

ADDENDUM NO. 01

JULY 28, 2017

PROJECT: **School of Public Health MEP Renovation**

FROM: **Infrastructure Associates, Inc.
6117 Richmond Ave.
Houston, Texas 77057**

TO: **Prospective Bidders**

THE SOLICITATION MENTIONED ABOVE IS AMENDED AS SET FORTH BELOW.

This Addendum uses the "change-page" method as follows:

For Revisions to the Project Manual:

Remove obsolete pages and delete, replace, or add pages as indicated issued under this Addendum.

For Revisions to Drawings:

Remove obsolete sheets and replace or add sheets issued as indicated under this Addendum.

PART 1 - CHANGES TO PROJECT MANUAL

A. Delete the following specification sections in their entirety from the project manual:

1. 232113 – HYDRONIC PIPING
2. 232200A – STEAM AND STEAM CONDENSATE SPECIALTIES

B. Replace the following specifications sections in their entirety with revised sections issued July 28, 2017 as Addendum #1:

1. 012300 – ALTERNATES
2. 230923 – DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC
3. 232000A – PIPING, VALVES, AND FITTINGS
4. 232200 – STEAM AND STEAM CONDENSATE PIPING
5. 232223 – STEAM CONDENSATE PUMPS
6. 235700 – HEAT EXCHANGER UNITS
7. 237323 – AIR HANDLING UNITS

PART 2 - CHANGES TO DRAWINGS

C. Add the following new drawing sheets issued July 28, 2017 as Addendum #1:

1. G103 – GENERAL NOTES AND SPECIFICATIONS
2. A115 – FLOOR PLANS – LEVELS 3-6
3. A116 – FLOOR PLANS – LEVELS 7-10
4. M200A – BASEMENT FLOOR PLAN - AIR FLOW DIAGRAM
5. M300 – ENLARGED PLAN - TYPICAL LOBBY - PROPOSED
6. M301 – ENLARGED PLAN - TYPICAL LOBBY - DETAILS
7. M704 – CONTROLS

- D. Replace the following drawing sheets in their entirety with revised drawing sheets issued July 28, 2017 as Addendum #1:

- 1 G100 – GENERAL INFORMATION
- 2 G101 – FIRE RESISTIVE ASSEMBLIES DESIGN REFERENCE
- 3 G102 - FIRE RESISTIVE ASSEMBLIES DESIGN REFERENCE
- 4 G110 – FIRE SAFETY PLAN – LEVEL 2
- 5 A103 – DEMOLITION PLAN – LEVEL 2
- 6 A111 – FLOOR PLAN – BASEMENT
- 7 A112 – FLOOR PLAN – LEVEL 1
- 8 A113 – FLOOR PLAN – LEVEL 2
- 9 A160 – REFLECTED CEILING PLAN – LEVEL 2
- 10 A520 – PARTITION TYPES AND INTERIOR CONSTRUCTION DETAILS
- 11 A540 – DOOR, WINDOW DETAILS, AND SCHEDULES
- 12 MEP100 - ROOF FLOOR PLAN - MEP – PROPOSED
- 13 M001 - NOTES AND LEGEND
- 14 M002 - SCHEDULES
- 15 M003 - SCHEDULES
- 16 M004 - SCHEDULES
- 17 M101 - BASEMENT FLOOR PLAN - HVAC - DEMO
- 18 M102 - 2ND FLOOR PLAN - HVAC - DEMO
- 19 M103 - 3RD FLOOR PLAN - HVAC - DEMO
- 20 M104 - 4TH FLOOR PLAN - HVAC - DEMO
- 21 M105 - 5TH FLOOR PLAN - HVAC - DEMO
- 22 M106 - 6TH FLOOR PLAN - HVAC - DEMO
- 23 M107 - 7TH FLOOR PLAN - HVAC - DEMO
- 24 M108 - 8TH FLOOR PLAN - HVAC - DEMO
- 25 M109 - 9TH FLOOR PLAN - HVAC - DEMO
- 26 M110 - 10TH FLOOR PLAN - HVAC - DEMO
- 27 M111 - PENTHOUSE - HVAC - DEMO
- 28 M200 - BASEMENT FLOOR PLAN - HVAC - NEW
- 29 M201 - FIRST FLOOR PLAN - HVAC - PROPOSED
- 30 M202 - 2ND FLOOR PLAN - HVAC - PROPOSED
- 31 M203 - 3RD FLOOR PLAN - HVAC - PROPOSED
- 32 M203A - 3RD FLOOR PLAN - AIR FLOW DIAGRAM
- 33 M204 - 4TH FLOOR PLAN -HVAC - PROPOSED
- 34 M205 - 5TH FLOOR PLAN - HVAC - PROPOSED
- 35 M206 - 6TH FLOOR PLAN - HAVC - PROPOSED
- 36 M206A - 6TH FLOOR PLAN - AIR FLOW DIAGRAM
- 37 M207 - 7TH FLOOR PLAN - HVAC - PROPOSED
- 38 M207A - 7TH FLOOR PLAN - AIR FLOW DIAGRAM
- 39 M208 - 8TH FLOOR PLAN - HVAC - PROPOSED
- 40 M209 - 9TH FLOOR PLAN - HVAC - PROPOSED
- 41 M210 - 10TH FLOOR PLAN - HVAC - PROPOSED
- 42 M211 - PENTHOUSE - HVAC - PROPOSED
- 43 M400 - ENLARGED CENTRAL PLANT - BASEMENT FLOOR PLAN - DEMO
- 44 M401- ENLARGED CENTRAL LANT - BASEMENT FLOOR PLAN - PROPOSED
- 45 M402 - ENLARGED BASEMENT FLOOR PLAN - MECHANICAL ROOMS
- 46 M403 - ENLARGED PLAN - 2ND FLOOR - MECHANICAL ROOM - DEMO
- 47 M404 - ENLARGED PLAN - 2ND FLOOR - MECHANICAL ROOM - PROPOSED
- 48 M405 - ENLARGED PLAN - 3RD FLOOR - MECHANICAL ROOM - DEMO
- 49 M406 - ENLARGED PLAN - 3RD FLOOR - MECHANICAL ROOM - PROPOSED
- 50 M407 - ENLARGED PLAN - TYPICAL 4TH-7TH FLOOR - MECHANICAL ROOM - DEMO
- 51 M408 - ENLARGED PLAN - TYPICAL 4TH-7TH FLOOR - MECHANICAL ROOM - PROPOSED
- 52 M409 - ENLARGED PLAN - TYPICAL 8th-10th FLOOR - MECHANICAL ROOM - DEMO
- 53 M410 - ENLARGED PLAN - TYPICAL 8TH-10TH FLOOR - MECHANICAL ROOM - PROPOSED
- 54 M411 - ALTERNATE - ENLARGED PLAN - TYPICAL 8th-10th FLOOR- MECHANICAL ROOM - PROPOSED
- 55 M501 - SECTIONS
- 56 M502 - SECTIONS

57	M503 - SECTIONS
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59	M505 - CUSTOM AHU CONFIGURATIONS - BASEMENT
60	M506 - CUSTOM AHU CONFIGURATIONS - 2ND FLOOR
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66	M601 - PIPING DIAGRAM - CHILLED WATER
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68	M603 - HEAT EXCHANGER STEAM TO HOT WATER DIAGRAM
69	M604 - STEAM PRESSURE REDUCER STATION DIAGRAM
70	M701 - CONTROLS
71	M702 - CONTROLS
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73	M705 - CONTROLS POINTS
74	M801 - DETAILS
75	M802 - DETAILS
76	M803 - DETAILS
77	M804 - DETAILS
78	P001 – SCHEDULES, NOTES, AND LEGEND
79	P101 – BASEMENT FLOOR PLAN - PLUMBING
80	P201 – BASEMENT FLOOR PLAN – PLUMBING
81	P202 – FIRST FLOOR PLAN – PLUMBING
82	P203 – SECOND FLOOR PLAN – PLUMBING
83	P204 – THIRD FLOOR PLAN – PLUMBING
84	P205 – FOURTH FLOOR PLAN – PLUMBING
85	P206 – FIFTH FLOOR PLAN – PLUMBING
86	P207 – SIXTH FLOOR PLAN – PLUMBING
87	P208 – SEVENTH FLOOR PLAN – PLUMBING
88	P209 – EIGHTH FOOR PLAN – PLUMBING
89	P210 – NINTH FLOOR PLAN – PLUMBING
90	P211 – TENTH FLOOR PLAN – PLUMBING
91	P212 – PENTHOUSE FLOOR PLAN – PLUMBING
92	P201 – BASEMENT FLOOR PLAN – PLUMBING
93	P304 – THIRD FLOOR PLAN – EXISTING EYE WASH & SAFETY SHOWER IN LABS
94	P307 – SIXTH FLOOR PLAN - EXISTING EYE WASH & SAFETY SHOWER IN LABS
95	P401 – ENLARGED FLLOR PLAN AND DETAILS - PLUMBING

- END -

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 (Additive) is for alternate AHU system configurations at building levels 8 through 10 using a single, tandem, custom air handling units with a separate dedicated outside air pretreatment unit.
- B. Alternate No. 2 (Deductive) is for the refurbishment of the outdoor distribution switchgear in the TECO pit instead of removal and replacement as indicated on the construction documents from the scope of contractor's work. As part of the base bid requirement, the contractor shall include construction costs related to the removal of the existing switchgear, building a complete platform in accordance with structural construction documents, and the installation of the new switchgear at a higher elevation. This deduction alternate assumes that the platform will not be built, all CenterPoint Energy equipment will be replaced by CenterPoint Energy (at their discretion) but remain at the same elevation, and the existing switchgear will be refurbished and not replaced. The refurbishment procedure is as follows:
1. The metal enclosure structure requires rust removal and/or panel replacement.
 2. The entire enclosure shall be repainted.
 3. Contractor shall provide a comprehensive inspection, cleaning, painting, and testing of all components of each load interrupter switch, and verify the integrity of each interrupter switch in accordance with Square D/Schneider Electric requirements and published data.
 4. Contractor shall clean the enclosure thoroughly and perform required testing procedures for all switch components listed above, and clean and inspect other components recommended by the manufacturer.
 5. Contractor shall perform required testing procedures after thorough cleaning of all switch components recommended by the manufacturer, and verify equipment is suitable to provide reliable operation for the next 20 years.
 6. Components and devices not meeting tolerances and limits as required by the manufacturer due to: age, environmental exposure, operational fatigue, will be considered for replacement as a part of the overhaul of this switchgear lineup.
 7. This lump sum will be deducted from contractor's base bid in lieu of work related to elevate all equipment in TECO pit.
- C. Alternate No. 3 (Additive) is for conversion of wire/conduit to busway/feeder:
1. Feeders for (8) 600 A circuits and (1) 800 A circuit to feeder bus.
 2. Conversion of group-mounted breakers to stack-mounted or individually mounted breakers as required for direct bus connection.
 3. Addition of cable-tap box adjacent to each load equipment to convert to equal cable-entry to equipment.
 4. Replace existing power factor correction capacitor with equal to existing.
- D. Alternate No. 4 (Additive) is for raising the Centerpoint Energy outdoor gear.
- E. Alternate No. 5 (Additive) is for conversion of the existing directly coupled chilled water pumping system to an indirectly coupled chilled water system using new plate & frame heat exchangers.

- F. Alternate No. 6 (Additive) is for inclusion of work related to replacement of lab panels. The contractor shall provide cost associated with demolition and replacement of 68 lab panels in lieu of reusing these panels as indicated on the construction documents.
- G. Alternate No. 7 (Additive) is for replacement of all existing 2x2 and 2x4 fluorescent troffer light fixtures with Cree LED, one-for-one.
 - 1. Replace 2x2 fixtures with Cree ZR22-32L-40K-CMA, with EB14 for emergency fixtures.
 - 2. Replace 2x4 fixtures with Cree ZR24-40L-40K-CMA, with EB14 for emergency fixtures.

RECESSED LINEAR SUMMARY		
	2'X2'	2'X4'
Basement	25	186
Level 1	2	217
Level 2	52	210
Level 3	96	235
Level 4	0	246
Level 5	0	250
Level 6	94	238
Level 7	89	229
Level 8	54	208
Level 9	55	234
Level 10	55	228
Penthouse	0	0
Subtotal	522	2481
5 % Adjustment	26	124
TOTAL	548	2605

NOTE: Any fixtures not used in the project will be turned over to the owner as attic stock.

- H. Alternate No. 8 (Additive) is for the addition of demand ventilation controls using automated electronic people counter devices at selected classrooms.

END OF SECTION

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SECTION 23 57 00

HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Coordinate with Commissioning Requirements indicated in Section 019100. This contractor is responsible to comply with all requirements for the above section.

1.2 SUMMARY

- A. This Section includes shell-and-tube heat exchangers.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Design Calculations: Calculate requirements for selecting seismic restraints and for designing bases.
 - 2. Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
- C. Coordination Drawings: Equipment room, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Tube-removal space.
 - 2. Structural members to which heat exchangers will be attached.
 - 3. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 4. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, performance, and dimensional requirements of heat exchangers and are based on the specific equipment indicated. Refer to Division 01 Section "Product Requirements."
- B. ASME Compliance: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

- C. Registration: Fabricate and label shell-and-tube heat exchangers to comply with the Tubular Exchanger Manufacturers Association's standards.

1.5 MAINTENANCE

- A. Provide twelve (12) months maintenance of all materials and equipment under this section. Cost of the twelve (12) month normal and preventive maintenance shall be included within this scope of work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHELL-AND-TUBE HEAT EXCHANGERS

- A. Manufacturers:
 - 1. API Heat Transfer Inc.
 - 2. Armstrong Pumps, Inc.
 - 3. ITT Industries; Bell & Gossett.
 - 4. Taco, Inc.
 - 5. Thrush Company, Inc.
- B. Configuration: U-tube with removable bundle.
- C. Shell Materials: Steel.
- D. Head:
 - 1. Materials: Fabricated steel with removable cover.
 - 2. Flanged and bolted to shell.
- E. Tube:
 - 1. Seamless steel.
 - 2. Tube diameter is determined by manufacturer based on service.
- F. Tube sheet Materials: Steel tube sheets.
- G. Baffles: Steel.
- H. Piping Connections:
 - 1. Shell: Flanged inlet and outlet fluid connections, threaded drain, and vent connections.
 - 2. Head: Marine style water boxes with flanged inlet and outlet fluid connections.
- I. Support Saddles:
 - 1. Fabricated of material similar to shell.
 - 2. Foot mount with provision for anchoring to support.
 - 3. Fabricate attachment of saddle supports to pressure vessel with reinforcement strong enough to resist heat-exchanger movement during a seismic event when heat-exchanger saddles are anchored to building structure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HEAT-EXCHANGER INSTALLATION

- A. Install shell-and-tube heat exchangers on saddle supports.
- B. Install shell-and-tube heat exchangers on concrete base. Concrete base is specified in Division 23 Section "Common Work Results for HVAC," and concrete materials and installation requirements are specified in Division 03.
- C. Concrete Bases: Anchor heat exchanger to concrete base.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Maintain manufacturer's recommended clearances for service and maintenance. Install piping connections to allow service and maintenance of heat exchangers.
- C. Install shutoff valves at heat-exchanger inlet and outlet connections.
- D. Install relief valves on heat-exchanger heated-fluid connection and install pipe relief valves, full size of valve connection, to floor drain.
- E. Install vacuum breaker at heat-exchanger steam inlet connection.
- F. Install hose end valve to drain shell.

3.4 FIELD QUALITY CONTROL

- A. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 CLEANING

- A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 23 22 23

STEAM CONDENSATE RETURN UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Coordinate with Commissioning Requirements indicated in Section 019100. This contractor is responsible to comply with all requirements for the above section.

1.2 SUMMARY

- A. This Section includes steam condensate pumping units.

1.3 SUBMITTALS

- A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated. Indicate pump's operating point on curves. Include receiver capacity and material.
- B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain steam condensate pumps through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of steam condensate pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Fabricate and label steam condensate pumps to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

- B. Store steam condensate pumps in dry location.
- C. Retain protective covers for flanges and protective coatings during storage.
- D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
- E. Comply with pump manufacturer's written rigging instructions.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.7 MAINTENANCE

- A. Provide twelve (12) months maintenance of all materials and equipment under this section. Cost of the twelve (12) month normal and preventive maintenance shall be included within this scope of work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEAM CONDENSATE RETURN UNITS

- A. Description: Factory-fabricated, packaged, electric-driven pumps; with receiver, pump(s), controls, and accessories suitable for operation with steam condensate.
- B. Configuration: **Duplex** floor-mounting pump with receiver and float switch(s); rated to pump 200 deg F (93 deg C) steam condensate.
 - 1. Manufacturers:
 - a. Bell & Gossett
 - b. Skidmore
 - c. Aurora
 - d. Spirax Sarco, Inc.
 - e. Pentair Pump Group.
 - f. Roth Pump Company.
 - g. Spence Engineering Company, Inc.; Division of Circor International, Inc.
 - h. Sterling, Inc.
 - 2. Receiver: welded steel, min 3/16" thick; galvanized inside & outside with magnesium anode, externally adjustable float switch connections, and flanges for pump mounting.
 - 3. Pumps: Centrifugal, close coupled, permanently aligned, stainless steel shaft, bronze fitted; with replaceable bronze case ring and mechanical seal; mounted on receiver flange.
 - 4. Factory Wiring: Between float switch(s), for single external electrical connection. Fused control power transformer if voltage exceeds 230 V.
 - 5. Pump alternator to operate pumps in lead-lag sequence and allow both pumps to operate if the normal start level for a single pump is exceeded.

6. Provide units complete with receiver, controls, pumps, valves, level switches, and sight glass.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine rough installation of steam condensate piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.
- B. Support pumps and piping separately so piping is not supported by pumps.
- C. Install pumps on concrete bases. Anchor pumps to bases using inserts or anchor bolts.
- D. Install thermometers and pressure gages.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Install gate and check valves on inlet and outlet of pressure-powered pumps.
- D. Install check valve, gate valve, and globe valve at pump discharge connections for each electric-driven pump.
- E. Pipe drain to nearest floor drain for overflow and drain piping connections.
- F. Install full-size vent piping to outdoors, terminating in 180-degree elbow at point above highest steam system connection or as indicated.
- G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 STARTUP SERVICE

- A. Verify that steam condensate pumps are installed and connected according to the Contract Documents.
- B. Complete installation and startup checks according to manufacturer's written instructions.
- C. Clean strainers.
- D. Set steam condensate pump controls.
- E. Set pump controls for automatic start, stop, and alarm operation.

- F. Perform the following preventive maintenance operations and checks before starting:
 - 1. Set float switches to operate at proper levels.
 - 2. Set throttling valves on pump discharge for specified flow.
 - 3. Check motors for proper rotation.
 - 4. Test pump controls and demonstrate compliance with requirements.
 - 5. Replace damaged or malfunctioning pump controls and equipment.
 - 6. Verify that pump controls are correct for required application.
- G. Start steam condensate pumps according to manufacturer's written startup instructions.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain steam condensate pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 23 22 00

STEAM AND STEAM CONDENSATE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following for steam and condensate piping:
 1. Pipe and fittings.
 2. Strainers.
 3. Flash tanks.
 4. Safety valves.
 5. Steam regulator valves.
 6. Steam traps.
 7. Thermostatic air vents and vacuum breakers.
 8. Steam and condensate meters.

1.3 DEFINITIONS

- A. HPS Systems: High-pressure steam systems operating at conditions up to 250 psig superheated to 450 deg F complying with requirements of ASME B31.1.
- B. MPS Systems: Medium-pressure steam systems operating at conditions up to 75 psig superheated to 405 deg F complying with requirements of ASME B31.1.
- C. LP Systems: Low-pressure stem systems operating at conditions up to 15 psig superheated to 383 deg F complying with requirements of ASME B31.1 and/or B31.9 as applicable or otherwise indicated.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures:
 1. Steam Piping: as indicated on drawings
 2. Steam Condensate Piping: at same rating as attached system but not less than 60 psig at 250 deg F.
 3. Makeup-Water Piping: 60 psig at 150 deg F.
 4. Blow down-Drain Piping: Equal to pressure of the piping system to which it is attached.
 5. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
 6. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

1.5 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Pipe, fittings, and accessories.
 - 2. Steam regulators and safety valves.
 - 3. Steam trap.
 - 4. Air vent and vacuum breaker.
 - 5. Flash tank.
 - 6. Meter.
- B. Shop Drawings: Detail, 1/4 inch equals 1 foot scale, flash tank assemblies and fabrication of pipe anchors, hangers, pipe, multiple pipes, alignment guides, and expansion joints and loops and their attachment to the building structure. Detail locations of anchors, alignment guides, and expansion joints and loops.
- C. Welding certificates – QPS, PQR, & WPS's
- D. Field quality-control test reports & weld map
- E. Operation and Maintenance Data: For valves, safety valves, pressure-reducing valves, steam traps, air vents, vacuum breakers, and meters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code - Steel."
- B. Pipe Welding:

Conform to ASME Code and applicable state labor regulations. Provide 100% visual welding inspection by a qualified welding inspector. Welding inspector shall examine fit-up for compliance with ASME requirements prior to weldout. Owner reserves the right to examine welds by any means desired including radiography and or ultrasonic technology. All welds must be fully penetrated, show no lack of fusion, show no slag inclusions in excess of ASME limits, or cluster porosities. Examined welds not meeting this criterion will be considered unacceptable and be fully replaced at no additional cost to the owner. The welding inspector shall maintain a current weld-map on the job site for submission with project close-out documents. See WELD TESTING for additional information.
- C. Welder's Certification: In accordance with ASME Sec. 9. Submit welder's certification, including WPS, PQR, & WPQs prior to any shop or field fabrication. Welder's certifications shall be current within six months of submission
- D. ASME Compliance: Comply with and ASME B31.1 & B31.9, for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1.7 QUALIFICATIONS

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

- B. Installer: Company specializing in performing the work of this section with minimum of three years' documented experience

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 23 00 00.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system

1.9 EXTRA MATERIALS

- A. Furnish under provisions of Section 23 00 00.
- B. Provide two repacking kits for each size valve

PART 2 - PRODUCTS

2.1 STEEL PIPE AND FITTINGS

- A. ASTM A53 or A106, Grade A or B, seamless. See Part 3 below for wall thickness schedule.
- B. NPS2-1/2 and larger shall be butt welded and flanged. NPS 2 or smaller shall be threaded or flanged and butt welded. Flanges shall be welding neck type. Extra strong Weld-O-Lets, Thread-O-Lets, or shaped nipples may be used only when take-off is 1/3 or less nominal size of main.
- C. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300 as indicated in Part 3 piping applications articles.
- D. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in Part 3 piping applications articles.
- E. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 piping applications articles.
- F. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated in Part 3 piping applications articles; raised ground face, and bolt holes spot faced.
- G. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- H. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.

3. Facings: Raised face.

- I. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, black steel of same Type, Grade, and Schedule as pipe in which installed.

2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Hart Industries, International Inc.
 - d. Watts Water Technologies, Inc.
 - e. Zurn Plumbing Products Group.
 2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Watts Water Technologies, Inc.
 2. Factory-fabricated companion-flange assembly, for 150 or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric-Flange Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.

- b. Calpico, Inc.
- c. Central Plastics Company.
- d. Pipeline Seal and Insulator, Inc.
2. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
3. Separate companion flanges and steel bolts and nuts shall have 150 or 300 psig minimum working pressure as required to suit system pressures.

2.4 VALVES

- A. Isolation Valves: OS&Y gate type suitable for steam service, pressure class as indicated
 1. HPS Service: Steel body
 2. MPS Service: Ductile Iron or Steel body
 3. LPS: Cast iron or steel body
- B. Throttling Valves: OS&Y globe type for steam service, pressure class as indicated
 1. HPS Service: Steel body
 2. MPS Service: Ductile Iron or Steel body
 3. LPS: Cast iron or steel body

2.5 STRAINERS

- A. Y-Pattern Strainers:
 1. Body: cast iron or ductile iron with bolted cover and bottom drain connection.
 2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
 3. Strainer Screen: Stainless-steel, 20 mesh strainer, and perforated stainless-steel basket with 50 percent free area.
 4. Tapped blow-off plug.
 5. Pressure Class: as indicated

2.6 SAFETY VALVES

- A. Bronze Safety Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Kunkle Valve; a Tyco International Ltd. Company.
 - c. Spirax Sarco, Inc.
 - d. Watts Water Technologies, Inc.
 2. Disc Material: Forged copper alloy.
 3. End Connections: Threaded inlet and outlet.
 4. Spring: Fully enclosed steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
 5. Pressure Class: 250 or as indicated.
 6. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
 7. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

B. Cast-Iron Safety Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Kunkle Valve; a Tyco International Ltd. Company.
 - c. Spirax Sarco, Inc.
 - d. Watts Water Technologies, Inc.
2. Disc Material: Forged copper alloy with bronze nozzle.
3. End Connections: Raised-face flanged inlet and threaded or flanged outlet connections.
4. Spring: Fully enclosed cadmium-plated steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
5. Pressure Class: 250 or as indicted
6. Drip-Pan Elbow: Cast iron and having threaded inlet, outlet, and drain, with threads complying with ASME B1.20.1.
7. Exhaust Head: Cast iron and having threaded inlet and drain, with threads complying with ASME B1.20.1.
8. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

2.7 STEAM REGULATING VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong International, Inc.
 2. Hoffman Specialty; Division of ITT Industries.
 3. Leslie Controls, Inc.
 4. Spence Engineering Company, Inc.
 5. Spirax Sarco, Inc.
- B. Size, Capacity, and Pressure Rating: Factory set for inlet and outlet pressures indicated.
- C. Description: Pilot-actuated, diaphragm type, with adjustable range and positive shutoff.
- D. Body: Cast iron
- E. End Connections: Threaded connections for valves NPS 2 and smaller and flanged connections for valves NPS 2-1/2 and larger.
- F. Trim: Hardened stainless steel.
- G. Head and Seat: Replaceable, main head stem guide fitted with flushing and pressure-arresting device cover over pilot diaphragm.
- H. Gaskets: Non-asbestos materials.
- I. Provide stem regulators with pilots and accessories as indicated.

