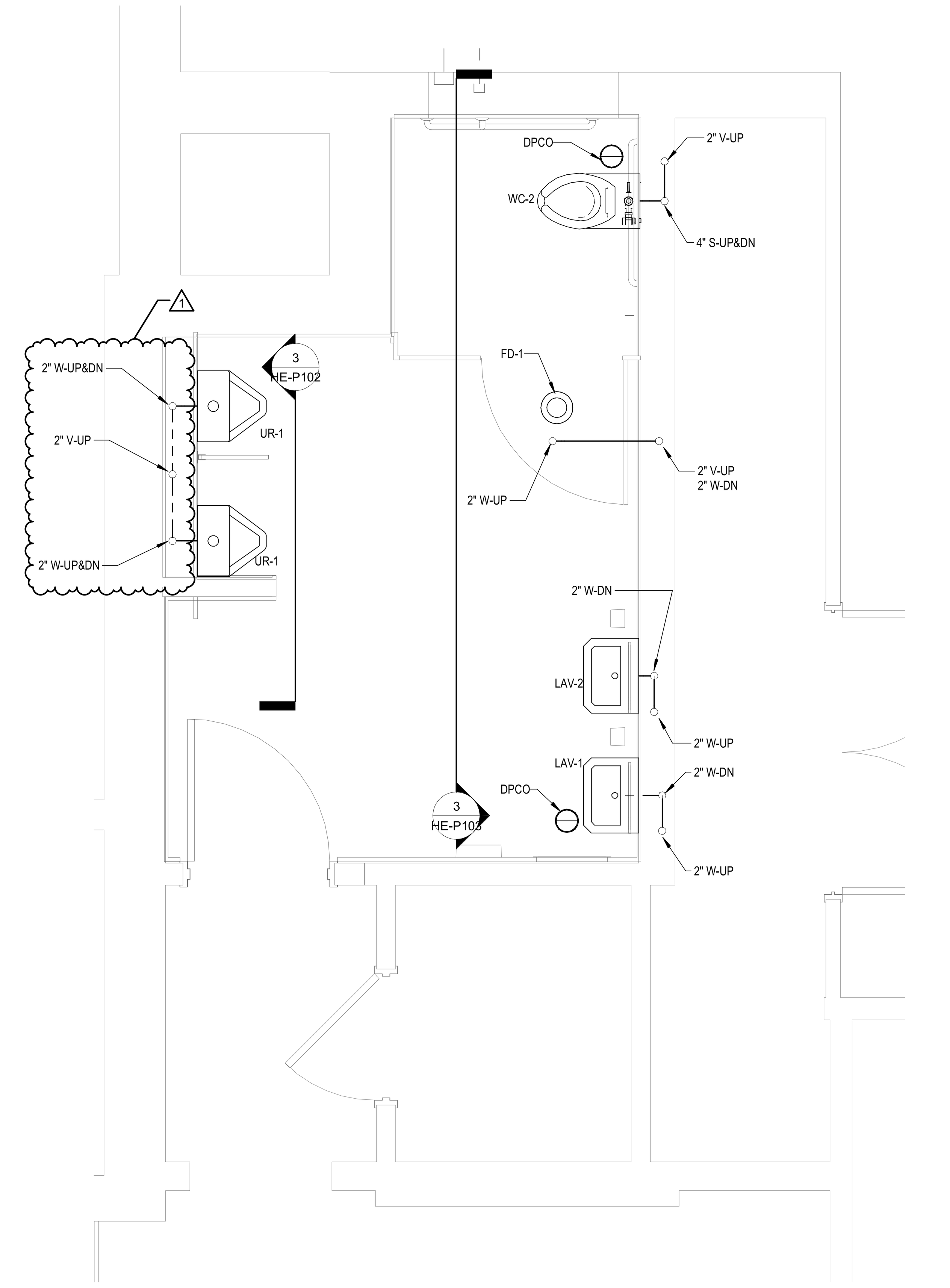
SHEET NAME:
HVAC ROOF REMOVALS

SHEET NUMBER:
HE-MR103

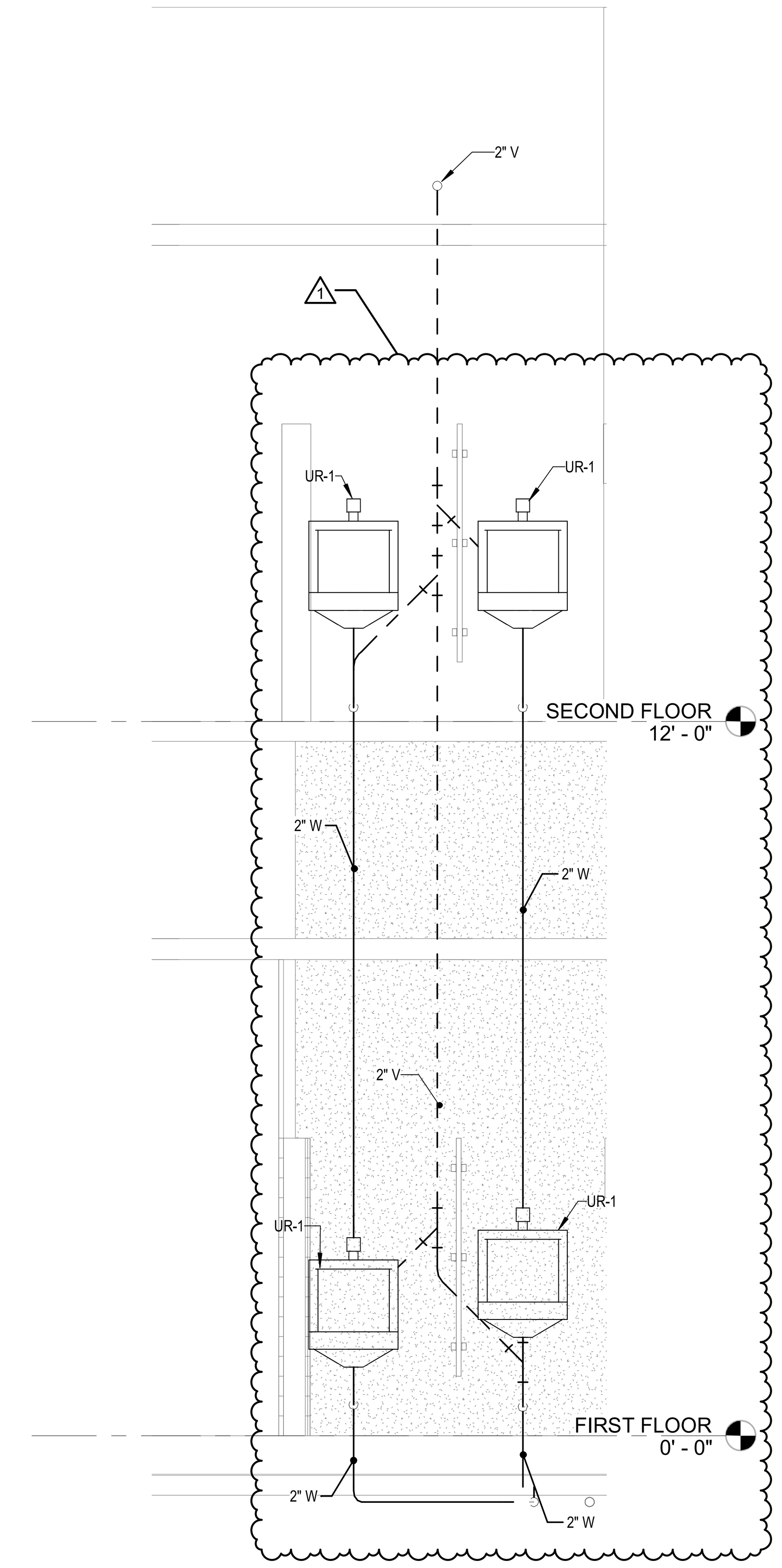
ISSUE FOR BID SET



1 FIRST FLOOR TEACHER'S BATHROOM SANITARY AND VENT INSTALLATION PLAN
1/2" = 1'-0"



2 FIRST FLOOR BOYS BATHROOM SANITARY AND VENT INSTALLATION PLAN
1/2" = 1'-0"



3 SANITARY AND VENT SECTION AT BOYS BATHROOM URINALS
1/2" = 1'-0"

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KEY PLAN

N

REVISIONS

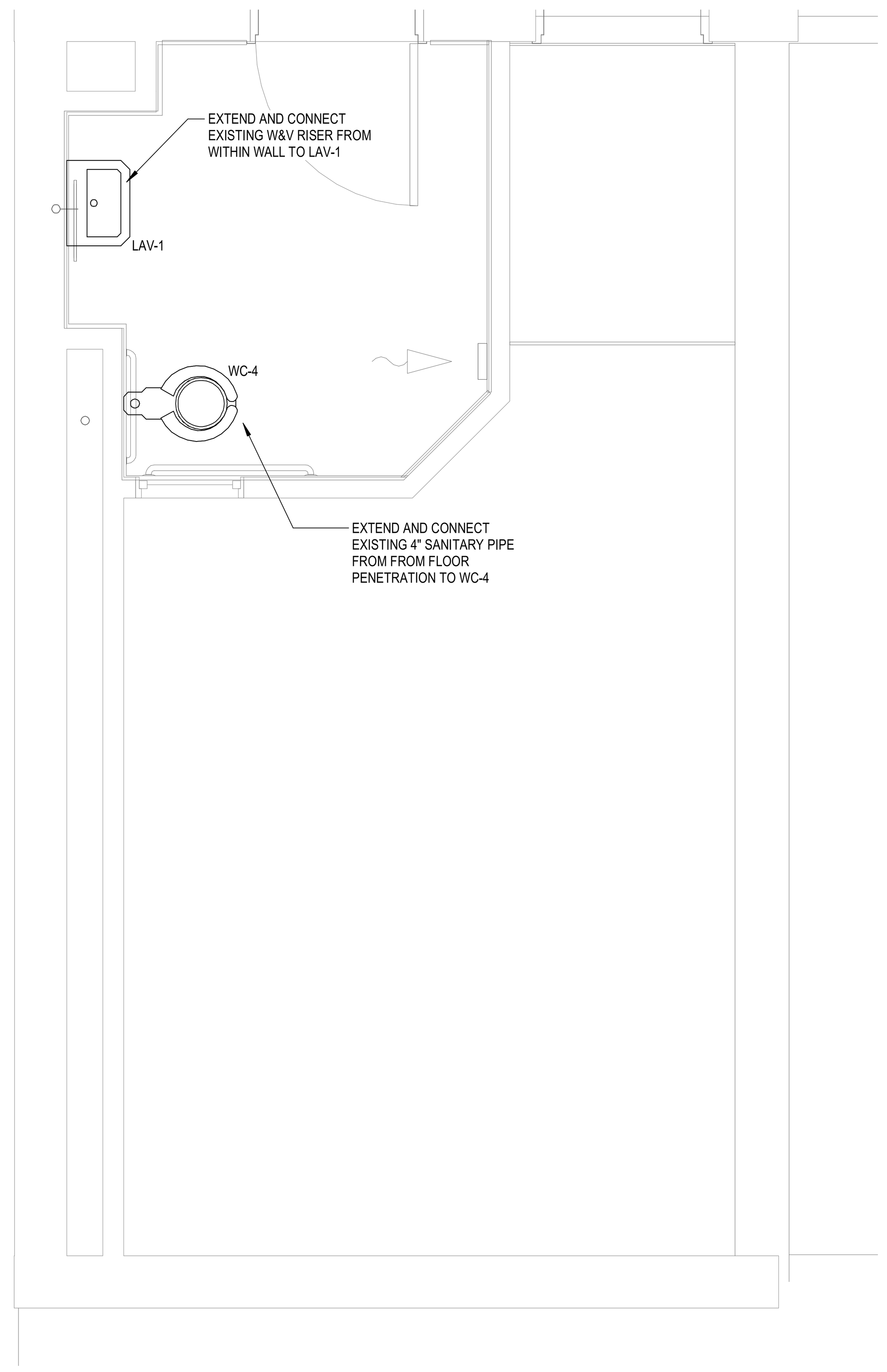
No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET
DATE: 06/21/2024
SCALE: 1/2" = 1'-0"
SHEET NAME:
FIRST FLOOR SANITARY AND VENT INSTALLATION PLAN
SHEET NUMBER:
HE-P102

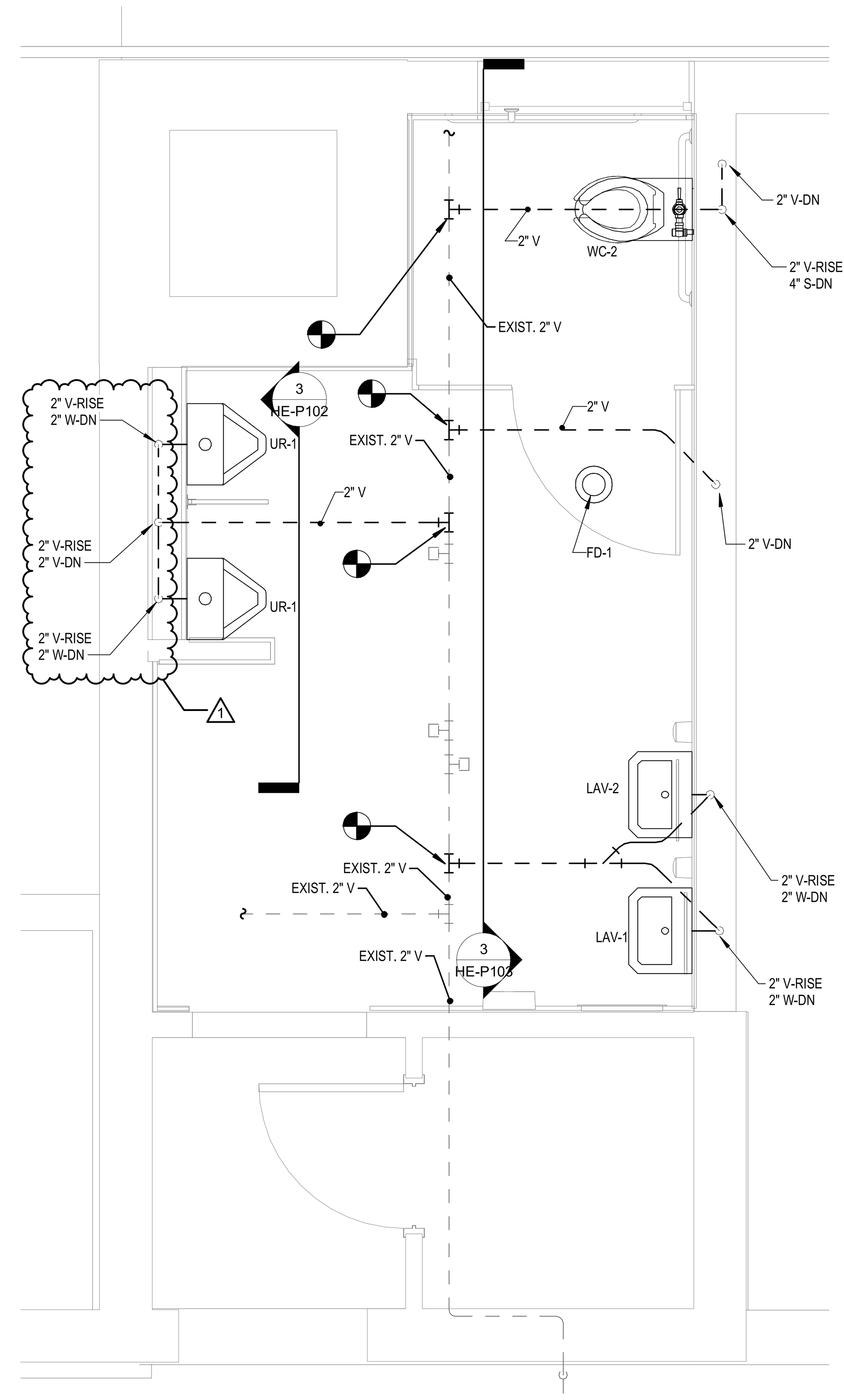
ISSUE FOR BID SET

2/4/2025 9:19:12 AM

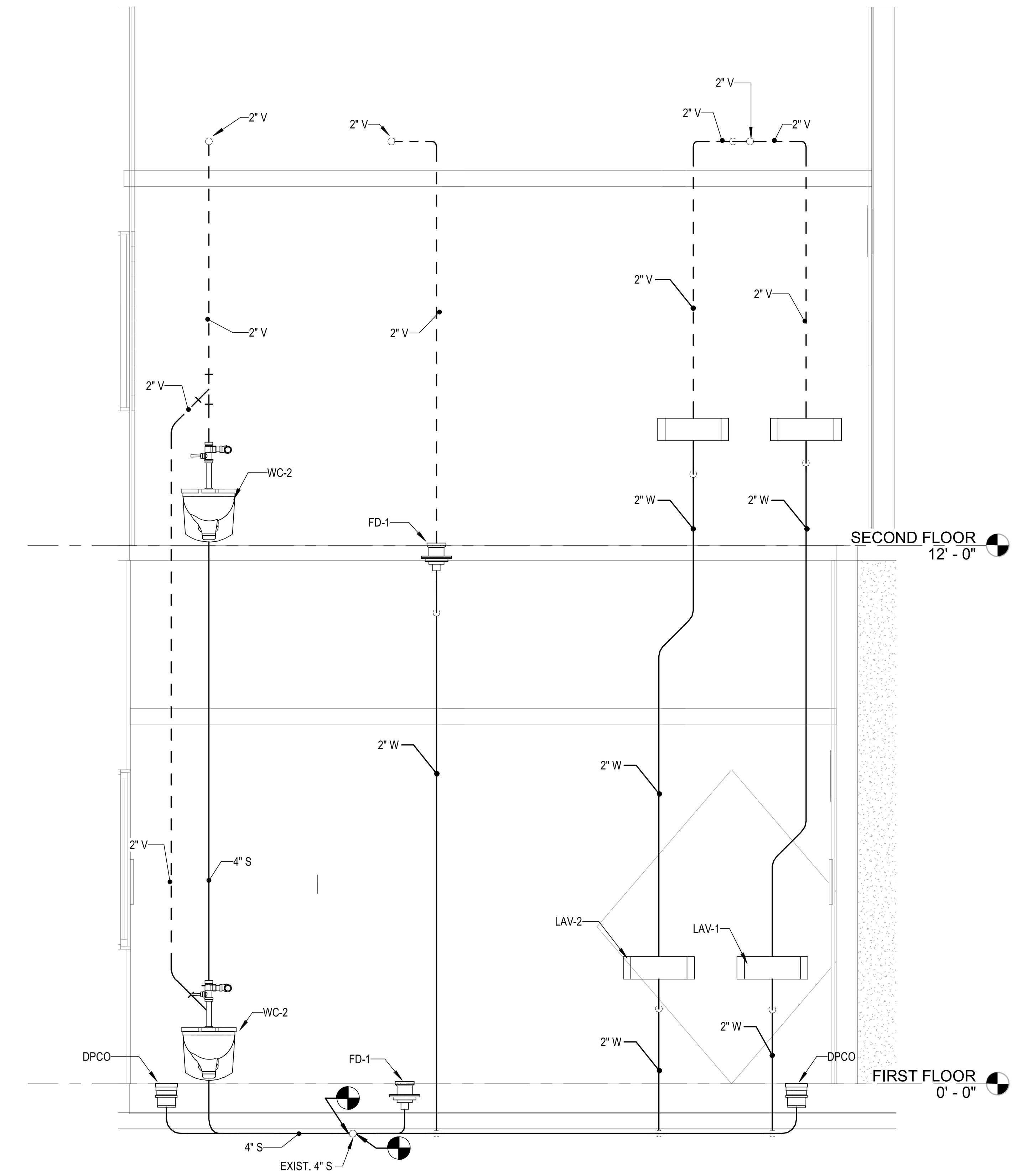
PROJECT NUMBER: 00000.00



1 SECOND FLOOR TEACHER'S BATHROOM SANITARY AND VENT INSTALLATION PLAN
1/2" = 1'-0"



2 SECOND FLOOR BATHROOM SANITARY AND VENT INSTALLATION PLAN
1/2" = 1'-0"



3 SANITARY AND VENT SECTION AT BOYS BATHROOM WATER CLOSETS AND LAVS
1/2" = 1'-0"

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NUFSD BOND PROJECT PHASE 5 - HIGHVIEW

- ■ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- ☐ SED#50-01-08-03-7-007-002 (Maintenance)
- ☐ SED#50-01-08-03-7-012-004 (OEC)
- ☐ SED#50-01-08-03-0-001-026 (MILLER ES)
- ☐ SED#50-01-08-03-0-004-022 (BARR MS)

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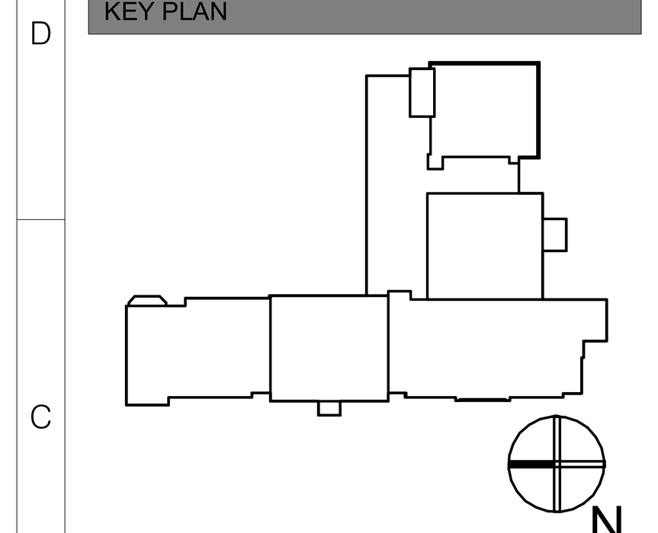
KEY PLAN



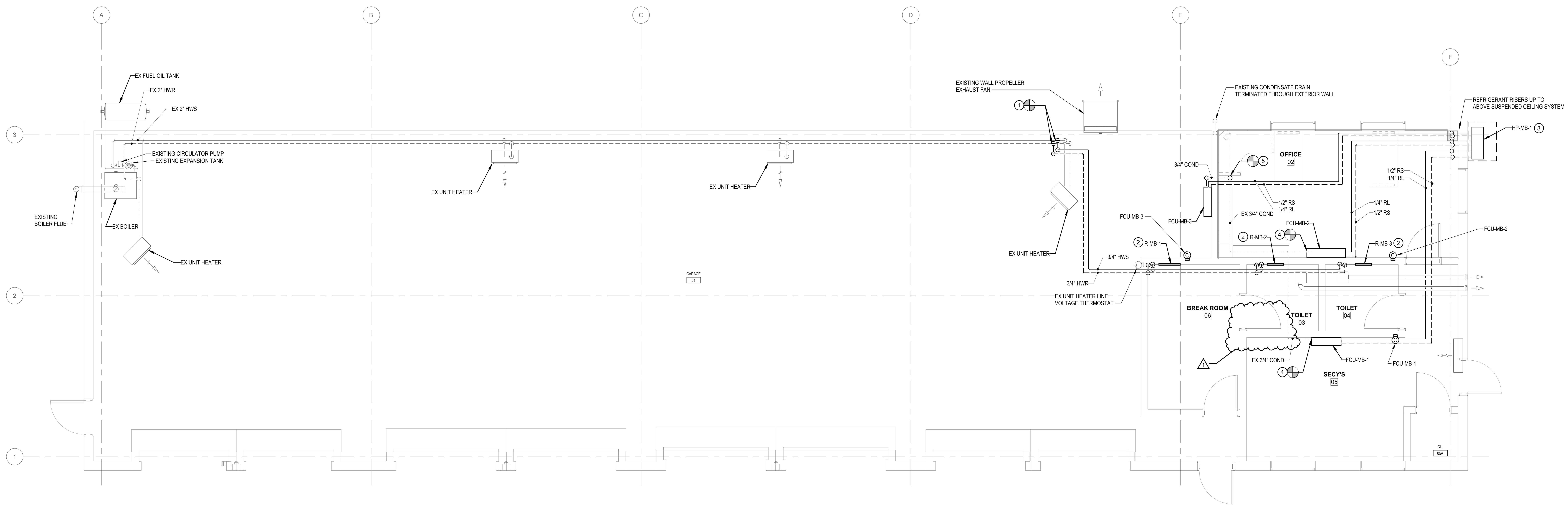
REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET
DATE: 06/21/2024
SCALE: 1/2" = 1'-0"
SHEET NAME:
SECOND FLOOR SANITARY AND VENT INSTALLATION PLAN
SHEET NUMBER:
HE-P103

ISSUE FOR BID SET

PROJECT NUMBER: 00000.00



G18 FIRST FLOOR PLAN

1/4" = 1'-0"

KEYED NOTES:

1. CONNECT TO EXISTING HWS/R PIPING AT LOCATIONS SHOWN AND ROUTE 3/4" HWS/R PIPING TO BREAK ROOM 402 EXPOSED THROUGH GARAGE BAY. PROVIDE PVC JACKETING OVER ALL EXPOSED, INSULATED PIPING AND FITTINGS.

2. PROVIDE 3/4" PIPING TAPS OFF THE HORIZONTAL HWS/R PIPING LINES AND ROUTE 3/4" HWS/R DROPS TO WALL MOUNTED RADIATOR SUPPLY AND RETURN CONNECTIONS AS SHOWN. PROVIDE 3/4" MECHANICAL THERMOSTATIC CONTROL VALVE ON THE HWS UPSTREAM OF THE CONNECTION TO THE RADIATOR. THE CONTROL VALVE SHALL BE FURNISHED WITH THE RADIATOR BY THE RADIATOR MANUFACTURER.

3. MOUNT OUTDOOR HEAT PUMP ON TOP OF 18" STAND AND MOUNT STAND TO EXISTING CONCRETE PAD. BOLT STAND TO PAD AS REQUIRED. ROUTE INDIVIDUAL REFRIGERANT BRANCHES THROUGH EXTERIOR WALL BELOW BOTTOM OF EXISTING OFFICE 401 WINDOW, THEN ROUTE INDIVIDUAL REFRIGERANT PIPING BRANCHES TO ABOVE OFFICE 401 SUSPENDED CEILING SYSTEM WITHIN A VERTICAL CHASE, THEN ROUTE REFRIGERANT BRANCHES TO WALL MOUNTED FAN COIL UNIT CONNECTIONS PORTS AS REQUIRED.

4. PROVIDE CONNECTIONS FROM FCU INLINE CONDENSATE PUMP TO EXISTING CONDENSATE PIPING ROUTED ABOVE SUSPENDED CEILING SYSTEMS AS REQUIRED.

5. ROUTE 3/4" CONDENSATE DRAIN PIPING FROM OUTLET OF FCU-MB-3 INLINE CONDENSATE PUMP TO EXISTING CONDENSATE DRAIN PIPING ABOVE OFFICE 401 SUSPENDED CEILING SYSTEM AT LOCATION SHOWN.

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NUFSD BOND PROJECT PHASE 5 - MAINTENANCE

- ☐ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- ■ SED#50-01-08-03-7-007-002 (Maintenance)
- ☐ SED#50-01-08-03-7-012-004 (OEC)
- ☐ SED#50-01-08-03-0-001-026 (MILLER ES)
- ☐ SED#50-01-08-03-0-004-022 (BARR MS)

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KEY PLAN

REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

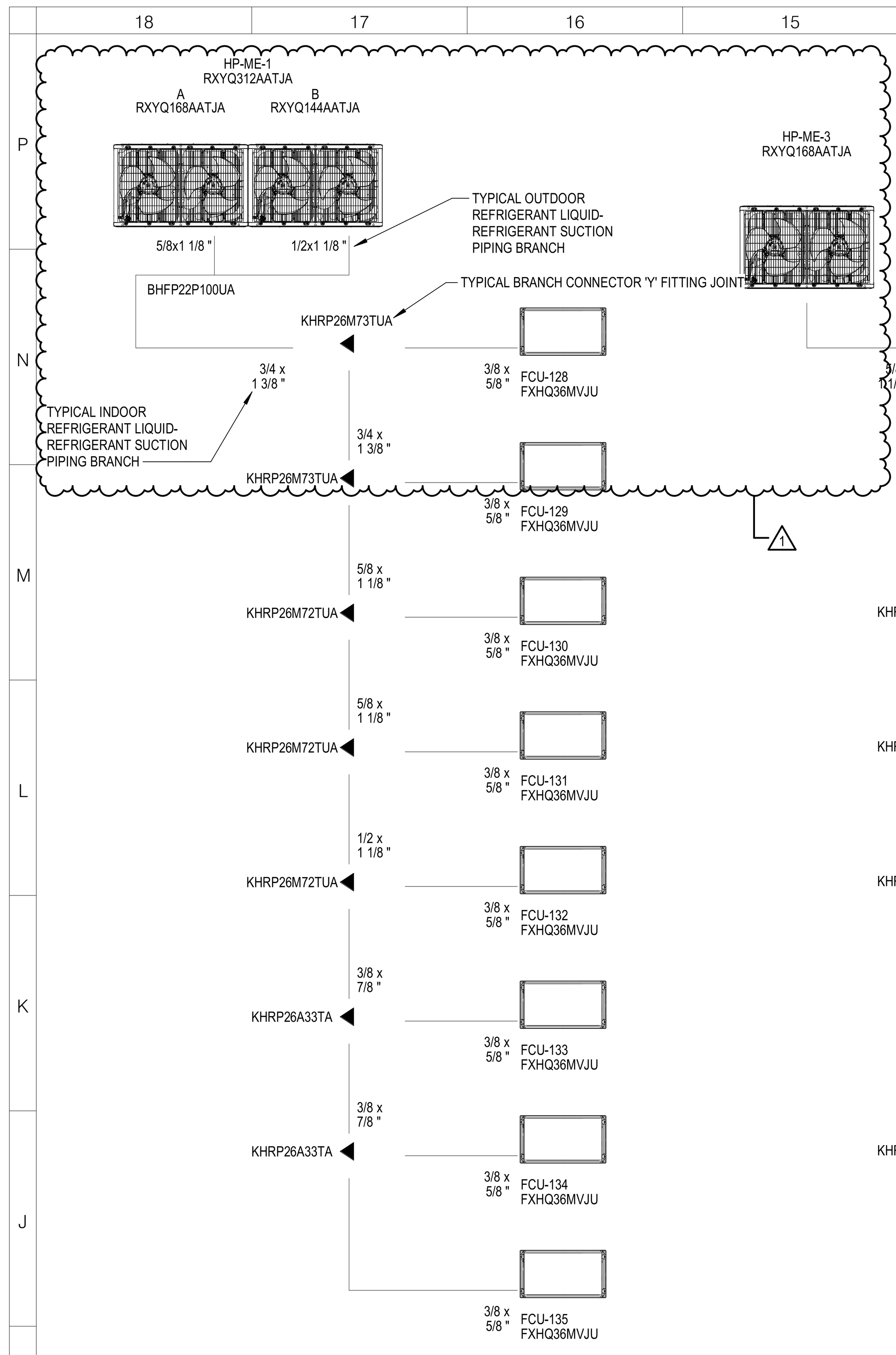
SCALE: 1/4" = 1'-0"

SHEET NAME:
FIRST FLOOR PLAN

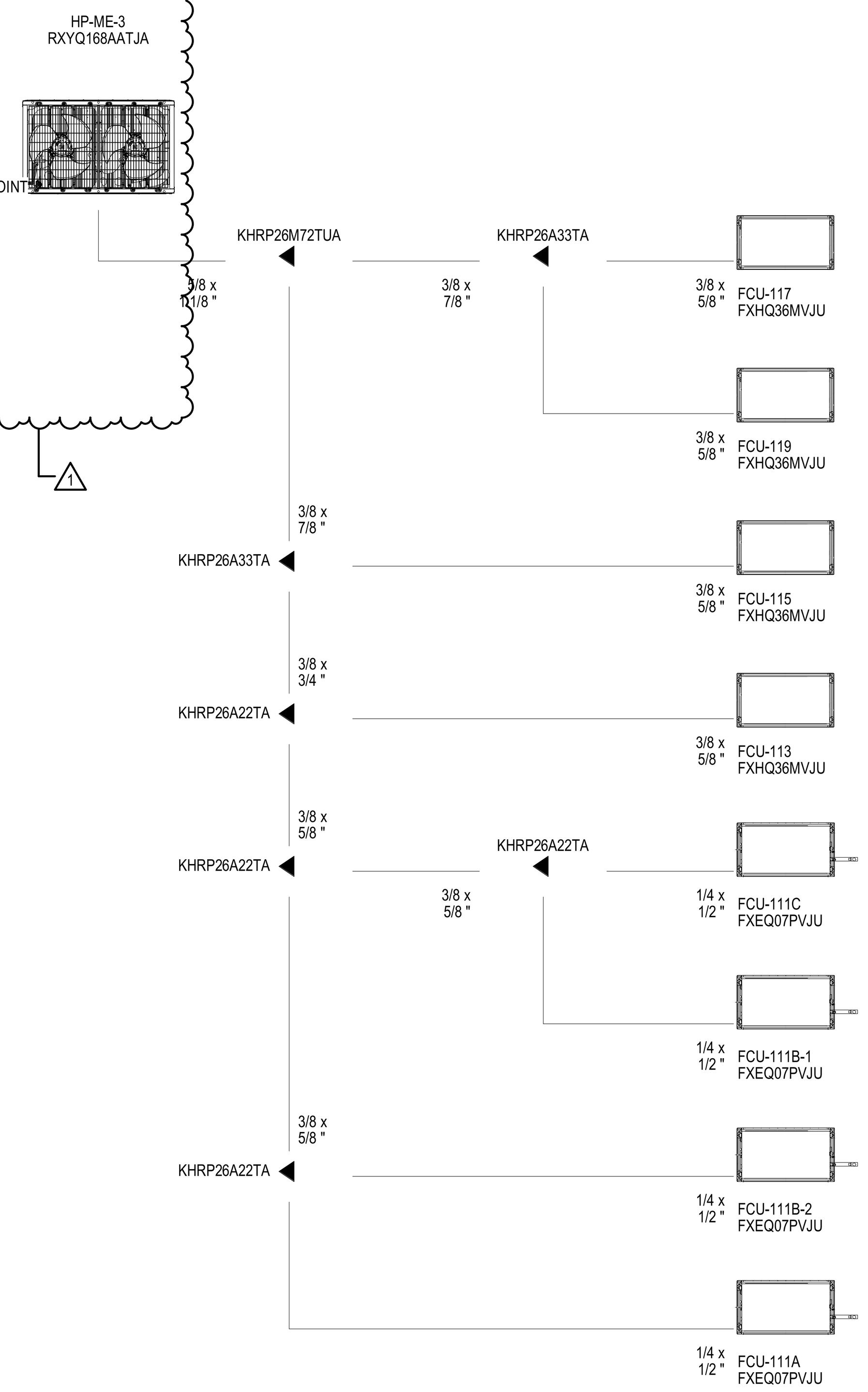
SHEET NUMBER:
MB-M101

ISSUE FOR BID SET

2/4/2025 8:56:37 AM



H18 HP-ME-1 PIPING DIAGRAM
NOT TO SCALE



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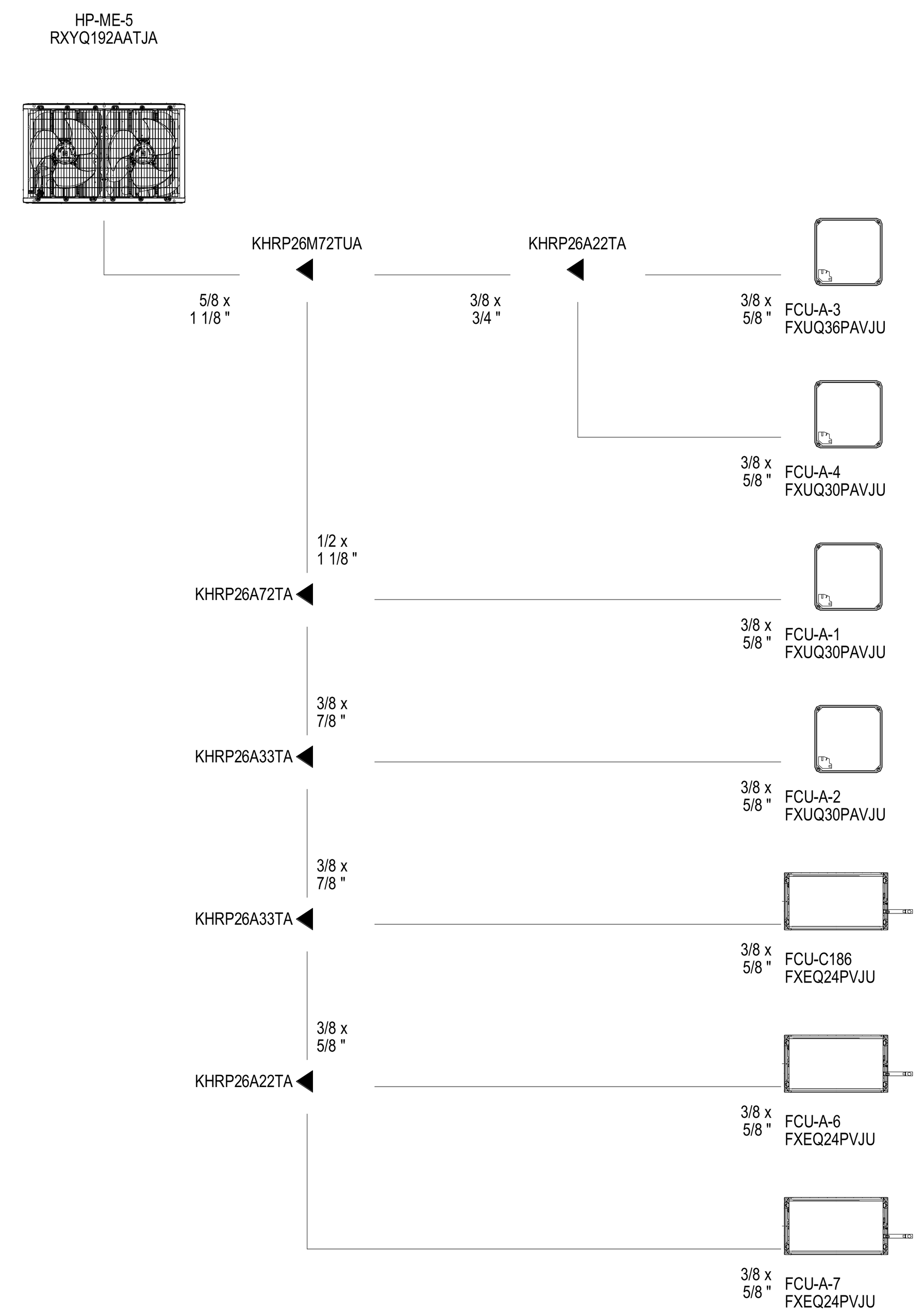

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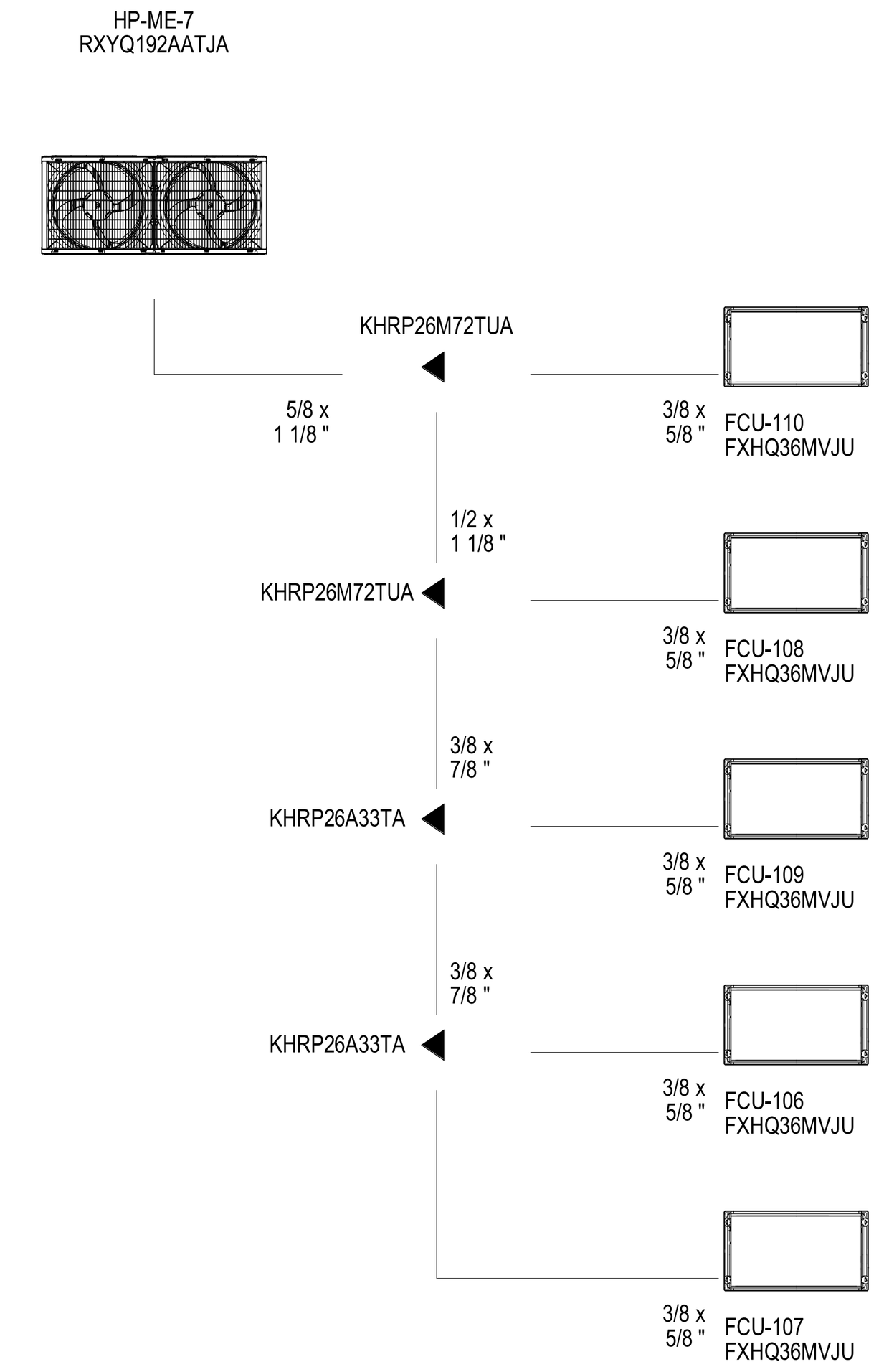

K7 HP-ME-7 PIPING DIAGRAM
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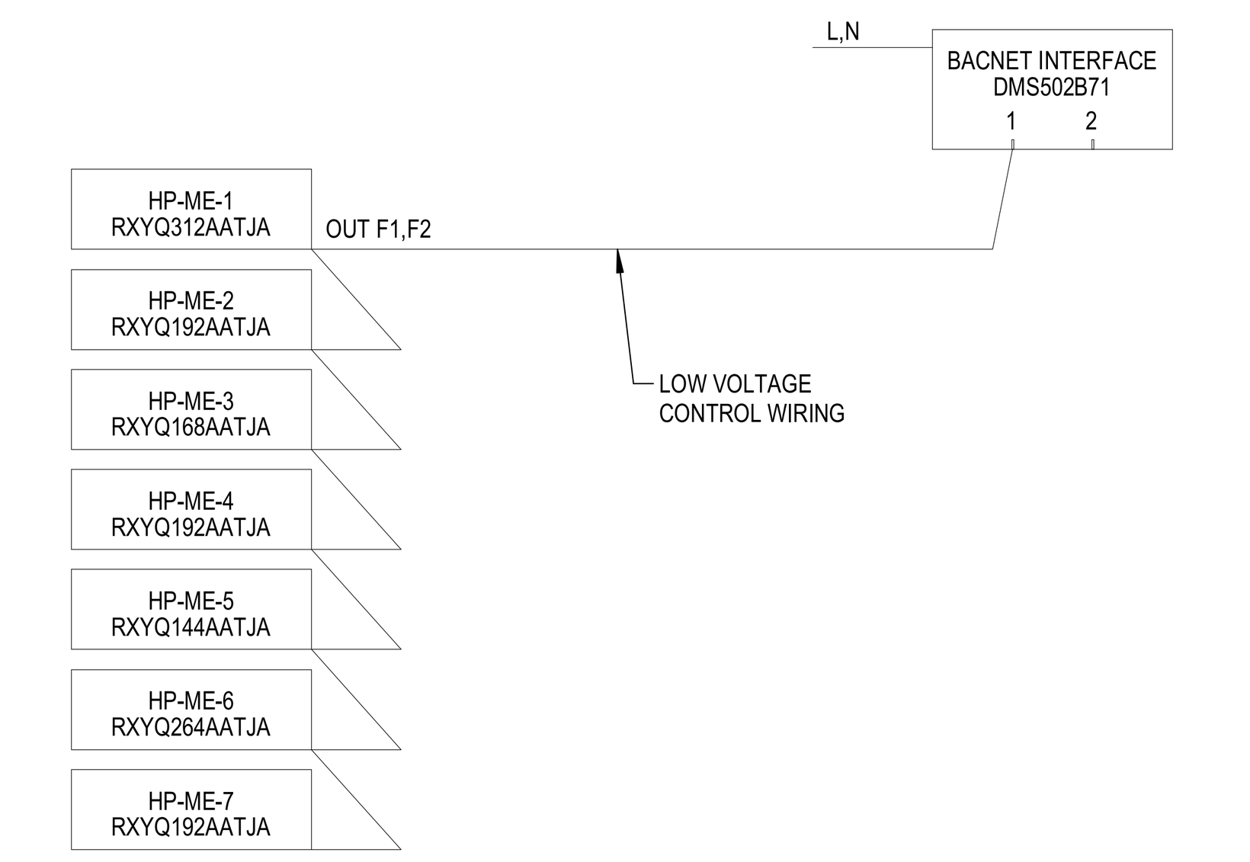

K4 VRV CENTRALIZED CONTROLLER WIRING DIAGRAM
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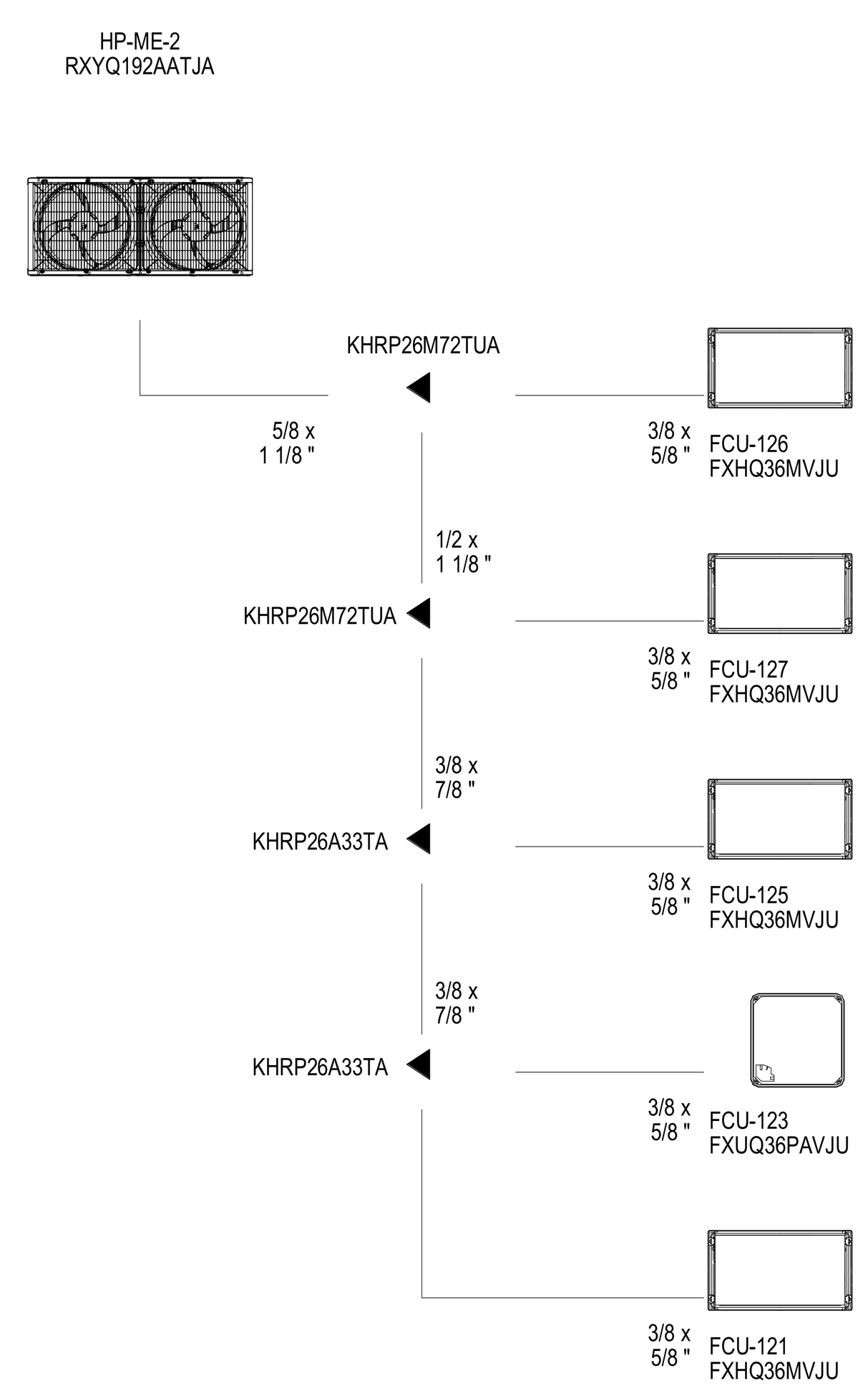