2.8 STEAM TRAPS

- A. Float and Thermostatic Traps:
- B. ASTM A126, cast iron or semi-steel body and bolted cover for 250 psig WSP; provide access to internal parts without disturbing piping; with bottom drain plug, stainless steel or bronze bellows type air vent, stainless steel or copper float, stainless steel lever and valve assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Armstrong International, Inc.
 - b. Barnes & Jones, Inc.
 - c. Dunham-Bush, Inc.
 - d. Hoffman Specialty; Division of ITT Industries.
 - e. Spirax Sarco, Inc.
 - f. Sterling.
2. Body: as scheduled.
 3. Trap Type: Balanced-pressure.
 4. Bellows: Stainless steel or monel.
 5. Head and Seat: Replaceable, hardened stainless steel.
 6. Pressure Class: as scheduled.
- C. Thermodynamic Traps:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Barnes & Jones, Inc.
 - c. Dunham-Bush, Inc.
 - d. Hoffman Specialty; Division of ITT Industries.
 - e. Spirax Sarco, Inc.
 2. Body: Stainless steel with screw-in cap.
 3. End Connections: Threaded.
 4. Disc and Seat: Stainless steel.
 5. Maximum Operating Pressure: 600 psig or as scheduled.

2.9 THERMOSTATIC AIR VENTS AND VACUUM BREAKERS

- A. Thermostatic Air Vents:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Barnes & Jones, Inc.
 - c. Dunham-Bush, Inc.
 - d. Hoffman Specialty; Division of ITT Industries.
 - e. Spirax Sarco, Inc.
 - f. Sterling.
 2. Body: Cast iron, bronze or stainless steel.
 3. End Connections: Threaded.
 4. Float, Valve, and Seat: Stainless steel.
 5. Thermostatic Element: Phosphor bronze bellows in a stainless-steel cage.
 6. Pressure Rating: 125 psig.
 7. Maximum Temperature Rating: 350 deg F.
- B. Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Spirax Sarco, Inc.
 - b. Armstrong International, Inc.
 - c. Hoffman Specialty; Division of ITT Industries.
 2. Body: Cast iron, bronze, or stainless steel.
 3. End Connections: Threaded.

4. Sealing Ball, Retainer, Spring, and Screen: Stainless steel.
5. O-ring Seal: EPR.
6. Pressure Rating: 125 psig.
7. Maximum Temperature Rating: 350 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATION

- A. High Pressure Steam Piping:
 1. All piping shall be Schedule 80 black steel piping.
 2. Fittings shall be extra heavy butt welding type. Flanges shall be 300# welding neck type. Extra strong Weld-O-Lets, Thread-O-Lets, or shaped nipples may be used only when take-off is 1/3 or less nominal size of main. Screwed fittings around traps shall be 2,000 pound forged steel.
- B. Condensate Return and Pumped Condensate Return Piping:
 1. All piping shall be Schedule 80 black steel piping.
 2. Fittings on piping 2-1/2" and larger shall be extra heavy butt welding type. Flanges shall be 150# welding neck type. Extra strong Weld-O-Lets, Thread-O-Lets, or shaped nipples may be used only when take-off is 1/3 or less nominal size of main.
 3. Screwed fittings around traps and for piping 2" and smaller shall be 125# black cast iron. (300# for unions). At contractor's option, socket weld fittings may be used.
- C. Low and Medium Pressure Steam Piping:
 1. All piping shall be Schedule 40 black steel piping, except sizes 1" and smaller shall be Schedule 80.
 2. Fittings on piping 2-1/2" and larger shall be standard weight butt welding type. Flanges shall be welding neck type. Standard weight Weld-O-Lets, Thread-O-Lets, and shaped nipples may be used only when take-off is 1/3 or less nominal size of main. Bushings shall not be used.
 3. Screwed fittings for piping 2" and smaller shall be malleable iron. Unions shall be Class 250 minimum. At contractor's option, socket weld fittings may be used.

3.2 ANCILLARY PIPING APPLICATIONS

- A. Makeup-water piping installed above grade shall be either of the following:
 1. Drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
- B. Blow down-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- C. Air-Vent Piping:
 1. Inlet: Same as service where installed.
 2. Outlet: Type K annealed-temper copper tubing with soldered or flared joints.
- D. Vacuum-Breaker Piping: Outlet, same as service where installed.
- E. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

3.3 VALVE APPLICATIONS

- A. Install shutoff duty valves at branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.
- B. Install safety valves on pressure-reducing stations and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

3.4 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Use indicated piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- K. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- L. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.
- M. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side down.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to top of main pipe.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

- S. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blow-down connection of strainers NPS and larger. Match size of strainer blow-off connection for strainers smaller than NPS 2.
- T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."
- U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."
- V. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.
 - 1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet.
 - 2. Size drip legs same size as main. In steam mains NPS 6 and larger, drip leg size can be reduced, but to no less than NPS 4.

3.5 STEAM-TRAP INSTALLATION

- A. Install steam traps in accessible locations as close as possible to connected equipment.
- B. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.

3.6 PRESSURE-REDUCING VALVE INSTALLATION

- A. Install pressure-reducing valves in accessible location for maintenance and inspection.
- B. Install bypass piping around pressure-reducing valves, with globe valve equal in size to area of pressure-reducing valve seat ring, unless otherwise indicated.
- C. Install gate valves on both sides of pressure-reducing valves.
- D. Install unions or flanges on both sides of pressure-reducing valves having threaded- or flanged-end connections respectively.
- E. Install pressure gages on low-pressure side of pressure-reducing valves after the bypass connection according to Division 23 Section "Meters and Gages for HVAC Piping."
- F. Install strainers upstream for pressure-reducing valve.
- G. Install safety valve downstream from pressure-reducing valve station.

3.7 SAFETY VALVE INSTALLATION

- A. Install safety valves according to ASME B31.1 & B31.9 requirements
- B. Pipe safety-valve discharge without valves to atmosphere outside the building.
- C. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.
- D. Install exhaust head with drain to waste, on vents equal to or larger than NPS 2-1/2.

3.8 HANGERS AND SUPPORTS

- A. Install hangers and supports according to Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with requirements below for maximum spacing.
- B. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- C. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.

3.9 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube ends. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.10 TERMINAL EQUIPMENT CONNECTIONS

- A. Size for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install traps and control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install vacuum breakers downstream from control valve, close to coil inlet connection.

- E. Install a drip leg at coil outlet.

3.11 FIELD QUALITY CONTROL

- A. Prepare steam and condensate piping according to ASME and as follows:
 - 1. Leave joints, including welds, un-insulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush system with clean water. Clean strainers.
 - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- B. Perform the following tests on steam and condensate piping:
 - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 - 2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
 - 3. After hydrostatic 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, and repeat hydrostatic test until there are no leaks.
- C. Prepare written report of testing.

3.12 CLEANING AND FLUSHING OF STEAM SYSTEMS

- A. Steam and condensate systems shall be thoroughly cleaned before placing in operation to rid systems of rust, dirt, piping compound, mill scale, oil, grease, any and all other material foreign to water being circulated.
- B. Extreme care shall be exercised during construction to prevent dirt and other foreign matter from entering the pipe or other parts of systems. Pipe stored on the project shall have open ends capped and equipment shall have openings fully protected. Before erection, each piece of pipe, fitting, or valve shall be visually examined and dirt removed.
- C. Chemicals, feeding devices, and water technician services shall be furnished by a single reputable manufacturer who will be responsible for the complete cleaning and flushing of the systems.
 - 1. Add a temporary line with drain and isolate the building steam and condensate piping from the campus distribution piping to allow for proper circulation and cleaning of the new piping in the new tunnel and/or in the new or modified building piping system(s).
- D. Systems shall be cleaned with a chemical compound specifically formulated for the purposes of removing the above listed foreign matter. These chemicals shall be injected to the systems, circulated and completely flushed out. Repeat the process if required. After each flushing, remove and thoroughly clean all strainers.
- E. Final connection is not to be made to the campus loop system until the Chemical Contractor has filed with the Owner's representatives, a report stating that the systems are clean.

END OF SECTION

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SECTION 23 20 00.A

PIPING, VALVES AND FITTINGS

PART 1 GENERAL

- 1.1 The following sections are to be included as if written herein:
 - A. Section 23 00 00 – Basic Mechanical Requirements
 - B. Section 23 05 29 – Sleeves, Flashings, Supports and Anchors
 - C. Section 23 05 53 – Mechanical Identification

- 1.2 SECTION INCLUDES
 - A. Pipe and Pipe Fittings
 - B. Valves

- 1.3 RELATED SECTIONS
 - A. Section 02222 - Excavating
 - B. Section 31 23 23.13 - Backfilling
 - C. Section 31 23 16.13 - Trenching
 - D. Section 33 13 00 - Disinfection of Water Distribution System
 - E. Section 08 31 13 - Access Doors and Frames
 - F. Section 09 91 00 - Painting
 - G. Section 23 05 16 - Expansion Compensation
 - H. Section 23 05 48 - Vibration Isolation
 - I. Section 23 07 19 - Piping Insulation
 - J. Section 22 13 16.A - Plumbing Specialties
 - K. Section 22 40 00 - Plumbing Fixtures
 - L. Section 22 11 23 - Plumbing Equipment

- 1.4 REFERENCES
 - A. AGA - American Gas Association
 - B. ANSI B31.1 - Power Piping
 - C. ANSI B31.2 - Fuel Gas Piping
 - D. ANSI B31.4 - Liquid Petroleum Transportation Piping Systems
 - E. ANSI B31.9 - Building Service Piping
 - F. ASME - Boiler and Pressure Vessel Code

- G. ASME Sec. 9 - Welding and Brazing Qualifications
- H. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800
- I. ASME B16.3 - Malleable Iron Threaded Fittings
- J. ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250
- K. ASME B16.18 - Cast Bronze Solder-Joint Pressure Fittings
- L. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings
- M. ASME B16.23 - Cast Copper Alloy Solder-Joint Drainage Fittings - DWV
- N. ASME B16.26 - Cast Bronze Fittings for Flared Copper Tubes
- O. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
- P. ASME B16.32 - Cast Copper Alloy Solder-Joint Fittings for Solvent Drainage Systems
- Q. ASTM A47 - Ferric Malleable Iron Castings
- R. ASTM A135 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
- S. ASTM A74 - Cast Iron Soil Pipe and Fittings
- T. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
- U. ASTM B32 - Solder Metal
- V. ASTM B42 - Seamless Copper Pipe
- W. ASTM B43 - Seamless Red Brass Pipe
- X. ASTM B75 - Seamless Copper Tube
- Y. ASTM B88 - Seamless Copper Water Tube
- Z. ASTM B251 - Wrought Seamless Copper and Copper-Alloy Tube
- AA. ASTM B302 - Threadless Copper Pipe (TP)
- BB. ASTM B306 - Copper Drainage Tube (DWV)
- CC. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe
- DD. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings
- EE. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
- FF. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings
- GG. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
- HH. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- II. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings
- JJ. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
- KK. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
- LL. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings
- MM. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- NN. ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) Composite-Sewer Piping

- OO. ASTM D2683 - Socket-Type Polyethylene Fillings for Outside Diameter - Controlled Polyethylene Pipe
 - PP. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - QQ. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
 - RR. ASTM D2846 - Chlorinated Polyvinyl Chloride (CPVC) Pipe, Fittings, Solvent Cements and Adhesives for Potable Hot Water Systems
 - SS. ASTM D2855 - Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
 - TT. ASTM D3033 - Type PSP Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
 - UU. ASTM D3034 - Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
 - VV. ASTM D3309 - Polybutylene (PB) Plastic Hot Water Distribution System
 - WW. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - XX. ASTM F493 - Solvent Cements for Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe and Fittings
 - YY. ASTM F845 - Plastic Insert Fittings for Polybutylene (PB) Pipe
 - ZZ. AWS A5.8 - Brazing Filler Metal. BA. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids
 - AAA. AWWA C110 - Ductile - Iron and Gray - Iron Fittings 3 in. through 48 in., for Water and Other Liquids
 - BBB. AWWA C111- Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings
 - CCC. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
 - DDD. AWWA C651 - Disinfecting Water Mains
 - EEE. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems
 - FFF. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems
 - GGG. CAN-3 B281 - Aluminum Drain, Waste, and Vent Pipe and Components
 - HHH. NCPWB - Procedure Specifications for Pipe Welding
 - III. NFPA 54 - National Fuel Gas Code
 - JJJ. NFPA 58 - Storage and Handling of Liquefied Petroleum Gases
 - KKK. TDH - Texas Department of Health, Water System Regulations
- 1.5 SUBMITTALS
- A. Submit under provisions of Section 23 00 00.
 - B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
 - C. Welding Certificates – WPS, PQR, & WPS's
 - D. Welding Inspector Qualifications
 - E. Field quality-control test reports & weld map

1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 23 00 00.
- B. Record actual locations of valves, etc. and prepare valve charts.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 23 00 00.
- B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.8 QUALITY ASSURANCE

- C. Valves: Manufacturer's name and pressure rating marked on valve body.
- D. Welding Materials and Procedure: Conform to ASME Code and applicable state labor regulations. Provide 100% visual welding inspection by a qualified welding inspector. Welding inspector shall examine fit-up for compliance with ASME requirements prior to weldout. Owner reserves the right to examine welds by any means desired including radiography and or ultrasonic technology. All welds must be fully penetrated, show no lack of fusion, show no slag inclusions in excess of ASME limits, or cluster porosities. Examined welds not meeting this criterion will be considered unacceptable and be fully replaced at no additional cost to the owner. The welding inspector shall maintain a current weld-map on the job site for submission with project close-out documents. See WELD TESTING for additional information.
- E. Welder's Certification: In accordance with ASME Sec. 9. Submit welder's certification, including WPS, PQR, & WPQs prior to any shop or field fabrication. Welder's certifications shall be current within six months of submission.
- F. Maintain one copy of each document on site.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years' documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum of three years' documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 23 00 00.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.12 EXTRA MATERIALS

- A. Furnish under provisions of Section 23 00 00.
- B. Provide two repacking kits for each size valve.

PART 2 PRODUCTS

2.1 STEEL PIPING:

- A. Scope: This section applies to all piping systems providing for welded piping, fittings, and other appurtenances. Specific systems requiring welded piping include, but are not limited to: chilled water, hot water, steam, steam condensate, and fire protection systems.
- B. Pipe: Unless otherwise indicated, chiller and boiler plants piping shall be Schedule 40, and underground and building piping shall be Standard weight, Grade A or B, seamless black steel pipe conforming in all details to Standard ASTM Designation A135, A106, and A53, latest revisions. Steam condensate shall be Schedule 80.
- C. Fittings:
 - 1. All weld fittings shall be domestic made wrought carbon steel butt-welding fittings conforming to ASTM A234 and ASME/ANSI B16.9, latest edition, as made by Weld Bend, Tube Turn, Hackney, or Ladish Company. Attach to only pipe with a hole for the entire length. Each fitting shall be stamped as specified by ASME/ANSI B16.9 and, in addition, shall have the laboratory control number metal stenciled on each fitting for ready reference as to physical properties required for any fittings selected at random. Fittings which have been machined, remarked, printed, or otherwise produced domestically from non-domestic forgings or materials will not be acceptable. Each fitting is to be marked in accordance with MSS SP-25. Markings shall be placed on the fittings at the farthest point from the edge to be welded to prevent disfiguring from the welding process. Submittal data for these fittings shall include a letter signed by an official of the manufacturing firm certifying compliance with these specifications.
 - 2. All screwed pattern fittings specifically called for shall be minimum Class 150 malleable iron fittings of Grinnell Company, Crane Company or Walworth Company manufacture (300 lb. for unions).
- D. FABRICATION:
 - 1. Welded piping and fittings in chiller and boiler plants shall be fabricated in accordance with ASME/ANSI the latest editions of Standards B31.9. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to recognized standards.
 - 2. Ensure complete penetration of deposited metal with base metal. Contractor shall provide filler metal suitable for use with base metal. Contractor shall keep inside of fittings free from globules of weld metal. All welded pipe joints shall be made by the fusion welding process, employing a metallic arc or gas welding process. All pipe shall have the ends beveled 37-1/2 degrees and all joints shall be aligned true before welding. Except as specified otherwise, all changes in direction, intersection of lines, reduction in pipe size and the like shall be made with factory-fabricated welding fittings. Mitering of pipe to form elbows, notching of straight runs to form tees, or any similar construction will not be permitted.
 - 3. Align piping and equipment so that no part is offset more than 1/16 inch. Set all fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
 - 4. Do not permit any weld to project within the pipe so as to restrict it. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.

5. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
6. Remove dirt, scale and other foreign matter from the inside of piping, by swabbing or flushing, prior to the connection of other piping sections, fittings, valves or equipment.
7. In no cases shall Schedule 40 pipe be welded with less than three passes including one stringer/root, one filler and one lacer. Schedule 80 pipe shall be welded with not less than four passes including one stringer/root, two filler and one lacer. In all cases, however, the weld must be filled before the cap weld is added.
8. Procedure of Assembling Screw Pipe Fittings: All screw joints shall be made with taper threads properly cut. Joints shall be made tight with Teflon applied to the pipe threads only and not to fittings. When threads are cut on pipes, the ends shall be carefully reamed to remove any burrs. Before installing pipe that has been cut and threaded, the lengths of pipe shall be upended and hammered to remove all shavings and foreign material.

E. WELD TESTING:

1. All welds are subject to inspection, visual and/or X-ray, for compliance with specifications. The owner will, at the owner's option, provide employees or employ a testing laboratory for the purposes of performing said inspections and/or X-ray testing. Initial visual and X-ray inspections will be provided by the owner. The contractor shall be responsible for all labor, material and travel expenses involved in the re-inspection and re-testing of any welds found to be unacceptable. In addition, the contractor shall be responsible for the costs involved in any and all additional testing required or recommended by ASME/ANSI Standards B31.1, B31.9, and B31.3 due to the discovery of poor, unacceptable, or rejected welds.
2. Welds lacking penetration, containing excessive porosity or cracks, or are found to be unacceptable for any reason, must be removed and replaced with an original quality weld as specified herein. All qualifying tests, welding and stress relieving procedures shall, moreover, be in accord with Standard Qualification for Welding Procedures, Welders and Welding Operators, Appendix A, Section 6 of the Code, current edition.

2.2 COPPER PIPE

- A. Copper Pipe: Piping four inches (4") and smaller shall be fabricated of Type K, hard drawn, copper pipe made of deoxidized copper (99.9% pure). This Type K copper pipe shall conform in every detail to ASTM Standard Specifications for COPPER WATER TUBE, Serial Designation B-88-66, and it shall be provided in 20-foot straight lengths. Copper pipe 4" and smaller may only be joined using non-lead-bearing solder, such as 95-5 silver or antimony solder (95 percent tin, and 5 percent silver or antimony). Copper pipe 4" and larger may be joined using roll grooved fittings.

(Note: For UT Austin, substitute the following sentence for the previous two sentences: "Copper pipe may only be joined using "Silvabrite" solder. No other solders may be used.")

- B. Fittings: All fittings for four inch (4") and smaller water lines shall be Streamline Solder Fittings manufactured by Streamline Pipe and Fittings Division, Mueller Brass Company, or approved equal. These wrought copper fittings shall be rigid and strong with openings machined to accurate capillary fit for the pipe.
- C. Lead: It is forbidden that lead in any form be used in any water system other than waste. If lead is used in the fabrication or installation of any water system other than waste, then ALL of the installed equipment and material, which may have come in contact with the lead, shall be marked with bright red or orange spray paint, and shall be removed from the project site. The system(s) shall then be restored and reinstalled using ALL NEW MATERIALS.

2.3 VALVES:

- A. All valves shall be located such that the removal of their bonnets is possible. All flanged valves shown in horizontal lines with the valve stem in a horizontal position shall be positioned so that the valve stem is inclined one bolt hole above the horizontal position. Screw pattern valves placed in horizontal lines shall be installed with their valve stems inclined at an angle of a minimum of 30 degrees above the horizontal position. All valves must be true and straight at the time the system is tested and inspected for final acceptance. Valves shall be installed as nearly as possible to the locations indicated in the Construction Drawings. Any change in valve location must be so indicated on the Record Drawings. All valves must be of threaded or flanged type. No solder connected or grooved fitting valves shall be used on this project. All bronze and iron body gate and globe valves shall be the product of one manufacture for each project. Manufacturers of other types may not be mixed on the same project; i.e., all butterfly valves shall be of the same manufacture, all ball valves shall be of the same manufacture, etc.
- B. All valves used in circulating systems, plumbing and steam systems (low and medium pressure) shall be Class 150 SWP. Class 300 valves shall be constructed of all ASTM B-61 composition. All gate, globe and angle valves shall be union bonnet design. Metal used in the stems of all bronze gate, globe and angle valves shall conform to ASTM B371 Alloy 694, ASTM B99 Alloy 651, or other corrosion resistant equivalents. Written approvals must be secured for the use of alternative materials. Alloys used in all bronze ball, gate, globe, check, or angle valves shall contain no more than 15% zinc. No yellow brass valves will be allowed.
- C. All iron body valves shall have the pressure containing parts constructed of ASTM designated of 126 class B iron. Stem material shall meet ASTM B16 Alloy 360 or ASTM 371 Alloy 876 silicon bronze or its equivalent. Gates and globes shall be bolted bonnet with OS&Y (outside screw and yoke) and rising stem design. A lubrication fitting is preferred on yoke cap for maintenance lubrication of the yoke bushing.
- D. All cast steel body valves shall have the pressure containing parts constructed of ASTM designation A-216-GR-WCB carbon steel. Gate and globe valves shall be bolted bonnet outside and screw and yoke design with pressure-temperature rating conforming to ANSI B16-34-1977. Stems shall meet ASTM designation A-186-F6 chromium stainless steel. Wedge (gate valves) may be solid or flexible type and shall meet ASTM A-182-F6 chromium stainless steel on valves from 2" to 6". Sizes 8" and larger may be A-216-WCB with forged rings or overlay equal to 182-F6. Seat ring shall be hard faced carbon steel or 13% chromium A-182-F6 stainless. Handwheels shall be A47 Grade 35018 malleable iron or Ductile Iron ASTM A536.
- E. All forged steel body valves shall have the pressure containing parts constructed of ASTM 105, Grade 2 forged carbon steel. Seat and wedges shall meet ASTM A-182-F6 chromium stainless steel. Seat rings shall be hard faced. Valves shall conform to ANSI B16-34 pressure-temperature rating.
- F. All valves shall be repackable, under pressure, with the valve in the full open position. All gate valves, globe valves, angle valves and shutoff valves of every character shall have malleable iron hand wheels, except iron body valves 2-1/2" and larger which may have either malleable iron or ASTM A-126 Class B, gray iron hand wheels.
- G. Packing for all valves shall be free of asbestos fibers and selected for the pressure-temperature service of the valve. It is incumbent upon the manufacturer to select the best quality, standard packing for the intended valve service. At the end of one year, period spot checks will be made, and should the packing show signs of hardening or causing stem corrosion then all valves supplied by the manufacturer shall be repacked by the Contractor, at no expense to the Owner, with a packing material selected by the Owner.

- H. Valves 12" and larger located with stem in horizontal position shall be drilled and tapped in accordance with MSS-SP-45 to accommodate a drain valve and equalizing by-pass valve assembly.
- I. Balancing and/or Shutoff Valves for Hot Water Systems: Two inches and smaller, three piece full port bronze body ball valve, stainless steel ball and stem. Teflon seats, packing and gasket, bronze gland follower, adjustable stuffing box, steel lever type handle, with plastic sheathed operating handle, adjustable memory stops, and shall be class 150 SWP/600 WOG, screwed pattern. Manufacturer shall certify ball valves for use in throttling service. Stem extensions shall be furnished for use in insulated lines. Cold water service valves shall be as above, except two piece construction. All valves 2 1/2" and larger shall be tapped full lug butterfly valves with aluminum bronze discs of ASTM B148 Alloy C955 and 316, 416, or 420 stainless steel shafts. Design must incorporate bushing between shafts and body of material suitable to provide a bearing surface to eliminate seizing or galling. Valve must be capable of providing a bubble tight seal at 200 psi for valves up to 12" (150 psi for larger valves) when used for end of line service without requiring the installation of a blind flange on the downstream side. Liners shall be resilient material suitable for 225 °F temperature and bodies of ductile iron. Butterfly valves 8" and larger and butterfly valves used for balancing service, regardless of size, shall have heavy duty weather proof encased gear operators, with malleable iron handwheel or crank. Valves 2 1/2" through 6" shall have lever handles which can be set in interim positions between full open and full closed. All butterfly valves shall be absolutely tight against a pressure differential of 150 psi.
- J. Check Valves for Water Systems: Bronze body, 2" and smaller, bronze body regrinding disc and seat with screw-in cap. Iron body, 2 1/2" and larger, bronze disc and seat or non slam wafer type with stainless pins and springs, and bronze plate. Forged steel lift check valves, 2" and smaller shall be bolted cap and body, screwed end connections and conform to ANSI B16.34 and pressure temperature rating.
- K. Valves for Fire Protection Service: 2" and smaller, bronze body ball valve as above, Underwriters' Laboratories Listed and Factory Mutual Approved, screw pattern 2 1/2" and larger, Underwriters' Laboratories Listed and Factory Mutual Approved butterfly valves with tapped full lug body and gear operated with malleable iron hand-wheel and position indicator. All valves to be furnished with two factory mounted internal supervisory switches.

Gate valves 2 1/2" and larger shall have approved rating of 175 psi WWP or greater, iron body with resilient rubber encapsulated wedge, epoxy-coated interior, and pre-grooved stem for supervisory switch.