D18 HP-ME-2 PIPING DIAGRAM
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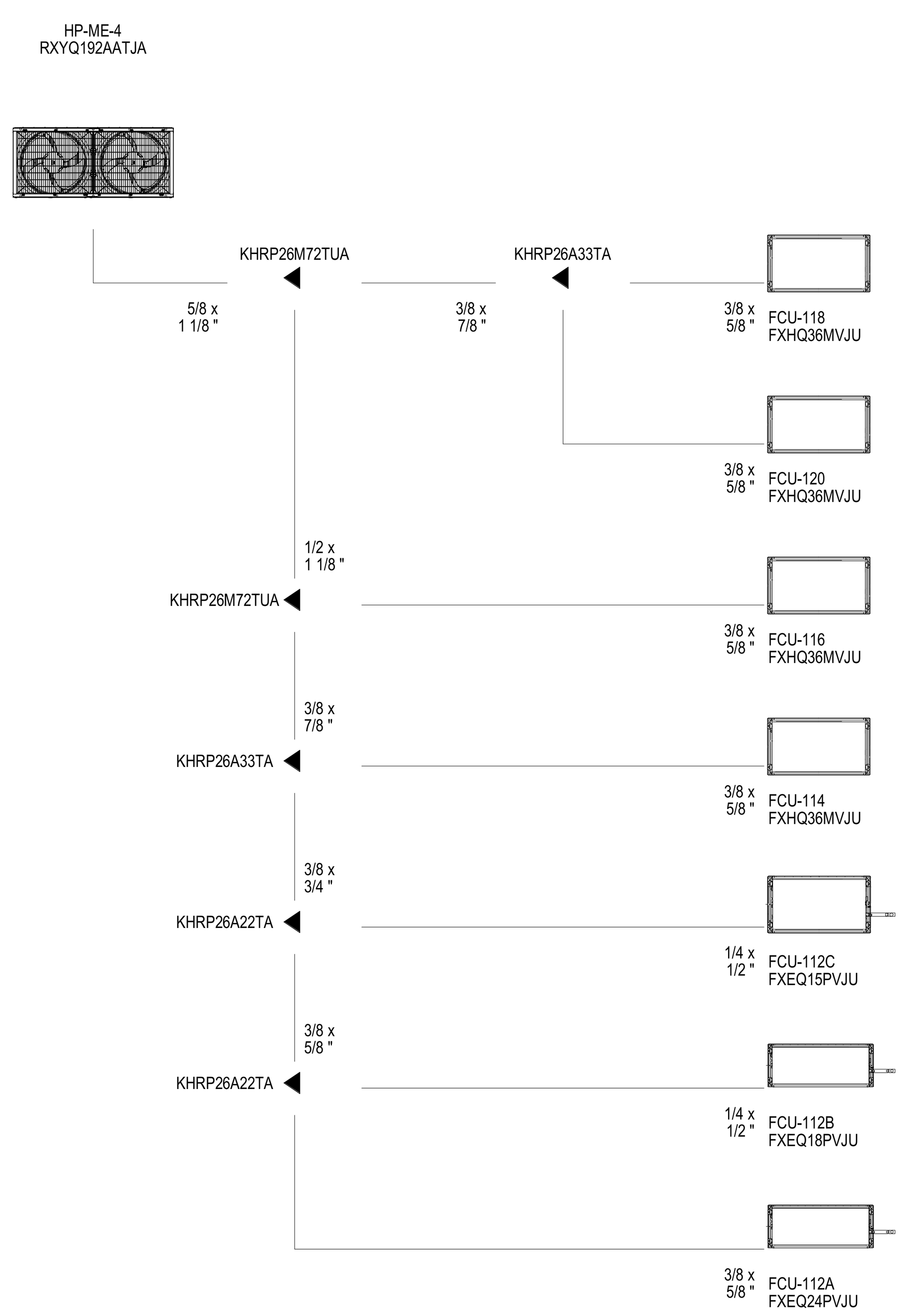

B15 HP-ME-4 PIPING DIAGRAM
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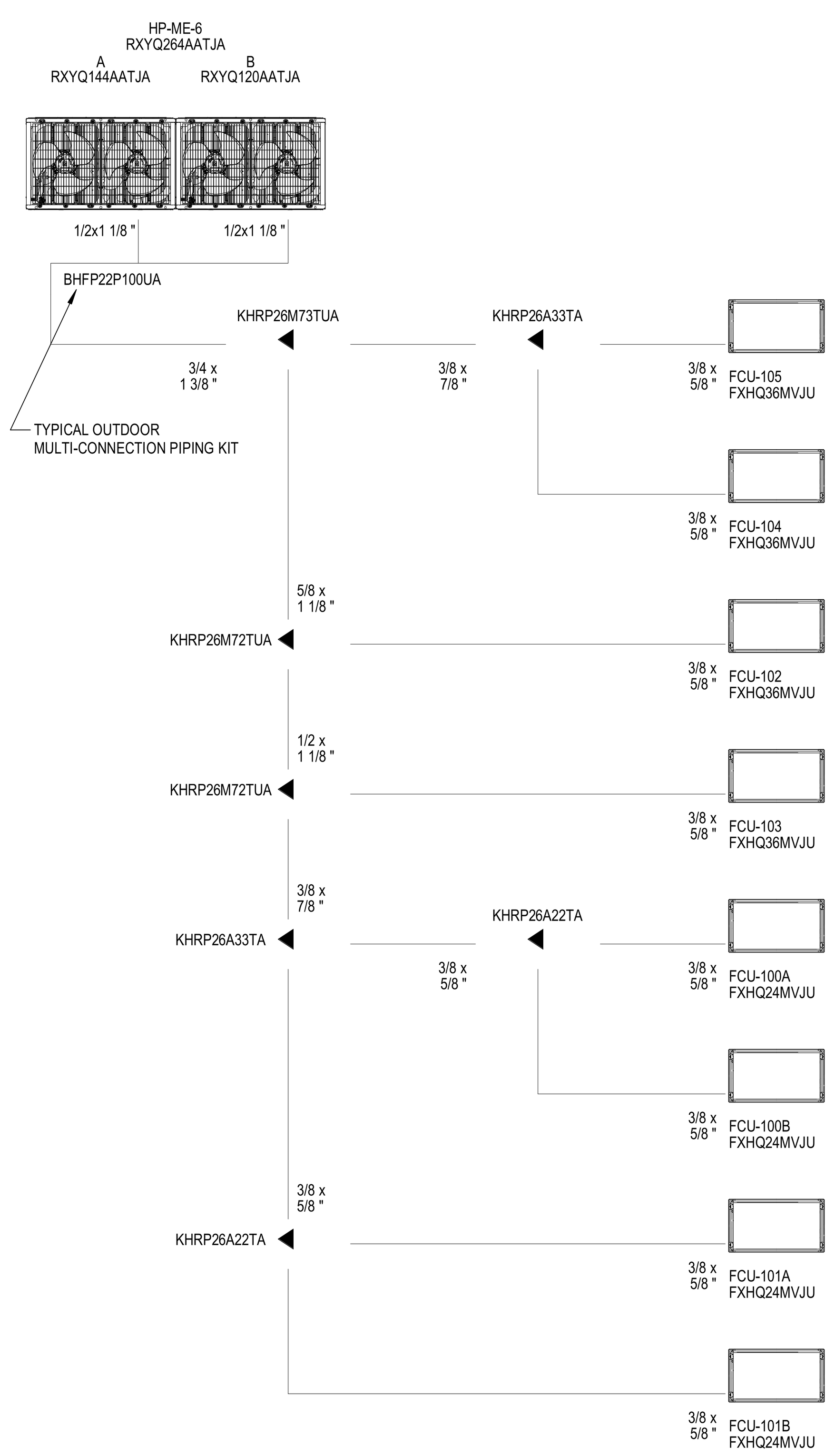

B11 HP-ME-6 PIPING DIAGRAM
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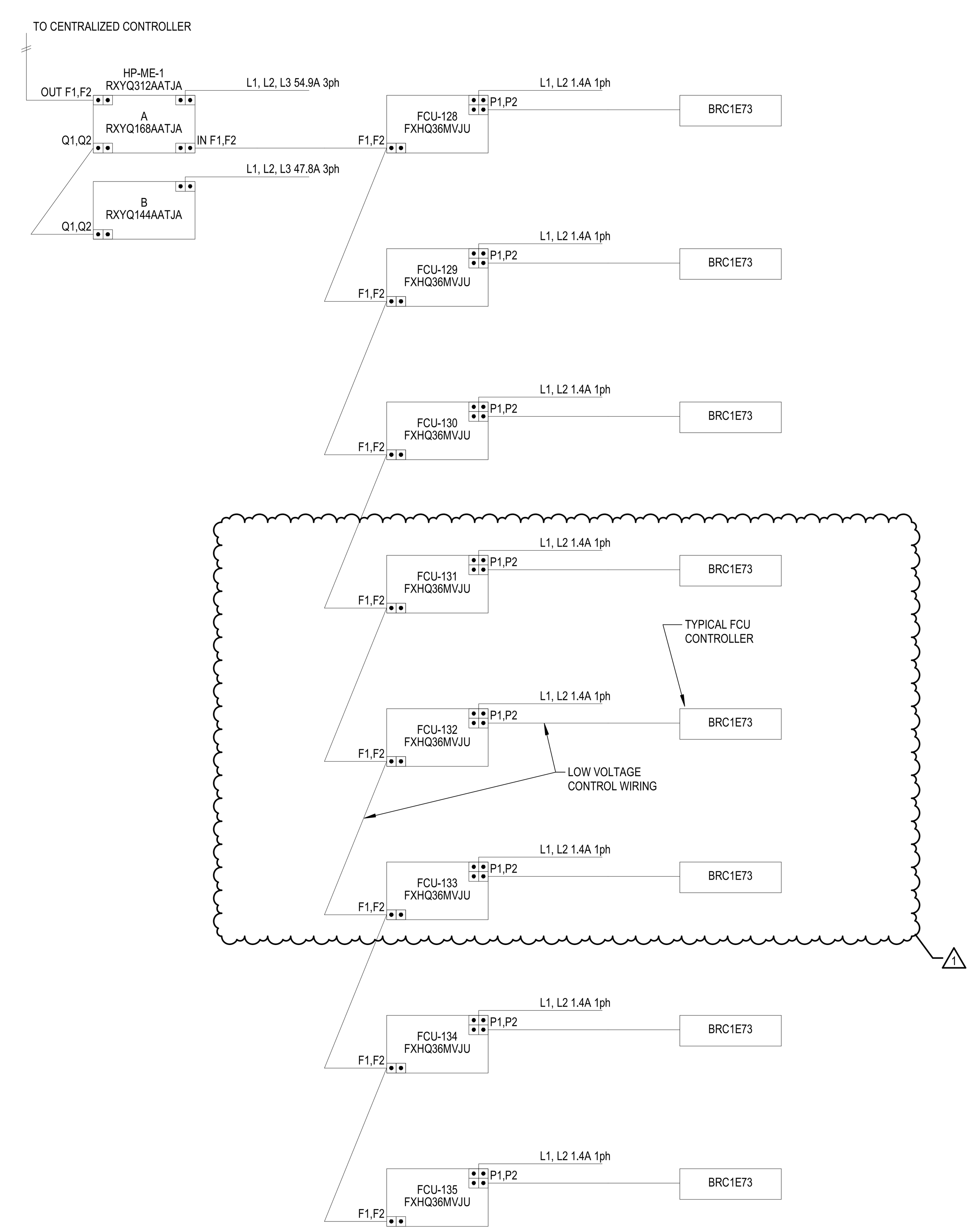

B6 HP-ME-1 WIRING DIAGRAM
NOT TO SCALE

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NUFSD BOND PROJECTS PHASE 5 - MILLER ES

- ☐ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- ☐ SED#50-01-08-03-7-007-002 (Maintenance)
- ☐ SED#50-01-08-03-7-012-004 (OEC)
- ■ SED#50-01-08-03-0-001-026 (MILLER ES)
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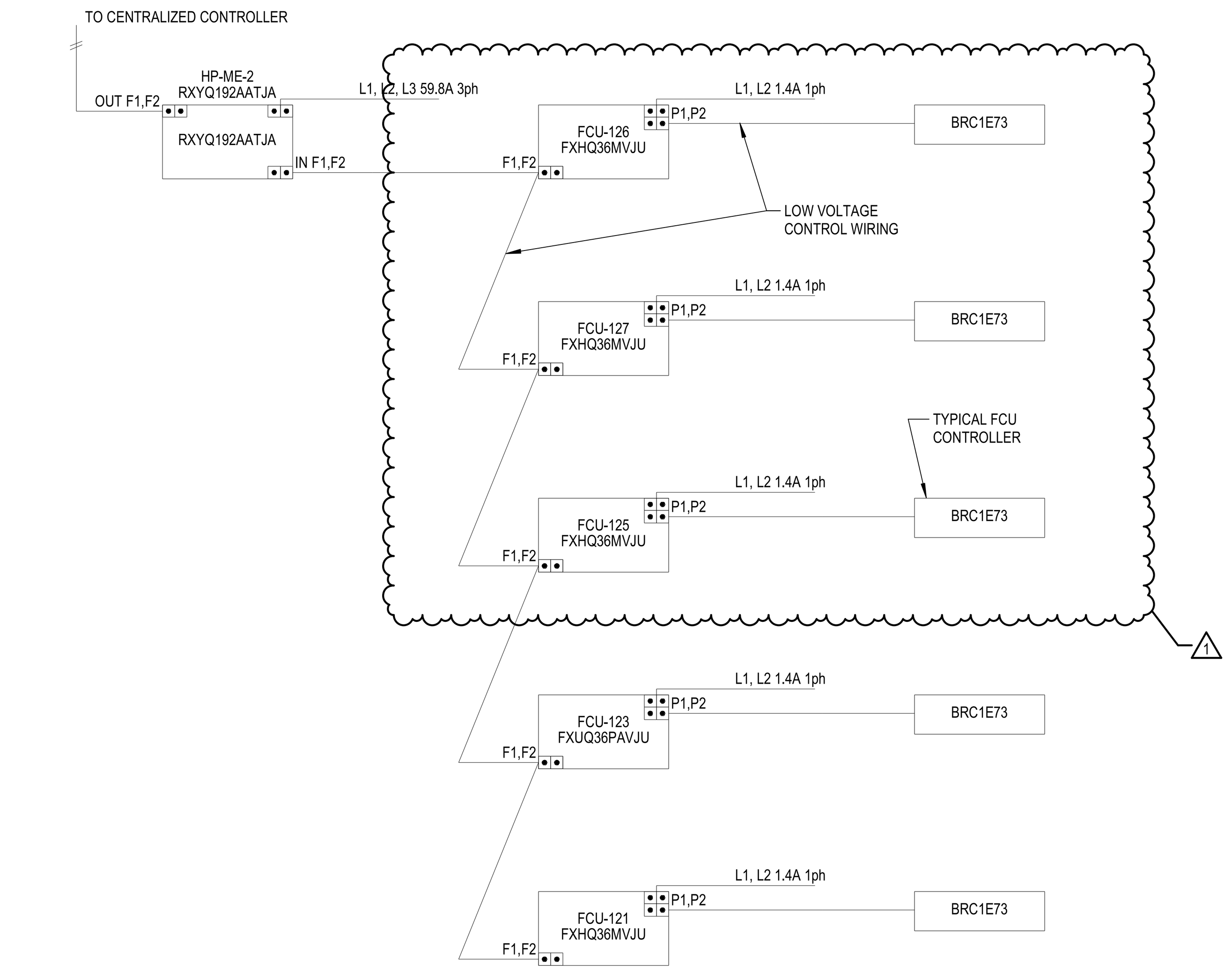
KEY PLAN

REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET
DATE: 06/21/2024
SCALE: NOT TO SCALE
SHEET NAME:
VRV PIPING AND WIRING DIAGRAMS
SHEET NUMBER:
ME-M003

ISSUE FOR BID SET



K18 HP-ME-2 WIRING DIAGRAM
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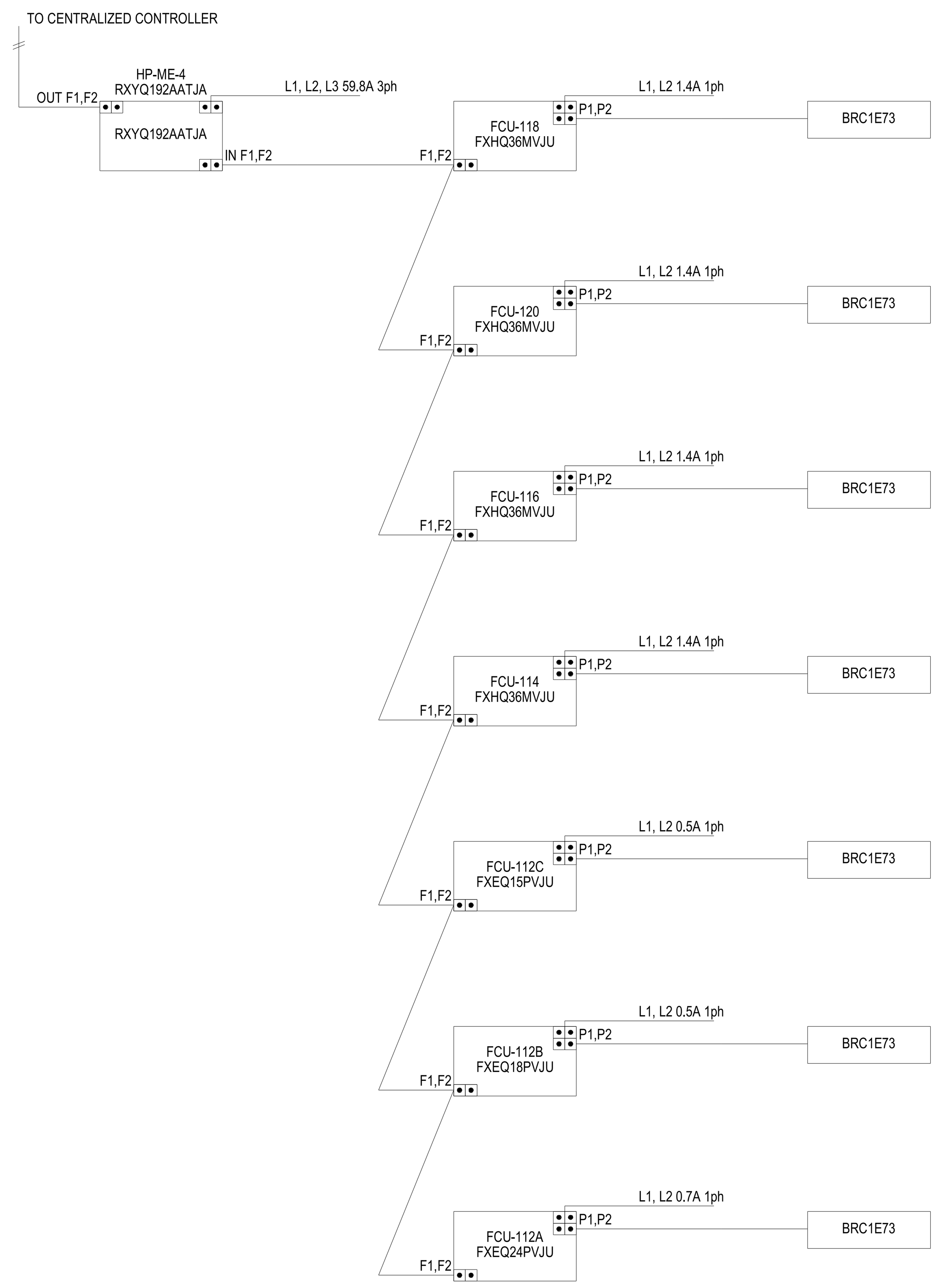

H13 HP-ME-4 WIRING DIAGRAM
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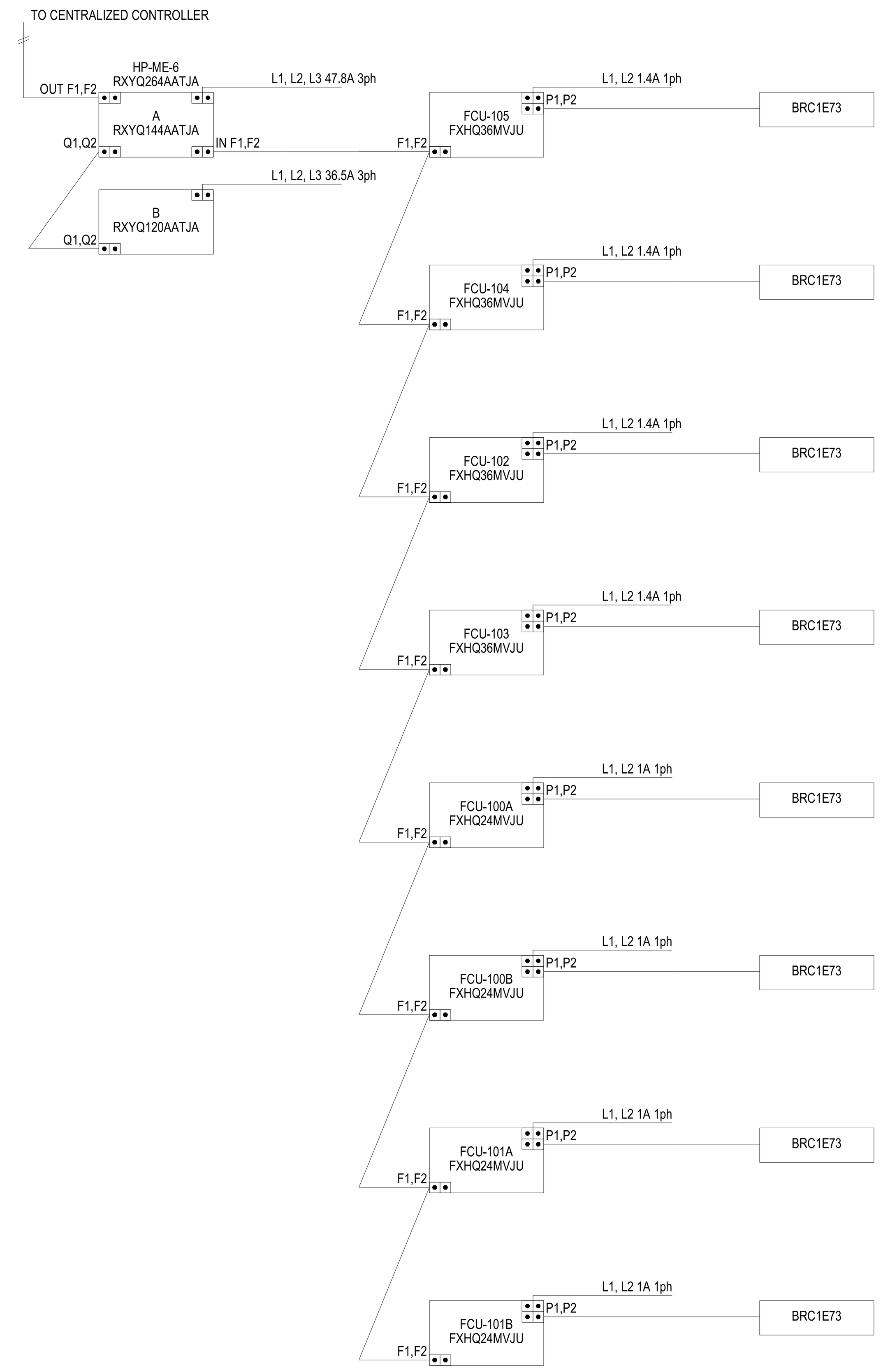

G8 HP-ME-6 WIRING DIAGRAM
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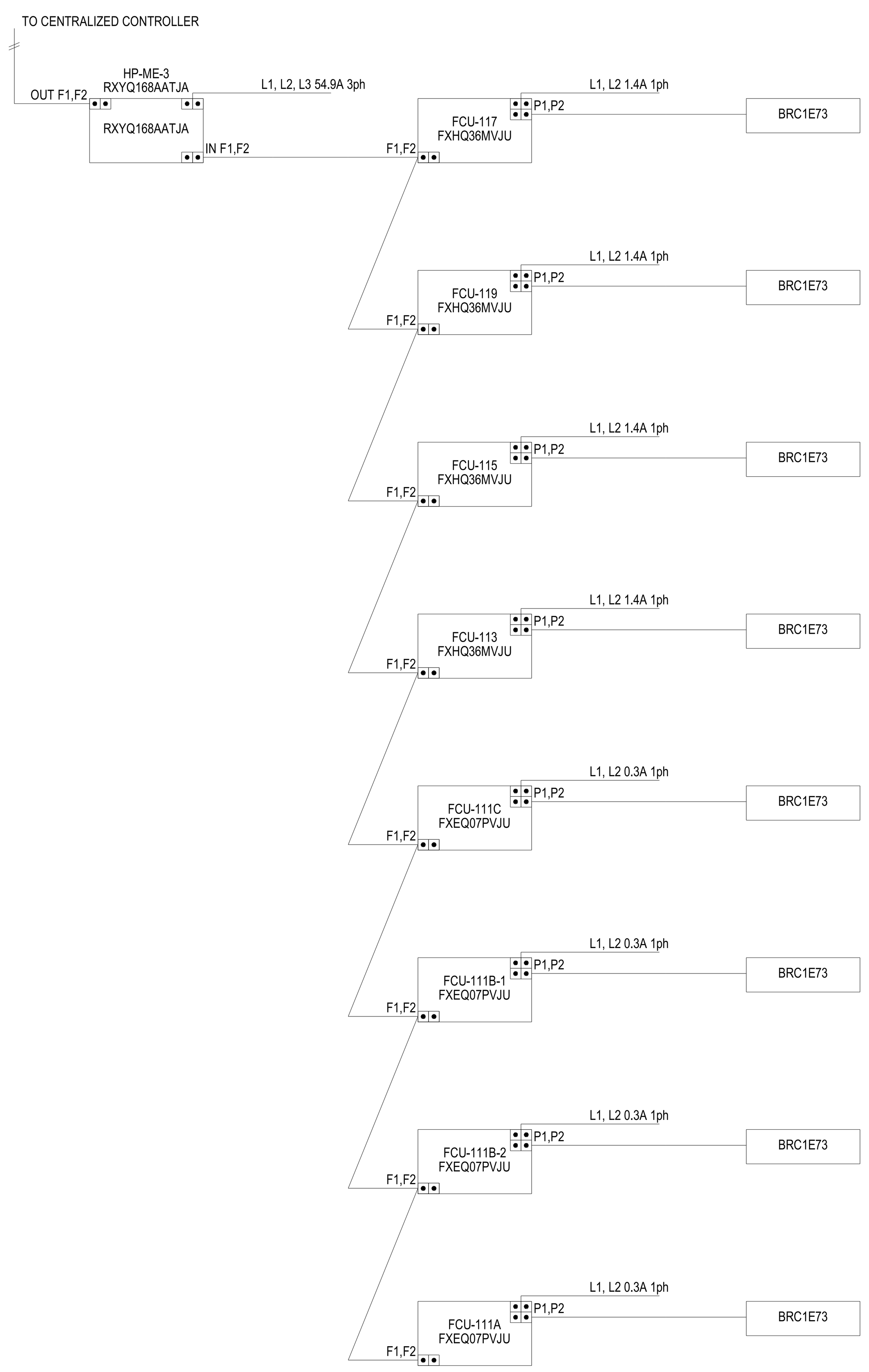