- L. Check Valves Fire Protection System: Iron body, swing-check, bronze disc, seat ring and hinge pin, 300 psi rated working pressure, Underwriters' Laboratories and Factory Mutual approved. Complete with ball drip assembly.
- M. Standards of Quality for Valves:

Standard of Quality for Valves:

		<u>Class</u>	<u>Milwaukee</u>	<u>Nibco</u>	Stockham or as <u>noted</u>
*2" & smaller	Ball Valve for shut-off	Domestic 150 Cold Water Plumbing	--	T-585-70	Apollo 77-100

		Systems Re-circulating Chilled Water					
Requires extended stems in insulated lines with adjustable memory stop.							
				Nibco Hydropur			
*2" & Smaller	Apollo Ball Valve	Domestic 150 Hot Water Plumbing Systems & Re-circulating Hot Water	--		T-585-Y-66	77-140	
Requires extended stems in insulated lines with adjustable memory stop.							
2" & smaller	Globe, Angle & Balancing Valve	Chilled Water,	150	590T	T-235	B-22	
2-1/2" & larger	Globe, Angle & Balancing Valve	Plumbing, Chilled Water,	125	F-2981	F-718-B	G-514-T	
2-1/2" & larger	Butterfly Valve for Shutoff	Domestic Hot & Cold Water Plumbing Systems Re-circulating Chilled and Heating Water	150	NE-C, NF	LD2000	DeZurik 632,L,D, RS66,6	
Valves 8" and larger, and valves used for balancing service regardless of size, shall have heavy-duty weatherproof encased gear operator.							
2" & smaller	Ball Valve (UL,FM)	Fire Protection	300		BB-SC T-505-4	--	
2-1/2" & larger	Butterfly Valve	Fire Protection	175	--	LD3510-8	LG72UF	
2-1/2" & larger	Gate Valve OS&Y	Fire Protection	175	--	F-607-RW	G-610	
2-1/2" & larger	Check Valve	**Fire Protection	175	--	F-908-W	G-940	
2" & smaller	Check Valve	All Water Systems	150	510	T-433	B-345	
2-1/2" & larger	Check Valve	All Water Systems	150	1400	W-920-W	Stockham 'Duo-Check'	
2" & smaller	Globe Valve	Primary Hot Water	300	1186	T-276-AP	B-74	

2-1/2" & larger	Globe Valve	Primary Hot Water	300	F-2983-M F-768-B	--	
2" to 12"	Hub End (below ground)	(AWWA) 1	50	--	--	Mueller 2380-5
1-1/2" & smaller	Lubricated Gas Cock	Medical, Lab Gases & Natural Gas	150	BB2-100		Rockwell 1796 & 142 With Wrench
2" & larger	Lubricated Gas Cock	Medical, Lab Gases & Natural Gas	150	--		Rockwell 143 & 1797 With Wrench
2" & smaller	Isolation Ball Valve	Medical, Lab Gases & Natural Gas	150			Sarco Spirax Model 60

Valves 8" and larger, and valves used for balancing service regardless of size, shall have heavy-duty weatherproof encased gear operators.

* Requires extended stem in insulated lines.

** Requires ball drip assembly.

2.4 UNIONS:

- A. Provide and install unions at proper points to permit removal of pipe and various equipment and machinery items without injury to other parts of the system. No unions will be required in welded lines or lines assembled with solder joint fittings except at equipment items, machinery items and other special pieces of apparatus. Unions in 2" and smaller in ferrous lines shall be Class 300 AAR malleable iron unions with iron to brass seats, and 2 1/2" and larger shall be ground flange unions. Unions in copper lines shall be Class 125 ground joint brass unions or Class 150 brass flanges if required by the mating item of equipment. Companion flanges on lines at various items of equipment, machines and pieces of apparatus shall serve as unions to permit removal of the particular items. See particular Specifications for special fittings and pressure.
- B. Unions connecting ferrous pipe to copper or brass pipe shall be dielectric type equal to Epco.
- C. In all water lines where the material of the pipe is changed from ferrous to copper or brass, a dielectric coupling shall be used at the transition.

2.5 FLANGES:

- A. All 150 lb. and 300 lb. ANSI flanges shall be weld neck and shall be domestically manufactured, forged carbon steel, conforming to ANSI B16.5 and ASTM A-181 Grade I or II or A-105-71 as made by Tube Turn, Hackney or Ladish Company. Slip on flanges shall not be used. Each fitting shall be stamped as specified by ANSI B16.9 and, in addition, shall have the laboratory control number stenciled on each fitting for ready reference as to physical properties and chemical composition of the material. Complete test reports may be required for any fitting selected at random. Flanges which have been machined, remarked, painted or otherwise produced domestically from imported forges will not be acceptable. Flanges shall have the manufacturer's trademark permanently identified in accordance with MSS SP-25. Contractor shall submit data for firm certifying compliance

with these Specifications. Bolts used shall be carbon steel bolts with semi-finished hexagon nuts of American Standard Heavy dimensions. Allthread rods will not be an acceptable for flange bolts. Steam system flange bolts shall have a tensile strength of 105,000 psi and an elastic limit of 81,000 psi and rated at least ANSI Grade V. Other bolts shall have a tensile strength of 80,000 psi and an elastic limit of 36,000 psi and rated at least ANSI Grade I.

- B. Flat faced flanges shall be furnished to match 125 lb cast iron flanges on pumps, check valves, strainers, etc. with full flange gaskets. Bolting of raised face flanges to flat faced flanges is not allowed.

C. FLANGE GASKETS

- 1. Gaskets shall be placed between the flanges of all flanged joints.
- 2. Gaskets for steam piping - All steam flange joints shall use Flexitallic Class 150 spiral wound for low pressure applications and Flexitallic Class 300 spiral wound gaskets for medium or high pressure applications. Raised and flat face flange gaskets shall be Flexitallic compression gauge (CG) style. External ring shall be Type 304 stainless steel and color coded yellow. Filler material shall be Flexite Super and color coded with pink stripe. Equivalents may be submitted with all design data so that an evaluation of the gasket can be made.
- 3. Gaskets for all other applications: Gaskets shall be ring form gaskets fitting within the bolt circle of their respective flanges. Gaskets shall be 1/16" thick asbestos free material recommended for service by Anchor, Garlock, or John Crane. The inside diameter of such gaskets shall conform to the nominal pipe size and the outside diameter shall be such that the gasket extends outward to the studs or bolts employed in the flanged joint.
- 4. Spares - Contractor shall provide ten spares for every flange size and rating.

D. Flange Bolt Installation:

- 1. Bolt Lubrication: Bolts shall be well lubricated with a heavy graphite and oil mixture.
- 2. Torque Requirements - Bolts shall be stressed to 45,000 psi.

Nominal Bolt Dia. (Inch)	Torque (Ft-Lbs)
.25	6
.3125	12
.375	18
.4375	30
.5	45
.5625	68
.625	90
.75	150
.875	240
1.0	368
1.125	533
1.25	750
1.375	1020
1.5	1200

- 3. Torque shall be checked with a calibrated breaking action torque wrench on the final torque round. Bolts shall be cold and hot torqued.

4. Torque Pattern - Shall be a cross or star pattern with at least four passes. Limit each pass to 30% of full torque increases.
5. Hot Torque - Re-torque the flange bolts with system at normal operating pressure and temperature for at least four hours.
6. Inspection - Owner shall verify hot torquing of all medium and high pressure steam flange bolts.

PART 3 EXECUTION

Refer to other Sections for service specific requirements.

3.1 EXAMINATION

- A. Verify excavations under provisions of Section 23 00 00.
- B. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 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.

3.3 INSTALLATION

- A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient.
- C. Install piping to conserve building space and not interfere with use of space.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Provide access where valves and fittings are not exposed. Coordinate access door location with architectural features.
- H. Establish elevations of buried piping outside the building to ensure a minimum of cover. Refer to Section 23 00 00.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Provide support for utility meters in accordance with requirements of utility companies.
- K. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting. Refer to Division 09.
- L. Excavate in accordance with Section 23 00 00 for work of this Section.
- M. Backfill in accordance with Section 23 00 00 for work of this Section.

- N. Install bell and spigot pipe with bell end upstream.
- O. Install valves with stems upright or horizontal, not inverted.

3.4 PIPE CLEANING & CHEMICAL TREATMENT

- a. Piping shall be thoroughly cleaned, flushed, passivated, and treated. Coordinate piping installations to avoid wetting the piping without proceeding immediately to clean, passivate, and introduce chemical inhibitors. Bypass equipment during flushing. Generate sufficient flow velocity in excess of 8 ft/second to remove welding slag during flushing. Provide a chemical pot feeder for chemical introduction and maintenance. Retain a qualified chemical treatment company and introduce chemical products formulated for removing oil, mill scale, and rust and achieve initial passivation of piping systems during flushing in accordance with water treatment vendor's instructions. Continue flushing until field testing by chemical vendor indicates acceptable results. Introduce biocides to prevent microbial consumption of corrosion inhibitors prior to introducing inhibitors. Adjust pH and alkalinity per chemical treatment vendors recommendations. Introduce blends of nitrate and triazole based inhibitors for steel and yellow metal corrosion protection. Monitor and add additional inhibitors for first 3 months to maintain target inhibitor concentrations. Submit regular water quality test reports.

3.5 ERECTION TOLERANCES

- A. Establish invert elevations, slopes for drainage to 1/8 inch per foot (one percent) minimum. Maintain gradients through each joint of pipe and throughout system.
- B. Slope water piping and arrange to drain at low points.

END OF SECTION

SECTION 23 09 23

DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC

PART 1 - GENERAL

1.1 WORK DESCRIPTION

- A. Scope: This section contains general requirements for the supply and installation of a microprocessor based Energy Management System (EMS) as an extension of the existing Campus Johnson Building Technologies System.
- B. Controls supplier shall be responsible for furnishing and installing all equipment and wiring for Building Automation Systems (Temperature and HVAC Equipment Control) for a complete and operable system as specified herein. All wiring shall be done in accordance with all local and national codes.
- C. Work Included: It is the intent of this specification for the EMS to be installed as a complete package by Johnson Controls. The system shall include all computer software and hardware, controllers, sensors, transmission equipment, local panels, installation, engineering, supervision, commissioning, acceptance test, training, and warranty service. **The work shall include all electrical power distribution and signal wiring required for a fully functional control system. Include all electrical power sources, raceways, conductors, etc. required for a fully functional system, in addition to electrical systems indicated on the drawings, at no additional cost to the owner.**

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Products connect to the EMS but not furnished or installed under this section include air flow stations, automatic dampers, valves, flow switches, flow sensors, thermos-wells and pressure taps to be installed by the Division 23 and/or 26.
 - 1. Section 23 05 19 Meters and Gauges
 - 2. Section 23 05 93 Testing adjusting and Balancing
 - 3. Section 23 05 13 Motors and Variable Frequency Drives
 - 4. Section 23 36 00 Air Terminal Unit
- B. Coordination with electrical:
 - 1. Installation of all line voltage power wiring including 120V power to each terminal unit and DDC panel by Division 26.
 - 2. Each motor starter provided under Division 23 or 26, shall be furnished with individual control power transformer to supply 120volt control power and auxiliary contacts (one N.O. and one N.C.) for use by this section.
- C. Work provided by this Section but listed elsewhere:
 - 1. Section 23 36 00 Air Terminal Units Controls
 - 2. Section 23 09 93 Control Sequence - HVAC on Drawings

1.3 QUALIFICATIONS

- A. System components shall be provided by Johnson Building Technologies.

- B. The control system shall be furnished, engineered and installed by a Johnson owned branch office having factory trained technicians to provide instruction, routine maintenance, and emergency service within 24 hours upon receipt of request.
- C. The control system components shall be new and in conformance with the following applicable standards for products specified:
 - 1. American Society for Testing and Materials, ASTM
 - 2. Institute of Electrical and Electronic Engineers, IEEE
 - 3. National Electrical Manufacturers Association, NEMA
 - 4. Underwriters Laboratory, UL (UL 916 & 864)
 - 5. FCC Regulation, Part 15, Section 156
 - 6. National Fire Protection Association, NFPA
 - 7. Local Building Codes

1.4 SUBMITTALS

- A. The controls contractor shall submit Auto CAD generated schematic drawings for the entire system for review and approval before work shall begin. Included in the submittal drawings shall be a one page diagram depicting the system architecture complete with a communications riser. Drawings shall include point-to-point wiring diagrams and any special connection information required for properly controlling the equipment. The submittal shall include a bill of material reference list as well as equipment sequences of operation.
- B. The submittals shall include the manufacturer's catalog data describing, highlighting and specifically indicating each item of equipment or component provided and installed for the project.

1.5 PROTECTION OF SOFTWARE RIGHTS

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

PART 2 - PRODUCTS

2.1 ACCEPTIBLE BIDDERS

- A. The specifications are intended to describe the microprocessor based Energy Management System – Johnson Building Technologies is the acceptable manufacturer/installer. Lab controls shall be by “Phoenix Controls”. Controls contractor shall be responsible to provide interface between Phoenix controls and existing Johnson Controls.

2.2 NETWORKING

- A. The design of the EMS shall network operator workstations and stand-alone DDC Controllers. The network architecture shall consist of three levels, a campus-wide (Management Level Network - MLN) Ethernet network based on TCP/IP protocol, high performance peer-to-peer Building Level Network (BLN) and Application Specific Controller Floor Level Networks (FLN) with access being totally transparent to the user when accessing data or developing control programs.

- B. The design of EMS shall allow the co-existence of new DDC Controllers with existing DDC Controllers in the same network without the use of gateways or protocol converters.
- C. All operator devices either network resident or connected via dial-up modems shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the peer-to-peer network. No hardware or software limits shall be imposed on the number of devices with global access to the network data at any time.
- D. A single Workstation shall support a minimum of four (4) Building Level Networks (BLN). The BLN's can be any combination of direct or modem connected Networks. All Networks shall be dynamically connected to allow access to points on different BLN's simultaneously.

2.3 DDC CONTROLLERS

- A. DDC Controllers shall be stand-alone, multi-tasking, multi-user, real-time digital control processors with a minimum word size of 16 bits, minimum 48MHz clock and minimum 12MB memory consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules (universal or discrete). Each major DDC Controller (PXC Modular) shall support a minimum of 96 FLN Devices.
- B. Each DDC Controller shall support its own operating system and databases, including:
 - 1. Control processes
 - 2. Energy management applications
 - 3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 - 4. Historical/trend data for points specified
 - 5. Maintenance support applications
 - 6. Custom processes
 - 7. Operator I/O
 - 8. Dial-up communications
 - 9. Manual override monitoring
- C. Each DDC Controller shall support any combination of industry standard inputs and outputs.
- D. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.
- E. DDC Controllers shall be provided with one RS-232C serial data communication port for the portable laptop operator's terminal. When a modem is required for remote operation, a second RS-232C serial data communication port shall be provided. DDC Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.
- F. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
 - 1. Switches shall be mounted within the DDC Controllers key-accessed enclosure.
 - 2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.
- G. DDC Controllers shall provide local LED 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.

Graduated intensity LED's for analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door (MBC only).

- H. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
- I. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.
- J. In the event of loss of all power, there shall be an orderly shutdown of all DDC 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 100 hours.
 - 1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
 - 2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or automatically from the network workstation PC.
- K. As a minimum, a separate DDC Controller shall be provided for each mechanical room.

2.4 DDC CONTROLLER RESIDENT SOFTWARE

- A. General:
 - 1. The software programs specified in this Section shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer for execution.
- B. Control Software Description:
 - 1. The DDC Controllers shall have the ability to perform the following pre-tested control algorithms:
 - a. Two-position control
 - b. Proportional control
 - c. Proportional plus integral control
 - d. Proportional, integral, plus derivative control
 - e. Automatic tuning of control loops
- C. DDC Controllers shall have the ability to perform any or all the following energy management routines:
 - 1. Time-of-day scheduling
 - 2. Calendar-based scheduling
 - 3. Holiday scheduling
 - 4. Temporary schedule overrides
 - 5. Start-Stop Time Optimization
 - 6. Automatic Daylight Savings Time Switchover
 - 7. Night setback control
 - 8. Enthalpy switchover (economizer)
 - 9. Peak demand limiting
 - 10. Temperature-compensated duty cycling
- D. DDC Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

1. A single process shall be able to incorporate measured or calculated data from any and all other DDC Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC Controllers on the network.
 2. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
- E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.
1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
 2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
 3. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs.
 4. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.
 5. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.
- F. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary.
1. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided. Each DDC Controller shall have a dedicated RAM-based buffer for trend data. All trend data shall be available for use in 3rd party personal computer applications such as Excel 5.0.
 2. DDC Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary.
 - a. Loop tuning shall be capable of being initiated either locally at the DDC Controller, from a network workstation or remotely using dial-in modems. For all loop-tuning functions, access shall be limited to authorized personnel through password protection.
- G. DDC Controllers shall automatically accumulate and store run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O summary.
- H. DDC Controllers shall be password protected. The user's Password and Privileges shall be identical to the Password and Privileges used at the EMS Workstation.

2.5 APPLICATION SPECIFIC CONTROLLERS

- A. TERMINAL EQUIPMENT CONTROLLERS (TEC)
1. Provide for control of each piece of equipment, including, but not limited to, the following:
 - a. VAV Terminal Units with heating coils
 - b. VAV Terminal Units without heating coils
 2. The controllers shall include all inputs and outputs necessary to perform the specified control sequences. Analog outputs shall 24 volt floating.
 3. Each controller performing space temperature control shall be provided with a matching room temperature sensor with a setpoint adjustment between 55 °F and 95°F.
 4. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the respective controller.
 5. Set point adjustment and override function shall have the ability to be locked out, overridden, or limited as to time or temperature through software by an authorized operator at the central workstations, at the DDC Controller, or via the portable operator's terminal.
 6. Each controller shall perform its primary control function independent of the DDC Controller. The controller shall receive its real-time data from the DDC Controller time clock. Each controller shall include algorithms incorporating proportional, integral, and derivative (PID) gains for all applications. All PID gains and biases shall be adjustable by the user via terminals as specified herein. This functionality shall allow for tighter control and shall facilitate optimal occupant comfort and energy savings.
 7. Provide each terminal equipment controller with sufficient memory to accommodate point databases and operating programs. All databases and programs shall be stored in non-volatile EEPROM, EPROM, and PROM. The controllers shall be able to return to full normal operation without user intervention after a power failure. Operating programs shall be selectable and may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility:
 8. Controllers shall be powered from a 24 VAC source, and shall function normally under an operating range of 18 to 28 VAC (-25% to +17%), allowing for power source fluctuations and voltage drops. The controllers shall also function normally under ambient conditions of 32 Degrees to 122 Degree F and 10-95% RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly.
 9. Pressure independent controllers shall include differential pressure transducers that shall connect to the terminal unit manufacturer's standard averaging air velocity sensor to measure the average differential pressure in the duct. The controller shall convert this value to actual airflow. The differential pressure transducer shall have a measurement range of 400 to 4,000 FMP and measurement accuracy of +/-5% at 400 FPM insuring primary air flow condition shall be controlled and maintained to within +/-5% of setpoint at the specified parameters. Each controller shall include provisions for manual and automatic calibration of the differential pressure transducer in order to maintain stable control and insuring against drift overtime. The controller requiring 24 hours a day operation shall calibrate the airflow sensor every 24 hours with the use of an auto-zero module to eliminate the requirement of closing the supply damper to calibrate the flow sensor. It shall not be necessary to remove the controller to remove the damper actuator.

2.6 VALVES, DAMPERS AND ACTUATORS

- A. VALVES:
1. Water valves shall be sized by the control manufacturer to produce the required capacity at a pressure loss of 5 psi. Nominal body rating shall be not less than ANSI Class 125. However, the valve body and packing selected shall be designed to withstand the system static head plus

the maximum pump head and the maximum temperature of control medium and hot water, or as indicated. Single-seated valves shall have close-off ratings equal to 125% of the system pressure encountered that is the maximum upstream pressure. The valve body and packing selected shall be designed to withstand the system static head plus the maximum pump head and the maximum temperature of control medium without leakage for hot water.

2. Two-Way and Three-Way Valves:
 - a. Valves used for control of hot and chilled water shall be of the modulating globe type.
 - b. Valve sizes two inch and smaller shall be screwed and supplied with union fittings. The valves shall be constructed of bronze with stainless steel trim with equal percentage flow characteristics and have a rangeability of 50:1 or greater.
 - c. Valve sizes 2.5 inch and larger shall be flanged. The valves shall be constructed of cast iron ASTM A126 Class B. The trim shall be stainless steel with equal percentage flow characteristics. The valve rangeability shall be 100:1 or greater.
 - d. Valves shall be of the straight-through type as required by the sequence or indicated on the drawings.
3. Low Pressure Steam Valves: Shall be rated to 385 °F at a maximum inlet pressure to the valve of 100 psig. Valves for low-pressure steam shall be sized for 80% pressure drop of inlet pressure. Valves shall be equipped with stainless steel trim and disc with linear flow characteristics. Applications, which require steam valves larger than 2", shall utilize two valves in a 1/3 - 2/3 parallel arrangement.
4. With 2 control valves, modulate the 1/3 control valve to the 50% open position, sequence the 2/3 control valve when the 1/3 control valve is at 50% position, and modulate the 2/3 control valve at a faster rate than the 1/3 control valve as the load increases so that they both reach full open position at the same time. On a decrease in load, the 1/3 and 2/3 control valves shall modulate in the reverse sequence.
5. Approved manufacturers: Valve Solutions, Inc. Series V-port High Performance Ball Valve, Belimo B2, B3, B6, VB, VSS Series, and A-T Controls Triac "V" series.
6. Butterfly Valves: Where butterfly valves are indicated to be used as automatic control valves, they shall be line size and designed for motorized control operation with upper disc steam keyed or machined square for mating with the control operators linkage. All butterfly control valves over 8 inches shall be equipped with a manual, mechanical control actuator override, gear box operator for emergency manual control of the valve position. Provide required accessories to mechanically disengage automatic control actuator linkage and engage manual gear operator without dismantling the valve stem and stem extensions during changeover. Valves 4-20" and larger shall be tapped, full lug, cast iron body butterfly valves with aluminum bronze discs, stainless steel stem and EPDM seat. Design must incorporate top and bottom bushings between shafts and body of material suitable to provide a bearing surface to eliminate seizing or galling. Valves 4-20" must provide bubble-tight seal at 150 PSIG. Liners are to be resilient material suitable for 250 °F temperature.
7. Valve Constant (Cv) Charts: Control drawings shall indicate the valve constant (Cv rating) of all valves used so that the valve pressure drop may be used for balancing and performance tests. Submittal data shall also state calculated shut-off pressure for each valve size.

B. DAMPERS:

1. The Temperature Control Manufacturer shall provide control dampers of the types and sizes indicated on the drawings, including but not limited to outside air, return, relief air dampers, isolation and exhaust system bypass dampers.
2. Damper frames shall be 5" X 1" 6063T5 extruded aluminum hat channel with .125" minimum wall thickness with mounting holes for flange and enclosed duct mounting.

3. Dampers shall be available in two-inch size increments from 8" horizontal and vertical to 48". Requirements over 48" shall be standard modules with interconnecting hardware (jack shafting).
4. All damper blades shall be 6" 6063T5 heavy gage extruded aluminum airfoil for high velocity performance. Blades on all dampers must be not over 6" wide. Blade bearing shall be molded synthetic with 1/2" hex plated steel shafts. All blade linkage hardware shall be of corrosion-resistant finish and readily accessible for maintenance after installation.
5. Extruded vinyl edging seals for outdoor dampers and flexible metal compressible type side seals for all dampers shall be provided.
6. Dampers and seals shall be suitable for temperature ranges of -50 Degrees F. to +250 Degrees F. at specified leakage ratings.
7. Dampers used for proportional control shall have opposed blades.
8. Leakage rates shall not exceed 6.25 CFM/Sq. Ft. at 4" wg. differential rated in accordance with AMCA 500.
9. Acceptable manufacturers are Ruskin, Arrow United Industries, American Warming and Ventilating, Inc. or approved equal.

C. DAMPER AND VALVE ACTUATORS:

1. Electronic actuators shall be of 0-10 VDC type. The minimum actuator impedance shall be 800 ohms even when more than one actuator is connected in parallel. Spring return shall be required for two-position (NO/NC) control sequence or for steam valve control. Non-spring return actuators shall be used for all modulating sequence of control. They shall conform to all requirements of sequence descriptions specified or scheduled. Main mechanical equipment actuators shall have a manual position dial to allow manual positioning of valve in absence of control power.
2. Size each actuator for the specific application. All digital control applications shall use electric actuators suitable for the application (chilled water, hot water, or steam). All electric actuators associated with the digital control system shall be of the same manufacturer throughout the project, except for 120 volt actuators required for high torque applications. Stacking two actuators to meet torque requirements is acceptable, when torque requirement exceeds rated torque for listed actuators.
3. Major equipment applications: Use 24 VAC power and a 0/2-10 VDC control signal. Each actuator shall have a maximum run time of 150 seconds and spring return time of less than 60 seconds and shall utilize brushless motor. Actuator shall be adjustable for reversing rotation without dismounting. Approved manufacturers and models: Belimo F or K series, or Promation/ Schischek Inc. D4/D5.S Series.
4. Terminal equipment applications: Use 24 VAC power and 0/2-10 VDC or floating point control signal, spring return or non-spring return, actuator. Actuator shall have a maximum run time of 150 seconds and spring return time of less than 60 seconds and shall utilize brushless motor. Actuator shall be adjustable for reversing rotation without dismounting. Approved manufacturer and model: Belimo or approved equal.
5. High torque applications: Use 120 VAC power and 2-10 VDC control signal, non-spring return, metal housing. Actuator shall have a minimum torque of 347 in-lb. with maximum run time of 25 seconds. Actuator shall be adjustable for reversing rotation without dismounting. Provide manual override of actuator. Approved manufacturers and models: Valve Solutions, Inc., Series 1000 and Promation/Schischek Inc. D4/D5.S Series.
6. Fail Positions: Unless otherwise specified, the fail (normal) positions for AHU automatic control valves shall be as follows: Preheat Coils – NO, Cooling Coils – NO, Heating Coils, NC.
7. Valve actuators shall be of sufficient size to close valves at system pressure drop across the valve plus 50%.

8. Actuators for Terminal Equipment Controllers shall be 24V floating point, 0-10Vdc or pneumatic depending on Sequence of Operation and required speed of response. Regardless of actuator type, they shall be modulating and their position shall be readable in percentage open at the Workstation.