B18 HP-ME-3 WIRING DIAGRAM
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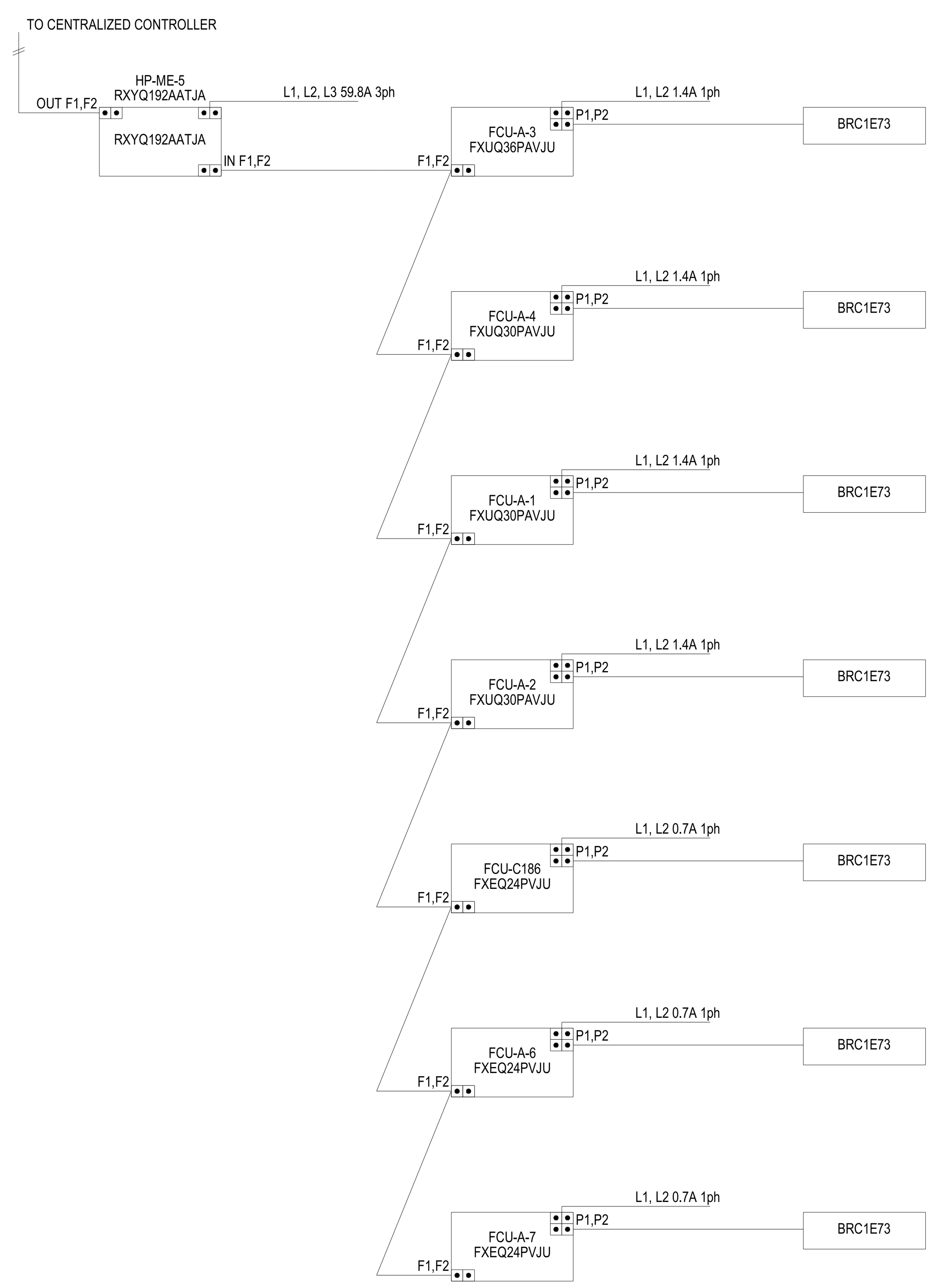

B13 HP-ME-5 WIRING DIAGRAM
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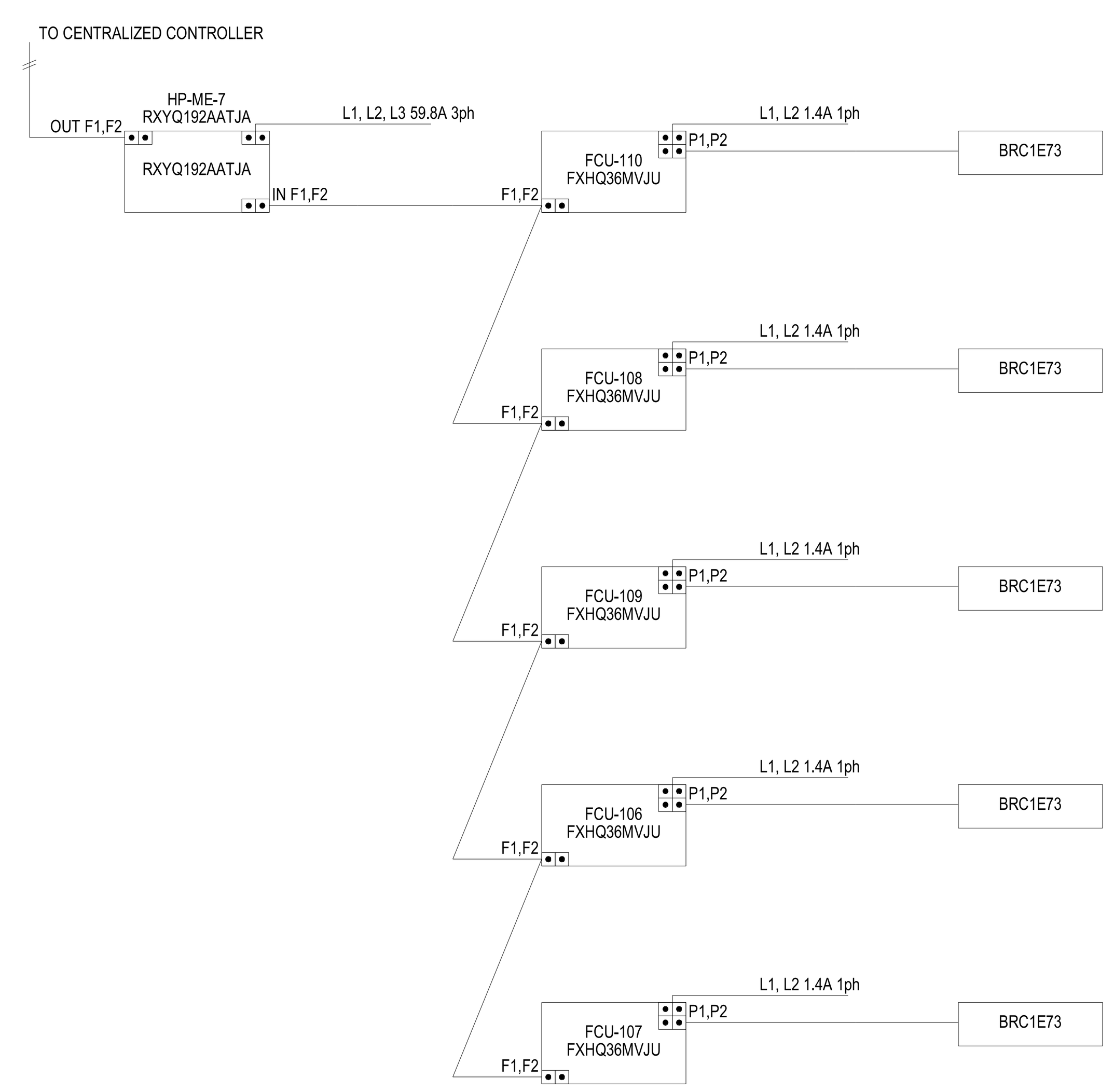

B8 HP-ME-7 WIRING DIAGRAM
NOT TO SCALE

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- ☐ SED#50-01-08-03-7-012-004 (OEC)
- ■ SED#50-01-08-03-0-001-026 (MILLER ES)
- ☐ SED#50-01-08-03-0-004-022 (BARR MS)

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KEY PLAN

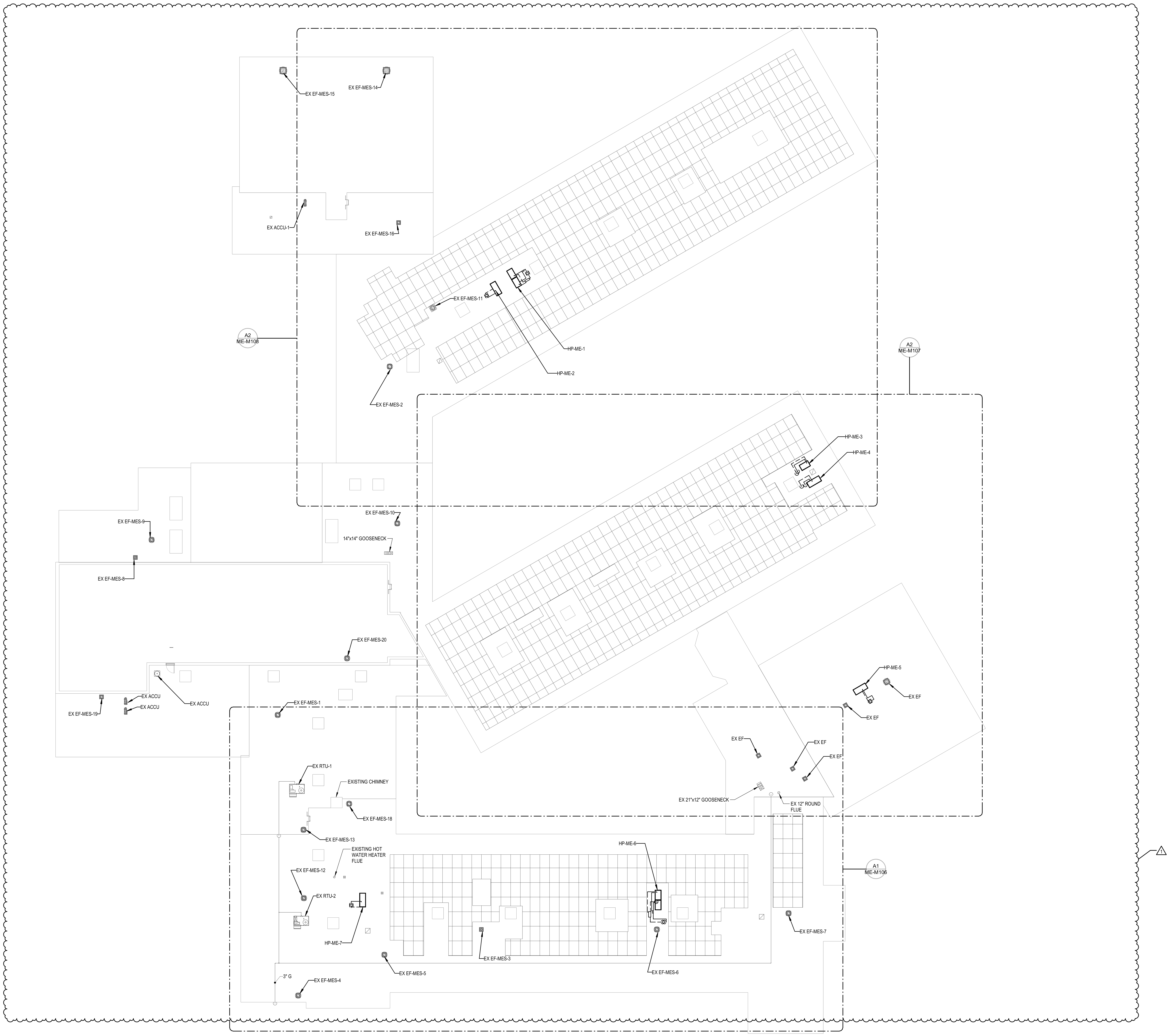
REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET
DATE: 06/21/2024
SCALE: NOT TO SCALE
SHEET NAME:
VRV WIRING DIAGRAMS
SHEET NUMBER:
ME-M004

ISSUE FOR BID SET

2/4/2025 9:11:22 AM



ROOF HVAC PLAN
A6
1/16" = 1'-0"

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- ☐ SED#50-01-08-03-7-012-004 (OEC)
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KEY PLAN

REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET
DATE: 06/21/2024
SCALE: 1/16" = 1'-0"
SHEET NAME:
OVERALL ROOF PLAN AND LIBRARY ROOF PLAN & REMOVALS
SHEET NUMBER:
ME-M102

ISSUE FOR BID SET

2/4/2025 9:11:23 AM

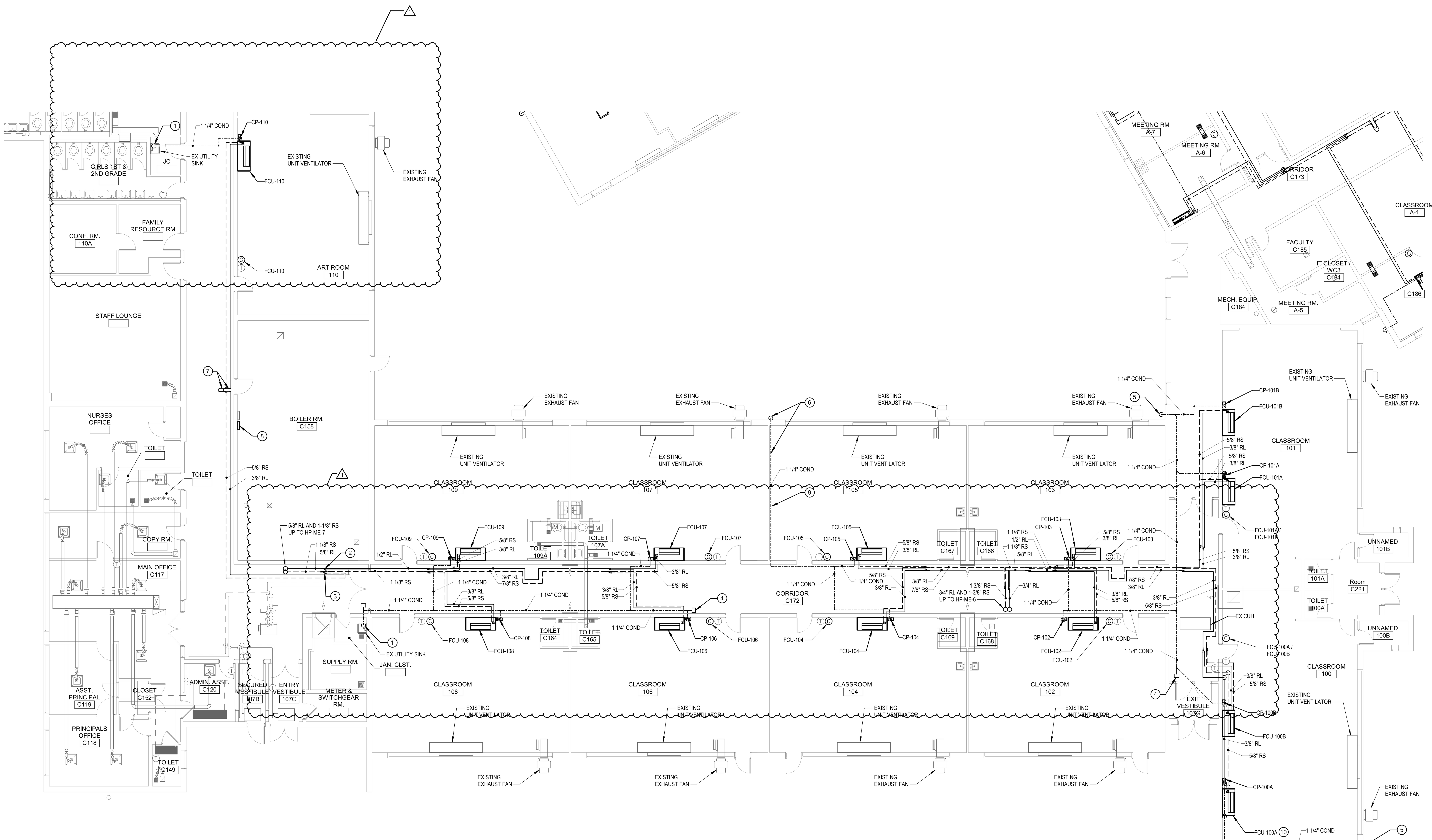
PROJECT NUMBER: 2111003.00

KEYED NOTES:

1. ROUTE 1-1/4" CONDENSATE DRAIN PIPING INTO JANITOR CLOSET AND TERMINATE DRAIN PIPING OPEN-ENDED WITH MITER CUT OUTLET 6" ABOVE RIM OF EXISTING UTILITY SINK.
2. TYPICAL REFRIGERANT LIQUID BRANCH CONNECTOR 'Y' FITTING JOINT.
3. TYPICAL REFRIGERANT SUCTION BRANCH CONNECTOR 'Y' FITTING JOINT.
4. PROVIDE CONDENSATE CLEANOUT PLUG AT LOCATIONS SHOWN.
5. PROVIDE 1-1/4" CONDENSATE DRAIN PIPING THROUGH EXTERIOR WALL AT LOCATION SHOWN. TERMINATE WITH MITER CUT ELBOW FACING DOWN AND OPEN-ENDED.
6. ROUTE 1-1/4" CONDENSATE DRAIN PIPING EXPOSED THROUGH CLASSROOM BELOW EXISTING CEILING SYSTEM AND PROVIDE 1-1/4" CONDENSATE DRAIN PIPING THROUGH EXTERIOR WALL AT LOCATION SHOWN. TERMINATE WITH MITER CUT ELBOW FACING DOWN AND OPEN-ENDED. PROVIDE PVC JACKETING OVER EXPOSED, INSULATED PIPING WHERE ROUTED BELOW CEILING SYSTEMS IN CLASSROOMS.
7. PROVIDE UL-207 LISTED EXPANSION LOOP FOR THE 3/8" REFRIGERANT LIQUID AND 5/8" REFRIGERANT SUCTION LINES AT LOCATION SHOWN. THE 3/8" LOOP SHALL BE 28" LONG x 17-1/2" HIGH WITH +/-4" MOVEMENT. THE 5/8" LOOP SHALL BE 28-1/2" LONG x 19-3/4" WIDE WITH +/-4" MOVEMENT. PROVIDE PIPE GUIDES ON EITHER SIDE OF LOOP AND PIPE ANCHORS AT END OF PIPING RUNS PER MANUFACTURER'S RECOMMENDATIONS. INSTALL REFRIGERANT MAINS AT DIFFERENT ELEVATIONS TO ALLOW LOOPS TO AVOID CONFLICT ABOVE THE CEILING.
8. PROVIDE DAIKIN MODEL DCM014A51 BACNET INTERFACE AT LOCATION SHOWN CAPABLE OF INTEGRATION WITH THE BUILDING'S EXISTING DIRECT DIGITAL CONTROL (DDC) SYSTEM. THE DDC SHALL PROVIDE A LOW VOLTAGE CONNECTION FROM THE NEAREST DDC CONTROL PANEL TO THE BACNET INTERFACE AS REQUIRED. THE BACNET INTERFACE DEVICE SHALL ALLOW THE DDC SYSTEM PROVIDER TO MONITOR AND CONTROL THE VARIABLE REFRIGERANT VOLUME INDOOR AND OUTDOOR UNITS INSTALLED. TWISTED PAIR COMMUNICATION WIRING SHALL BE PROVIDED FROM EACH ROOFTOP HEAT PUMP UNIT TO THE BACNET INTERFACE DEVICE, AND TWISTED PAIR COMMUNICATION WIRING SHALL BE PROVIDED FROM EACH HEAT PUMP UNIT TO EACH INDOOR FAN COIL UNIT AND FAN COIL UNIT REMOTE CONTROLLER.
9. ROUTE 1-1/4" CONDENSATE PIPING BELOW EXISTING ELECTRICAL RACEWAY INSTALLED TIGHT TO CLASSROOM 105 CEILING SYSTEM.
10. ROUTE BRANCH REFRIGERANT SUCTION AND REFRIGERANT LIQUID SERVING FCU-100A BELOW FAN COIL UNIT FCU-100B, THEN ELBOW UP TO FCU ELEVATION AND CONNECT TO REFRIGERANT PORTS ON FCU-100A AS REQUIRED. FOR FCU-100A, LOCATE THE UNIT'S CONDENSATE PUMP CP-100A BELOW THE ELEVATION OF THE FCU, ROUTE THE CONDENSATE FROM THE DRAIN OUTLET PORT ON FCU-100A, THEN ROUTE THE CONDENSATE PIPING FROM THE OUTLET OF CP-100A BELOW FCU-100A, THEN ELBOW UP TO TIGHT TO THE CLASROOM 100 CEILING AND ROUTE OUT THROUGH THE EXTERIOR WALL AS SHOWN.

GENERAL NOTES:

1. REFRIGERANT PIPING NOTE: 90 DEGREE ELBOWS SHALL BE KEPT A MINIMUM OF 20" FROM CEILING UV DX COILS AND 20" FROM BRANCH CONNECTOR 'Y' JOINTS. IN ADDITION, BRANCH CONNECTOR 'Y' JOINTS SHALL BE A MINIMUM OF 40" FROM ANOTHER BRANCH 'Y' CONNECTOR JOINT.
2. REFRIGERANT PIPING NOTE: THE HEAT PUMP SYSTEM MANUFACTURER SHALL INSPECT ALL FIELD INSTALLED REFRIGERANT PIPING PRIOR TO INSULATION INSTALLATION.
3. THE EXISTING SUSPENDED CEILING SYSTEMS LOCATED WITHIN THE SCOPE OF WORK AREA OUTSIDE OF AREAS BEING RENOVATED BY THE GENERAL CONTRACTOR SHALL BE DISCONNECTED AND REMOVED TO ALLOW FOR THE INSTALLATION WORK AND REINSTALLED FOLLOWING COMPLETION OF THE WORK BY THE MECHANICAL CONTRACTOR. THE SUSPENDED CEILING GRID SYSTEMS SHALL BE REMOVED AND MODIFIED TO COMPLETE THE WORK AND REINSTALLED FOLLOWING THE COMPLETION OF WORK. THE CEILING TILES SHALL BE REMOVED AS REQUIRED TO COMPLETE THE WORK AND REINSTALLED FOLLOWING THE COMPLETION OF THE INSTALLATION WORK. ANY CEILING TILES DAMAGED DURING THE INSTALLATION WORK SHALL BE REPLACED BY THE MECHANICAL CONTRACTOR TO MATCH THE EXISTING CEILING TILES.
4. ALL CUTTING, PATCHING, AND FIREPROOFING ASSOCIATED WITH THE INSTALLATION WORK SHALL BE COMPLETED BY THE MECHANICAL CONTRACTOR. PATCHED AREAS SHALL MATCH EXISTING CONDITIONS. ALL REFRIGERANT PIPING AND CONDENSATE PIPING PENETRATIONS THROUGH CORRIDOR WALLS SHALL BE FIREPROOFED PER SPECIFICATION SECTION 078400.
5. ROUTE REFRIGERANT SUCTION AND LIQUID PIPING FROM THE UNIT VENTILATOR DX COIL CONNECTIONS TO THE HEAT PUMP UNITS. SIZE PIPING AND PROVIDE BRANCH CONNECTOR 'Y' JOINTS PER THE DRAWING. CONFIRM PIPING SIZES AND BRANCH CONNECTOR 'Y' JOINT LOCATIONS REQUIRED WITH HEAT PUMP SYSTEM MANUFACTURER.
6. THE SMALLEST VOLUME ROOM THAT THE REFRIGERANT PIPING SYSTEMS ROUTE THROUGH FOR EACH OF THE HEAT PUMP SYSTEMS IS BELOW THE ASHRAE STANDARD 15 REFRIGERANT CONCENTRATION LIMIT OF 26 POUNDS PER 1,000 CUBIC FEET OF ROOM VOLUME FOR OCCUPIED SPACES.
7. PROVIDE FIRESTOPPING PER SPECIFICATION SECTION 078400 AT ALL PIPING PENETRATIONS THROUGH CORRIDOR WALLS AND STORAGE ROOM WALLS.
8. PROVIDE A DAIKIN MODEL MADOKA WIRED, REMOTE CONTROLLER FOR EACH INDOOR FAN COIL UNIT. ROUTE CONTROLLER WIRING DOWN WALL FRAMING SYSTEMS AS REQUIRED FROM FAN COIL UNIT TO CONTROLLER. CUT AND PATCH EXISTING WALL SYSTEMS AS REQUIRED TO INSTALL CONTROLLER WIRING TO MATCH EXISTING CONDITIONS.



PARTIAL FIRST FLOOR PLAN - KINDERGARTEN WING (A2)
1/8" = 1'-0"

ARCHITECT

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REGISTRATION EXPIRES: 11/30/2026

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NUFSD BOND PROJECTS PHASE 5 - MILLER ES

- ☐ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- ☐ SED#50-01-08-03-7-007-002 (Maintenance)
- ☐ SED#50-01-08-03-7-012-004 (OEC)
- ■ SED#50-01-08-03-0-001-026 (MILLER ES)
- ☐ SED#50-01-08-03-0-004-022 (BARR MS)

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Miller Elementary School
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A MacArthur Barr Middle School
143 Church St
Nanuet, NY 10954

KEY PLAN

REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

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

SHEET NAME: PARTIAL FIRST FLOOR PLAN - KINDERGARTEN WING

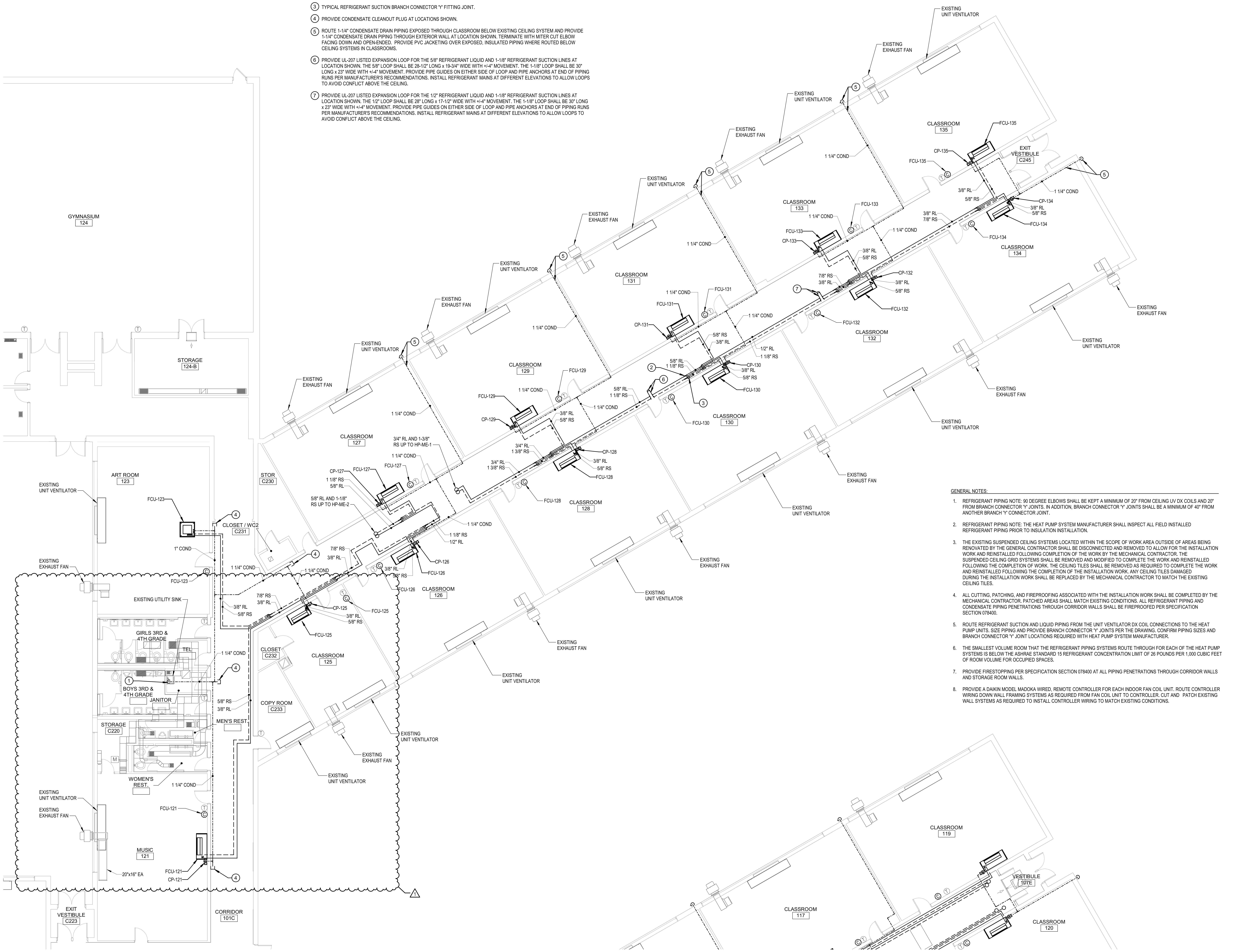
SHEET NUMBER: ME-M103

ISSUE FOR BID SET

PROJECT NUMBER: 2111003.00

KEYED NOTES:

1. ROUTE 1-1/4" CONDENSATE DRAIN PIPING INTO JANITOR CLOSET AND TERMINATE DRAIN PIPING OPEN-ENDED WITH MITER CUT OUTLET 6" ABOVE RIM OF EXISTING UTILITY SINK.
2. TYPICAL REFRIGERANT LIQUID BRANCH CONNECTOR 'Y' FITTING JOINT.
3. TYPICAL REFRIGERANT SUCTION BRANCH CONNECTOR 'Y' FITTING JOINT.
4. PROVIDE CONDENSATE CLEANOUT PLUG AT LOCATIONS SHOWN.
5. ROUTE 1-1/4" CONDENSATE DRAIN PIPING EXPOSED THROUGH CLASSROOM BELOW EXISTING CEILING SYSTEM AND PROVIDE 1-1/4" CONDENSATE DRAIN PIPING THROUGH EXTERIOR WALL AT LOCATION SHOWN. TERMINATE WITH MITER CUT ELBOW FACING DOWN AND OPEN-ENDED. PROVIDE PVC JACKETING OVER EXPOSED, INSULATED PIPING WHERE ROUTED BELOW CEILING SYSTEMS IN CLASSROOMS.
6. PROVIDE UL-207 LISTED EXPANSION LOOP FOR THE 5/8" REFRIGERANT LIQUID AND 1-1/8" REFRIGERANT SUCTION LINES AT LOCATION SHOWN. THE 5/8" LOOP SHALL BE 28-1/2" LONG x 19-3/4" WIDE WITH +/-4" MOVEMENT. THE 1-1/8" LOOP SHALL BE 30" LONG x 23" WIDE WITH +/-4" MOVEMENT. PROVIDE PIPE GUIDES ON EITHER SIDE OF LOOP AND PIPE ANCHORS AT END OF PIPING RUNS PER MANUFACTURER'S RECOMMENDATIONS. INSTALL REFRIGERANT MAINS AT DIFFERENT ELEVATIONS TO ALLOW LOOPS TO AVOID CONFLICT ABOVE THE CEILING.
7. PROVIDE UL-207 LISTED EXPANSION LOOP FOR THE 1/2" REFRIGERANT LIQUID AND 1-1/8" REFRIGERANT SUCTION LINES AT LOCATION SHOWN. THE 1/2" LOOP SHALL BE 28" LONG x 17-1/2" WIDE WITH +/-4" MOVEMENT. THE 1-1/8" LOOP SHALL BE 30" LONG x 23" WIDE WITH +/-4" MOVEMENT. PROVIDE PIPE GUIDES ON EITHER SIDE OF LOOP AND PIPE ANCHORS AT END OF PIPING RUNS PER MANUFACTURER'S RECOMMENDATIONS. INSTALL REFRIGERANT MAINS AT DIFFERENT ELEVATIONS TO ALLOW LOOPS TO AVOID CONFLICT ABOVE THE CEILING.



GENERAL NOTES:

1. REFRIGERANT PIPING NOTE: 90 DEGREE ELBOWS SHALL BE KEPT A MINIMUM OF 20" FROM CEILING UV DX COILS AND 20" FROM BRANCH CONNECTOR 'Y' JOINTS. IN ADDITION, BRANCH CONNECTOR 'Y' JOINTS SHALL BE A MINIMUM OF 40" FROM ANOTHER BRANCH 'Y' CONNECTOR JOINT.
2. REFRIGERANT PIPING NOTE: THE HEAT PUMP SYSTEM MANUFACTURER SHALL INSPECT ALL FIELD INSTALLED REFRIGERANT PIPING PRIOR TO INSULATION INSTALLATION.
3. THE EXISTING SUSPENDED CEILING SYSTEMS LOCATED WITHIN THE SCOPE OF WORK AREA OUTSIDE OF AREAS BEING RENOVATED BY THE GENERAL CONTRACTOR SHALL BE DISCONNECTED AND REMOVED TO ALLOW FOR THE INSTALLATION WORK AND REINSTALLED FOLLOWING COMPLETION OF THE WORK BY THE MECHANICAL CONTRACTOR. THE SUSPENDED CEILING GRID SYSTEMS SHALL BE REMOVED AND MODIFIED TO COMPLETE THE WORK AND REINSTALLED FOLLOWING THE COMPLETION OF WORK. THE CEILING TILES SHALL BE REMOVED AS REQUIRED TO COMPLETE THE WORK AND REINSTALLED FOLLOWING THE COMPLETION OF THE INSTALLATION WORK. ANY CEILING TILES DAMAGED DURING THE INSTALLATION WORK SHALL BE REPLACED BY THE MECHANICAL CONTRACTOR TO MATCH THE EXISTING CEILING TILES.
4. ALL CUTTING, PATCHING, AND FIREPROOFING ASSOCIATED WITH THE INSTALLATION WORK SHALL BE COMPLETED BY THE MECHANICAL CONTRACTOR. PATCHED AREAS SHALL MATCH EXISTING CONDITIONS. ALL REFRIGERANT PIPING AND CONDENSATE PIPING PENETRATIONS THROUGH CORRIDOR WALLS SHALL BE FIREPROOFED PER SPECIFICATION SECTION 078400.
5. ROUTE REFRIGERANT SUCTION AND LIQUID PIPING FROM THE UNIT VENTILATOR DX COIL CONNECTIONS TO THE HEAT PUMP UNITS. SIZE PIPING AND PROVIDE BRANCH CONNECTOR 'Y' JOINTS PER THE DRAWING. CONFIRM PIPING SIZES AND BRANCH CONNECTOR 'Y' JOINT LOCATIONS REQUIRED WITH HEAT PUMP SYSTEM MANUFACTURER.
6. THE SMALLEST VOLUME ROOM THAT THE REFRIGERANT PIPING SYSTEMS ROUTE THROUGH FOR EACH OF THE HEAT PUMP SYSTEMS IS BELOW THE ASHRAE STANDARD 15 REFRIGERANT CONCENTRATION LIMIT OF 26 POUNDS PER 1,000 CUBIC FEET OF ROOM VOLUME FOR OCCUPIED SPACES.
7. PROVIDE FIRESTOPPING PER SPECIFICATION SECTION 078400 AT ALL PIPING PENETRATIONS THROUGH CORRIDOR WALLS AND STORAGE ROOM WALLS.
8. PROVIDE A DAIKIN MODEL MADOKA WIRED, REMOTE CONTROLLER FOR EACH INDOOR FAN COIL UNIT. ROUTE CONTROLLER WIRING DOWN WALL FRAMING SYSTEMS AS REQUIRED FROM FAN COIL UNIT TO CONTROLLER. CUT AND PATCH EXISTING WALL SYSTEMS AS REQUIRED TO INSTALL CONTROLLER WIRING TO MATCH EXISTING CONDITIONS.

PARTIAL FIRST FLOOR PLAN - 1962 WING

A2

1/8" = 1'-0"

ARCHITECT

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REGISTRATION EXPIRES: 11/30/2026

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NUFSD BOND PROJECTS PHASE 5 - MILLER ES

- SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- SED#50-01-08-03-7-007-002 (Maintenance)
- SED#50-01-08-03-7-012-004 (OEC)
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- SED#50-01-08-03-0-004-022 (BARR MS)

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KEY PLAN

REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

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

SHEET NAME:
PARTIAL FIRST FLOOR PLAN - 1962 WING

SHEET NUMBER:
ME-M105

ISSUE FOR BID SET

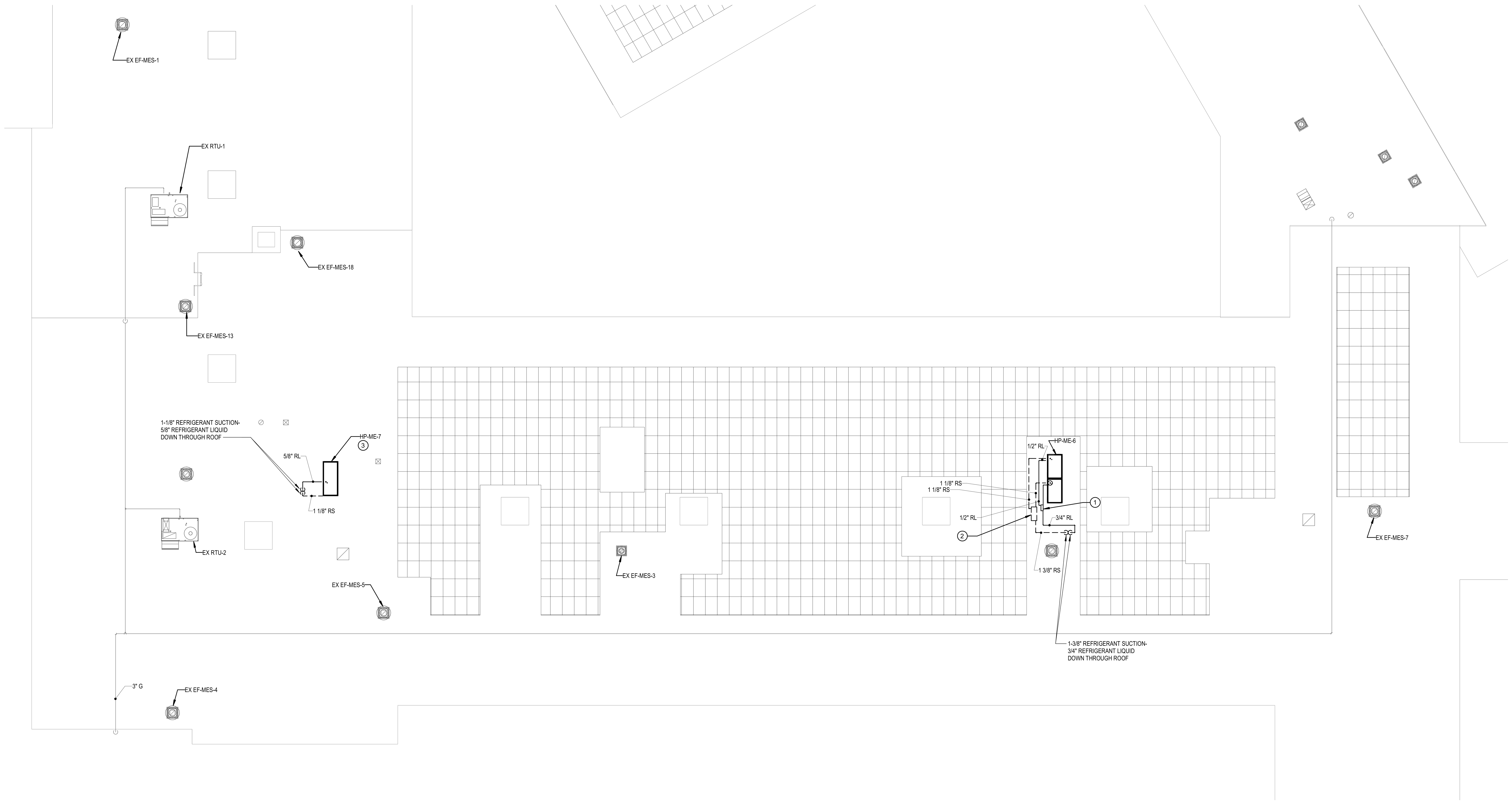
2/4/2025 9:11:30 AM

KEYED NOTES:

1. LIQUID OUTDOOR MULTI-CONNECTION PIPING KIT.
2. SUCTION OUTDOOR MULTI-CONNECTION PIPING KIT.
3. MOUNT HEAT PUMP HP-ME-7 ON TOP OF ROOF MOUNTED STEEL DUNNAGE 18" ABOVE ROOF SURFACE. COORDINATE AFIXXING HEAT PUMP TO TOP OF DUNNAGE WITH MANUFACTURER AS REQUIRED.

GENERAL NOTES:

1. REFRIGERANT PIPING NOTE: THE HEAT PUMP SYSTEM MANUFACTURER SHALL INSPECT ALL FIELD INSTALLED REFRIGERANT PIPING PRIOR TO INSULATION INSTALLATION.
2. ALL ROOFING WORK REQUIRED TO COMPLETE THE MECHANICAL INSTALLATION WORK SHALL BE BY THE MECHANICAL CONTRACTOR. ALL ROOFING WORK SHALL BE DONE AS TO MAINTAIN THE EXISTING ROOFING WARRANTY.
3. ROUTE REFRIGERANT PIPING THROUGH THE ROOF TO THE ROOF MOUNTED HEAT PUMP SYSTEMS. PROVIDE A PIPE CURB AND SIDE REFRIGERANT PIPIPNG OUTLET PORTAL AT THE ROOF PENETRATION OF EACH HEAT PUMP SYSTEM.
4. PROVIDE EQUIPMENT SUPPORT ROOF CURBS AND VIBRATION ISOLATION RAILS FOR MOUNTING OF THE HEAT PUMP TO THE ROOF PER SPECIFICATION SECTION 238129. MOUNT HEAT PUMPS 24" ABOVE ROOF SURFACE.
5. PROVIDE INSULATION AND INSULATION PROTECTION SYSTEM AROUND ALL ROOFTOP REFRIGERANT PIPING PER SPECIFICATION SECTION 230719.



PARTIAL ROOF PLAN - KINDERGARTEN WING (A1)

1/8" = 1'-0"

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REGISTRATION EXPIRES: 11/30/2026

NUFSD BOND PROJECTS PHASE 5 - MILLER ES

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KEY PLAN

REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

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

SHEET NAME:
PARTIAL ROOF PLAN - KINDERGARTEN WING

SHEET NUMBER:
ME-M106

ISSUE FOR BID SET

2/4/2025 9:11:31 AM

GENERAL NOTES:

1. REFRIGERANT PIPING NOTE: THE HEAT PUMP SYSTEM MANUFACTURER SHALL INSPECT ALL FIELD INSTALLED REFRIGERANT PIPING PRIOR TO INSULATION INSTALLATION.
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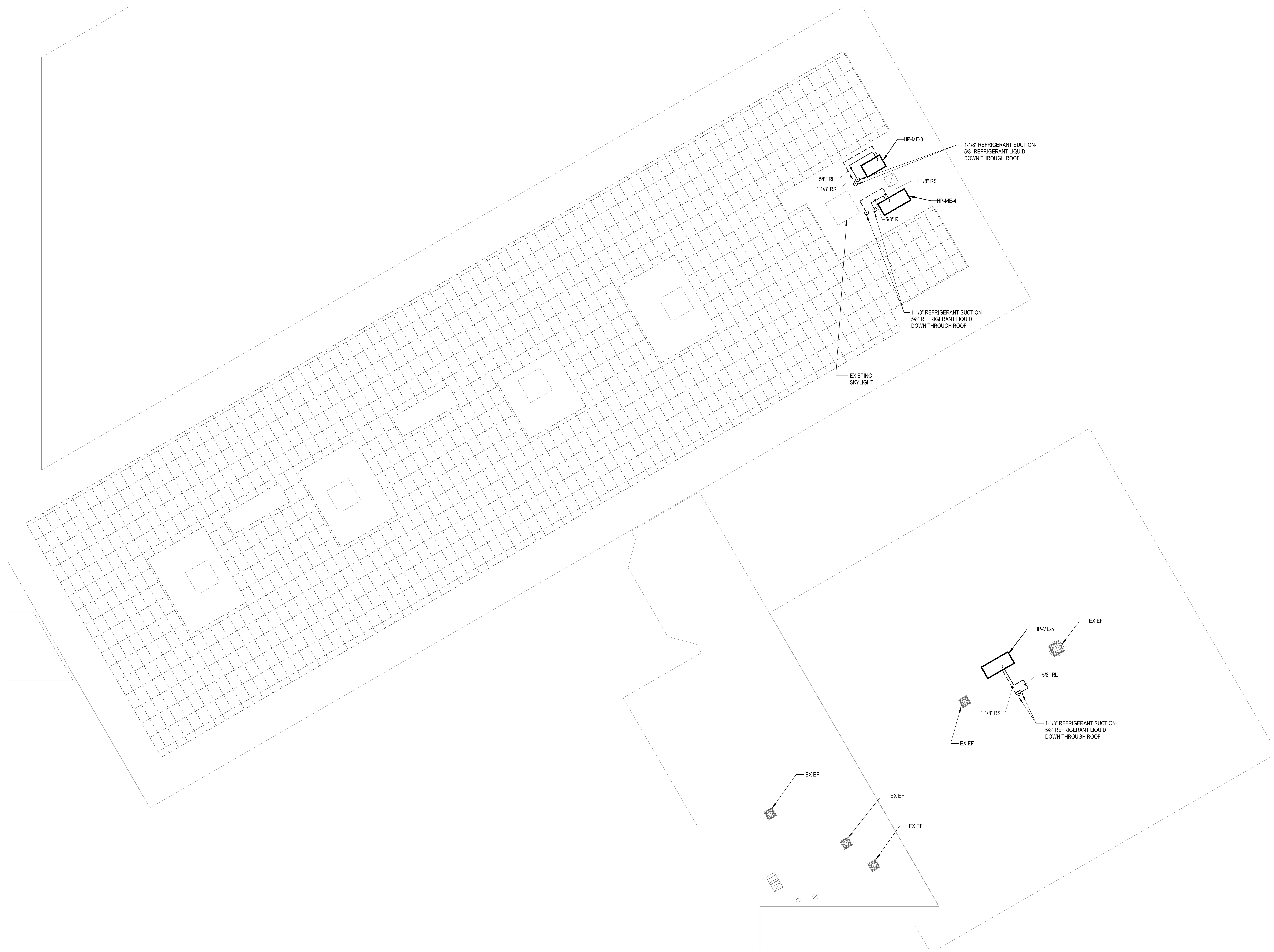
5. PROVIDE INSULATION AND INSULATION PROTECTION SYSTEM AROUND ALL ROOFTOP REFRIGERANT PIPING PER SPECIFICATION SECTION 230719.

1



PARTIAL ROOF PLAN - A-WING AND MIDDLE WING
1/8" = 1'-0"
A2

ARCHITECT

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REGISTRATION EXPIRES: 11/30/2026

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☐ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
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☐ SED#50-01-08-03-7-012-004 (OEC)
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KEY PLAN

REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

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

SHEET NAME:
PARTIAL ROOF PLAN - A-WING AND MIDDLE WING

SHEET NUMBER:
ME-M107

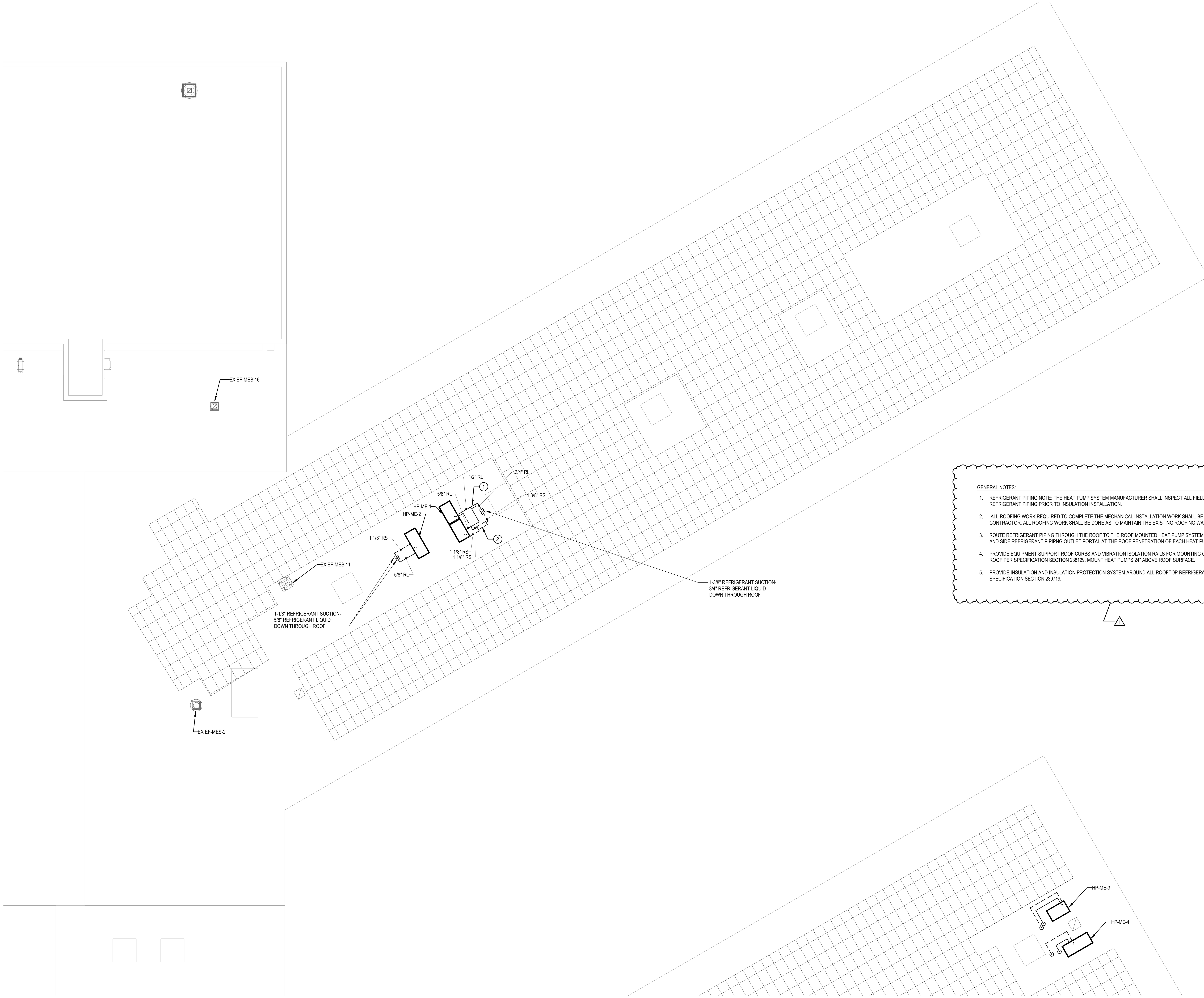
ISSUE FOR BID SET

PROJECT NUMBER: 2111003.00

2/4/2025 9:11:31 AM

KEYED NOTES:

1. LIQUID OUTDOOR MULTI-CONNECTION PIPING KIT.
2. SUCTION OUTDOOR MULTI-CONNECTION PIPING KIT.



GENERAL NOTES:

1. REFRIGERANT PIPING NOTE: THE HEAT PUMP SYSTEM MANUFACTURER SHALL INSPECT ALL FIELD INSTALLED REFRIGERANT PIPING PRIOR TO INSULATION INSTALLATION.
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5. PROVIDE INSULATION AND INSULATION PROTECTION SYSTEM AROUND ALL ROOFTOP REFRIGERANT PIPING PER SPECIFICATION SECTION 230719.