2.7 LABORATORY AND LAB SUPPORT SPACE, SUPPLY AND EXHAUST AIR TERMINALS.

- A. Provide pressure independent air valves, as scheduled on the drawing. Flow control shall be accurate to plus or minus 5 percent over the scheduled range of operation.
- B. Valve bodies shall be minimum 16-gauge spun aluminum. All exhaust valves serving fume hoods, bio-safety cabinets, wet exhaust, and H3 exhaust shall have corrosion-resistant baked phenolic coatings on aluminum surfaces exposed to the airstream.
- C. Supply valves shall be shipped from the factory with duct transition and properly sized heating coils where such configurations are shown on the drawings. Supply valves shall be insulated at the factory with material meeting flame/smoke rating 25/50.
- D. Laboratory Actuators: Actuators for VAV Laboratory Applications shall be provided for Laboratory Supply Air Terminals, Laboratory General Exhaust Terminals and Fume Hood Exhaust Terminals. The actuators shall be maintenance free high speed actuators capable of stroking in 1.0 second from minimum flow to 90% of maximum flow. The actuators shall have a fail-safe position based on Sequence of Operation. The actuators shall be capable of accepting either 3-position floating or 0-10 VDC signal.
- E. Controls: Provide laboratory air terminals with manufacturer's microprocessor based, fast acting control systems. Provide air valve manufacturer's auxiliary control components as indicated such as room integrators, laboratory hood sensors and monitoring panels, room pressure monitoring panels, and room temperature sensors which are compatible with manufacturer's control systems.
- F. Software: Provide laboratory air terminals with manufacturer's local and user interface software packages compatible with equipment provided. Include engineering, programming, configuration, setup, testing, commissioning, demonstration, and training for all software systems provided. Include all required software licensing in owner's name.
- G. Integration: Provide laboratory control systems with local area network communication interfaces for communication with building automation system. Include all labor required to assist, coordinate, test, and demonstrate building automation controls interface.
- H. Approved manufacturers: Phoenix approved for this project. Alternate manufacturer such as "Siemens" may be considered if prior approval by owner is provided.

2.8 FUME HOOD EXHAUST TERMINAL

- A. Provide a fume hood exhaust terminal (FHET) having an orifice ring flow sensor with two sets of pressure taps 90 degrees apart, offset from vertical by 45 degrees. The accuracy of the flow sensor shall be $\pm 5\%$ of the flow signal over the duct velocities of 600 FPM to 3000 FPM. The fume hood exhaust terminal shall be constructed of 20-gauge 316L stainless steel. The fume hood exhaust

terminal shall use a 90° butterfly damper without seal and the damper shaft shall be solid stainless steel with Teflon bearings. All joints and seams shall be sealed with RTV silicone.

- B. The fume hood exhaust terminal shall be supplied with factory mounted airflow transmitter and electric/electronic damper actuator. The electric/electronic damper actuator and pressure transmitter shall be housed within a galvanized steel enclosure with exterior supply connection.
- C. Provide a bio-safety cabinet/general exhaust terminal (GET) having an orifice ring flow sensor with two sets of pressure taps 90 degrees apart, offset from vertical by 45 degrees. The accuracy of the flow sensor shall be $\pm 5\%$ of the flow signal over the duct velocities of 600 FPM to 3000 FPM. The GET shall be constructed of 20-gauge galvanized steel. The GET shall use a 90° butterfly damper with peripheral neoprene gasket seal (gasket seal shall be scheduled on drawings) having leakage rating of 0.6% of flow at 2" wg, and the damper shaft shall be solid stainless steel with Teflon bearings. All joints and seams shall be sealed with RTV silicone.
- D. The GET shall be supplied with factory mounted airflow transmitter and electric/electronic damper actuator. The electric/electronic damper actuator and pressure transmitter shall be housed within a galvanized steel enclosure with exterior supply connection.

2.9 FLOW STATIONS

- 1. Provide where indicated on the plans airflow traverse probes mounted in the ductwork capable of continuously measuring the air volume of the respective ductwork.
- 2. The ductwork airflow traverse probes shall contain multiple total and static pressure sensors placed at concentric area centers along the exterior surface of the cylindrical probe and internally connected to their respective averaging manifolds. Sensors shall not protrude beyond the surface of the probe, nor be adversely affected by particle contamination normally present in building system airflows.
- 3. The duct work airflow traverse probes (two per duct) shall have dual end support swivel brackets suitable for mounting in the fan inlet bell and symmetrical averaging signal takeoffs and fittings, and shall be of aluminum construction with hard anodized finish.
- 4. The airflow traverse probes shall not induce a measurable pressure drop, nor shall the sound level within the system be amplified by its presence in the ductwork. The probes shall be capable of producing steady, non-pulsating signals of standard total and static pressure, without need for flow corrections or factors, with an accuracy of 2% of actual flow. Traverse probes shall be Air Monitor or equal.

2.10 FIELD SENSORS

- A. Temperature Sensors:
 - 1. The sensor shall be one of the following temperature sensor types:
 - a. 1000 ohm ($\pm 0.2\%$) platinum resistance temperature detectors having a coefficient of resistivity of 0.00385 ohms/ohm/°C (for animal room locations).
 - b. 100 ohm ($\pm 0.12\%$) platinum resistance temperature detectors having a coefficient of resistivity of 0.00385 ohms/ohm/°C. Provide RTD temperature transducers with of 4-20 ma output signal variations of less than 0.2% of full scale output for supply voltage variations $\pm 10\%$ and integral and accessible zero and span adjustment.
 - c. 10,000 ohm thermistor having an accuracy of .5°F at calibration point of 77°F may be used for room temperature only.

- d. Immersion temperature sensors shall have 316 Stainless Steel wells and duct mounted sensors shall use averaging bulbs of not less than 24" and when mounted in the preheat or mixed air position the averaging bulb shall be twice the diagonal length of the coil or duct.

B. DUCT SENSERS

1. Duct Sensor: 10K thermistor, accurate to $\pm 0.5^{\circ}\text{F}$, over 0° to 130°F range. All sensors in ducts shall be of the single point type and mounted on a standard duct bracket in location not affected by temperature stratification. Approved manufacturer and model: Precon ST-D series or Veris TJ series for plenum terminal units, or approved equal.
2. Averaging Sensor: 10K thermistor, accurate to $\pm 0.5^{\circ}\text{F}$, over 0° to 130°F range. It must contain at least one sensor for every 3 feet, with a minimum tube length of 12 feet. See the Controls Diagram for installation locations. Approved manufacturer and model: Precon ST-FZ series or ACI A/AN-A-XX-GD series, or approved equal.
3. Immersion Sensors: 10K thermistor, accurate to $\pm 0.5^{\circ}\text{F}$, over 10° to 230°F range. Sensors used in comparative applications shall be matched pairs. Provide stainless steel immersion well fitting, with Thread-o-let, for sensor and empty stainless steel well for test equipment. Pressure rating of well is to be consistent with the system pressure in which it is installed and must withstand the flow velocities in the pipe. Immersion length shall be $\frac{1}{3}$ to $\frac{1}{2}$ of the pipe diameter. Approved manufacturer and model: Precon ST-W Series or approved equal.

C. Dew point Sensors:

1. The sensor shall be a two-wire loop powered duct mounted relative humidity and temperature sensor having a measuring range 0 to 100% of R.H. with an accuracy no less than $\pm 2.5\%$. The sensor will calculate dewpoint temperature between -20°C and 80°C . The output from the sensor shall be 4-20 ma. Dewpoint sensors shall be Vaisala HMT100 or equal.

D. Carbon Dioxide Sensors

1. Provide non-dispersive, infra-red (NDIR) carbon dioxide gas diffusion sensing and transmitting equipment, 4-20 ma and 0-5 VDC/0-10 VDC (selectable) analog output linear with CO₂ measured. For duct-mounted applications, the CO₂ sensing element shall be located in the airstream. The unit shall sense and transmit carbon dioxide readings from 0 to 2000 ppm linear with a minimum accuracy of $\pm 5\%$ of reading from 1000 to 2000 ppm and a repeatability of $\pm 1\%$ full scale. Input voltage shall be 24 VDC.
2. Approved manufacturers and models:
Veris CDLS (duct) or CWLS (wall) Series
BAPI BA/BS3F Series, combination CO₂, temperature and RH sensors.
3. Provide sensors with one field calibration kit. Kit shall contain one tank with an 8-hour supply of 99.8% N₂, one tank with an 8-hour supply of 1000 ppm CO₂, one pressure regulator, one flow meter and a carrying case.
4. Wall mounted sensors shall be provided with LCD readout of CO₂ sensed level and shall be mounted next to the room temperature sensor.

E. Liquid level Sensors

1. Enclosed and Open Pit Sumps: Float type switch suitable for fluid in which immersed. Switch shall be assembly mounted, designed, and located for ease of maintenance access, removal, and level adjustment.
2. Steam Condensate Receiver Tanks: Float type switch suitable for steam condensate. Coordinate location of tee into receiver vent pipe for sensor location. When receiver control

package is equipped with local alarm, connect remote alarm indication into local alarm circuit. Provide interposing relay as required.

- F. Pressure Sensors:
1. The sensor shall be an air differential pressure transducers with output of 4-20 ma proportional to pressure. The airflow transmitter will have an accuracy of at least $\pm 0.5\%$ F.S for velocity pressure applications and $\pm 1.0\%$ F.S for static pressure applications. Airflow transmitter shall be either Dresser Industries Ashcroft Model XLDp or Setra C264 Lab.
 2. The sensor shall be a water or steam differential pressure transducers with output of 4-20 ma proportional to pressure. The transmitter will have an accuracy of at least $\pm 0.2\%$ of the transmitter range. The transmitter shall be Rosemount Series 1151 or equal.
 3. Duct Static: Accurate to ± 0.1 "wg over 0 to 5" range. Approved manufacturer: BaPI model ZPS series with display or approved equal.
 4. Building or Room Static: Accurate to ± 0.01 "wg over 0 to 0.1" range. Approved manufacturer: BAPI model ZPS series with display or approved equal.
 5. Filter Status Differential: Accurate to ± 0.1 "wg over 0 to 2" range. Approved manufacturer: BAPI model ZPS series with display or approved equal.
 6. Steam: Provide transducer in watertight enclosure, with gauge, isolation valve, pressure snubber, and steam pigtail. Output signal to be 4-20 ma. Approved manufacturer: For low pressure, 0-30 psig range Kele PTX1EG-05 or approved equal. For medium pressure, 0-100 psig range, Kele PTX1EG-07 or approved equal.
 7. Water: Provide transducer with stainless steel wetted parts, 0-10 VDC output, bi-directional, with range selected according to specific application. Provide three-valve manifold assembly with Pete's Plugs and flush ports on the supply and return tubes for zero and span calibration and maintenance of sensor. Provide $\frac{1}{2}$ " brass body, stainless steel ball isolation valves at locations where sensor lines tap into fluid. For chilled water applications, provide minimum schedule 40 stainless steel nipples extended past insulation, between isolation valves and pipe thread-o-let. Approved manufacturer: Veris PW2 series wet/wet differential pressure transmitter or approved equal.
- G. Smoke Detectors:
1. Smoke sensors are provided and installed under Division 28 to conform to local codes.
- H. Low Limit Temperature Switch
1. The sensor shall be a Low Limit Temperature Switch with minimum 20 ft. element for freeze protection as specified hereinafter. Element shall be serpentine across the face of the coil and shall be of sufficient length or number for three passes across the width of the coil it is protecting. Connect Low Limit Temperature Switch in series with other safety devices to de-energize fans serviced when a drop in temperature below setpoint is detected.
- I. Differential Pressure Switches:
1. The sensor shall be a pressure switch to monitor the pressure drops across each piece of equipment specifically a filter banks, fans and pumps.
 2. Design and sensitivity shall match application, with SPDT contacts to make/break from a field adjustable differential pressure setting for alarm reporting to the EMS. Switches utilized for filter banks and fans shall be Powers Static Pressure Air Flow Switches Series SW 141 or equal. Switches for pumps shall be Penn P74 differential pressure switch or equal.
- J. Current Status Switch (CSS)
1. The sensor shall be a high performance miniature split-core current status switch with adjustable set point. The current status switch shall have an operating range of between 1.25 – 50 amps and be able to detect belt loss and mechanical failure. CSS shall be Veris Hawkeye H908 or equal.

- K. Pressure Electric Switch (PE)
 - 1. The sensor shall be a pressure operated snap switch that can actuate electrical circuits. The contact ratings shall be 8 amps at 240V inductive.

- 2. 11 LOCAL CONTROL PANELS
 - A. Provide control panels with suitable brackets for wall mounting, for each miscellaneous control system. Locate panel adjacent to systems served.
 - B. Fabricate panels of 14-gauge furniture-grade steel, or 6063-T5 extruded aluminum alloy, totally enclosed, with hinged doors and keyed lock, with manufacturer's standard shop-painted finish and color. Provide UL listed cabinets for use with line voltage devices.
 - C. Panel Mounted Equipment: Include temperature controllers, relays, and other devices excluded in the sequence of operation. Mount devices with adjustments accessible through the fronts of panels.

- 2. 12 Fume Hood Controllers (FHC)
 - A. The fume hood face velocity is controlled by monitoring the vertical/horizontal sash position utilizing Phoenix Sash Sensors. As the sash is raised and lowered the sash sensor sends a signal to the local Fume Hood Monitor for proper control modulation of the Phoenix Variable Volume Fume Hood Exhaust Valve. Local indication is provided the by the fume hood monitor to verify a safe working condition and alarm if there is problem detected. As the fume hood control modulates, the supply and general exhaust airflows modulate to maintain a proper balance and keep the desired offset set point
 - B. Provide a separate Variable Volume Fume Hood Controller (FHC) for each fume hood to work in conjunction with an exhaust air valve(s) to achieve the required turndown, accuracy, and speed of response. The FHC shall be a stand alone microprocessor, direct digital controller. The controller shall connect to sensors and its corresponding fume hood Operator Display Panel (ODP). It shall perform closed-loop control of fume hood exhaust airflow to maintain an Owner-selectable constant hood intake velocity in response to changes in sash height. The FHC shall be able to maintain control in the event of disconnection or failure of the ODP. The FHC shall be able to detect and indicate the failure of any of its sensor and maintain control in a degraded mode until the sensor is repaired.
 - C. For safety purposes, actual airflow shall be measured for each fume hood. Only closed loop measurement of actual airflow shall be provided and available to the operator through designated operator terminal and PC workstations.
 - D. FHC shall include an adjustable set point for minimum airflow through the hood. This set point shall be adjustable through the Portable Operator's Terminal (POT) and shall be set be the laboratory safety officer to provide minimum dilution and air changes with the fume hood based upon it specific use.
 - I. The FHC shall be capable of sampling and commanding all points ten times per second. The controller shall contain a minimum of 32K of memory. All programming in the controller shall be maintained in non-volatile EEPROM type of memory. Momentary or extended losses of power shall not change or affect any of the controller's set points, calibration settings, or emergency exhaust mode programming.
 - J. The FHC operates as an independent, stand-alone DDC controller and shall be connected on the Local Area Network (LAN) of the Laboratory Control System.

- K. The FHC shall be UL 916 listed and CSA approved.
- L. Provide an Operator Display Panel for each fume hood to comply with the laboratory safety standards.
- M. The Operator Display Panel shall have selectable digital LCD display of average face velocity (FPM, MPS, or no indication) or of the type of alarm/emergency condition, indicating "LOW face velocity" or "HIGH face velocity" or "EMERGENCY" when the emergency purge has been enabled. A diagnostic message shall be provided to notify the hood operator of control function failure and/or sash sensor failure.
- N. The Operator Display Panel shall have indicator lights – green, yellow, and red (normal, warning, alarm). In alarm (red), an audible horn will initiate. The horn shall be turned off as the red light is turned off. The ODP shall have a horn silence button. The indicator lights/horn sequence is intended to be the hood user's primary indication of safe operation. The face velocity setpoint, high/low warning and alarm limits, and time delays shall be capable of being set by safety personnel based on the type of chemicals being used in and the performance characteristics of each hood.
- O. The Operator Display Panel shall have an "emergency purge" button. When pressed, the controller shall respond immediately by turning on the red alarm light and horn and sequencing the hood exhaust first to the maximum and, after an adjustable delay, to a selected airflow value. The selected airflow value must be adjustable and programmable value that can be changed from the BAS workstation. When the emergency purge button is pressed again, the emergency sequence shall be terminated and the controller shall revert to its normal operation. The airflow values and time delays shall be capable of being set by safety personnel based on the type of chemicals being used in each hood.
- P. The Operator Display Panel shall have a terminal jack for connection to the portable operator's terminal to monitor/edit all points internal to the FHC. As a minimum, the following points must be available to be programmed and adjustable from the terminal jack: Face velocity, low alarm, high alarm, emergency alarm, general failure, face velocity setpoint, high alarm limit, high warning limit, low warning limit, low alarm limit, emergency setpoint, exhaust flow, flow setpoint and flow minimum.

2.13 LABORATORY PRESSURIZATION CONTROLLER (LPC=RPC)

- A. The supply air entering the lab space is controlled via the Phoenix Variable Volume makeup air valves to maintain the required volume of supply/makeup air as pressure INDEPENDENT devices, regardless of static pressure fluctuations from the supply air system. The volume of exhaust air leaving the lab space is controlled via the Phoenix Variable Volume air valves to maintain the required volume of exhaust air, as pressure INDEPENDENT devices, regardless of static pressure fluctuations from the exhaust air system. The total supply and general exhaust flows are summed to verify and provide the required offset for the space, thus providing the required pressurization. Each pressurization zone's differential pressure is Monitored via the Phoenix Pressure Monitor, as shown on the drawings, to generate local indication of the room differential pressure and generate a local alarm if the differential pressure is not maintained.
- B. Provide a Laboratory Pressurization Controller (LPC) utilizing closed loop Direct Digital Control for laboratory space pressurization and temperature control to work in conjunction with an exhaust air valve(s) to achieve the required turndown, accuracy, and speed of response. The controller shall

maintain a user defined differential airflow between the room air supply, Fume Hood Controller exhaust, Bio-Safety Cabinet controller exhaust and general exhaust terminals by measuring the airflow and controlling the damper position of the supply and general exhaust terminals. Temperature control is provided by measuring the room temperature and controlling the supply air heating coil valve.

- C. The LPC operates as an independent, stand-alone DDC controller and shall be connected on the Local Area Network (LAN) of the Laboratory Control System.
- D. The LPC shall consist of the controller module, three analog outputs (two for pressure control, one for temperature control), two auto-zero modules (for flow measurement), and a flush mounted wall enclosure. All assemblies are pre-mounted and pre-terminated (electric and pneumatic connections) within the enclosure.
- E. The controller module includes a micro-processor-based assembly with preprogrammed control algorithm and on-board differential pressure transmitters for airflow measurement. Wiring terminations for point inputs and outputs, LAN communications, and power are provided via screw type terminal block connections. The room temperature sensor is connected to an on-board RJ-11 telephone style jack. A metal enclosure assembly supports the controller module, pneumatic transducers, auto-zero modules, and all electrical and pneumatic inter-connections. External connection for the pneumatic damper actuator and low sensors are located on the inside of the enclosure.
- F. The airflow sensors shall be accurate to $\pm 2\%$ of actual airflow with velocities between 450 and 4000 FPM. The LPC shall calibrate the airflow sensor every 24 hours with the use of the auto-zero modules to eliminate the requirement of closing the supply and exhaust dampers to calibrate the flow sensors.
- G. An MS-DOS based laptop computer shall serve as the Portable Operator's Terminal and shall communicate with the LPC through the plug-in jack on either the controller, the room temperature sensor associated with the LPC, or the DDC controller.
- H. The controller shall contain a minimum of 32K of memory. All programming in the controller shall be maintained in non-volatile EEPROM type of memory. Momentary or extended losses of power shall not change or affect any of the controller's set points or calibration settings.

2. 14 LABORATORY ROOM CONTROLLER (LRC) / ROOM INTEGRATOR

- A. Each supply and associated exhaust terminal shall be controlled to maintain an actual CFM airflow differential between total room exhaust and supply air that is equal to $\pm 5\%$ of the maximum laboratory room design airflow or 200 CFM, whichever is greater, to meet space pressure relationship requirements. For negatively pressurized rooms, supply airflow shall be controlled to equal the total room exhaust airflow less the required airflow differential. For positively pressurized rooms, total exhaust airflow shall track supply airflow less the required airflow differential.
- B. Each laboratory room controller shall be specifically designed for control of laboratory temperature, (humidity and differential pressure monitoring where applicable) and room ventilation. Each controller shall be a microprocessor-based, multi-tasking, real-time digital control processor to work in con-

junction with an exhaust air valve(s) to achieve the required turndown, accuracy, and speed of response. Control sequences shall be included as part of the factory supplied software. These sequences shall be field customized by adjusting parameters such as control loop algorithm gains, temperature setpoint, alarm limits, airflow differential setpoint, and pressurization mode. Closed loop Proportional Integral Derivative (PID) control algorithms shall be used to maintain temperature and airflow offset setpoints.

- C. Controllers using a differential pressure switch to monitor differential pressure across control devices such as an air valve shall include provisions for manual and automatic zeroing in order to maintain stable control and ensure against drift over time.
- D. Controller shall include all inputs and outputs necessary to perform all specified control sequences.
- E. Each controller shall operate stand alone, performing its specified control responsibilities independently.
- F. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM memory, or a minimum of 72-hour battery backup shall be provided. All controllers shall return to full normal operation without any need for manual intervention after a power failure of unlimited duration.
- G. Should a power failure or operational failure occur within the controller, the terminal unit damper shall automatically be positioned to the fully open or fully closed (failsafe) position as defined by the design.

2.15 LABORATORY TEMPERATURE CONTROL

- A. Provide temperature controllers and laboratory thermostats as part of laboratory terminal unit control package.
- B. The temperature with the lab space is monitored by room temperature sensors to provide control by the respective existing dual duct terminal boxes and Phoenix supply air valve combination. As the temperature in the lab increases above the room setpoint, the corresponding dual duct terminal box dampers modulates to open to provide more cooling to the space. On a continued rise in room temperature the dual duct terminal boxes damper to provide additional airflow to the space and the general exhaust valve opens in concert to keep proper pressurization. The room offset is maintained at all times. As the temperature in the lab decreases below the room setpoint, dual duct terminal boxes supply air valve closes to it's minimum position with the Phoenix general exhaust valve tracking. The room offset is maintained at all times. On a continued drop in room temperature, the corresponding dampers in dual duct terminal heating damper shall modulate the open to provide more heating to the space.
- C. The space temperature shall be controlled by the existing dual duct terminal boxes, where as the room pressure and off-set shall be controlled by new "Phoenix" supply air valve.

2.16 OPERATING SYSTEM SOFTWARE

- A. Software needed for complete and functioning operation of each laboratory space shall be provided for all hardware. The server shall include all operating system, network, database, etc. software applications for complete functionality. Workstations shall include operating system and all application software including vendor specific software for complete functionality. Laptops shall include operating systems and all application graphical software including vendor specific software for functionality as a system service tool.
- B. All controllers, network and ASC, shall utilize the same programming language for all applications including implementation of control algorithms, alarms, pseudo points, etc.
- C. The Contractor shall use their standard software library for all system and controller programs.
- D. The Contractor shall prepare, install, configure, and debug all software necessary for complete operation of the BAS and related systems, including the loop control statements, algorithms, and tuning constants required to achieve the Sequence of Operation. Control algorithms shall be manufacturer's standard PID control loops or other Engineer approved control algorithms.
- E. All system data, controller programs, historical and trend data shall be archived in the system server database. System shall be provided with backup of this database. Backup shall include mirroring of data to backup server as well as provisions for removable media backup. Provide program which allows saving and restoring of operating data.
- F. Operator Access Control: Restrict any operator commands through use of software password. Provide capability for a minimum of 5 levels of access related to system operational control, monitoring, and programming functions.
- G. Information Access: Obtain point status information from any designated output device with access command. Point status consists of point identification, numerical value (analog points) and associated engineering units, and individual function label indicating that point is on or off or in Alarm Normal condition. Output includes date and time of execution.

2.16 WIRING AND CONDUIT

- A. All wire shall be copper and meet the minimum wire size and insulation type listed below:

Wire/Cable Type	A Wire Size	Insulation Type	Maximum Ca-pacitance	Typical Voltage
Power	#12	600 Volt		120 AC and above
Class 1	#14	600 Volt		120 AC and below
Class 2	#18	300 Volt, overall shield		24 DC and below
Communications	#24	300 Volt, overall shield	12.5 pf/ft	24 DC and below
Communications Network		Category 5e cable		

- B. Where different wiring types terminate within or pass through the same enclosure, maintain clearances and install barriers per the National Electric Code.
- C. Multi-conductor cables, which group independent BAS inputs or outputs, power conductors, communication circuits, etc. wiring into one jacketed sheath, are not acceptable. Each wiring circuit shall be run independently sheathed from other circuits.
- D. Provide conduit types as follows:
 - 1. Electric Metallic Tubing (EMT): Concealed in interior finished spaces; exposed in interior unfinished spaces.

2. Rigid Galvanized Metal Conduit: All exterior locations; interior locations subject to moisture.
3. Flexible metallic conduit: For transitions from stationery structure or equipment to rotating or moving equipment and for final connections to field devices.
4. Liquid-tight flexible metallic conduit: All exterior locations; interior locations subject to moisture for transitions from stationery structure or equipment to rotating or moving equipment and for final connections to field devices.
5. The minimum conduit size shall be $\frac{3}{4}$ ", except room temperature sensor and communication conduit, which may be $\frac{1}{2}$ ". Use compression or threaded fittings. Watertight compression or screwed fittings shall be used for exterior locations and interior locations subject to moisture. Provide raceway seal-off fitting where exterior raceways enter the building or between areas of high temperature/moisture differential.
6. Flexible metallic conduit, maximum 3-foot length, shall be used for transitions between stationary and non-stationary equipment and/or structure (for example, motors, actuators, air handlers) and for final connections to sensors and control devices mounted on vibration producing equipment. Liquid-tight flexible conduit shall be used in exterior locations and interior locations subject to moisture.
7. Junction boxes shall be provided at all Power and Class 1 wire splices, equipment terminations, and transitions to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

- A. Provide a project manager who shall, as a part of his duties, be responsible for the following activities:
 1. Coordination between this Contractor and all other trades, Owner, local authorities and the design team.
 2. Scheduling of manpower, material delivery, equipment installation and checkout.
 3. Maintenance of construction records such as project scheduling and manpower planning and Auto CAD for project coordination and as-built drawings.