1

PARTIAL ROOF PLAN - 1962 WING (A2)

1/8" = 1'-0"

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KEY PLAN

REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

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

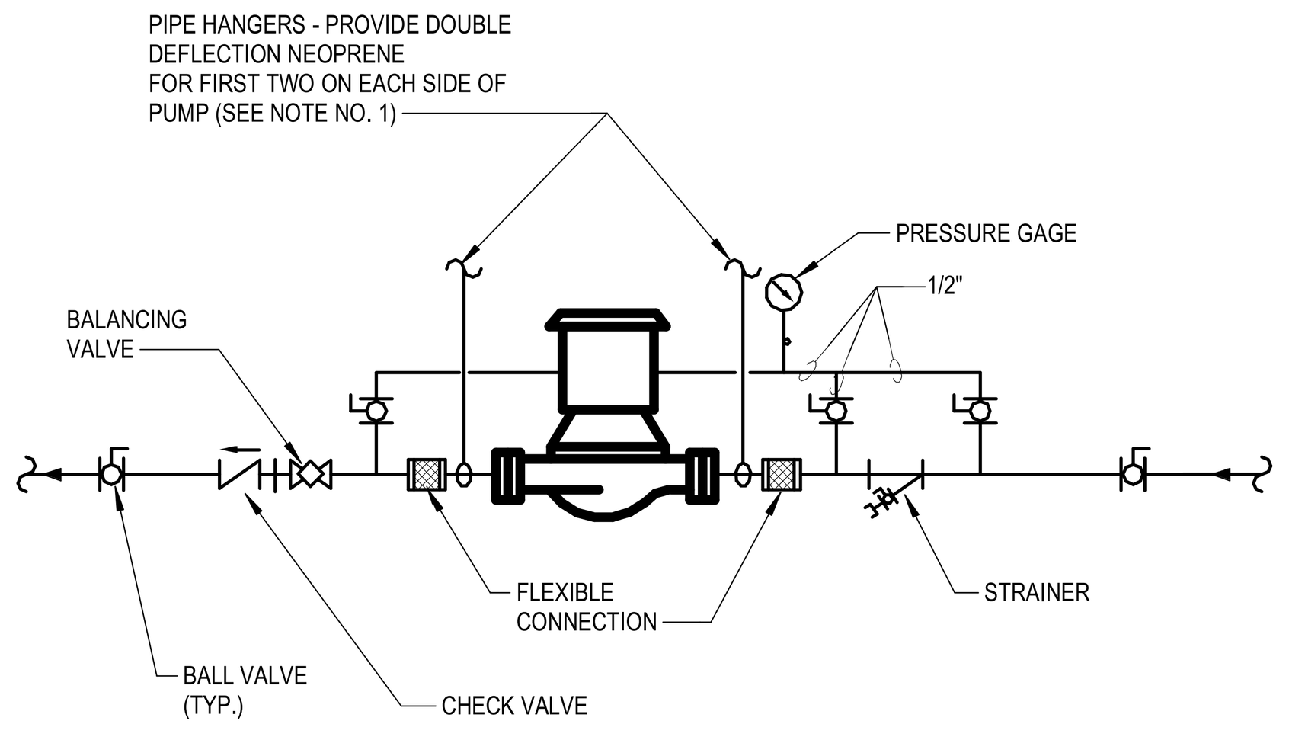
SHEET NAME:
PARTIAL ROOF PLAN - 1962 WING

SHEET NUMBER:
ME-M108

ISSUE FOR BID SET

2/4/2025 9:11:31 AM

PROJECT NUMBER: 2111003.00

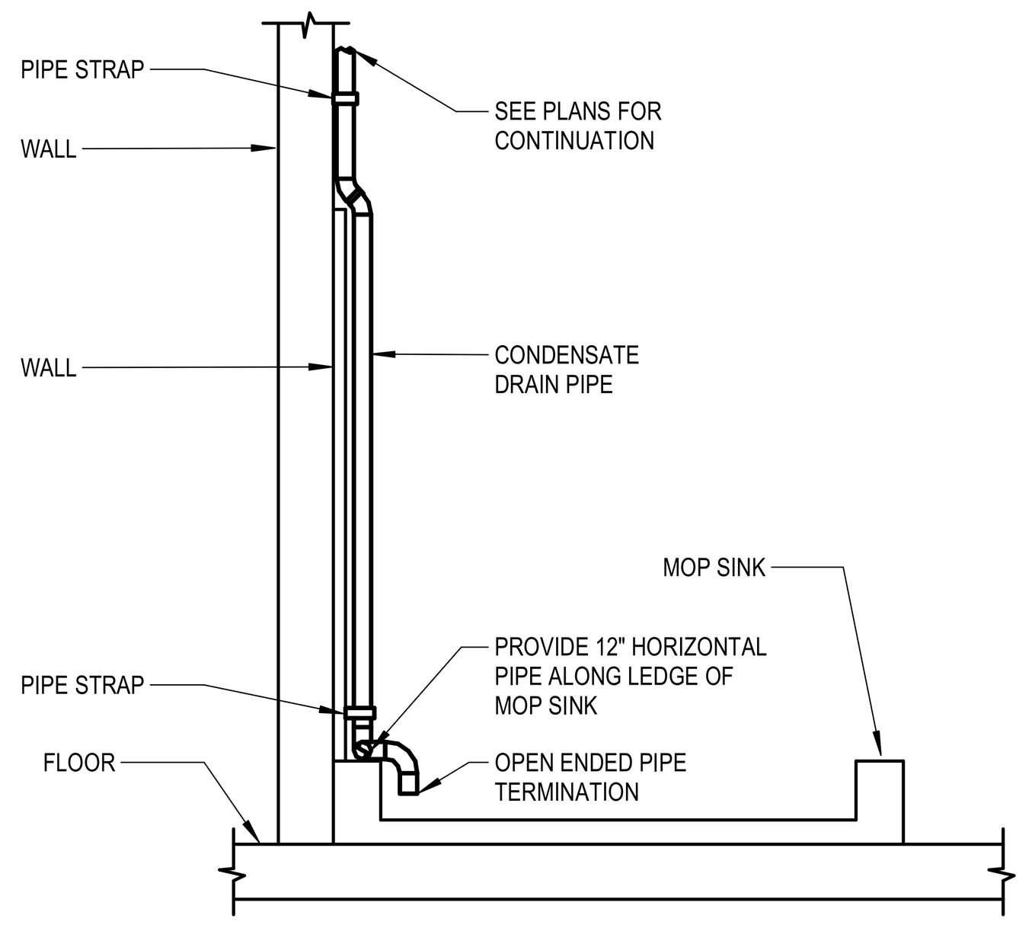


NOTES:

1. SUPPORT PUMP FROM PIPING ONLY. DO NOT SUPPORT PUMP FROM MOTOR.

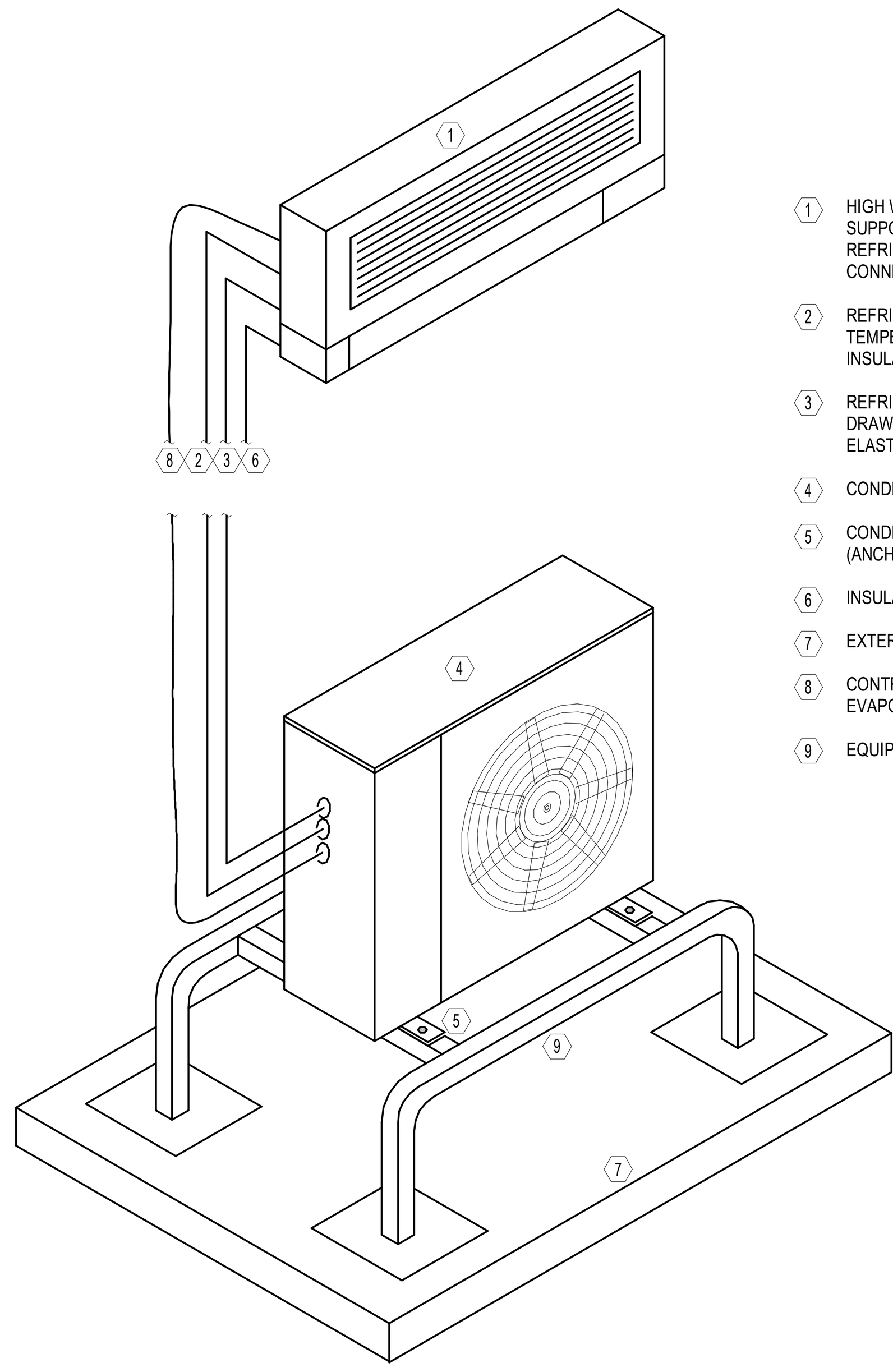
M18 IN-LINE PUMPS - CONNECTIONS

NOT TO SCALE



J18 DRAIN TERMINATION IN MOP SINK

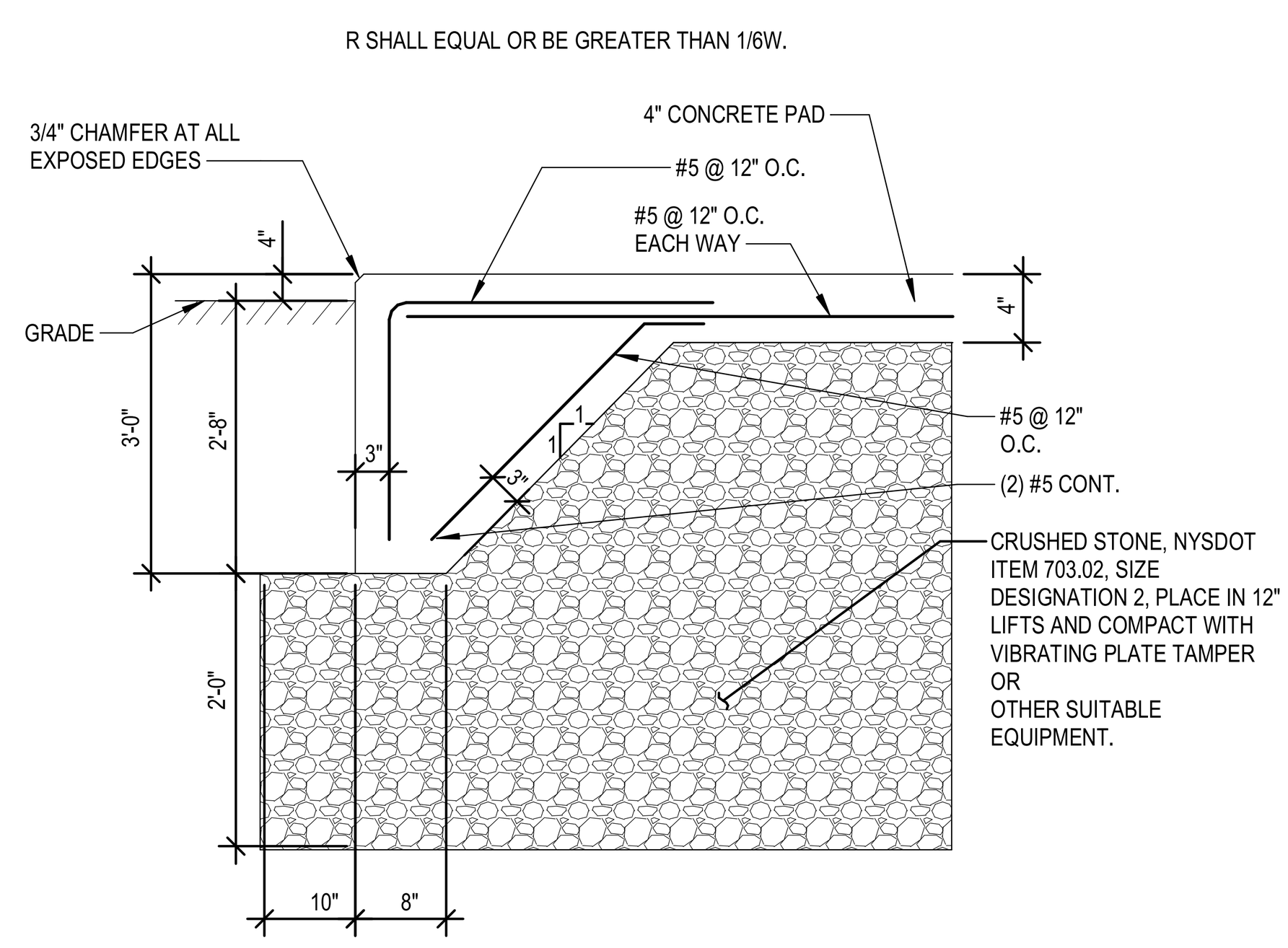
NOT TO SCALE



1. HIGH WALL MOUNT FAN COIL UNIT (TYP). SUPPORT AND SPACE AS NECESSARY FOR REFRIGERANT AND CONDENSATE PIPING CONNECTIONS.
2. REFRIGERANT LIQUID LINE (TYPE L DRAWN TEMPER COPPER WITH ELASTOMERIC INSULATION)
3. REFRIGERANT SUCTION LINE (TYPE L DRAWN TEMPER COPPER WITH ELASTOMERIC INSULATION)
4. CONDENSING UNIT
5. CONDENSING UNIT ANCHOR POINT (ANCHOR TO EQUIPMENT STAND, TYPICAL OF 4)
6. INSULATED CONDENSATE DRAIN LINE
7. EXTERIOR CONCRETE PAD
8. CONTROL WIRING/POWER WIRING TO EVAPORATOR
9. EQUIPMENT STAND (18" HIGH)

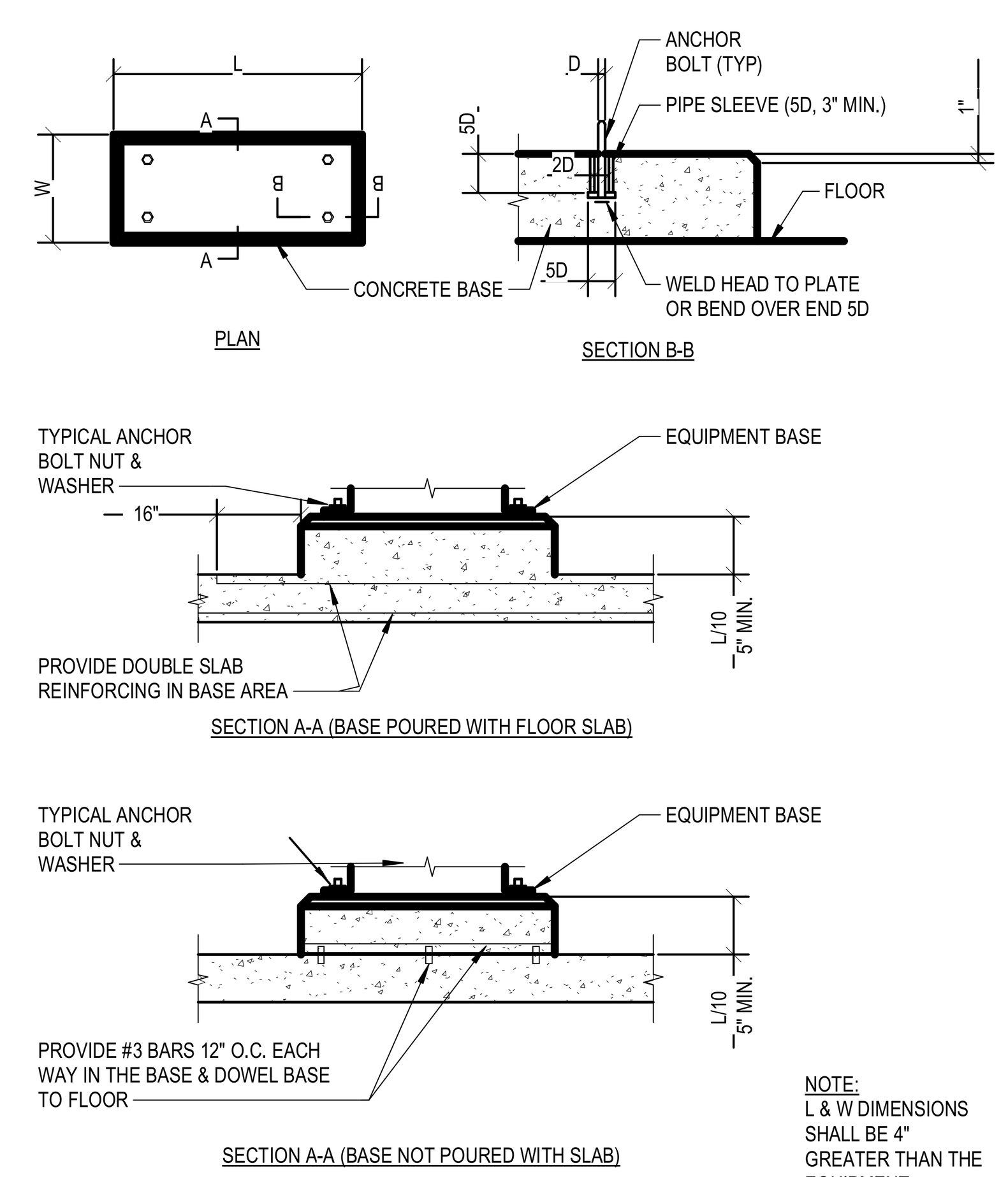
J14 DUCTLESS SPLIT DETAIL WITH WALL MOUNTED FAN COIL UNIT

NOT TO SCALE



E13 EXTERIOR CONCRETE PAD DETAIL

NOT TO SCALE



NOTE:
L & W DIMENSIONS SHALL BE 4" GREATER THAN THE EQUIPMENT.

A12 INTERIOR CONCRETE EQUIPMENT BASES

NOT TO SCALE

SINGLE LINE SYMBOLS LEGEND

- HWS — HEATING WATER SUPPLY PIPING
- HWR — HEATING WATER RETURN PIPING
- COND — COOLING COIL CONDENSATE PIPING
- RL — REFRIGERANT LIQUID PIPING
- RS — REFRIGERANT SUCTION PIPING
- 90 DEGREE PIPE ELBOW DOWN
- PIPE RISER UP SYMBOL
- MID-PIPE DOWN
- PIPE CAP
- PIPE BREAK
- PIPE GUIDE
- UNION
- FLOW DIRECTION
- PIPING/DUCTWORK/EQUIPMENT REMOVALS
- CHECK VALVE
- SHUTOFF BALL VALVE
- 2-WAY MODULATING CONTROL VALVE
- 2-WAY CONTROL VALVE
- 3-WAY MODULATING CONTROL VALVE
- GATE VALVE CIRCUIT SETTER BALANCING VALVE - 2-1/2" SIZE AND UP
- CALIBRATED BALANCE VALVE CIRCUIT SETTER BALANCING VALVE - 2" SIZE AND BELOW
- PRESSURE REDUCING VALVE
- 3-WAY CONTROL VALVE
- OR — BUTTERFLY VALVE
- RELIEF VALVE
- PRESSURE RELIEF VALVE
- AUTOMATIC AIR VENT
- PUMP
- OR — PRESSURE GAGE
- OR — STRAINER
- OR — THERMOMETER
- POINT OF CONNECTION
- POINT OF DISCONNECTION
- EXPANSION COMPENSATOR

DOUBLE LINE SYMBOLS LEGEND

- SUPPLY DIFFUSER
- RETURN DIFFUSER
- SQUARE-THROATED ELBOW WITH TURNING VANES
- DS-X — ELBOW STYLE DUCT SILENCER
- DS-X — STRAIGHT DUCT STYLE DUCT SILENCER
- R — DUCTWORK RADIUS ELBOW
- F/S — COMBINATION FIRE/SMOKE DAMPER
- F — FIRE DAMPER
- S — SMOKE DAMPER
- M — MOTORIZED DAMPER
- FLEXIBLE SUPPLY AIR DUCTWORK MAXIMUM 3-FOOT LENGTH
- VOLUME DAMPER
- RETURN AIR RISE
- EXHAUST AIR RISE
- SUPPLY AIR RISE
- X — KEYED NOTE DESIGNATION TAG
- C — FCU CONTROLLER
- T — SPACE TEMPERATURE SENSOR

ABBREVIATIONS LEGEND

AC	AIR CONDITIONER	LMTD	LOGARITHMIC MEAN TEMPERATURE DIFFERENCE
ACCU	AIR COOLED CONDENSING UNIT	LWT	LEAVING WATER TEMPERATURE
AD	ACCESS DOOR	MAX	MAXIMUM
AFF	ABOVE FINISHED FLOOR	MBH	THOUSAND BTUH
AFG	ABOVE FINISHED GRADE	MC	MOTOR CONTROLLER
AFUE	ANNUAL FUEL UTILIZATION EFFICIENCY	MCA	MINIMUM CIRCUIT AMPACITY
AH	AIR HANDLER	MER	MECHANICAL EQUIPMENT ROOM
AHU	AIR HANDLING UNIT	MH	MOUNTING HEIGHT
APD	AIR PRESSURE DROP	MD	MOTORIZED DAMPER
AS	AIR SEPARATOR	MIN	MINIMUM
ATS	AIR TRANSFER SLEEVE	MOP	MAXIMUM OVERCURRENT PROTECTION
AVG	AVERAGE SPACE TEMPERATURE	N/A	NOT APPLICABLE
BHP	BRAKE HORSEPOWER	NC	NORMALLY CLOSED
BM	BAILEY MIDDLE SCHOOL	MFG	MANUFACTURER
BTM	BOTTOM	NG	NATURAL GAS DETECTOR
BTUH	BRITISH THERMAL UNITS/HOUR	NO	NORMALLY OPEN
BTU/H/LF	BRITISH THERMAL UNIT/HOUR/ LINEAR FOOT	NOL	NON OVER LOADING
CAP	CAPACITY	OA	OUTSIDE AIR
CFM	CUBIC FEET PER MINUTE	OAD	OUTSIDE AIR DAMPER
CI	CAST IRON	OED	OPEN END DUCT
CO	CARBON MONOXIDE SENSOR	OS&Y	OPEN STEM & YOKE
COND.	CONDENSATE PIPING	OZ	OUNCE
CONT.	CONTINUATION	P	PUMP
CP	STEAM CONDENSATE PUMP/RECEIVER SET	PC	PLUMBING CONTRACTOR
CUH	CABINET UNIT HEATER	PD	PRESSURE DROP
CW	DOMESTIC COLD WATER	PG	PROPYLENE GLYCOL
CV	CONVECTOR	PH	PHASE
cV	VALVE COEFFICIENT	PPM	PARTS PER MILLION
D	DIFFUSER	PRV	PRESSURE REDUCING VALVE
DB	DRY BULB	PSI	POUNDS PER SQUARE INCH
dBA	A-WEIGHTED DECIBEL LEVEL	PSIG	POUNDS PER SQUARE INCH GAUGE
DCW	DOMESTIC COLD WATER	R	HEATING WATER RADIATION UNIT
DDC	DIRECT DIGITAL CONTROL	RA	RETURN AIR
DEG. F	DEGREES FAHRENHEIT	RD	RETURN DIFFUSER
DHWR	DOMESTIC HOT WATER RETURN	REF	ROOF EXHAUST FAN
DIA	DIAMETER	RF	RELIEF FAN
DN	DOWN	RH	RELATIVE HUMIDITY
DS	DUCT SILENCER	RHG	REFRIGERANT HOT GAS
DWDI	DUAL WIDTH, DUAL INLET	RL	REFRIGERANT LIQUID
DWG	DRAWING	RLA	RATED LOAD AMPS
EA	EXHAUST AIR	RPM	REVOLUTIONS PER MINUTE
EAT	ENTERING AIR TEMPERATURE	RP	HYDRONIC RADIANT HEAT PANEL
E.C.	EXPANSION COMPENSATOR	RPZ	REDUCED PRESSURE ZONE ASSEMBLY
EDB	ENTERING DRY BULB	RR	RETURN REGISTER
EER	ENERGY EFFICIENCY RATIO	RS	REFRIGERANT SUCTION
E	EXHAUST FAN TAG	RTU	ROOF TOP UNIT
EF	EXHAUST FAN	S	INDOOR AIR HANDLING UNIT TAG
EG	EXHAUST GRILLE	SA	SUPPLY AIR
EHC	IN-DUCT ELECTRIC HEATING COIL	SF	SQUARE FOOT
EL	EXPANSION LOOP	SD	SUPPLY DIFFUSER
ER	EXHAUST REGISTER	SEER	SEASONAL ENERGY EFFICIENCY RATIO
ERV	STATIC PLATE ENERGY RECOVERY VENTILATOR	SP	STATIC PRESSURE
ESP	EXTERNAL STATIC PRESSURE	SPS	STATIC PRESSURE SENSOR
ET	EXPANSION TANK	SR	SHORT RADIUS
EWT	ENTERING WATER TEMPERATURE	SS	STAINLESS STEEL
EX	EXISTING	SWSI	SINGLE WIDTH SINGLE INLET
F	FAN	TEMP	TEMPERATURE
°F	FAHRENHEIT	TG	TRANSFER GRILLE
FAI	FRESH AIR INTAKE	TR	DUCTWORK TRANSITION
FC	FORWARD CURVED	TSP	TOTAL STATIC PRESSURE
FD	FIRE DAMPER	TYP	TYPICAL
FCU	FAN COIL UNIT	UH	UNIT HEATER
FLA	FULL LOAD AMPS	VAV	VARIABLE AIR VOLUME
FLR	FLOOR	VEL	VELOCITY
FO	FLAT OVAL	VERT	VERTICAL
FPM	FEET PER MINUTE	VFD	VARIABLE FREQUENCY DRIVE
FSD	FIRE SMOKE DAMPER	VRF	VARIABLE REFRIGERANT FLOW
FT	FIN TUBE	VRV	VARIABLE REFRIGERANT VOLUME
FT. OR '	FEET	W	WIDTH
FTR	FIN TUBE RADIATION	WB	WET BULB
G	GRILLE	WC	WATER COLUMN
gal/GAL	GALLON	WPD	WATER PRESSURE DROP
GPH	GALLONS PER HOUR	WH	WATER HEATER
GPM	GALLONS PER MINUTE		
GV	GRAVITY RELIEF VENTILATOR		
H	HOOD		
HP	HORSEPOWER OR HEAT PUMP		
HPSF	HEAT PUMP SEASONAL PERFORMANCE FACTOR		
HS	HIGH SCHOOL		
H&V	HEATING AND VENTILATION		
HW	DOMESTIC HOT WATER		
HWP	HOT WATER PUMP		
HWR	HOT WATER RETURN		
HWS	HOT WATER SUPPLY		
HX	HEAT EXCHANGER		
HZ	HERTZ		
IEER	INTEGRATED ENERGY EFFICIENCY RATIO		
IN OR "	INCHES		
INT	INTERNAL		
KEF	KITCHEN EXHAUST FAN		
KW	KILOWATT		
L	LENGTH		
LAT	LEAVING AIR TEMPERATURE		
LBS	POUNDS		
LDB	LEAVING DRY BULB		
LF	LINEAR FOOT		

CONTROLS LEGEND

- D — DIGITAL INPUT
- D — DIGITAL OUTPUT
- A — ANALOG INPUT
- A — ANALOG OUTPUT
- M — MOTOR OPERATOR / MOTORIZED DAMPER
- DP — DIFFERENTIAL PRESSURE SENSOR
- SP — STATIC PRESSURE SENSOR
- S/S — START/STOP
- NG — NATURAL GAS DETECTOR
- T — SPACE DRY BULB TEMPERATURE SENSOR
- TH — COMBINATION SPACE DRY BULB TEMPERATURE SENSOR WITH RELATIVE HUMIDITY SENSOR INCLUDED
- C — FAN COIL UNIT REMOTE CONTROLLER
- H — RELATIVE HUMIDITY SENSOR
- H — WALL MOUNTED HUMIDITY SENSOR
- CO2 — CARBON DIOXIDE SENSOR
- CO — CARBON MONOXIDE DETECTOR
- M — MOTORIZED DAMPER
- ST — STARTER
- VFD — VARIABLE FREQUENCY DRIVE
- ECM — ELECTRICALLY COMMUTATED MOTOR INTERFACE BOARD
- AMS — AIR MEASURING STATION
- CS — CURRENT SENSOR
- ES — END SWITCH
- OS — OCCUPANCY SENSOR
- PS — PRESSURE SENSOR
- SP — STATIC PRESSURE SENSOR
- H — HUMIDITY
- SD — SMOKE DETECTOR
- R — RELAY
- T — ELECTRIC THERMOSTAT DUCT MOUNTED
- F — AIRFLOW SENSOR
- A — ALARM
- T — TREND
- RT — RUN TIME
- T — TEMPERATURE SENSOR SINGLE POINT
- T — TEMPERATURE SENSOR AVERAGING SENSING ELEMENT
- M — 2-WAY CONTROL VALVE ELECTRIC ACTUATOR
- M — 3-WAY CONTROL VALVE ELECTRIC ACTUATOR

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NUFSD BOND PROJECT PHASE 5 - OEC

- ☐ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- ☐ SED#50-01-08-03-7-007-002 (Maintenance)
- ■ SED#50-01-08-03-7-012-004 (OEC)
- ☐ SED#50-01-08-03-0-001-026 (MILLER ES)
- ☐ SED#50-01-08-03-0-004-022 (BARR MS)

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KEY PLAN

REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

SCALE: NOT TO SCALE

SHEET NAME:
SYMBOLS, LEGENDS, ABBREVIATIONS, AND DETAILS

SHEET NUMBER:
OEC-M001

ISSUE FOR BID SET

NATURAL GAS CONDENSING BOILER SCHEDULE

1. PROVIDE BOILER NEUTRALIZER AND PUMP THAT FITS INSIDE AND PLUGS INTO BOILER CABINET. CONDENSATE PUMP HARTELL MODEL KL-1DG OR EQUAL, MAXIMUM 2 AMPS @ 115 VOLT. PROVIDE BOILER WITH FULL MODULATION OF 10:1 TURNDOWN.
2. AHRI CERTIFIED AFUE RATING TO BE 95.3%.
3. PROVIDE WITH INTEGRAL BOILER OPERATION CONTROLLER AND LCD PANEL CAPABLE OF OUTDOOR RESET SCHEDULE AND CIRCULATOR PUMP OPERATION. PROVIDE LOW VOLTAGE WIRING BETWEEN BOILER CONTROL BOARD AND CIRCULATOR PUMP TO ENABLE PUMP ON CALL FOR BOILER FIRING. PROVIDE WIRING BETWEEN OUTDOOR AIR SENSOR AND BOILER OPERATION CONTROLLER AS REQUIRED FOR OUTSIDE RESET OPERATION. FIELD LOCATE OUTDOOR AIR SENSOR PER MANUFACTURER'S RECOMMENDATIONS.

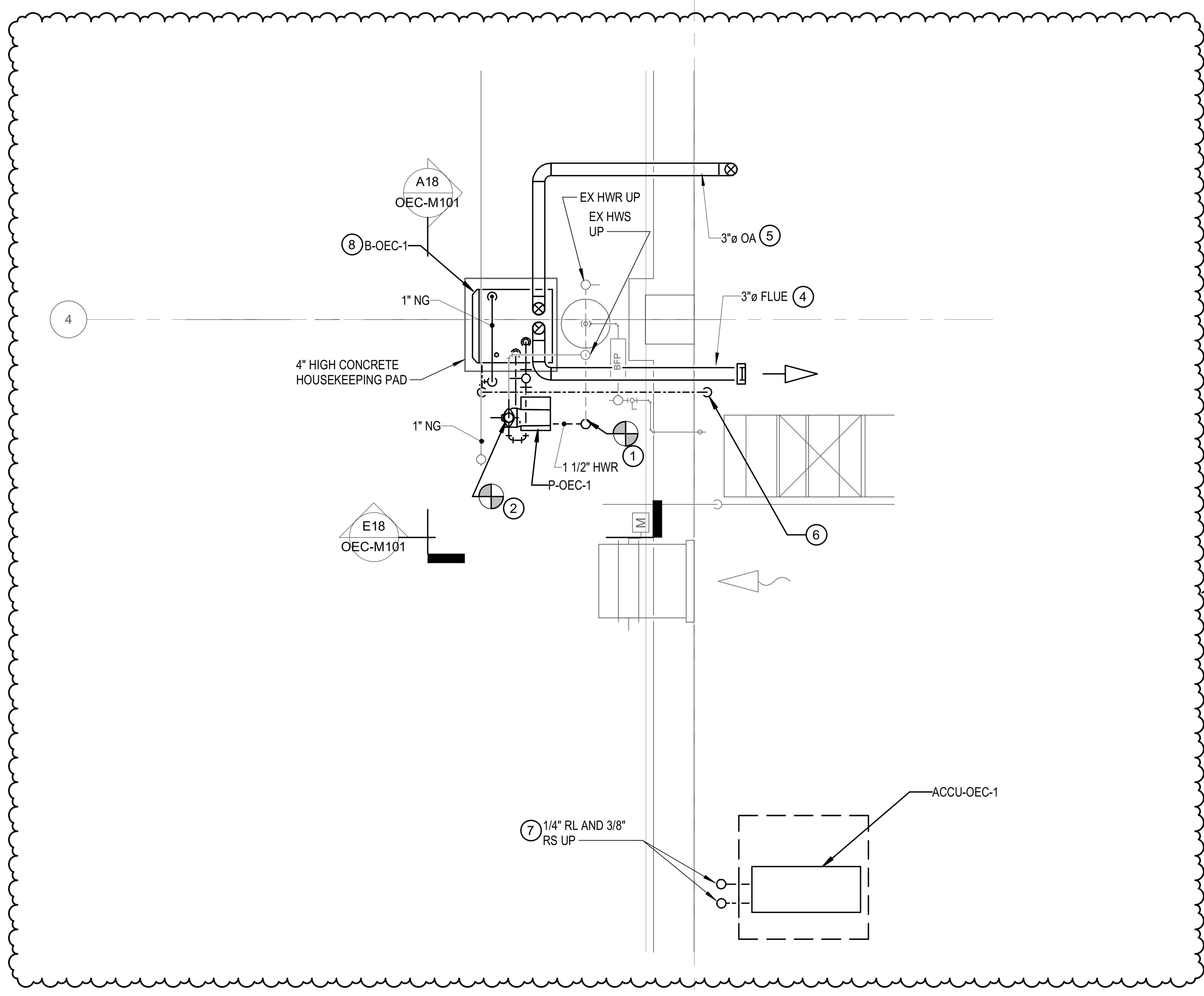
												ELECTRICAL DATA					
TAG	SERVICE	HP	GROSS INPUT (MBH)	AHRI CERTIFIED HETAING CAPACITY (MBH)	NET AHRI RATING (MBH)	VENT DIAMETER	ASME RELIEF VALVE SETTING	GPM	EWT	LWT	AFUE EFFICIENCY	OPERATING WEIGHT	VOLTS	PH	AMPS	MOP	BASIS OF DESIGN MFG. AND MODEL	REMARKS
B-OEC-1	BUILDING HEAT	5.4	199	182	158	3"	30 psi	15.8 GPM	160 °F	180 °F	95.3%	130 lb	120	1	4	15	LAARS FTHF199	1,2,3

PUMP SCHEDULE

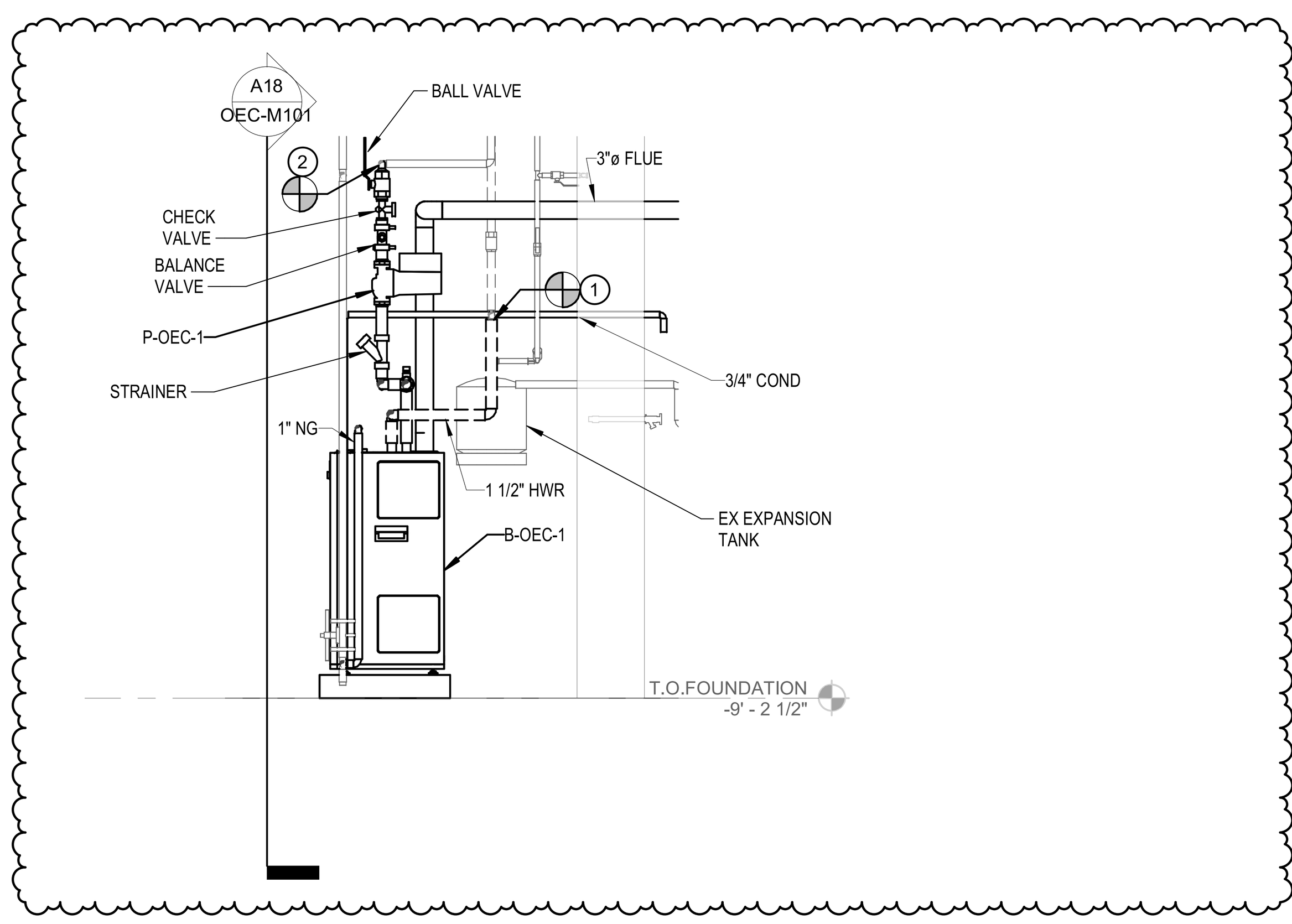
												ELECTRICAL DATA						
Mark	TYPE	FLOW	HEAD	RPM	IMPELLER DIAMETER	SUCTION X DISCHARGE (IN. X IN.)	FLUID TEMP	FLUID TYPE	WIRE TO WATER EFFICIENCY	ELECTRICAL FLA	MAXIMUM ELECTRICAL WATTS	BRAKE HP	NOL HP	HP	VOLTS	PH	BASIS OF DESIGN MFG. AND MODEL	REMARKS
P-OEC-1	HIGH EFFICIENCY LARGE WET ROTOR CIRCULATOR WITH EC MOTOR	15.8 GPM	30 ft	3,588		1.5"x1.5"	180 °F	WATER	39.3%	2.0 A	500 W			1/2	208	1	BELL&GOSSETT ecocirc XL 55-45	

KEYED NOTES:

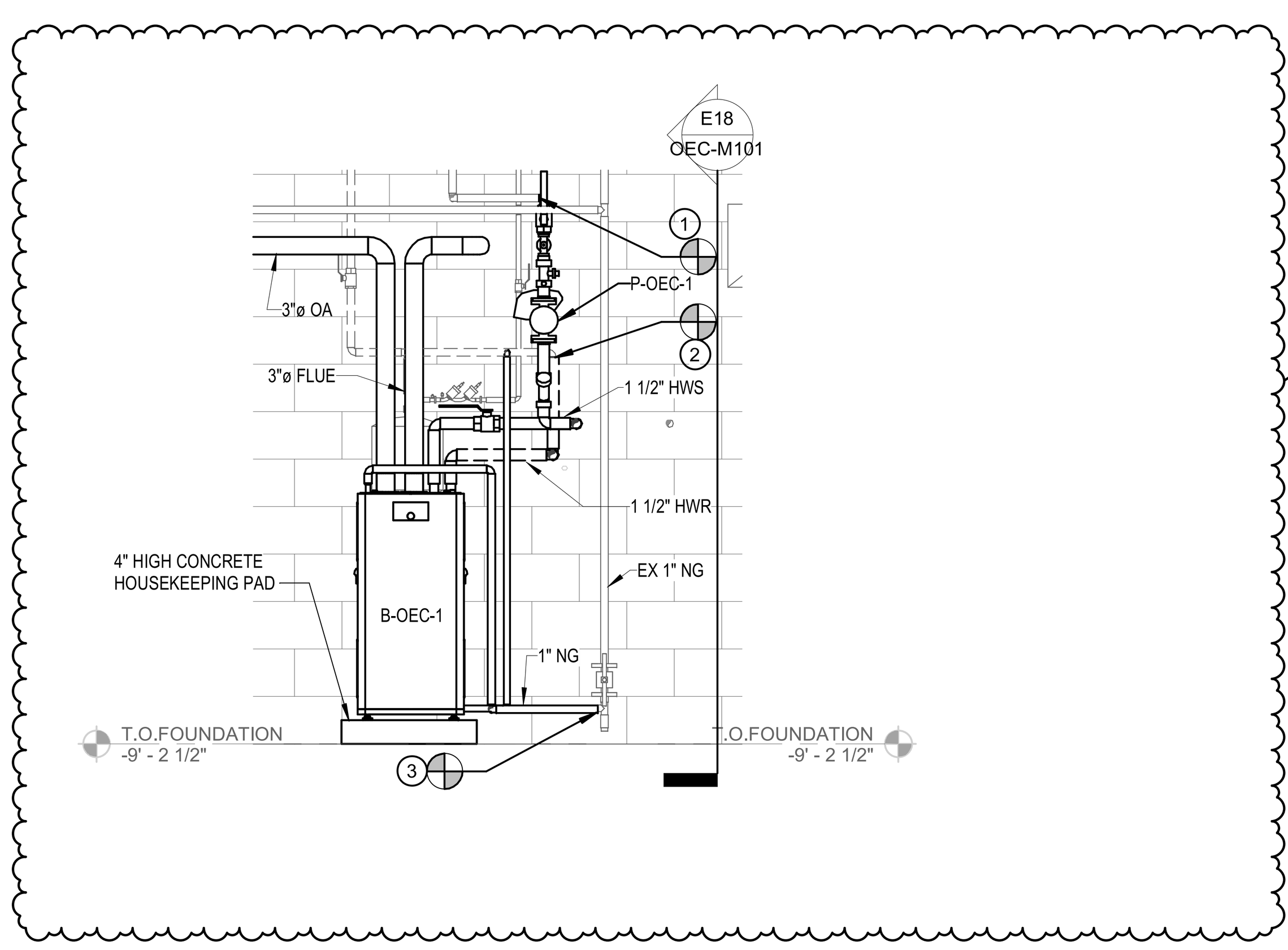
1. ROUTE 1-1/2" HWR FROM EXISTING HWR PIPING AT CONNECTION POINT SHOWN TO TOP HEATING WATER INLET CONNECTION ON BOILER.
2. ROUTE 1-1/2" HWS FROM EXISTING HWS PIPING AT CONNECTION POINT SHOWN TO TOP HEATING WATER OUTLET CONNECTION ON BOILER. PROVIDE INLINE CIRCULATOR PUMP WITHIN HWS RISER AS SHOWN.
3. CONNECT TO EXISTING NATURAL GAS PIPING AT LOCATION SHOWN AND ROUTE 1" GAS PIPING TO TOP GAS INLET CONNECTION ON BOILER.
4. TERMINATE 3" ROUND BOILER VENT WITH VENT SCREEN APPROXIMATELY 36" ABOVE GRADE AND 12" FROM EXTERIOR WALL PENETRATION.
5. TERMINATE 3" ROUND BOILER INTAKE AIR DUCT WITH ELBOW FACING DOWN AND INTAKE SCREEN.
6. ROUTE CONDENSATE FROM BOILER CONDENSATE PUMP OUTLET OUT THROUGH EXTERIOR WALL AND TERMINATE OPEN-ENDED FACING DOWN TOWARDS GRADE WITH MITER CUT OUTLET.
7. REFER TO FIRST FLOOR PLAN FOR CONTINUATION OF REFRIGERANT LIQUID AND SUCTION PIPE RISERS.
8. MOUNT BOILER B-OEC-1 ON 4" HIGH CONCRETE HOUSEKEEPING PAD SIZED 4" WIDER THEN BOILER IN ALL DIRECTIONS.
9. MOUNT ACCU SUPPORT STAND ON 4" HIGH EXTERIOR CONCRETE HOUSEKEEPING PAD.