3.2 INSTALLATION METHODS

- A. Electrical Wiring
 1. Install systems and materials in accordance with manufacturer's instructions, rough-in drawings and equipment details. Install electrical components and use electrical products complying with requirements of applicable Division 26 Sections of these Specifications except where specifically stated in this Section.
 2. The term "control wiring" is defined to include providing of wire, conduit, and miscellaneous material as required for mounting and connecting electric or electronic control devices.
 3. Install all control wiring in EMT conduit (minimum $\frac{3}{4}$ " size) with compression fittings for electric/electronic control systems. Conceal wiring, except in mechanical rooms and areas where other conduit and piping are exposed. UL plenum rated cable shall be allowable above accessible lift out ceiling, in air plenums, and in other areas as approved by local and NEC codes.
 4. Wall sensors shall be installed on electrical "J" boxes and conduit stubbed to above lift out ceilings. Plastic bushing shall be installed where the sensor wire exits the conduit to prevent damage.

5. Number-code or color-code conductors, excluding those used for individual zone controls, appropriately for future identification and servicing of control system.
6. This section shall provide all line voltage power wiring required because of substitution of equipment specified in this section.
7. Division 26 shall provide 120 volt power to all DDC Controllers specified in paragraph 2.3 of this Section.
8. Install all control wiring in galvanized rigid conduit and seal tight flex connectors where run outside the building structure or install in wet areas.

3.3 IDENTIFICATION

- A. Install permanent wire labels at each end. Label shall cross-reference exactly with as-built drawings.
- B. All field device wiring shall be labeled consistent with that shown on the as-built drawings and shall include the point's name to which the wire connects. Provide a label at the field device and at the terminal strip in the BAS controller enclosure. Label shall be neatly typed and permanent.
- C. Label all terminal strips. Terminal strips identification shall match the identification of the wire terminated.
- D. Identify all pneumatic tubing with labeling tape or sleeves using words, letters, or numbers that can be exactly cross-referenced with as-built drawings.
- E. Conduit: Provide conduit labels inscribed "CONTROLS" at the following locations:
 1. Within 3 feet of all BAS enclosures
 2. At 20-foot intervals along conduit runs
 3. All pull and junction box covers shall be painted orange with the cover permanently labeled "CONTROL"
- F. Provide nameplates at each BAS controller or group of controllers at the power wire terminal strip inside the enclosure that identifies the name and location (room number and building location) of the building electrical distribution panel where power for the BAS equipment is obtained.
- G. All field device and controller enclosures shall be identified with a nameplate. Controller enclosure nameplates shall be engraved "HVAC CONTROLS," shall also identify each controller contained in the enclosure and mechanical equipment monitored or controlled by controllers located inside enclosure. Field Interface Panels nameplates shall be engraved "CONTROLS FIELD DEVICE" and indicate by name or function each control component in the enclosure. Equipment identification shall follow UT Facilities Maintenance standard nomenclature.
- H. Label output transducers with the point name of the device controlled and the normal position and spring range of controlled device.

3.4 SYSTEM ACCEPTANCE

- A. General: The system installation shall be complete, tested, and commissioned for proper operation prior to acceptance testing for the Owner's authorized representative. A letter shall be submitted to the Architect requesting system acceptance. This letter shall certify all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing will commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative, the system will be accepted. The warranty period will start at this time.
- B. Field Equipment Test Procedures: DDC control panels shall be demonstrated via a functional end-to-end test. Such that:
1. All output channels shall be commanded (on/off, stop/start, adjust, etc.) and their operation verified.
 2. All analog input channels shall be verified for proper operation.
 3. Changing the state of the field device and observing the appropriate change of displayed value shall verify all digital input channels.
 4. If a point should fail testing, perform necessary repair action and retest failed point and all interlocked points.
 5. Introducing an error into the system and observing the proper corrective system response shall verify automatic control operation.
 6. Changing the schedule and observing the correct response on the controlled outputs shall verify selected time and setpoint schedules.
- C. Workstation Test Procedures: The system workstation test procedures shall be as follows:
1. Communication with each DDC control panel shall be demonstrated.
 2. Operator commands will be explained and demonstrated.
 3. Control sequences shall be demonstrated for proper operation.
 4. All available system reports and logs shall be demonstrated at the system workstation.
 5. Correct system start-up and shutdown procedures shall be demonstrated.
 6. All controllers shall be demonstrated to operate in a standalone mode.
- D. Record Documentation: After a successful acceptance demonstration, the Contractor shall submit as-built drawings of the completed project for final approval. After receiving final approval, supply 6 copies of complete 11 x 17 as-built drawings sets and one (1) CD of ACAD drawings.
- E. Operation and Maintenance Manuals: Submit three copies of operation and maintenance manuals. Include the following:
1. Manufacturer's catalog data and specifications on sensors, transmitters, controllers, control valves, damper actuators, gauges, indicators, terminals and any miscellaneous components used in the system.
 2. An operator's manual that will include detailed instructions for all operations of the system.
 3. An operator's reference table listing the addresses of all connected input points and output points. Settings shall be shown where applicable.
 4. A programmer's manual that will include all information necessary to perform programming functions.
 5. A language manual that will include a detailed description of the language used and all routines used by the system.
 6. Complete program listing file and parameter listing file for all programs.
 7. A copy of the warranty.
 8. Operating and maintenance cautions and instructions.
 9. Recommended spare parts list.

3.5 TRAINING

- A. Contractor shall provide to the engineer a training class outline prior to any scheduled training.
- B. Factory trained control engineers and technicians shall provide training sessions for the Owner's personnel.
- C. The control contractor shall conduct five six-hour training sessions on the DDC System for the designated Owner's personnel in the maintenance and operation of the Systems. The class shall be given upon system acceptance.
- D. The course shall include instruction on specific systems and instructions for operating the installed system to include as a minimum:
 - 1. HVAC system overview
 - 2. Operation DDC Systems
 - 3. Function of each Component
 - 4. System Operating Procedures
 - 5. Programming Procedures
 - 6. Maintenance Procedures

3.6 SERVICE AND GUARANTEE

- A. This system specified under this Section of the Specifications shall be guaranteed from defects in workmanship and material under normal use and service for a period of twelve (12) months from the date of acceptance. If, during the one year period, any of the factory equipment or materials provided in the system is found to be defective in materials or workmanship, it shall be replaced or repaired by the DDC Manufacturer at no additional cost to the Owner.
- B. Upon completion of the installation, the Contractor shall thoroughly inspect, check, adjust, calibrate, and make ready for use all devices/sensors comprising the control system and certify that they are installed in accordance with "Record" Drawings.

END OF SECTION

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SECTION 23 73 23

AIR HANDLING UNITS

PART 1 GENERAL

- 1.1 The following sections are to be included as if written herein:
- A. Section 23 00 00 – Basic Mechanical Requirements
 - B. Section 23 05 29 – Sleeves, Flashings, Supports and Anchors
 - C. Section 23 05 53 – Mechanical Identification
- 1.2 SECTION INCLUDES
- A. Custom Air Handling Units
 - B. Factory Installed Fans
 - C. Dampers
 - D. Filters
 - E. Coils
 - F. Drives
- 1.3 RELATED SECTIONS
- A. Section 23 05 48 - Vibration Isolation
 - B. Section 22 13 16 - Plumbing Piping: Equipment Drains
 - C. Section 23 05 13.- Motors
 - D. Section 23 05 16 - Expansion Compensation
 - E. Section 23 07 13 - Ductwork Insulation
 - F. Section 23 29 23 – Variable Frequency Drives

- G. Section 23 31 00 - Ductwork
- H. Section 23 33 00 - Ductwork Accessories: Flexible Duct Connections
- I. Section 23 34 16 - Fans
- J. Section 23 41 00 - Filters
- K. Section 23 82 16 - Air Coils
- L. Section 26 05 19 - Cable, Wire and Connectors, 600 Volt
- M. Section 26 27 26 - Wiring Devices and Floor Boxes

1.4 REFERENCES

- A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings
- B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings
- C. AMCA 99 - Standards Handbook
- D. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes
- E. AMCA 300 - Test Code for Sound Rating Air Moving Devices
- F. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices
- G. AMCA 500 - Test Methods for Louver, Dampers, and Shutters
- H. ARI 410 – Forced-Circulation Air-Cooling and Air-Heating Coils
- I. ARI 430 – Central-Station Air-Handling Units
- J. ARI 435 - Application of Central-Station Air-Handling Units
- K. ARI 610 - Central System Humidifiers
- L. NEMA MG1 - Motors and Generators
- M. NFPA 70 - National Electrical Code
- N. SMACNA - HVAC Duct Construction Standards - Metal and Flexible
- O. UL 900 - Test Performance of Air Filter Units

1.5 SUBMITTALS

- A. Submit under provisions of Section 23 00 00.
- B. Include with the initial submittal a letter signed by the manufacturer's national sales manager (or any corporate officer) and the production manager, acknowledging that this equipment is intended for a University of Texas facility and that all specification requirements shall be complied with. Submit copy of letter to OFPC engineer and Building Manager.
- C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics, connection requirements, and.
- D. Product Data:
 - 1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, electrical characteristics and connection requirements.
 - 2. Provide data of filter media, filter performance data, filter assembly, and filter frames as tested and certified per ASHRAE standards.
 - 3. Provide fan curves with specified operating point clearly plotted, as tested and certified per AMCA standards. Ratings to include system effects. Bare fan ratings will not satisfy this requirement, but shall be submitted for comparison purposes.
 - 4. Submit sound power level data for both fan outlet and casing radiation at rated capacity, as tested and certified per AMCA standards.
 - 5. Provide data on all coils as tested and certified per ARI standards.
 - 6. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
 - 7. All materials shall have NFPA-90 rating of 25/50 or better.
- E. Manufacturer's Installation Instructions.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 23 00 00.
- B. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience, who issues complete catalog data on total product.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 23 00 00.
- B. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
- C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation of the Owner's RCM.

1.10 EXTRA MATERIALS

- A. Furnish under provisions of Section 23 00 00.
- B. Manufacturer to provide three sets of filters for each unit. One set of filters is to be installed when unit is started up, and shall be protected from construction debris with additional media either at the first bank of filters, or covering each air intake (outside air and return air). The second set of filters is to be installed when test and balance activities begin. At substantial completion, OFPC RCM shall inspect filters to determine if the third set should be installed or delivered to campus operations personnel.

1.11 SCHEDULES ON DRAWINGS:

- A. In general, all capacities of equipment, and motor and starter characteristics are shown in schedules on the drawings. Reference shall be made to the schedules for such information. The capacities shown are minimum capacities. Variations in the capacities of the scheduled equipment supplied under this contract will be permitted only with the written direction of the owner. All equipment shall be shipped to the job with not less than a prime coat of paint or as specified hereinafter. Insofar as is possible, all items of the same type (i.e., pumps, fans, etc.) shall be by the same manufacturer. Where installation instructions are not included in these specifications or on the drawings, the manufacturer's instructions

shall be followed. All equipment affected by altitude shall be rated to operate at the altitude where it is installed.

- B. Warranty: Manufacturer shall provide the complete unit with a limited parts only warranty covering the first year of operation. The warranty period shall commence on the date of first equipment startup or six months after the date of shipment, whichever shall occur first.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Energy Labs – **Basis of Design**
- B. ClimateCraft
- C. Air Enterprises
- D. Haakon
- E. Temtrol
- F. Thermal Corporation
- G. Substitutions: Under provisions of Section 23 00 00. The equipment as supplied by any of the acceptable manufacturers or an approved equal shall comply with all of the provisions of this specification.

2.2 GENERAL DESCRIPTION

- A. Configuration: Fabricate with modular sections as scheduled. All custom air-handling units shall be "SITE BUILT" and fully commissioned under the supervision of AHU manufacturer, and shall consist of the following modules:
 - i. Air mixing module with filters
 - ii. Access module
 - iii. Plug fan module with heating coil (hot deck)
 - iv. Multi-zone module with cooling coil (cold deck – top discharge)
 - v. Total unit dimensions must NOT exceed the size indicated on the drawings.
- B. Performance Base: Sea level conditions
- C. Fabrication: Conform to AMCA 99 and ARI 430 in the absence of direction in this specification.

- D. Performance: Refer to schedule in drawings.

2.3 AIR HANDLER CASING AND GENERAL CONSTRUCTION:

- A. Unit casing exterior (walls and roof) shall be a minimum 0.050 Type 5052 textured aluminum with mill applied, industrial grade, high solids polyurethane paint. Paint shall provide a durable, "wet look" finish with excellent color and gloss retention, shall meet ASTM B117 salt spray performance criteria for a minimum rating of 1,000 hours, and shall be covered by a 10-year manufacturer's limited warranty. Walls shall be insulated internally, throughout (double wall construction with thermal break / no thru metal). Wall and roof panel insulation shall be 4" thick, R-25 moisture resistant polyisocyanurate foam protected by a solid interior liner. Interior liner shall be 0.040 Type 5052 smooth aluminum with mill applied, industrial grade, high solids polyurethane paint. All sheet metal joints throughout the air handler, and between panelized sections, shall be gasketed with closed cell, soft rubber gaskets, fabricated from neoprene, EPDM, or other approved material. Internal walls and roof outside shall be sealed such that there is no passage of air from inside the unit to the outer casing. Paint shall provide a durable, "wet look" finish with excellent color and gloss retention, shall meet ASTM B117 salt spray performance criteria for a minimum rating of 1,000 hours, and shall be covered by a 10-year manufacturer's limited warranty.
- B. Individual panels of the fan section shall be removable without compromising the integrity of the unit. Casing assembly shall be configured to eliminate all thru-metal in portions of the unit subject to below ambient temperatures. Where fasteners are used in the assembly of the unit components, they shall not extend from the outside of the unit into the air stream.
- C. Drain pan liners shall be constructed of No. 16-gauge 316-L stainless steel or heavier as standard with the manufacturer. Drain pan shall extend as indicated past the cooling coil (leaving airside) into the fan section on draw through units. Entire drain pan shall be insulated with R-14 closed cell rigid insulation. Drain pans shall be sloped to the outside edge of the unit. On units over six feet wide, slope to each side of the unit. The insulation shall be installed and sealed as is appropriate for the equipment construction. Provide walk-on aluminum grate over drain pans.
- D. Unit shall have a complete perimeter channel base of at least 6" structural aluminum. All floors shall be insulated with R-14 insulation with 0.10" #3003 aluminum floor. An aluminum sheet shall enclose and form a vapor barrier for the insulation on the bottom of the unit. All points of contact between the floor, vapor barrier and structure shall be thermally isolated with gasketing of closed cell soft rubber or EPDM. Flooring shall be mechanically attached and feature a true thermal break.
- E. Access doors shall be provided to allow access to both sides (upstream and downstream) of the filter racks, into the fan section, and both sides of all coils. Access doors shall be double wall, insulated the same as wall panels, and the opening framed with Class A thermal break construction with no thermal bridging acceptable. Door size shall be as indicated. The construction of the access doors shall equal or exceed the quality and quantity of the air handler casing materials as specified herein. Each door shall have a minimum of an 8-inch by 12-inch wire reinforced double-glazed view window, capable of

withstanding the total developed pressure of the unit. The doors shall be hinged using either heavy-duty stainless butt hinges, cast aluminum, or a continuous stainless steel piano hinge, extending along the entire edge of the door, except for a maximum of two inches at each end. If butt hinges are used, provide two per door for up to 36" high doors and three per door for longer doors. There shall be a minimum of two latches on doors longer than 18," and three latches in doors over 36" long. Latches shall be Ventlok 310, heavy-duty latch, or approved equal. All access doors shall open against air pressure.

- F. Coils in the air-handling units shall be individually removable and shall not be used to provide structural stability for the casing. All coils shall be arranged for and piped to provide counter flow operation. All coil frames supplied in air handlers shall be fabricated of 316-L stainless steel to allow for removal of individual coils independently. The coils shall be completely enclosed within the coil housing of the air unit casing. All penetrations of the air handler casing shall be neatly sealed using a resilient sealant. Hinged gasketed quick access doors of adequate size for a man to enter shall be provided for each space between coils, filters and other components. Stacked coils shall have intermediate drain pans with at least 1" rigid drain piping and pipe supports to main drain pan.
 - G. Panels shall be reinforced with sufficient internal bracing to prevent excessive deflection of the panels to L/200 standard.
 - H. Not Used
 - I. Provide a unit housing, including joints, seams, and access doors, that will not condense moisture on the external surfaces of this housing when subjected to a surrounding ambient environment of 82°F dry-bulb / 75°F dew-point temperature air.
 - J. Not Used
 - K. Provide sealable test ports on either side of each filter bank and each coil section, in inlet plenum and discharge plenum, and suction and discharge side of all fans. Ports shall be equal to Ventfabrics test port Model 699-2.
- 2.4 FANS (See also Section 23 34 16)
- A. Shall be both dynamically and statically balanced. Motors shall be high efficiency type per Section 23 05 13. The motor mounting for each unit shall be an integral part of the fan support frame. The fan / motor unit shall be mounted on spring isolators within the air handler casing. Housed fans shall have an appropriately designed fabric duct vibration isolator installed within the air handler casing. The unit shall be supplied with a factory installed and sealed flange for connection to ductwork.
 - B. After assembly, the unit manufacturer shall balance the fan (per ANSI/AMCA 204-96 fan application category BV-5) at design fan speed with belts and drives in place to a vibration velocity less than or equal to 0.157 inches (0.100 inches for direct-drive applications) per second measured on horizontal, vertical, and axial planes at each bearing pad. Vibration amplitudes are in inches/second peak velocity. All values recorded are to be filter-in at the fan speed.

- C. Plug fans installed in walk-in units shall be provided with a fan shut down switch in the access door. Provide plug fan inlets with coated steel safety bars.
- D. Individual fan performance shall be based on tests run in an AMCA certified laboratory and administered in accordance with AMCA Standards 210 and 300. Fans shall be licensed to bear the AMCA seal for air and sound performance. Submitted fan performance shall be adjusted to reflect multiple fans running inside the cabinet and to reflect any affects from the unit cabinet and other internal components. Fans shall be minimum Class 3 construction.
- E. The fan wheel shall be aluminum with extruded aluminum airfoil blades continuously welded to the fan side plates. The fan back plane shall be bolted to a cast aluminum fan hub with keyway. Fans not using airfoil blades, or using steel construction, will not be considered. Fan inlets shall be isolated from the cabinet by means of a neoprene-coated flexible connection.
- F. Motors shall be premium efficiency to meet or exceed the requirements in EISA 2007. Motors shall be TEFC, NEMA frame, cast iron casing, ball bearing type complete with grease lubricated bearings and zerk fittings for field lubrication. Motors shall have a NEMA Class F insulation rating with Class B temperature rise, and have a 1.15 service factor. BHP values as shown on the Schedule are considered the maximum allowable.
- G. Fans shall be provided with thrust restraints.
- H. Each motor shall be provided with a shaft grounding device that will bleed potential induced motor shaft voltage to ground.

2.5 DAMPERS

- A. All automatic control dampers and manual volume control dampers located within air handling unit shall be furnished by AHU manufacturer.
- B. Mixing Boxes: Dampers shall be supplied with ultra-low leak extruded 6063T5 aluminum airfoil blades. Blades shall be supplied with dual durometer, Santoprene™, bulb type edge seals and stainless steel arc end seals. Edge seals shall be backed by the damper blade to assure a positive seal in the closed position. Dampers shall be provided with nylon bearings within extruded openings.
- C. Damper Leakage: Maximum 6 CFM/Sq. Ft. at 5 inch WG differential pressure. Dampers shall be sized for 2000 fpm maximum face velocity.
- D. Refer to Section 23 33 00-2.01 for additional requirements.

2.6 DRIVES

- A. Plenum fans shall be direct drive and housed fans shall be belt drive with adjustable sheaves unless indicated otherwise.
- B. Variable frequency drives: See Section 23 29 23.

2.7 COILS

Refer to Section 23 82 16 - Air Coils, and Unit Schedules for requirements.

2.8 FILTERS

Refer to Section 23 41 00 - Filters, and Unit Schedules for requirements. Provide aluminum or stainless steel filter racks.

2.9 ELECTRICAL

- A. Fan motors shall be factory-mounted and wired to an external j-box adjacent to the motor access door. Fan motors shall be interlocked with fan access door to shut down when door is opened.
- B. Vapor proof lights (ceiling or wall mounted so that fixture shall be no higher than 88" above floor) shall be provided in each compartment with access doors. Lights shall have a switch at each door into the compartment. Provide two GFI convenience outlets evenly spaced on the long dimension of the unit. Wire lights and outlets to two external 120v, 20a power connections (one for each service) by Division 16. All raceways and conductors shall be by Div 16 in the field after the units are assembled.
- C. All wiring shall be 600v rated type MTW/THWN stranded copper in EMT or LiquidTite conduit (max 3 feet). All junction boxes shall be UL approved and gasketed.
- D. Motors – see Section 23 05 13 for additional requirements.
- E. Provide in each section a electrical junction box with thru casing raceway by manufacturer for control wiring.

PART 3 EXECUTION

3.1 INSTALLATION

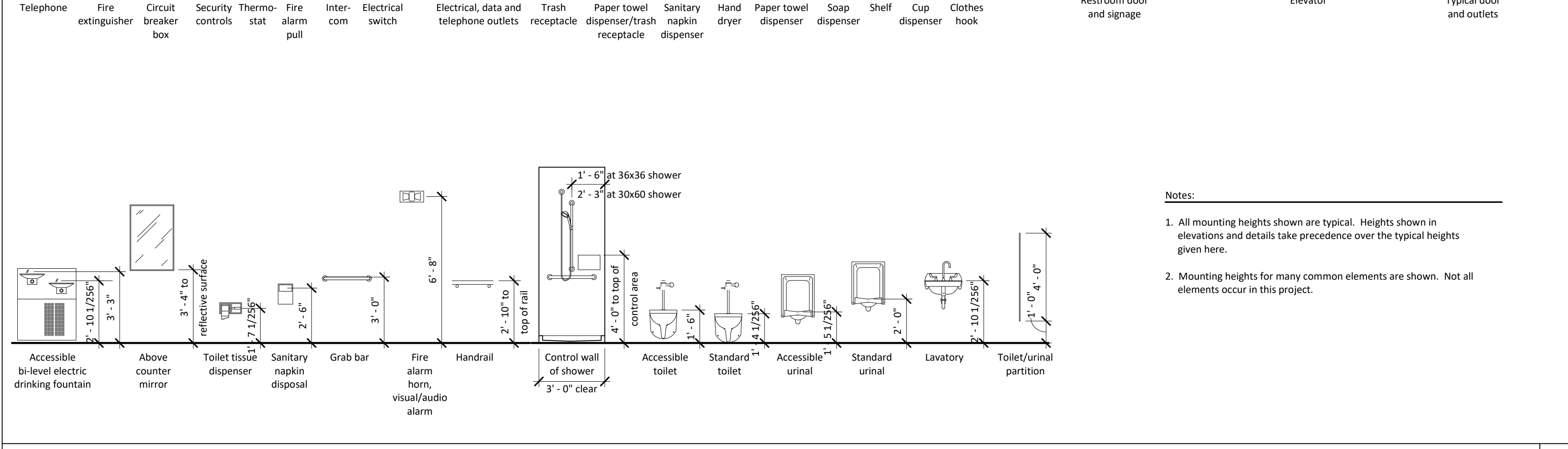
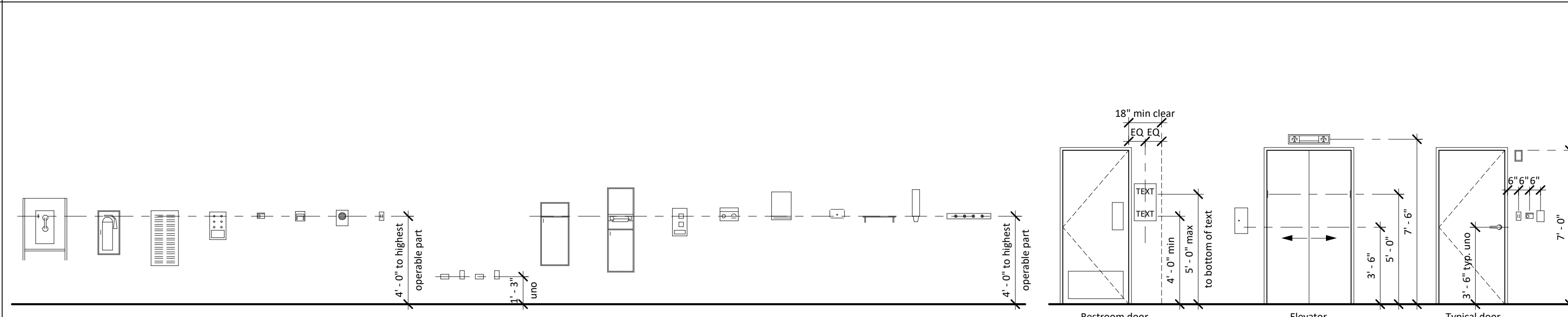
- A. Field assembly of the unit shall be the responsibility of the mechanical contractor. Provide manufacturer field technician to oversee installation of the first unit. Coordinate with building operations for the schedule and length of down time.

- B. Install in conformance with ARI 435.
- C. Assemble high-pressure units by bolting sections together.