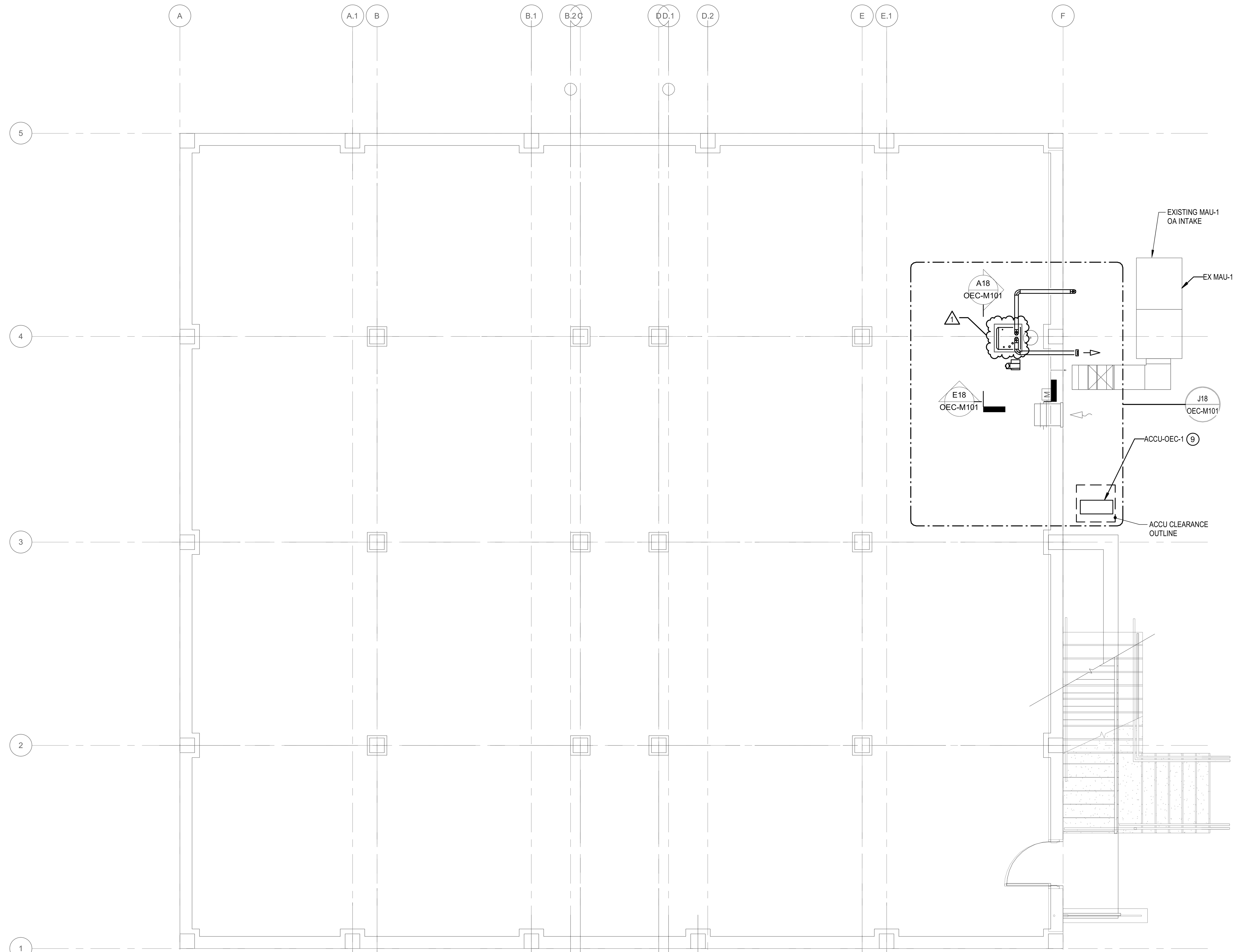
J18 ENLARGED BOILER PLAN
1/2" = 1'-0"



E18 BOILER SECTION VIEW - LOOKING SOUTH
1/2" = 1'-0"



A18 BOILER SECTION VIEW - LOOKING WEST
1/2" = 1'-0"



A11 BASEMENT PLAN
1/4" = 1'-0"

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NUFSD BOND PROJECT PHASE 5 - OEC

- ☐ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- ☐ SED#50-01-08-03-7-007-002 (Maintenance)
- ■ SED#50-01-08-03-7-012-004 (OEC)
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- ☐ SED#50-01-08-03-0-004-022 (BARR MS)

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KEY PLAN

REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET
DATE: 06/21/2024
SCALE: As indicated
SHEET NAME: BASEMENT PLAN
SHEET NUMBER: OEC-M101

ISSUE FOR BID SET

KEYED NOTES:

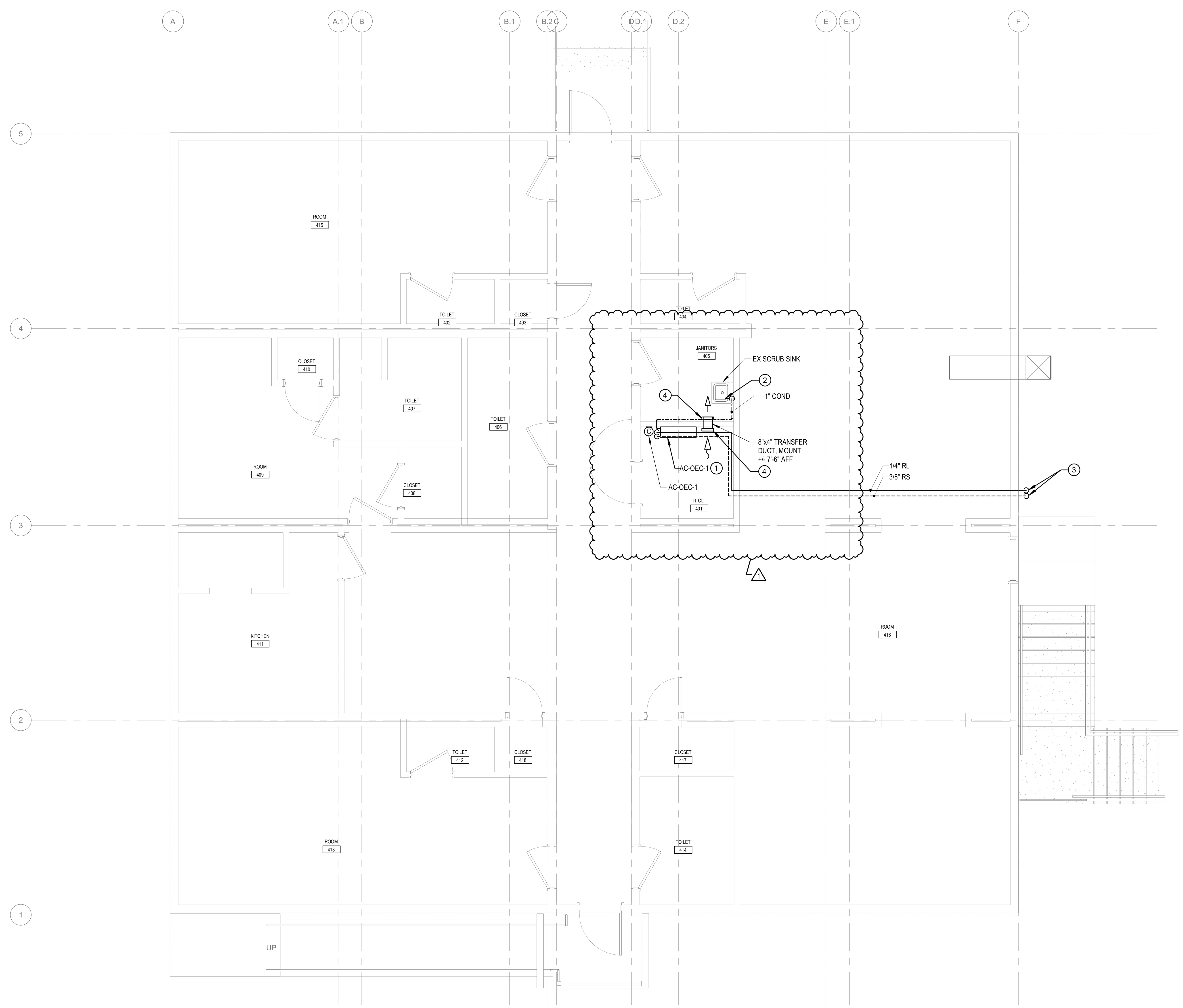
1. PROVIDE SPLIT-SYSTEM FAN COIL UNIT FOR COOLING THE IT RACK ROOM.
2. TERMINATE 1" CONDENSATE DRAIN OPEN-ENDED DOWN TO SCRUB SINK AT LOCATION SHOWN.
3. REFER TO BASEMENT PLAN FOR LOCATION OF AIR COOLED CONDENSING UNIT ACCU-OEC-1. REFRIGERANT LIQUID AND SUCTION LINES DROP DOWN TO ACCU-OEC-1.
4. PROVIDE GALVANIZED 1/4" WIRE MESH SCREEN OVER OPEN-ENDED TRANSFER AIR DUCT.

DUCTLESS SPLIT SYSTEM SCHEDULE

1.PROVIDE HEAT PUMP WITH 18" HIGH STAND AND PROVIDE INDOOR UNIT WITH WIRE REMOTE CONTROLLER.
2.PROVIDE POWER CONNECTION AND ALL REQUIRED WIRING FOR INDOOR UNIT FROM OUTDOOR UNIT POWER SOURCE. PROVIDE ALL REQUIRED CONTROL WIRING PER MANUFACTURER'S INSTALLATION INSTRUCTIONS BETWEEN OUTDOOR UNIT, INDOOR UNITS AND WIRED CONTROLLERS.

Mark	SERVICE	DESCRIPTION	RATED COOLING CAPACITY	CAPACITY COOLING MIN	RATED CAPACITY HEATING (@ 17 F)	CFM				SOUND PRESSURE H/M/L/Q (dBA)	ELECTRICAL DATA					WEIGHT	BASIS OF DESIGN MFG. AND MODEL
						HIGH	MEDIUM	LOW	QUIET		VOLTS	PHASE	HERTZ	INDOOR FAN MOTOR FLA	INDOOR FAN MOTOR W		
AC-OEC-1	IT CLOSET	WALL MOUNTED	9,000 Btu/h	4,400 Btu/h	6,600 Btu/h	515	340	249	219	45/33/25/22	208 V	1	60 Hz	0.25 A	27 W	29 lb	DAIKIN FTK09BXVJU

Mark	COOLING CAPACITY RANGE	RATED HEATING RANGE	RATED COOLING CAPACITY	RATED HEATING CAPACITY (@17 F)	AIRFLOW RATE	ELECTRICAL DATA				REFRIGERANT TYPE	REFRIGERANT CHARGE (LBS)	HSPF	SEER	EER	WEIGHT	BASIS OF DESIGN MFG. AND MODEL	REMARKS
						VOLTS	PH	MCA	MFA								
ACCU-OEC-1	4,400 - 12500 Btu/h	4,400 - 19,500	8,900 Btu/h	6,600 Btu/h	1,317 CFM	208	1	12.30	15	R-32	2.16	13.8	27.4	16.3	96 lb	DAIKIN RXM09VVJU	1-2



A12 FIRST FLOOR PLAN
1/4" = 1'-0"

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KEY PLAN

REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET

DATE: 06/21/2024

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

SHEET NAME:
FIRST FLOOR PLAN

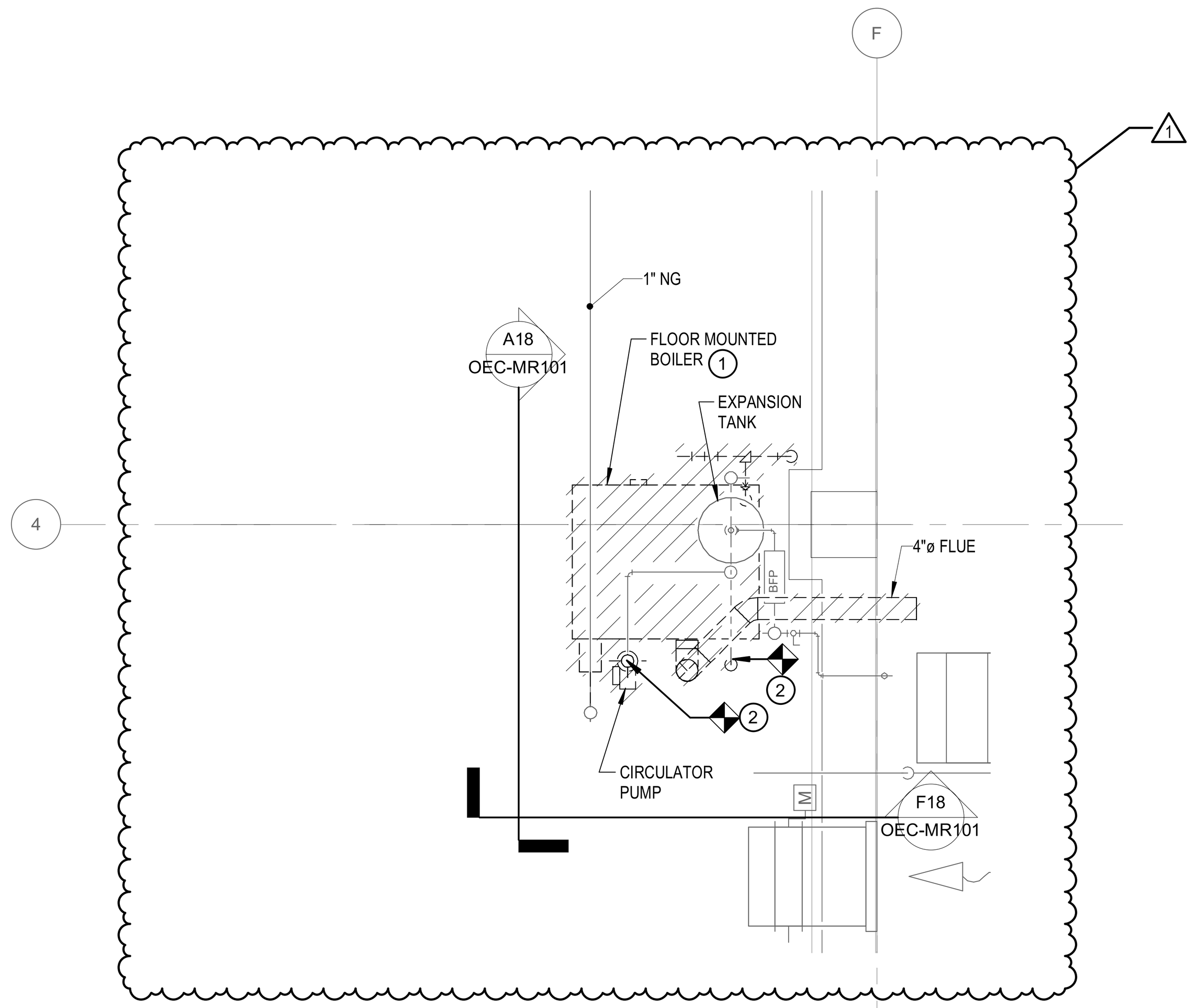
SHEET NUMBER:
OEC-M102

ISSUE FOR BID SET

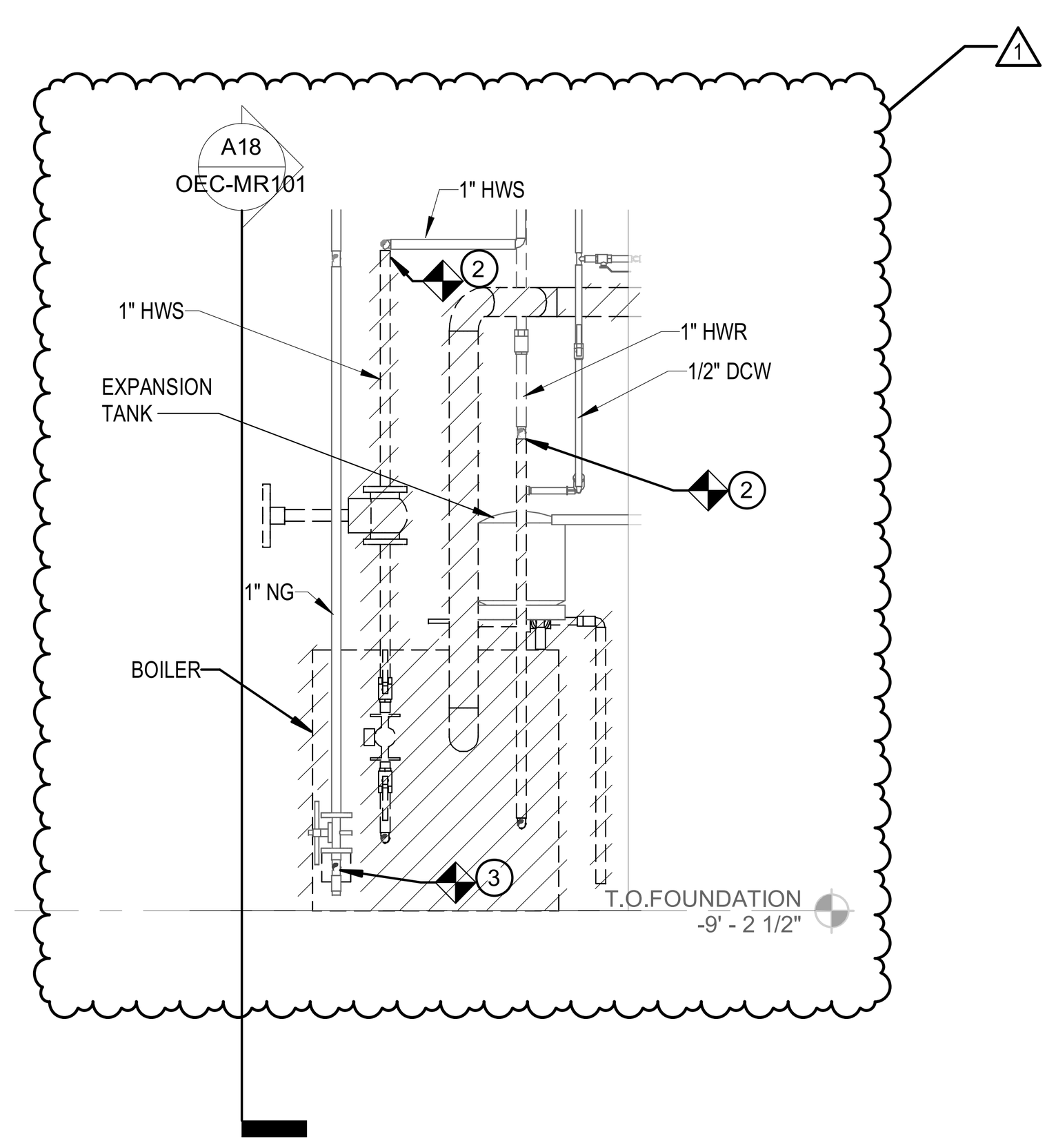
2/4/2025 8:52:13 AM

KEYED NOTES:

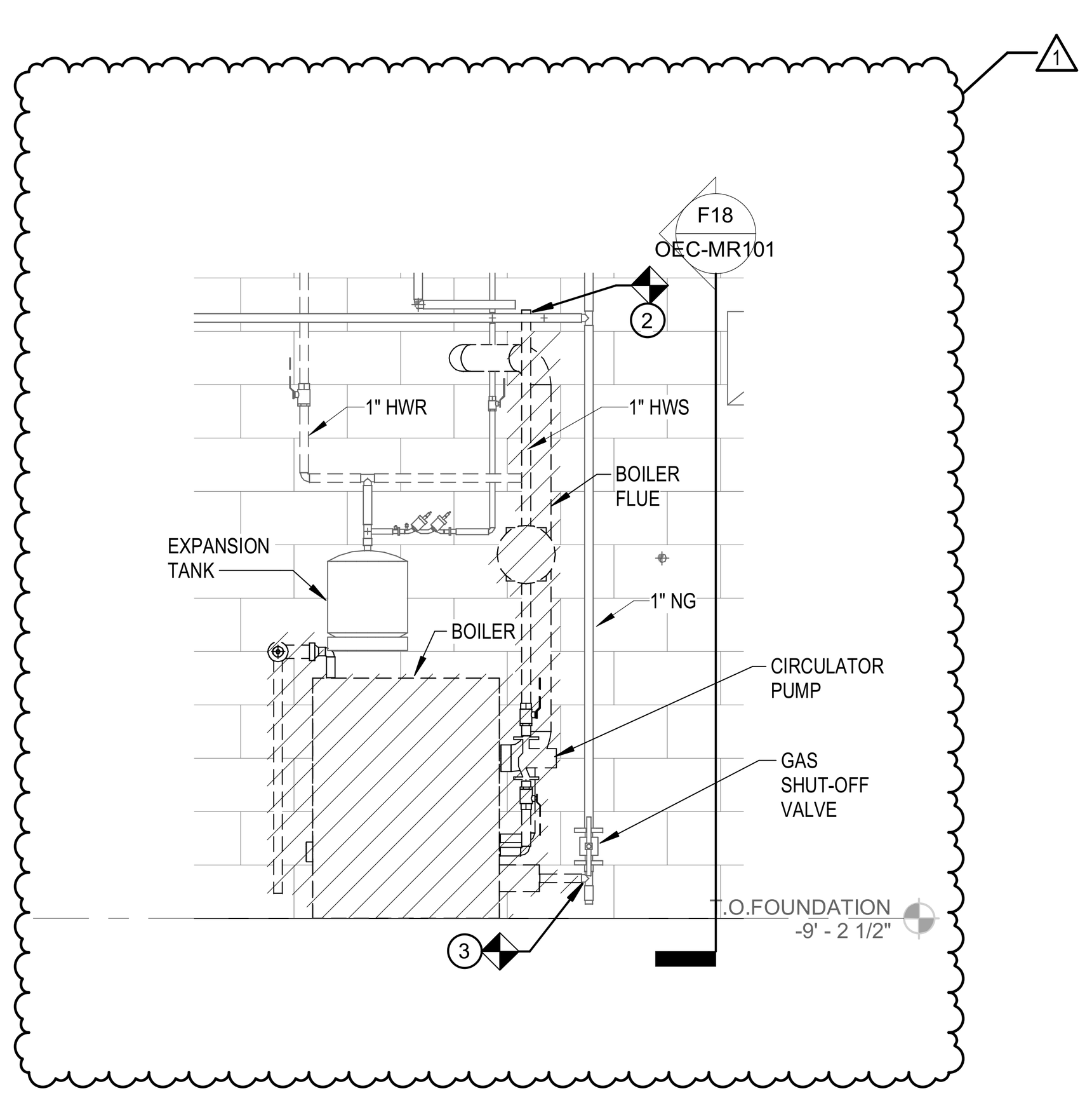
1. DISCONNECT AND REMOVE FLOOR MOUNTED, NATURAL GAS BOILER, HOT WATER CIRCULATOR PUMP, BOILER BREECHING, AND ALL ASSOCIATED BOILER CONTROLS.
2. DISCONNECT AND REMOVE HWS/R PIPING TO DISCONNECTION POINTS SHOWN AT TOP OF HWS/R RISERS DOWN TO REMOVED BOILER INLET/OUTLET PORTS. DISCONNECT AND REMOVE ASSOCIATED CIRCULATOR PUMP AND BOILER LOW WATER CUTOFF CONTROLS AND ALL ASSOCIATED LINE AND LOW VOLTAGE WIRING.
3. DISCONNECT AND REMOVE BRANCH GAS PIPING CONNECTION FROM REMOVED BOILER. MAINTAIN NATURAL GAS RISER AND SHUT-OFF VALVE.



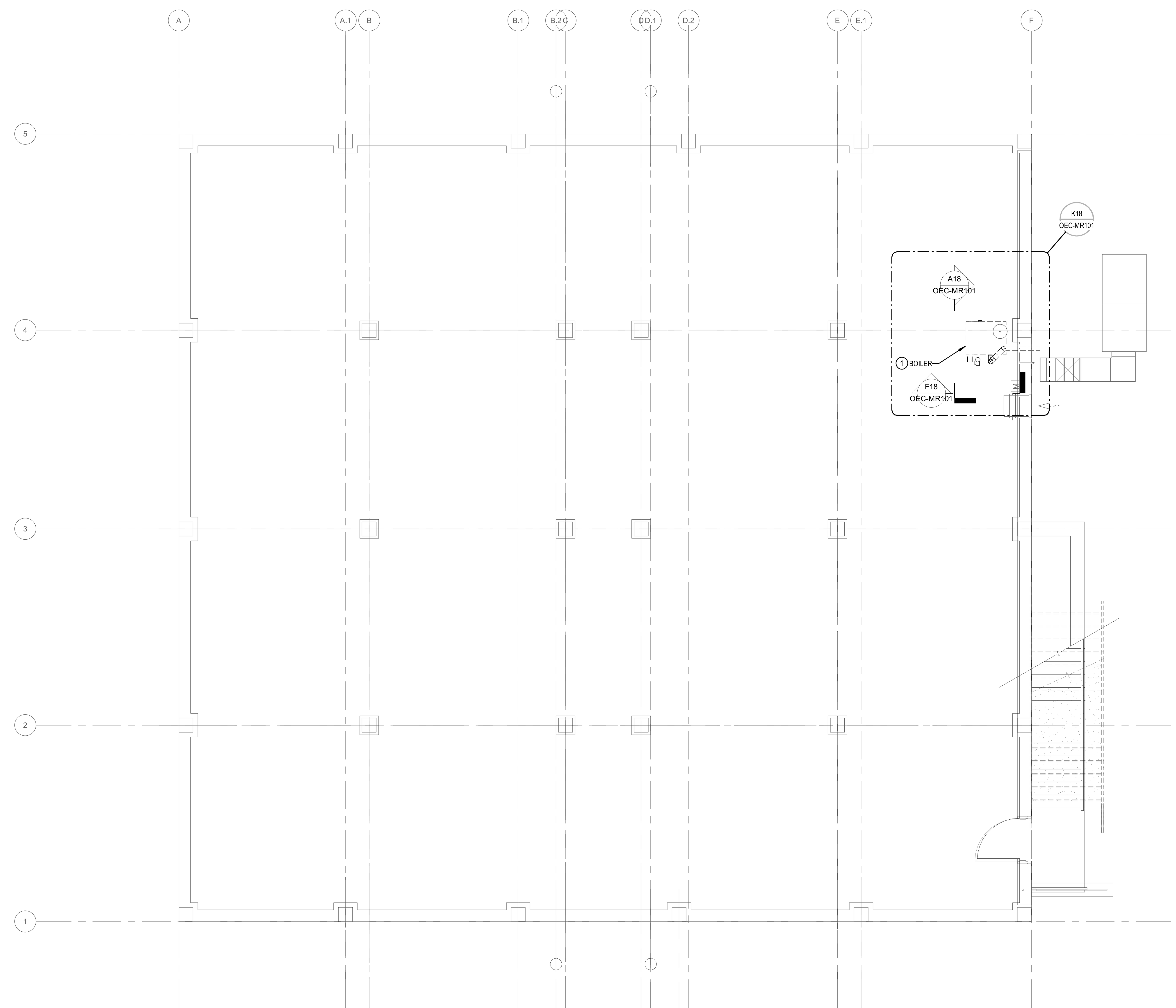
K18 ENLARGED BOILER REMOVALS PLAN
1/2" = 1'-0"



F18 BOILER SECTION VIEW REMOVALS - LOOKING SOUTH
1/2" = 1'-0"



A18 BOILER SECTION VIEW REMOVALS - LOOKING WEST
1/2" = 1'-0"



A11 BASEMENT REMOVALS PLAN
1/4" = 1'-0"

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Construction Manager

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NANUET

NUFSD BOND PROJECT PHASE 5 - OEC

- ☐ SED#50-01-08-03-0-002-020 (HIGHVIEW ES)
- ☐ SED#50-01-08-03-7-007-002 (Maintenance)
- ■ SED#50-01-08-03-7-012-004 (OEC)
- ☐ SED#50-01-08-03-0-001-026 (MILLER ES)
- ☐ SED#50-01-08-03-0-004-022 (BARR MS)

Highview Elementary School
24 Highview Ave
Nanuet, NY 10954

OEC Building
135 Convent Rd
Nanuet, NY 10954

Maintenance Building
103 Church St.
Nanuet, NY 10954

Miller Elementary School
50 Blauvelt Rd Unit1
Nanuet, NY 10954

A MacArthur Barr Middle School
143 Church St
Nanuet, NY 10954

KEY PLAN

REVISIONS

No.	Description	Date
1	BID ADDENDUM #4	02/05/25

ISSUED: BID SET
DATE: 06/21/2024
SCALE: As indicated
SHEET NAME: BASEMENT REMOVALS
SHEET NUMBER: OEC-MR101

ISSUE FOR BID SET