3.2 FIELD TESTING

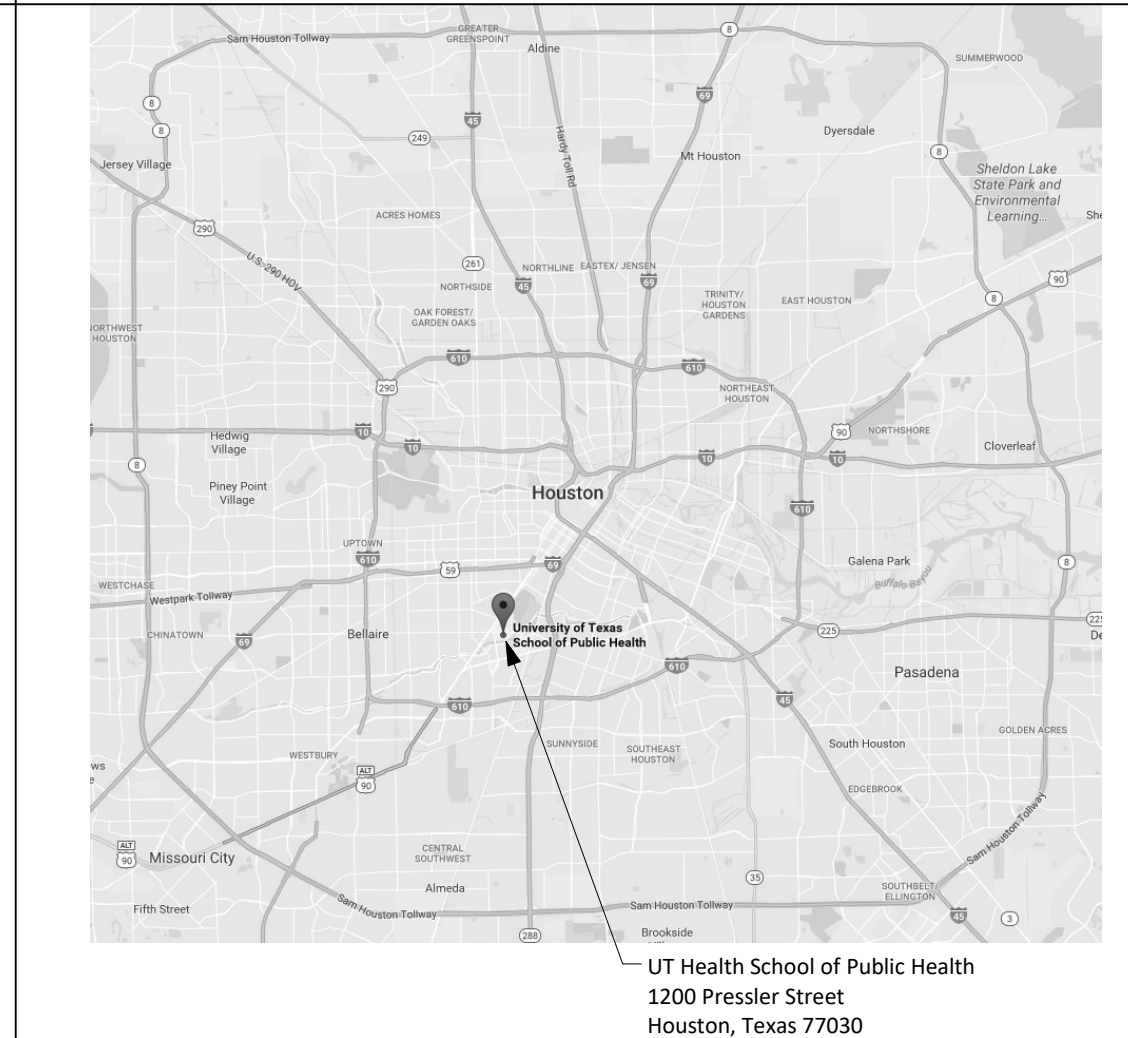
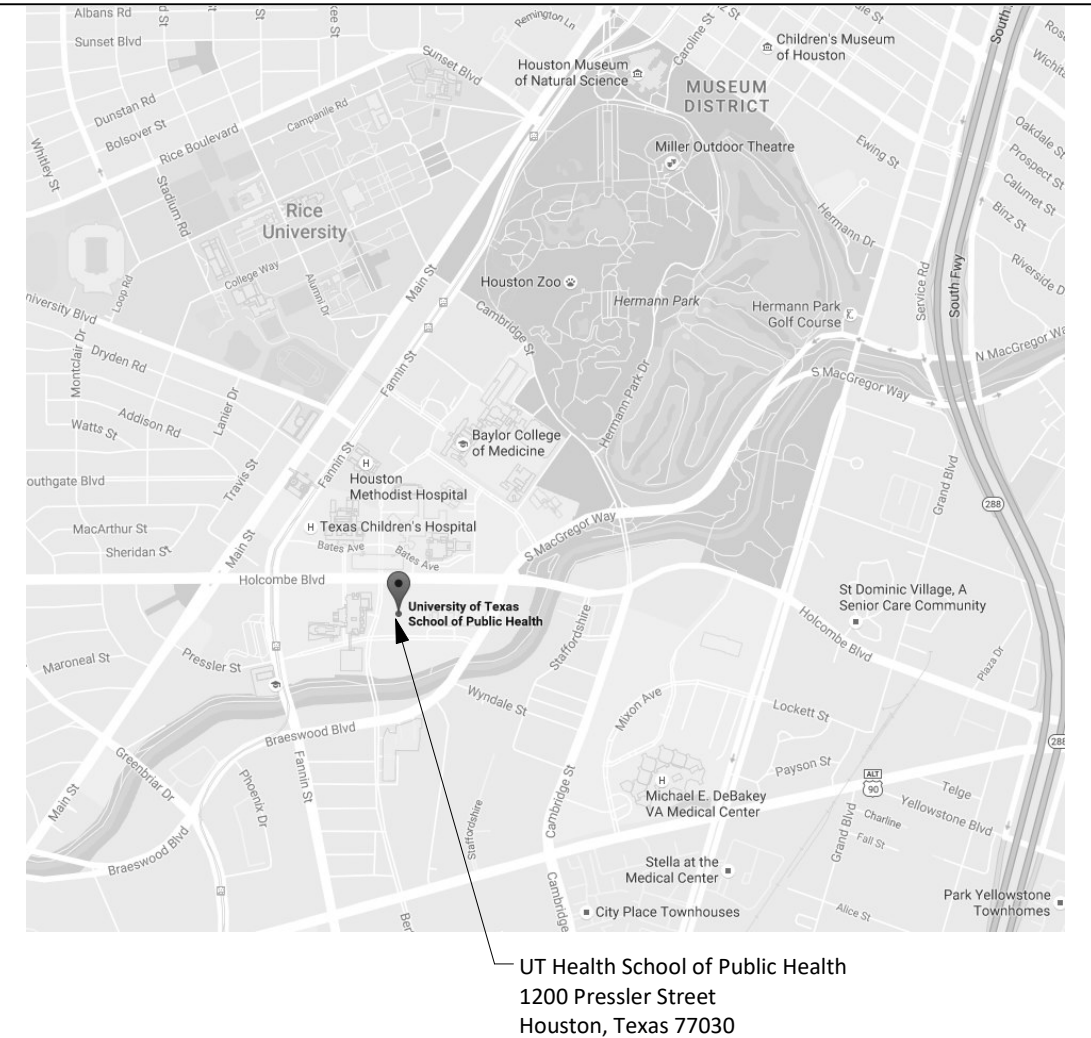
- C. Casing Leakage Test. With unit set in place, leveled and ready to receive duct work connections, unit shall be tested for casing leakage by sealing all openings and tested to criteria in Paragraph 3.02 B.1. Maximum allowable leakage rate is 1.5% of rated unit flow at 8" static pressure. Test is to be performed by the manufacturer using flow measurement devices and shall be witnessed by a representative of the Owner's Test & Balance firm.
- D. Fan/Motor Vibration Test. With the unit set in place, leveled, and ductwork attached, the manufacturer shall perform a final dynamic vibration trim balance to verify the fan/motor vibration velocity limit over the following operating speed range: Fans with VFDs shall be checked from 40 to 110% of the rated fan speed. Constant speed fans shall be checked at 100% of rated fan speed. 'Lock-out' ranges may be used to correct up to two ranges of excess vibration. The span of each 'lock-out' range shall be limited to an effective fan speed of 50 RPM. Any 'lock-out' range used shall be clearly identified in the test report and shall be prominently displayed on a typed, laminated legend mounted inside the VFD controller cabinet.
- E. Failure of the leakage test shall require correction of the unit and retesting until criteria is met. Failure of the vibration limit shall require rebalancing and re-testing until criteria is met. Contractor shall bear all costs involved in the modifications, balancing, and re-testing.

END OF SECTION



Notes:

- All mounting heights shown are typical. Heights shown in elevations and details take precedence over the typical heights given here.
- Mounting heights for many common elements are shown. Not all elements occur in this project.



Project Location Map 10

Project Vicinity Map 5

Applicable Codes and Standards

- International Building Code, 2012 Edition (IBC)
- NFPA 101, Life Safety Code, 2015 Edition (LSC)
- NFPA 1, Fire Code, 2012 Edition
- Texas Department of Licensing and Regulation (TDLR) - Texas Accessibility Standards of the Architectural Barriers Act, 2012
- International Mechanical Code, 2012 Edition (IMC)
- International Plumbing Code, 2012 Edition (IPC)
- International Energy Conservation Code, 2009 Edition (IECC)
- NFPA 10 - Fire Extinguishers (Referenced by IBC)
- NFPA 13 - Installation of Sprinkler Systems (Referenced by IBC)
- NFPA 70 - National Electrical Code (Referenced by IBC)
- NFPA 72 - National Fire Alarm Code (Referenced by IBC)
- NFPA 80 - Fire Doors and Fire Windows (Referenced by IBC)
- NFPA 110 - Standard for Emergency and Standby Power Systems
- NFPA 220 - Standard on Types of Building Construction (Referenced by NFPA 101)

Occupancy Classification
Business Group 9, 10A, 1 (IBC)
Business (6.1.11.1 NFPA)

Construction Classification
Type II (IBC)
Type II(222) (NFPA 220)

Fire Resistance Ratings (IBC Table 601)

- Party Walls: N/A
- Fire Wall: N/A
- Occupancy Separations: N/A
- Interior Bearing Walls: N/A
- Corridor Walls (1004.3.2.1): Non-Rated, Smoke Resistant
- Smoke Barrier Walls: 1-Hour, 20-Min. Doors
- Hazardous Area Protection (Only Applicable Areas / Most Restrictive Requirements Shown):
 - Heat Plant Rooms (TDLR): 2-Hours, 90 min. doors
 - Laboratories (IBC, NFPA): 1-Hour, 45 min. Doors
 - Central Laundry (IBC, NFPA): 1-Hour
 - Storage > 100 Sq. Ft. (IBC, NFPA): 1-Hour
 - Storage > 50 Sq. Ft. (NFPA): Non-Rated Separation
 - Solvent Rooms (NFPA): 1-Hour
 - Structural Frame Supporting Roof Only (See 4 G-102): 2-Hours
 - Structural Frame (See 14 G-102): 2-Hours
 - Floor Construction (See 19 G-102): 2-Hours
 - Roof Construction (Including Beams and Joists) (See 24 G-102): 1-Hour
 - Exterior Bearing Walls: N/A
 - Exterior Non-Bearing Walls: Non-Combustible
 - Unprotected Exterior Openings: Permitted (Iard>30 Ft.)
 - Interior Non-Bearing Walls: Non-Combustible
 - Shaft and Vertical Exit Enclosure Walls (707.4): 2-Hours, 90 min. doors
 - Through penetrations in fire-resistive walls and floors are protected with an approved firestop system installed as tested in accordance with ASTM E814.
 - Joints in and between fire-resistance-rated walls and floor/roof assemblies are protected with fire-resistant joint systems tested in accordance with the requirements of UL 2079.

Fire Protection

- A sprinkler system installed in conformance to NFPA 13 is required. (IBC)
- All sprinkler heads in the smoke compartment containing partial sleeping rooms shall be quick-response type. (IBC, NFPA)
- A manual fire alarm system and automatic fire detection system is required. An electrically supervised, automatic smoke detection system is required in corridors, and waiting areas that are open to corridors.
- Fire extinguishers are required to be located no more than 75 ft. travel distance from any point. (NFPA 10)
- All fire extinguishers shall have a UL rating of 4A-GBC. (NFPA 10)
- Maximum allowable area per fire extinguisher: 11,250 Sq. Ft.
- Fire extinguishers provided per floor:
 - Level 2: 2
 - Level 2: 2

Occupant Load and Egress (IBC Table 1004.1.1)

- Exit Width:
 - Exit Width Required (0.2 In./Person) (NFPA): 46 inches
 - Exit Width Provided: 58 inches
- Arrangement of Exits:
 - Minimum Number of Exits Required (IBC): 3
 - Number of Exits Provided: 4
 - Minimum Separation Permitted (1/2 Diagonal Dimension of Building): 65 feet
 - Actual Separation Provided: 41 feet
- Maximum Exit Travel Distance (NFPA, IBC):
 - 150 Ft., Any Point to Exit
 - 150 Ft., Any Exit Access Door to Exit

Finishes

- Walls and Ceilings: ASTM E 84 Class 0 or 1 (NFPA, IBC)
Exception: May be Class C in rooms with capacity less than 4. (NFPA, IBC)
Exception: Class C wainscot less than 1,000 sq. ft. permitted in lobby.

General

G-100	General Information	M-803	Details
G-101	Fire Resistive Assemblies Design Reference	M-804	Details
G-102	Fire Resistive Assemblies Design Reference	Electrical	
G-110	Fire Safety Plan - Level 2	E-001	Note, Symbols, and Legend
		E-002	Demolition - One Line Diagram
		E-003	Demolition - One Line Diagram
		E-004	Demolition - One Line Diagram
		E-005	Demolition - One Line Diagram
		E-006	Demolition - One Line Diagram (Emergency)
		E-007	Proposed - One Line Diagram
		E-008	Proposed - One Line Diagram
		E-009	Proposed - One Line Diagram
		E-010	Proposed - One Line Diagram
		E-011	Proposed - Emergency One Line Diagram
		E-012	Electrical Riser Diagram-E-012
		E-013	Electrical Riser Diagram-E-013
		E-014	Electrical Riser Diagram-E-014
		E-015	Electrical Riser Diagram-E-015
		E-016	Existing - Basement Panel Schedules
		E-021	Existing - First Floor Panel Schedules
		E-022	Existing - Second Floor Panel Schedules
		E-023	Existing - Third Floor Panel Schedules
		E-024	Existing - Fourth Floor Panel Schedules
		E-025	Existing - Fourth Floor Panel Schedules
		E-026	Existing - Fifth Floor Panel Schedules
		E-027	Existing - Fifth Floor Panel Schedules
		E-028	Existing - Sixth Floor Panel Schedules
		E-029	Existing - Seventh Floor Panel Schedules
		E-030	Existing - Eighth Floor Panel Schedules
		E-031	Existing - Ninth Floor Panel Schedules
		E-032	Existing - Tenth Floor Panel Schedules
		E-033	Existing - Tenth Floor Panel Schedules
		E-034	Existing - Typical Panel Schedules
		E-035	Proposed - Panel Schedules
		E-036	Proposed - Panel Schedules
		E-100	Existing - Basement Floor Plan - Power
		E-101	Existing - First Floor Plan - Power
		E-102	Existing - Second Floor Plan - Power
		E-103	Existing - Third Floor Plan - Power
		E-104	Existing - Fourth Floor Plan - Power
		E-105	Existing - Fifth Floor Plan - Power
		E-106	Existing - Sixth Floor Plan - Power
		E-107	Existing - Seventh Floor Plan - Power
		E-108	Existing - Eighth Floor Plan - Power
		E-109	Existing - Ninth Floor Plan - Power
		E-110	Existing - Tenth Floor Plan - Power
		E-111	Existing - Penthouse Floor Plan - Power

Mechanical

M-001	Notes and Legend		
M-002	Schedules		
M-003	Schedules		
M-004	Schedules		
M-101	Basement Floor Plan - HVAC - Demo		
M-102	2nd Floor Plan - HVAC - Demo		
M-103	3rd Floor Plan - HVAC - Demo		
M-104	4th Floor Plan - HVAC - Demo		
M-105	5th Floor Plan - HVAC - Demo		
M-106	6th Floor Plan - HVAC - Demo		
M-107	7th Floor Plan - HVAC - Demo		
M-108	8th Floor Plan - HVAC - Demo		
M-109	9th Floor Plan - HVAC - Demo		
M-110	10th Floor Plan - HVAC - Demo		
M-111	Penthouse - HVAC - Demo		
M-200	Basement Floor Plan - HVAC - Proposed		
M-201	2nd Floor Plan - HVAC - Proposed		
M-202	3rd Floor Plan - HVAC - Proposed		
M-203	4th Floor Plan - HVAC - Proposed		
M-204	5th Floor Plan - HVAC - Proposed		
M-205	6th Floor Plan - HVAC - Proposed		
M-206	7th Floor Plan - HVAC - Proposed		
M-207	8th Floor Plan - HVAC - Proposed		
M-208	9th Floor Plan - HVAC - Proposed		
M-209	10th Floor Plan - HVAC - Proposed		
M-210	10th Floor Plan - HVAC - Proposed		
M-211	Penthouse - HVAC - Proposed		
M-212	Basement Floor Plan - HVAC - Proposed		
M-400	Enlarged Central Plant - Basement Floor Plan - Demo		
M-401	Enlarged Central Plant - Basement Floor Plan - Proposed		
M-402	Enlarged Basement Floor Plan - Mechanical Room - Demo		
M-403	Enlarged Plan - 2nd Floor - Mechanical Room - Demo		
M-404	Enlarged Plan - 2nd Floor - Mechanical Room - Proposed		
M-405	Enlarged Plan - 3rd Floor - Mechanical Room - Demo		
M-406	Enlarged Plan - 3rd Floor - Mechanical Room - Proposed		
M-407	Enlarged Plan - Typical 4th-7th Floor - Mechanical Room - Demo		
M-408	Enlarged Plan - Typical 4th-7th Floor - Mechanical Room - Proposed		
M-409	Enlarged Plan - Typical 8th-10th Floor - Mechanical Room - Demo		
M-410	Enlarged Plan - Typical 8th-10th Floor - Mechanical Room - Proposed		
M-410A	Alternate - Enlarged Plan - Typical 8th-10th Floor - Mechanical Room		
M-501	Sections		
M-502	Sections		
M-503	Sections		
M-504	Sections		
M-505	AHU Details - Basement		
M-506	AHU Details - 2nd Floor		
M-507	AHU Details - 2nd Floor		
M-508	AHU Details - 2nd Floor Roof		
M-509	AHU Details - 3rd Floor		
M-510	AHU Details - 3rd-7th Floor		
M-511	AHU Details - 8th-10th Floor		
M-601	Piping Diagram - Chilled Water		
M-602	Piping Diagram - Hot Water		
M-603	Heat Exchanger Steam to Hot Water Diagram		
M-604	Steam Pressure Reducer Station Diagram		
M-605	Heat Exchanger Support Frame - Plan View		
M-701	Controls		
M-702	Controls		
M-703	Controls		
M-704	Controls Points		
M-801	Details		
M-802	Details		

Infrastructure Associates

INFRASTRUCTURE ASSOCIATES, INC.
6117 RICHMOND AVENUE, SUITE 200
HOUSTON, TEXAS 77057
TBPB REGISTRATION NO. F-4606
(713) 622-0120 PH (713) 622-0557 FAX
WWW.IAHOUSTON.COM

UTHealth™
The University of Texas
Health Science Center at Houston

UT Health Science School of Public Health
1200 Presler Street
Houston, TX 77030

Typical Mounting Heights 14

Symbol	Description
	Reflected Ceiling Plan
	Surface mounted incandescent, compact fluorescent or LED downlight
	Recessed incandescent, compact fluorescent or LED downlight
	Recessed wall washer - shading indicates direction
	Lay-in or recessed fluorescent light troffers - prismatic lens
	Lay-in or recessed fluorescent light troffers - parabolic lens
	Lay-in or recessed direct and indirect fluorescent light
	Suspended fluorescent strip fixture
	Suspended architectural fluorescent strip fixture
	Wall mounted architectural fixture
	Under cabinet fluorescent light fixture
	Speaker
	Smoke detector
	Supply air grille
	Return/exhaust air grille
	Sprinkler head
	Ceiling/wall mtd. exit sign - arrow/line indicates direction

Floorplans

	Height	110V, 20A duplex outlet (Height indicated if not standard)
	Height	110V, 20A duplex dedicated outlet (Height indicated if not standard)
	Height	110V, 30A duplex outlet (Height indicated if not standard)
	Height	110V, 30A quadplex outlet (Height indicated if not standard)
	Height	110V, 20A flush floor mounted duplex outlet
	Height	Flush floor mounted telephone outlet
	Height	Telephone outlet (R111) (Height indicated if not standard)
	Height	Computer data outlet (RJ45) (Height indicated if not standard)
	Height	Combined telephone/computer data outlet (Height indicated if not standard)
	Height	Electrical/communications junction box
	FAS	Fire Alarm Strobe
	FAP	Fire Alarm Pull
	T	Thermostat
	P	Door operator push button
	CR	Card reader
	NCAP	Nurse call alarm panel
	S	Single pole switch
	3	3-way switch
	D	Dimmer switch
	FEC	Fire extinguisher cabinet
	FE	Fire extinguisher on bracket
	ZV	Zone valve

Elevations

	Electrical, voice, data, voice/data outlets in elevation
	Medical gases/Lab gas outlets (Air, Vacuum, Oxygen, Waste Anes Vac, Nitrogen, Slide

Notes:

- See the individual drawings for additional symbol legends for symbols not shown.
- Refer to the Construction Specifications Institute's (CSI) publication TD-2-6, Standard Reference Symbols, 10/91 Edition, for additional building element symbols not shown here or elsewhere in the Drawings.
- See additional legends located in the specific discipline drawings (Structural, MEP, etc.) for building element symbols used on those discipline drawings.

Note: Refer to the Specifications for abbreviations of trade association names.

Typical Mounting Heights 14

Description	Symbol	Designators
Benchmark Indicator		BM = Coordinate, Elevation, or Station Sequence Designation
Building Section		No = Detail Number Dwg = Sheet Number
Control Elevation Indicator		No = Alphanumeric Grid Designation
Column Line or Grid Indicator		No = Detail Number Dwg = Sheet Number
Detail Indicator (Enlarged Detail)		No = Detail Number Dwg = Sheet Number
Detail Indicator (Section)		No = Detail Number Dwg = Sheet Number
Door Tag		No = Door Type HS = Hardware Set
Exterior Elevation/View Indicator		No = Detail Number Dwg = Sheet Number
Interior Elevation/View Indicator		No = Detail Number Dwg = Sheet Number
Equipment Identifier		No = Equipment Designation
Face Dimension		Dim = Distance, Face of Finish to Face of Finish
Finish Grade Indicator (New)		Elev = Finish Grade Elevation
Finish Grade Indicator (Existing)		Elev = Finish Grade Elevation
Finish Type Identifiers		No = Finish Designation
Cabinet type Identifiers		No = Cabinet Type Identifier
Countertop Type Identifiers		No = Countertop Type Identifier, See 3 A560 for legend
Glass Type/Opening Identifier		No = Glass Type or Opening Designation
Graphic Scale		
Keyed Note Indicator		No = Note Designation
North Indicator		PN = Plan North TN = True North
Partition Type Indicator		No = Partition Type Designation
Revision Indicator		No = Revision Designation
Room Identifier		Name = Name of Space No = Room Designation
Room and Finish Type Identifier		Name = Name of Space No = Room Designation FT = Room Finish Type Designator
Toilet Accessory Identifier		No = Accessory Designation

Standard Material Indications

	Acoustical Ceiling Board	Plaster with Expanded Metal Lath
	Aluminum	Plastic Glazing
	Brick	Plastic Laminate (Large Scale)
	Carpet	Plywood
	Ceramic Tile	Precast Concrete, Cast Stone
	Concrete	Reinforced Flooring, Pre-Molded Joint Filler
	Concrete Masonry Unit	Rigid Insulation Board
	Earth	Sand, Grout
	Exterior Insulation and Finishing System	Steel
	Insulation - batt or blanket	
	Finished Wood, Hardwood	Ceramic Tile
	Glass	Concrete, Plaster, Limestone, Synthetic Stone
	Gravel, Coarse Porous Fill	Glass, Mirrors
	Gypsum Board	Metal, Plastic Laminate
	Gypsum Sheathing	
	Oriented Standard Board (OSB)	Gypsum Board or Plaster
	Ornamental Metal, Bronze, Brass	
	Particle Board	Pre-finished Metal Suspension Grid with Lay-in Panels

Note: Refer to the Construction Specifications Institute's (CSI) publication TD-2-6 Standard Reference Symbols, 10/91 Edition, for additional material indications not shown.

Standard Material Indications 11

The project consists of the renovation of existing conference rooms and converting them into an electrical switchgear room at level 2 of the UT Health School of Public Health Building located at 1200 Presler Street, Houston, TX 77030.

Standard Abbreviations 21

Standard Building Element Symbols 16

Project Description 9

Standard Reference Symbols 6

Building Code Information 26

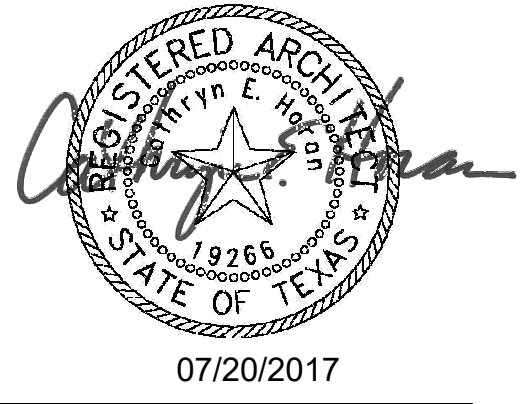
Drawing Index 1

UT Health Science School of Public Health
1200 Presler Street
Houston, TX 77030

Philo Wilke

Partnership

11276 S. Sam Houston Parkway W.
Suite 200
Houston, Texas 77031
(832) 854-1130
www.pwarch.com



REVISIONS	
05/31/2017	Issue for Bid
07/20/2017	Addendum 01

Sheet Information	
Date	03/31/2017
Job Number	216-159
Drawn	DS
Checked	BL
Approved	BL
Title	

General Information

Sheet

G-100

System No. W-1-7033 September 07, 2004 F Rating - 1 and 2 Hr T Rating - 1/2 Hr L Rating At Ambient - 75 CFM/sq ft L Rating At 400 F - 7 CFM/sq ft (See Item 4)	System No. W-1-3030 May 19, 2005 F Ratings - 1 and 2 Hr (See Item 1) T Rating - 1/2 Hr L Rating At Ambient - 75 CFM/sq ft (See Item 4) L Rating At 400 F - 7 CFM/sq ft (See Item 4)	Design No. U415 November 15, 2010 Nonbearing Wall Ratings - 1 or 2 Hr	System No. W-1-7008 June 15, 2005 F Rating - 1 & 2 Hr (See Item 1) T Ratings - 0 Hr	Design No. U905 March 17, 2004 Bearing Wall Rating - 2 Hr Nonbearing Wall Rating - 2 Hr	
1. Wall Assembly - The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or U400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features: A. Studs - Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nominal 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) O.C. with nominal 2 by 4 in. (51 by 102 mm) lumber end plates and cross bracs. Steel studs to be min 3/8 in. (9.5 mm) wide by 1-3/8 in. (33 mm) deep channels spaced max 24 in. (610 mm) O.C. B. Gypsum Board* - Two layers of min 5/8 in. (16 mm) thick, type gypsum wallboard, as specified in the individual Wall and Partition Design. Max diam of opening is 2 1/2 in. 2. Through-Penetrator - One steel duct to be installed either concentrically or eccentrically within the freestop system. An annular space of min 0.6 in. to max 1.52 in. (15.2 mm) is required within the freestop system. Steel duct to be rigidly supported through sides of wall assembly. The following types and sizes of steel ducts may be used: A. Steel Duct - Nom 16 in. diam (or smaller) No. 24 gage (or heavier) spiral wound galv steel duct. B. Seal Duct - Nom 10 in. diam (or smaller) No. 28 gage (or heavier) galv steel vent duct. 3. Fill, Void or Cavity Material* - Caulk or Sealant - Min 1/4 in. (6 mm) thickness of filler material applied within annulus, flush with both surfaces of wall assembly. At the point contact location between duct and wallboard, a min 1/4 in. diam bead of caulk shall be applied at the wallboard/duct interface on both surfaces of wall assembly. JM COMPANY - CP25WB or FB-3000 WT	1. Wall Assembly - The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400, U400 or V400 Series Wall or Partition Designs in the UL Fire Resistance Directory and shall include the following construction features: A. Studs - Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nominal 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) O.C. with nominal 2 by 4 in. (51 by 102 mm) lumber end plates and cross bracs. Steel studs to be min 3/8 in. (9.5 mm) wide by 1-3/8 in. (33 mm) deep channels spaced max 24 in. (610 mm) O.C. B. Gypsum Board* - Nom 5/8 in. (16 mm) thick, 4 ft. (122 cm) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening is 2 1/2 in. (63.5 mm). 2. Through-Penetrator - One steel duct to be installed either concentrically or eccentrically within the freestop system. An annular space of min 0.6 in. to max 1.52 in. (15.2 mm) is required within the freestop system. Steel duct to be rigidly supported through sides of wall assembly. The following types and sizes of steel ducts may be used: A. Steel Duct - Nom 16 in. diam (or smaller) No. 24 gage (or heavier) spiral wound galv steel duct. B. Seal Duct - Nom 10 in. diam (or smaller) No. 28 gage (or heavier) galv steel vent duct. 3. Fill, Void or Cavity Material* - Caulk or Sealant - Min 1/4 in. (6 mm) thickness of filler material applied within annulus, flush with both surfaces of wall assembly. At the point contact location between duct and wallboard, a min 1/4 in. diam bead of caulk shall be applied at the wallboard/duct interface on both surfaces of wall assembly. JM COMPANY - CP25WB or FB-3000 WT	1. Wall Assembly - The 1 or 2 hr fire rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features: A. Studs - Wall framing shall consist of steel channel studs to be min 3/8 in. (9.5 mm) wide and spaced max 24 in. (610 mm) O.C. Additional 1/2 in. (13 mm) wide steel studs shall be used to complete framing opening. B. Gypsum Board* - Thickness, type, number of layers and fasteners as required in the individual Wall and Partition Design. Max size of opening to be 1216 sq. in. (780 cm ²) with a maximum dimension of 38 in. (965 mm). The hourly F Rating of the freestop system is equal to the hourly rating of the wall assembly in which it is installed. C. Penetrator - One steel duct to be installed either concentrically or eccentrically within the freestop system. An annular space of min 0.6 in. to max 1.52 in. (15.2 mm) is required within the freestop system. Steel duct to be rigidly supported through both sides of floor or wall assembly. The hourly F Rating of the freestop system is equal to the hourly rating of the wall assembly in which it is installed. D. Furring Members - The details of the freestop system shall be as follows: 1. Fixing Method - (Optional) Polyethylene backer rod, mineral wool batt insulation of furring/batt insulation friction fit into annular space to accommodate the required thickness of fill material (Item 3B). 2. Filling - (Optional) Mineral wool or glass fiber batts partially or completely filling stud cavity. 3. Furring Channels - Formed of No. 25 MSG galv steel, 2-3/8 in. wide by 7/8 in. deep, spaced 24 in. O.C. perpendicular to studs. Channels secured to studs as described in Item 3. Gypsum board installed vertically only and attached to furring channels as described in Item 3. 4. Furring Channels - Formed of No. 25 MSG galv steel, 2-3/8 in. wide by 7/8 in. deep, spaced 24 in. O.C. perpendicular to studs. Channels secured to studs as described in Item 3. Gypsum board installed vertically only and attached to furring channels as described in Item 3. 5. Steel Framing Members* - Used to attach furring channels (Item 3B) to studs (Item 2 or 3A). Class spaced max 24 in. O.C. and secured to studs with No. 8 x 1-1/2 in. minimum self-drilling, 5/16 steel screw through the center grommet. Furring channels are friction fitted into place. PAC INTERNATIONAL INC. - Type RIG-1	1. Concrete Blocks* - Various design. Classification D-2 (D-2) R. See Concrete Blocks category for list of eligible manufacturers. 2. Mortar - Blocks laid in full bed of mortar, nom. 3/8 in. thick, not less than 2-3/4 and not more than 3-1/2 parts of clean sharp sand to 1 part Portland cement (proportioned by volume) and not more than 30 percent hydrated lime (by cement volume). Vertical joints between blocks shall be filled with 1:3 cement mortar. 3. Rebar/Cement Stubs or Gypsum Furring - Add 1/2 in. to classification if used. Where combustible members are framed in wall, plaster or stucco must be applied on the face opposite framing to achieve a max. Classification of 1-1/2 hr to concrete blocks (Item 1). 4. Loose Masonry Filler - If all core spaces are filled with loose dry expanded slag, expanded cello or shale (Starex Kin Process), water repellent vermiculite masonry filler insulation, or silicone treated perlite loose fill insulation add 2 hr to classification. 5. Foamed Plastic* - (Optional Not Shown) - 1-1/2 in. thick, max 4 ft wide sheathing attached to concrete blocks (Item 1). THE DOW CHEMICAL CO. - Type Thermax		
Penetration Seal at Small Diameter Steel Duct	N.T.S.	29	Penetration Seal at Rectangular Steel Duct	N.T.S.	9

System No. W-1-1146 September 03, 2004 F Ratings - 1 and 2 Hr (See Item 1) T Rating - 0 Hr	System No. W-1-0011 December 15, 2007 F Ratings - 1 and 2 Hr (See Item 1) T Ratings - 1 and 2 Hr (See Item 1) L Rating at Ambient - 2 CFM/sq ft L Rating at 400 F - 2 CFM/sq ft	Design No. U415 November 15, 2010 Nonbearing Wall Ratings - 1 or 2 Hr	Design No. U465 December 23, 2008 Nonbearing Wall Rating - 1 Hr		
1. Wall Assembly - The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or U400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features: A. Studs - Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nominal 2 by 4 in. lumber spaced 16 in. O.C. Steel studs to be min 3/8 in. (9.5 mm) wide and spaced max 24 in. O.C. When steel studs are used and the diam of opening exceeds the width of stud cavity, the opening shall be framed on all sides using lengths of steel stud installed between the vertical studs and secured to the steel studs at each end. The framed opening in the wall shall be 4 to 6 in. wider and 4 to 6 in. higher than the diam of the penetrating item such that, when the penetrating item is centered in the opening, a 2 to 3 in. clearance is present between the penetrating item and the framing in the opening. B. Gypsum Board* - The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U400 or U400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 2 1/2 in. for steel studs with a max diam of opening 14-1/2 in. for wood studs wall. The hourly F Rating of the freestop system is equal to the hourly rating of the wall assembly in which it is installed. 2. Through-Penetrator - One metallic pipe, conduit or tubing installed either concentrically or eccentrically within the freestop system. The annular space between pipe/conduit or tubing and proprietary opening shall be min 0.1 in. (joint contact to max 2 in. in pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used: A. Steel Pipe - Nom 24 in. diam (or smaller) Schedule 10 (or heavier) steel pipe, nom 12 in. diam (or smaller) or Class 50 (or heavier) ductile iron pressure pipe. C. Conduit - Nom 6 in. diam (or smaller) steel conduit or nom 4 in. diam (or smaller) steel electrical metallic tubing. D. Copper Tubing - Nom 6 in. diam (or smaller) Regular (R) (or heavier) copper tubing. E. Copper Pipe - Nom 6 in. diam (or smaller) Type (L) (or heavier) copper pipe. 3. Fill, Void or Cavity Material* - Caulk or Sealant - Min 5/8 in. (16 mm) thickness of filler material applied within annulus, flush with both surfaces of wall assembly. At the point contact location between duct and wallboard, a min 1/4 in. diam bead of caulk shall be applied at the wallboard/duct interface at the point contact location on both sides of wall. JM COMPANY - CP25WB or FB-3000 WT	1. Wall Assembly - The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or U400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features: A. Studs - Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nominal 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) O.C. Steel studs to be min 3/8 in. (9.5 mm) wide and spaced max 24 in. (610 mm) O.C. Additional framing members shall be used to complete frame opening. B. Gypsum Board* - Thickness, type, number of layers and fasteners as required in the individual Wall and Partition Design. Max area of opening is 140 in. (2.03 m ²) with a max dimension of 30 in. (762 mm). The hourly F and T Ratings for the freestop system are equal to the hourly F rating of the wall assembly in which it is installed. 2. Firestop System - The firestop system shall consist of the following: A. Fill Void or Cavity Material* - Putty - Min 1/2 in. (13 mm) thickness of putty formed to a min 1 in. (25 mm) width and applied within annulus at all corners of opening and within 1/2 in. (13 mm) to both directions from each corner, flush with both surfaces of wall. B. JM COMPANY - MPS-2 3. Firestop System - The firestop system shall consist of the following: A. Fill Void or Cavity Material* - Putty - Min 1/2 in. (13 mm) thickness of putty formed to a min 1 in. (25 mm) width and applied within annulus at all corners of opening and within 1/2 in. (13 mm) to both directions from each corner, flush with both surfaces of wall. JM COMPANY - Fire Barrier Pillow or Fire Barrier Self-Locking Pillow	1. Floor and Ceiling Runners - (Not Shown) - Min. 1/8 in. (3 mm) galv steel 1 in. high, return legs 2-1/2 in. (63.5 mm), attached to floor and ceiling with fasteners 24 in. O.C. 2. Steel Studs - Max 2-1/2 in. wide, 1-1/4 in. high, 3/8 in. return, formed of min 25 MSG galv steel stud spaced 24 in. O.C. Studs to be cut to 3-1/4 in. less than assembly height. 3. Batts and Blankets* - (Optional) - Mineral wool or glass fiber batts partially or completely filling stud cavity. Fasten each batt to wallboard base layer with a min 9/16 in. long staples. Use only filling tabs on edges. See Batts and Blankets (B22) category for names of classified products. 4. Fiber, Spray* - As an alternate to Batts and Blankets (Item 3) - Spray applied cellulose insulation material. The fiber is applied with water to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. Nominal dry density of 3.0 lbs/ft ³ . Alternate application method: The fiber is applied with U.S. Greenfibre LLC Type AD100 hot melt adhesive at a nominal ratio of one part adhesive to 8 parts fiber to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. Nominal dry density of 3.2 lbs/ft ³ . U.S. GREENFIBRE LLC - Cocoon® Stabilized or Cocoon-FRM (Fire Rated Material) 5. Fiber, Spray* - As an alternate to Batts and Blankets (Item 3) and Item 3A - Spray applied cellulose insulation material. The fiber is applied with water to interior surfaces in accordance with the application instructions supplied with the product. Applied to completely fill the enclosed cavity. Minimum dry density of 4.3 pounds per cubic ft. NI-WOOD CO INC. - Cellulose Insulation	1. Floor and Ceiling Runners - (Not shown) - Channel shaped runners, 3-5/8 in. wide (min.), 1-1/4 in. high, formed from min. 25 MSG galv steel, attached to floor and ceiling with fasteners spaced 24 in. O.C. 2. Steel Studs - Channel shaped, 3-5/8 in. wide (min.), 1-1/4 in. high, 3/8 in. folded back returns, formed from min. 25 MSG galv steel spaced 24 in. O.C. 3. Batts and Blankets* - (Optional) - Mineral wool or glass fiber batts partially or completely filling stud cavity. See Batts and Blankets (B22) category for names of classified products. See Batts and Blankets (B22) category for names of classified products. 4. Fiber, Spray* - As an alternate to Batts and Blankets (Item 3) - Spray applied cellulose insulation material. The fiber is applied with water to interior surfaces in accordance with the application instructions supplied with the product. Nominal dry density of 3.0 lbs/ft ³ . Alternate application method: The fiber is applied with U.S. Greenfibre LLC Type AD100 hot melt adhesive at a nominal ratio of one part adhesive to 8 parts fiber to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. Applied to completely fill the enclosed cavity. Minimum dry density of 4.3 pounds per cubic ft. U.S. GREENFIBRE LLC - Cocoon® Stabilized or Cocoon-FRM (Fire Rated Material) 5. Fiber, Spray* - As an alternate to Batts and Blankets (Item 3) and Item 3A - Spray applied cellulose insulation material. The fiber is applied with water to interior surfaces in accordance with the application instructions supplied with the product. Applied to completely fill the enclosed cavity. Minimum dry density of 4.3 pounds per cubic ft. NI-WOOD CO INC. - Cellulose Insulation		
Penetration Seal for Metalic Pipes, Conduit, or Tubing	N.T.S.	28	Penetration Seal at Insulated Pipe	N.T.S.	21

System No. W-1-2003 May 23, 2005 F Ratings - 1 and 2 Hr (See Item 3) T Ratings - 1 and 2 Hr (See Item 3) L Rating At Ambient - 7 CFM/sq ft (See Item 3B) L Rating At 400 F - less than 2 CFM/sq ft (See Item 3B)	System No. W-1-5001 May 19, 2005 F Ratings - 1 and 2 Hr (See Item 3) T Ratings - 3/4, 1 and 1-1/2 Hr (See Item 3) L Rating At Ambient - 2 CFM/sq ft L Rating At 400 F - less than 2 CFM/sq ft	Design No. U415 November 15, 2010 Nonbearing Wall Ratings - 1 or 2 Hr	Design No. U420 August 15, 2008 Nonbearing Wall Rating - 1 or 2 Hr		
1. Wall Assembly - The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or U400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features: A. Studs - Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nominal 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) O.C. with nominal 2 by 4 in. (51 by 102 mm) lumber end plates and cross bracs. Steel studs to be min 3/8 in. (9.5 mm) wide by 1-3/8 in. (33 mm) deep channels spaced max 24 in. (610 mm) O.C. B. Gypsum Board* - 5/8 in. (16 mm) thick, 4 ft. (122 cm) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Design in the UL Fire Resistance Directory. Max diam of opening is 14-1/2 (368 mm) in. for wood studs walls and 18 in. (457 mm) for steel stud walls. The hourly F Rating of the freestop system is 1 hr when installed in a 1 hr fire rated wall and 2 hr when installed in a 2 hr fire rated wall. 2. Through Penetrators - One metallic pipe or tubing to be centered in the through opening. The annular space between pipe or conduit and periphery of opening shall be min. 1/8 in. (3 mm) and max 3/8 in. (10 mm). Pipe or conduit to be rigidly supported on both sides of wall assembly. The following types and sizes of nonmetallic pipes or conduits may be used: A. Polypropylene (PP) Pipe - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 or 80 PVC pipe for use in closed (pressure or supply) or vented (drain, waste or vent) piping system. B. Rigid Nonmetallic Conduit (NMC) - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 or 80 PVC conduit installed in accordance with the National Electric Code (NEC) No. 70. C. Chlorinated Polyvinyl Chloride (CPVC) Pipe - Nom 2 in. (51 mm) diam (or smaller) DR15 S CPVC pipe for use in closed (pressure or supply) piping systems. D. Cellular Core Polyethylene Chloride (LCPC) Pipe - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 cellular core PVC pipe for use in closed (pressure or supply) or vented (drain, waste or vent) piping systems. E. Acrylonitrile Butadiene Styrene (ABS) Pipe - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 solid or ABS pipe for use in closed (pressure or supply) or vented (drain, waste or vent) piping systems. 3. Firestop System - Installed symmetrically on both sides of wall assembly. The hourly F and T Ratings for the freestop system are equal to the hourly fire rating of the wall assembly in which it is installed. The details of the freestop system shall be as follows: A. Fill, Void or Cavity Material* - Wrap Strip - Nom 1/4 in. (6 mm) thick, 4 ft. (122 cm) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Design in the UL Fire Resistance Directory. Max diam of opening is 14-1/2 in. (368 mm) in. (19 mm) of the wrap strip protrudes from the wall surface. JM COMPANY - FS-155	1. Wall Assembly - The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or U400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features: A. Studs - Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nominal 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) O.C. with nominal 2 by 4 in. (51 by 102 mm) lumber end plates and cross bracs. Steel studs to be min 3/8 in. (9.5 mm) wide by 1-3/8 in. (33 mm) deep channels spaced max 24 in. (610 mm) O.C. B. Gypsum Board* - Nom 5/8 in. (16 mm) thick, 4 ft. (122 cm) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Design in the UL Fire Resistance Directory. Max diam of opening is 14-1/2 (368 mm) in. for wood studs walls and 18 in. (457 mm) for steel stud walls. The hourly F Rating of the freestop system is 1 hr when installed in a 1 hr fire rated wall and 2 hr when installed in a 2 hr fire rated wall. 2. Through Penetrators - One metallic pipe or tubing to be centered in the through opening. The annular space between pipe or conduit and periphery of opening shall be min. 1/8 in. (3 mm) and max 3/8 in. (10 mm). Pipe or conduit to be rigidly supported on both sides of wall assembly. The following types and sizes of nonmetallic pipes or conduits may be used: A. Polypropylene (PP) Pipe - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 or 80 PVC pipe for use in closed (pressure or supply) or vented (drain, waste or vent) piping systems. B. Rigid Nonmetallic Conduit (NMC) - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 or 80 PVC conduit installed in accordance with the National Electric Code (NEC) No. 70. C. Chlorinated Polyvinyl Chloride (CPVC) Pipe - Nom 2 in. (51 mm) diam (or smaller) DR15 S CPVC pipe for use in closed (pressure or supply) piping systems. D. Cellular Core Polyethylene Chloride (LCPC) Pipe - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 cellular core PVC pipe for use in closed (pressure or supply) or vented (drain, waste or vent) piping systems. E. Acrylonitrile Butadiene Styrene (ABS) Pipe - Nom 2 in. (51 mm) diam (or smaller) Schedule 40 solid or ABS pipe for use in closed (pressure or supply) or vented (drain, waste or vent) piping systems. 3. Firestop System - Installed symmetrically on both sides of wall assembly. The hourly F and T Ratings for the freestop system are equal to the hourly fire rating of the wall assembly in which it is installed. The details of the freestop system shall be as follows: A. Fill, Void or Cavity Material* - Wrap Strip - Nom 1/4 in. (6 mm) thick, 4 ft. (122 cm) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Design in the UL Fire Resistance Directory. Max diam of opening is 14-1/2 in. (368 mm) in. (19 mm) of the wrap strip protrudes from the wall surface. JM COMPANY - FS-155	1. Floor and Ceiling Runners - (Not Shown) - Min. 1/8 in. (3 mm) galv steel 1 in. high, return legs 2-1/2 in. (63.5 mm), attached to floor and ceiling with fasteners 24 in. O.C. 2. Steel Studs - Max 2-1/2 in. wide, 1-1/4 in. high, 3/8 in. return, formed of min 25 MSG galv steel stud spaced 24 in. O.C. Studs to be cut to 3-1/4 in. less than assembly height. 3. Batts and Blankets* - (Optional) - Mineral wool or glass fiber batts partially or completely filling stud cavity. Fasten each batt to wallboard base layer with a min 9/16 in. long staples. Use only filling tabs on edges. See Batts and Blankets (B22) category for names of classified products. 4. Fiber, Spray* - As an alternate to Batts and Blankets (Item 3) - Spray applied cellulose insulation material. The fiber is applied with water to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. Nominal dry density of 3.0 lbs/ft ³ . Alternate application method: The fiber is applied with U.S. Greenfibre LLC Type AD100 hot melt adhesive at a nominal ratio of one part adhesive to 8 parts fiber to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. Nominal dry density of 3.2 lbs/ft ³ . U.S. GREENFIBRE LLC - Cocoon® Stabilized or Cocoon-FRM (Fire Rated Material) 5. Fiber, Spray* - As an alternate to Batts and Blankets (Item 3) and Item 3A - Spray applied cellulose insulation material. The fiber is applied with water to interior surfaces in accordance with the application instructions supplied with the product. Applied to completely fill the enclosed cavity. Minimum dry density of 4.3 pounds per cubic ft. NI-WOOD CO INC. - Cellulose Insulation	1. Floor and Ceiling Runners - (Not shown) - Channel shaped runners, 3-5/8 in. wide (min.), 1-1/4 in. high, formed from min. 25 MSG galv steel, attached to floor and ceiling with fasteners spaced 24 in. O.C. 2. Steel Studs - Channel shaped, 3-5/8 in. wide (min.), 1-1/4 in. high, 3/8 in. folded back returns, formed from min. 25 MSG galv steel spaced 24 in. O.C. 3. Batts and Blankets* - (Optional) - Mineral wool or glass fiber batts partially or completely filling stud cavity. See Batts and Blankets (B22) category for names of classified products. See Batts and Blankets (B22) category for names of classified products. 4. Fiber, Spray* - As an alternate to Batts and Blankets (Item 3) - Spray applied cellulose insulation material. The fiber is applied with water to interior surfaces in accordance with the application instructions supplied with the product. Nominal dry density of 3.0 lbs/ft ³ . Alternate application method: The fiber is applied with U.S. Greenfibre LLC Type AD100 hot melt adhesive at a nominal ratio of one part adhesive to 8 parts fiber to completely fill the enclosed cavity in accordance with the application instructions supplied with the product. Applied to completely fill the enclosed cavity. Minimum dry density of 4.3 pounds per cubic ft. U.S. GREENFIBRE LLC - Cocoon® Stabilized or Cocoon-FRM (Fire Rated Material) 5. Fiber, Spray* - As an alternate to Batts and Blankets (Item 3) and Item 3A - Spray applied cellulose insulation material. The fiber is applied with water to interior surfaces in accordance with the application instructions supplied with the product. Applied to completely fill the enclosed cavity. Minimum dry density of 4.3 pounds per cubic ft. NI-WOOD CO INC. - Cellulose Insulation		
Penetration Seal for Non-Metallic Pipes and Conduit	N.T.S.	26	Penetration Seal at Insulated Pipe	N.T.S.	21

System No. W-1-3030 May 19, 2005 F Ratings - 1 and 2 Hr (See Item 1) T Rating - 1/2 Hr L Rating At Ambient - 75 CFM/sq ft (See Item 4) L Rating At 400 F - 7 CFM/sq ft (See Item 4)	Design No. U415 November 15, 2010 Nonbearing Wall Ratings - 1 or 2 Hr	System No. W-1-7008 June 15, 2005 F Rating - 1 & 2 Hr (See Item 1) T Ratings - 0 Hr	Design No. U905 March 17, 2004 Bearing Wall Rating - 2 Hr Nonbearing Wall Rating - 2 Hr		
1. Wall Assembly - The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features: A. Studs - Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nominal 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) O.C. with nominal 2 by 4 in. (51 by 102 mm) lumber end plates and cross bracs. Steel studs to be min 3/8 in. (9.5 mm) wide by 1-3/8 in. (33 mm) deep channels spaced max 24 in. (610 mm) O.C. B. Gypsum Board* - Two layers of min 5/8 in. (16 mm) thick, type gypsum wallboard, as specified in the individual Wall and Partition Design. Max diam of opening is 2 1/2 in. 2. Through-Penetrator - One steel duct to be installed either concentrically or eccentrically within the freestop system. An annular space of min 0.6 in. to max 1.52 in. (15.2 mm) is required within the freestop system. Steel duct to be rigidly supported through sides of wall assembly. The following types and sizes of steel ducts may be used: A. Steel Duct - Nom 16 in. diam (or smaller) No. 24 gage (or heavier) spiral wound galv steel duct. B. Seal Duct - Nom 10 in. diam (or smaller) No. 28 gage (or heavier) galv steel vent duct. 3. Fill, Void or Cavity Material* - Caulk or Sealant - Min 1/4 in. (6 mm) thickness of filler material applied within annulus, flush with both surfaces of wall assembly. At the point contact location between duct and wallboard, a min 1/4 in. diam bead of caulk shall be applied at the wallboard/duct interface on both surfaces of wall assembly. JM COMPANY - CP25WB or FB-3000 WT	1. Wall Assembly - The 1 or 2 hr fire rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features: A. Studs - Wall framing shall consist of steel channel studs to be min 3/8 in. (9.5 mm) wide and spaced max 24 in. (610 mm) O.C. Additional 1/2 in. (13 mm) wide steel studs shall be used to complete framing opening. B. Gypsum Board* - Thickness, type, number of layers and fasteners as required in the individual Wall and Partition Design. Max size of opening to be 1216 sq. in. (780 cm ²) with a maximum dimension of 38 in. (965 mm). The hourly F Rating of the freestop system is equal to the hourly rating of the wall assembly in which it is installed. C. Penetrator - One steel duct to be installed either concentrically or eccentrically within the freestop system. An annular space of min 0.6 in. to max 1.52 in. (15.2 mm) is required within the freestop system. Steel duct to be rigidly supported through both sides of floor or wall assembly. The hourly F Rating of the freestop system is equal to the hourly rating of the wall assembly in which it is installed. D. Furring Members - The details of the freestop system shall be as follows: 1. Fixing Method - (Optional) Polyethylene backer rod, mineral wool batt insulation of furring/batt insulation friction fit into annular space to accommodate the required thickness of fill material (Item 3B). 2. Filling - (Optional) Mineral wool or glass fiber batts partially or completely filling stud cavity. 3. Furring Channels - Formed of No. 25 MSG galv steel, 2-3/8 in. wide by 7/8 in. deep, spaced 24 in. O.C. perpendicular to studs. Channels secured to studs as described in Item 3. Gypsum board installed vertically only and attached to furring channels as described in Item 3. 4. Furring Channels - Formed of No. 25 MSG galv steel, 2-3/8 in. wide by 7/8 in. deep, spaced 24 in. O.C. perpendicular to studs. Channels secured to studs as described in Item 3. Gypsum board installed vertically only and attached to furring channels as described in Item 3. 5. Steel Framing Members* - Used to attach furring channels (Item 3B) to studs (Item 2 or 3A). Class spaced max 24 in. O.C. and secured to studs with No. 8 x 1-1/2 in. minimum self-drilling, 5/16 steel screw through the center grommet. Furring channels are friction fitted into place. PAC INTERNATIONAL INC. - Type RIG-1	1. Concrete Blocks* - Various design. Classification D-2 (D-2) R. See Concrete Blocks category for list of eligible manufacturers. 2. Mortar - Blocks laid in full bed of mortar, nom. 3/8 in. thick, not less than 2-3/4 and not more than 3-1/2 parts of clean sharp sand to 1 part Portland cement (proportioned by volume) and not more than 30 percent hydrated lime (by cement volume). Vertical joints between blocks shall be filled with 1:3 cement mortar. 3. Rebar/Cement Stubs or Gypsum Furring - Add 1/2 in. to classification if used. Where combustible members are framed in wall, plaster or stucco must be applied on the face opposite framing to achieve a max. Classification of 1-1/2 hr to concrete blocks (Item 1). 4. Loose Masonry Filler - If all core spaces are filled with loose dry expanded slag, expanded cello or shale (Starex Kin Process), water repellent vermiculite masonry filler insulation, or silicone treated perlite loose fill insulation add 2 hr to classification. 5. Foamed Plastic* - (Optional Not Shown) - 1-1/2 in. thick, max 4 ft wide sheathing attached to concrete blocks (Item 1). THE DOW CHEMICAL CO. - Type Thermax			
Penetration Seal at Small Diameter Steel Duct	N.T.S.	29	Penetration Seal at Rectangular Steel Duct	N.T.S.	9

System No. W-1-1146 September 03, 2004 F Ratings - 1 and 2 Hr (See Item 1) T Rating - 0 Hr	System No. W-1-0011 December 15, 2007 F Ratings - 1 and 2 Hr (See Item 1) T Ratings - 1 and 2 Hr (See Item 1) L Rating at Ambient - 2 CFM/sq ft L Rating at 400 F - 2 CFM/sq ft	Design No. U415 November 15, 2010 Nonbearing Wall Ratings - 1 or 2 Hr	Design No. U465 December 23, 2008 Nonbearing Wall Rating - 1 Hr
1. Wall Assembly - The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or U400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features: A. Studs - Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nominal 2 by 4 in. lumber spaced 16 in. O.C. Steel studs to be min 3/8 in. (9.5 mm) wide and spaced max 24 in. O.C. When steel studs are used and the diam of opening exceeds the width of stud cavity, the opening shall be framed on all sides using lengths of steel stud installed between the vertical studs and secured to the steel studs at each end. The framed opening in the wall shall be 4 to 6 in. wider and 4 to 6 in. higher than the diam of the penetrating item such that, when the penetrating item is centered in the opening, a 2 to 3 in. clearance is present between the penetrating item and the framing in the opening. B. Gypsum Board* - The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U400 or U400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 2 1/2 in. for steel studs with a max diam of opening 14-1/2 in. for wood studs wall. The hourly F Rating of the freestop system is equal to the hourly rating of the wall assembly in which it is installed. 2. Through-Penetrator - One metallic pipe, conduit or tubing installed either concentrically or eccentrically within the freestop system. The annular space between pipe/conduit or tubing and proprietary opening shall be min 0.1 in. (joint contact to max 2 in. in pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used: A. Steel Pipe - Nom 24 in. diam (or smaller) Schedule 10 (or heavier) steel pipe, nom 12 in. diam (or smaller) or Class 50 (or heavier) ductile iron pressure pipe. C. Conduit - Nom 6 in. diam (or smaller) steel conduit or nom 4 in. diam (or smaller) steel electrical metallic tubing. D. Copper Tubing - Nom 6 in. diam (or smaller) Regular (R) (or heavier) copper tubing. E. Copper Pipe - Nom 6 in. diam (or smaller) Type (L) (or heavier) copper pipe. 3. Fill, Void or Cavity Material* - Caulk or Sealant - Min 5/8 in. (16 mm) thickness of filler material applied within annulus, flush with both surfaces of wall assembly. At the point contact location between duct and wallboard, a min 1/4 in. diam bead of caulk shall be applied at the wallboard/duct interface at the point contact location on both sides of wall. JM COMPANY - CP25WB or FB-3000 WT	1. Wall Assembly - The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400 or U400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features: A. Studs - Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nominal 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) O.C. Steel studs to be min 3/8 in. (9.5 mm) wide and spaced max 24 in. (610 mm) O.C. Additional framing members shall be used to complete frame opening. B. Gypsum Board* - Thickness, type, number of layers and fasteners as required in the individual Wall and Partition Design. Max area of opening is 140 in. (2.03 m ²) with a max dimension of 30 in. (762 mm). The hourly F and T Ratings for the freestop system are equal to the hourly F rating of the wall assembly in which it is installed. 2. Firestop System - The firestop system shall consist of the following: A. Fill Void or Cavity Material* - Putty - Min 1/2 in. (13 mm) thickness of putty formed to a min 1 in. (25 mm) width and applied within annulus at all corners of opening and within		



MEMBERS

MEP Engineer
Infrastructure Associates, Inc.
 6117 Richmond Avenue, Suite 200
 Houston, Texas 77057

STOPS

- 1. Stops: Complying with BHMA A156.8, provide a stop for every swinging door, unless otherwise indicated.
 - a. Provide wall stops, unless otherwise indicated.
 - b. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.
 - c. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop unless specifically so stated.

GLAZING

- A. Glass Materials
 - 1. Float Glass: All glazing is to be float glass unless otherwise indicated.
 - a. Annealed Type: ASTM C 1036, Type 1, transparent flat, Class 1 clear, Quality Q3 (glazing select).
 - b. Heat-Strengthened and Fully Tempered Types: ASTM C 1048.
 - c. Thicknesses: As indicated.
- B. Glazing Compound
 - 1. Butyl Sealant: Single component; Shore A hardness of 10 to 20; black color; non-skinning.
 - 2. Silicone Sealant: Single component; chemical curing; capable of water immersion without loss of properties; non-skinning, non-staining; ASTM C 920, Type 5, Grade NS, Class 25, Uses M, A, and G; cured Shore A hardness of 15 to 25; color as selected.

GYPSUM BOARD ASSEMBLIES

- A. Gypsum Board Assemblies
 - 1. Provide completed assemblies complying with ASTM C 840 and GA-216.
 - 2. Board Materials
 - a. Manufacturers: Paper-faced gypsum panels as defined in ASTM C 1396/C 1396M; sies to minimize joints in place; ends square out.
 - b. Applications: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - c. Thickness: As indicated.
 - C. Fiberglass Reinforced Panel Materials
 - 1. Glass Mat Gypsum Board: Gypsum panels with moisture-resistant core and coated inorganic fiberglass mat back surface designed to resist growth of mold and mildew, per ASTM D 3273.
 - 2. Panels: "Dens-Shield Tile Backer" manufactured by G-P Gypsum Corporation.
 - D. Accessories
 - 1. Finishing Accessories: ASTM C 1047; galvanized steel or rolled zinc, unless otherwise indicated.
 - 2. Types: As detailed or required for finished appearance.
 - 3. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.
 - 4. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 5. Ready-mixed vinyl-based joint compound.
 - 6. Textured Finish Materials: Latex-based compound; plain.
 - 7. Screws: ASTM C 1002; self-piercing tapping type.
 - 8. Nails for Attachment to Wood Members: ASTM C 514.
 - 9. Staples: ASTM C 84.
 - 7. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
 - 8. Adhesive for Attachment to Wood: ASTM C 557.

TILING

- A. Ceramic Tile
 - 1. Manufacturers, sizes, patterns and colors: See Schedule on the drawings.
- B. Special Shapes: In addition to recommended cornerbead and control joints, provide U-bead at exposed panel edges.
- C. Textured Finish Materials: Latex-based compound; plain.
- D. Accessories
 - 1. Organic Adhesive: ANSI A136.1, thinset bond type; use Type I in areas subject to prolonged moisture.
 - 2. Mortar Materials
 - 1. Mortar Bed Materials: Portland cement, sand, latex additive, and water.
 - D. Grout Materials
 - 1. Latex-Portland Cement Grout:
 - a. Characteristics: Dry-set grout with dry polymers added in re-emulsifiable powder form, factory-mixed; conforming to ANSI A118.6. Comply with the following requirements:
 - a. Sanded Dry-Grout Mix: Commercial portland cement grout complying with ANSI A118.6 for materials described in Section H-2.1, for joints 1/8 inch (3.2 mm) and wider.
 - b. Latex Additive: Acrylic resin.
 - c. Color: To be selected from manufacturer's full range of available colors.

ACOUSTICAL CEILING

- 1. Manufacturers:
 - a. Supply acoustical panels from manufacturers listed in the Finish Schedule located on the Finish Schedule.
- 2. Acoustical Tiles - General: ASTM E 1264, Class A.
 - a. Suspended Acoustical Grid
 - 1. The acoustical grid is existing.

RESILIENT FLOORING

- A. The Flooring
 - 1. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness, and:
 - a. Minimum Requirements: Comply with ASTM F 1066, of Class corresponding to type specified.
 - b. Size: 12 x 12 inch.
 - c. Thickness: 1/8 inch.
 - 2. Patterns: See Finish Materials Schedule.
- B. Resilient Base
 - 1. Resilient Base: ASTM F 1863, Type TS rubber, vulcanized thermoset; top set style straight or cove as indicated, and as follows:
 - a. Height: 4 inch.
 - b. Thickness: 1/2 inch thick.
 - c. Finish: Matte.
 - d. Length: Roll.
 - e. Color: Color as selected from manufacturer's standards.
 - f. Accessories: Premolded external corners and end stops.
- C. Accessories
 - 1. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
 - 2. Primers, Adhesives, and Seaming Materials: Waterproof, types recommended by manufacturer.
 - 3. Moldings, Transition and Edge Strips: Metal.
 - 4. Filler for Coved Base: Plastic.
 - 5. Sealer and Wax: Types recommended by flooring manufacturer.

CARPET

- A. Manufacturer
 - 1. Manufacturer, Pattern and colors: See Finish Materials Schedule.
- B. Accessories
 - 1. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.
 - 2. Moldings and Edge Strips: Vinyl, color as selected.
 - 3. Adhesives: Compatible with materials being adhered.
 - 4. Seam Adhesive: Recommended by manufacturer.
 - 5. Contact Adhesive: Compatible with carpet material; releasable type.

WALL COVERINGS

- A. MANUFACTURER
 - 1. Provide wall coverings from manufacturers listed in the Finish Materials Schedule.
- B. MATERIALS
 - 1. Requirements for all

GENERAL NOTES AND SPECIFICATIONS

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ARCHITECTURAL WOOD CASEWORK

- A. Wood-Based Components
 - 1. Wood fabricated from old growth timber is not permitted.
 - 2. Lumber Material:
 - 1. Softwood Lumber: NIST PS 20; Graded in accordance with AWW/AMMAC Architectural Woodwork Quality Standards Illustrated, Grade III/Economy; average moisture content of 4-9 percent; species as follows:
 - a. Applicable Grades: Species Douglas fir.
 - b. Semi-Exposed Surfaces: Species Douglas fir.
 - c. Concealed Surfaces: Species Douglas fir.
 - 2. Hardwood Lumber: NIA; Graded in accordance with AWW/AMMAC Architectural Woodwork Quality Standards Illustrated, Grade III/Economy; average moisture content of 4-9 percent; species as follows:
 - a. Drawer Sides and Back: Species Red Oak, Grade AA.
 - b. Exposed Siles and Rails: Species Red Oak, Grade AA.
 - c. Exposed Surfaces: Species Red Oak.
 - d. Semi-Exposed Surfaces: Species Poplar.
 - e. Concealed Surfaces: Species Poplar.
 - 3. Panel Materials
 - 1. Exposed Surfaces: PS 1; APA A-A Grade, plain-sliced redwood face veneer, interior rated adhesives, core of medium density fiberboard, thickness as indicated.
 - 2. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWW/AMMAC Architectural Woodwork Quality Standards Illustrated; composed of wood fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thickness as required.
 - a. Use for painted components, concealed components, and components not indicated as another material.
 - b. Use as backing for plastic laminate unless otherwise indicated.
 - 3. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S3); use for dust panels and other components indicated on drawings.
 - D. Laminate Materials
 - 1. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications and finish as scheduled.
 - a. Horizontal Surfaces: HGS, 048 inch nominal thickness, colors as scheduled, finish as scheduled.
 - b. Vertical Surfaces: VVS, 028 inch nominal thickness, colors as scheduled, finish as scheduled.
 - c. Post-Formed Horizontal Surfaces: HGP, 039 inch nominal thickness, colors as scheduled, finish as selected.
 - d. Post-Formed Vertical Surfaces: VGP, 028 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
 - e. Cabinet Liner: CLS, 020 inch nominal thickness, colors as scheduled, finish as scheduled.
 - f. Laminate Backer: BKL, 020 inch nominal thickness, uncoated, for application to concealed backside of panels faced with high-pressure decorative laminate.
 - E. Accessories
 - 1. Adhesive: Type recommended by AWW/AMMAC to suit application.
 - 2. Plastic Edge Banding: Extruded PVC, fish-shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 - a. Use at all exposed plywood edges.
 - b. Use at all exposed shell edges.
 - 3. Fasteners: Size and type to suit application.
 - 4. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome plated finish in concealed locations and stainless steel, or chrome-plated finish in exposed locations.
 - 5. Concealed Joint Fasteners: Threaded steel.
 - 6. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.
 - F. Shop Treatment of Wood Materials
 - 1. Provide UL approved identification on fire retardant treated material.
 - 2. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.
 - G. Fabrication
 - 1. Cabinet Style: Flush overlay.
 - 2. Cabinet Doors and Drawer Fronts: Flush style.
 - 3. Drawer Construction Technique: Dovetail joints.
 - 4. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
 - 5. Edging: Fit shelves, doors, and exposed edges with specified finish. Do not use more than one piece for any single length.
 - 6. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scabing and site cutting.
 - 7. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufacturer sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel angles. Locate counter joint joints minimum 2 feet from joint cut-outs.
 - a. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - b. Cap exposed plastic laminate finish edges with material of same finish and pattern.
 - 8. Matching Wood Grains: Comply with requirements of quality standard for specified Grade and as follows:
 - 1. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.
 - 2. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime joint edges.
 - H. Factory Finishing
 - 1. Sand wood smooth and set exposed nails and screws.
 - 2. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.
 - 3. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.
 - 4. Finish work in accordance with AWW/AMMAC Architectural Woodwork Quality Standards Illustrated, Section 1500, Pre-treated Lacquer, Transparent.

JOINT SEALERS

- A. Sealants
 - 1. Type I - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF single component; paintable.
 - a. Color: Standard colors matching finished surfaces.
 - b. Product: "Tremflex 834" manufactured by Tremco, Inc.: www.tremco sealants.com.
 - c. Applications: Use for:
 - i. Interior wall and ceiling control joints.
 - ii. Joints between interior door and window frames and wall surfaces.
 - iii. Other interior joints for which no other type of sealant is indicated.
 - 2. Type I - Bathroom Joint Sealant: Silicone, anti-fungal, anti-bacterial; ASTM C 920, Uses M, G and A; single component, mildew resistant.
 - a. Product: "Tremseal 200" manufactured by Tremco, Inc.: www.tremco sealants.com.
 - b. Color(s): Clear.
 - c. Applications: Use for:
 - i. Joints between plumbing fixtures and floor and wall surfaces.
 - ii. Joints between kitchen and bath countertops and wall surfaces.
- B. Accessories
 - 1. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
 - 2. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
 - 3. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

ALUMINUM FRAMES

- A. Manufacturers
 - 1. The design of the project has been based on products manufactured by RACO Interior Products.
- 2. Acceptable products:
 - a. Interior Door Frames: RACO Classic Prestige fixed throat frames to accommodate wall thicknesses indicated on Drawings; ceiling height system.
- B. Materials
 - 1. Extruded Aluminum: ASTM B 1221 (ASTM B 221M), alloy 6063-T5 or alloy 6463-T5.
- C. Components
 - 1. Aluminum Door Frames: Provide Frames sized to fit wall thicknesses indicated on the drawings, in profiles indicated, and constructed from materials as follows:
 - a. Frame Members: Extruded aluminum shapes, not less than 062 in. thick, reinforced at hinge and strike locations.
 - b. Corner Brackets: Extruded aluminum, fastened with stainless steel screws.
 - c. Trim: Extruded aluminum, not less than 062 in. thick, removable snap-in type without exposed fasteners.
 - 2. Glazing: Clear, 1/4 in. tempered glass.
- D. Finishes
 - 1. Aluminum frames: Match existing building standard unless otherwise indicated.
 - 2. Factory finish extruded frame and door components so that all parts exposed to view upon completion of installation are uniform in finish and color. Exposed surfaces shall be free of scratches and other serious blemishes.
- E. Fabrication
 - 1. Door sizes shown are nominal; provide standard clearances as follows:
 - a. Hinge and Lock Siles: 1/25 inch.
 - b. Between Meeting Siles: 2/32 inch.
 - c. At Top Rail and Bottom Rail: 1/25 inch.
 - 2. Sizes and locations of lights: As indicated on drawings.
 - 3. Aluminum frames: Sizes and contours as indicated on drawings.
- F. Accessories
 - 1. Fasteners: Aluminum, non-magnetic stainless steel, or other material warranted by manufacturer as non-corrosive and compatible with aluminum components.
 - 2. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible, otherwise, non-magnetic stainless steel or steel hot-dip galvanized in compliance with ASTM A 123/A 123M.

WOOD DOORS

- A. General
 - 1. All Doors: See drawings for locations and additional requirements.
 - a. Quality Level: Premium Grade, in accordance with AWW/AMMAC Architectural Woodwork Quality Standards Illustrated, Section 130.
 - b. High Pressure Decorative Laminate Faced Doors: 5-ply or 9-ply unless otherwise indicated.
 - 2. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - a. Provide solid core doors at all locations.
 - b. High pressure decorative laminate finish where indicated on drawings.
 - 3. Solid Core: Type particleboard core (PC), plies and faces as indicated above.
- C. Door Facings
 - 1. High Pressure Decorative Laminate Facing for Non-Fire-Rated Doors: NEMA LD 3, HGS, color as selected; finish as selected.
 - 2. Facing Adhesive: Type I - waterproof.
- D. Accessories
 - 1. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- E. Door Construction
 - 1. Fabricate doors in accordance with door quality standard specified.
 - 2. Cores Constructed with stiles and rails:
 - a. Provide solid blocking for other through bolted hardware.
 - b. Fit door edge trim to edge of stiles after applying veneer facing.
 - 3. Vertical Exposed Edge of Siles - Veneer Faces: Hardwood for paint finish.
 - 4. Fit door edge trim to edge of siles after applying veneer facing.
 - 7. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- F. Factory fit doors for Frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- 9. Provide edge clearances in accordance with AWI Quality Standards Illustrated Section 130.

GENERAL CONDITIONS AND SPECIFICATIONS

- A. The Specifications, General Conditions, and Supplementary Conditions for the building in which this project is located ("Shell Building") are hereby made part of these Contract Documents, and shall govern all work described herein, except to the extent specifically noted otherwise.
- B. The Contractor shall contact the Owner and discuss insurance, performance and payment bonds, and bid bond requirements prior to submitting pricing information. The Contractor's understanding of the above provisions must be stated in a written agreement prior to commencement of the Work.

GENERAL REQUIREMENTS

- A. Codes and Standards: The Work shall be performed in accordance with all applicable codes, regulations, and ordinances having jurisdiction.
- B. Permits: The Contractor shall obtain and pay for all fees, taxes, permits and inspections required in connection with the Work.
- C. Cutting and Patching: Each miscellaneous item of cutting, patching, and fitting is not necessarily individually shown on the Drawings. The absence of specific descriptions of cutting, patching, and fitting required to properly accommodate the Work shall not relieve the Contractor from responsibility to perform such work as required.
- D. The Contractor shall fill and patch all openings and holes, seal around all pipes, ducts, and other penetrating objects, and insure the integrity of all required fire and smoke separations in accordance with all applicable Codes and Ordinances.
- E. Relocation: Relocation of any existing items or materials involved in the Work is subject to the Contractor's ability to do so without permanently damaging or marring the item to be relocated. If the Contractor is unable to relocate any item described herein without permanent damage, then he shall substitute new items or materials to match the existing in lieu of relocating the material or item. The Contractor may also elect to use new items or materials to match existing in lieu of relocation for his own convenience.
- F. Cooperate and coordinate job operations with the operations of others doing adjacent work in order to prevent delay and conflict, or damage to either party's operations.
- G. In performing the Work, it will be the Contractor's responsibility to repair all existing and new construction that is disturbed, relocated, damaged, and altered. Make all repairs as required to eliminate all evidence of damage, and refinish damaged construction to match like new finish and appearance. Where new work is installed, or existing finishes are disturbed, refinish such areas to match existing as indicated herein, with the following minimum requirements:
 - 1. Walls: From floor to ceiling and between nearest corners. New wall construction shall be flush with no visible joint showing. For walls with wall covering other than paint, the entire wall shall receive new wall covering of equal quality, as approved by the Architect.
 - 2. Ceilings: The complete surface of the room.
 - 3. Floor: The complete surface of the room.
 - 4. Openings: The entire unit, including frame.
 - 5. Base: Between nearest inside corners.

- 6. Shop Drawings: The Contractor shall submit, in electronic format, all required shop drawings and product literature to the Architect for review for design intent and general compliance with the information given in the Contract Documents. All shop drawings and product literature signed "No Exception Taken" shall supercede the originating drawings. The Architect's review of shop drawings does not relieve the Contractor from his responsibilities to fulfill the requirements of the Contract Documents.
- H. The Contractor shall arrange for elevator or other hoisting facilities for his materials.
 - 1. Do not scale the Drawings. All dimensions indicated govern. Larger scale details govern smaller scale drawings. All dimensions shown on floor plans are to face of gypsum board finish, and exclude ceramic tile, paneling, and other thick finishes, unless noted otherwise.
- I. If dimensions are in question, the Contractor shall be responsible for obtaining clarification from the Architect before continuing with construction activity.
- 2. Unless shown on the drawings by exact dimension, the Contractor shall verify with the Architect the exact location of all electrical outlets, telephone outlets, special devices and apparatus indicated on the drawings.
- J. Where the term "approved equal" or "equal" is used, it shall be understood that reference is made to the ruling and judgment of the Architect and the proposed substitution shall be submitted for review and written approval.
- K. Existing Conditions:
 - 1. The Contractor shall be deemed to be thoroughly familiar with the condition of the building and Project environment before submitting a proposal for the Work, and to be satisfied as to the condition under which the Work is to be performed, or that will, in any manner, affect the Work. No extra payment will be made for claims for additional work that could have been determined or anticipated prior to submitting the Proposal.
 - 2. The Contractor shall check and verify the Contract Documents and field conditions for accuracy, confirming that the Work is buildable as shown, before proceeding with construction. If there are any questions regarding the drawings or other coordinating questions, the Contractor is responsible for obtaining clarification from the Architect before proceeding with the work, or related work, in question.
 - 3. Verify all space dimensions as shown with existing job conditions before starting construction. Notify the Architect of any discrepancies found.
 - 4. The existing structure is presently served with active electrical, water, sewer, communications, and drainage lines. Interruption of, or tie-ins to, these lines and services must occur during non-operating hours and must be scheduled in advance with the Owner. When an interruption to one of these services does occur, the Contractor shall restore the service promptly.

- 5. All areas of the Work must be sealed off from occupied portions of the building to prevent entry of dust and noise. Furnish and maintain temporary partitions and other types of protection as necessary to adequately protect and prevent accidental injury of the public, Owner's personnel and other personnel employed at the site of the Work. Properly place and maintain barriers to prevent access to areas not in progress.
 - a. The Owner intends to occupy and utilize portions of the building in which the Work is located during normal business hours. Coordinate work with the Owner to minimize disruption.
 - b. Work utilizing noise-producing equipment shall be subject to the Owner's approval at all times.
 - c. Dust producing work, or work that produces excessive noise levels may be required to be conducted during non-business hours, at the Owner's direction.
- 6. The Contractor shall patch and finish to match existing, any adjacent rooms or corridors that are affected, in any manner, by the Work, including those spaces above or below the construction site that may provide required access to the Work. When it becomes necessary to obtain access to adjacent spaces, including those above or below the construction site, the Contractor shall coordinate such access with the Owner, allowing as much advance notice as possible.
- 7. In laying out and detailing the Work, consideration shall be given to variations in the floor levelness resulting from construction quality and live and dead loads imposed on the structure. Field verification shall be made of the condition to verify construction tolerances. Alignment of door heads and other horizontal elements shall be maintained at a constant level and shall not follow variations of the floor plane. Level floors as required using approved leveling compound.
- 8. The Contractor and all sub-contractors shall verify building opening clearances for delivery of equipment and materials (e.g. size of elevator doors, doors, corridors, etc.).

OWNER SUPPLIED MATERIALS

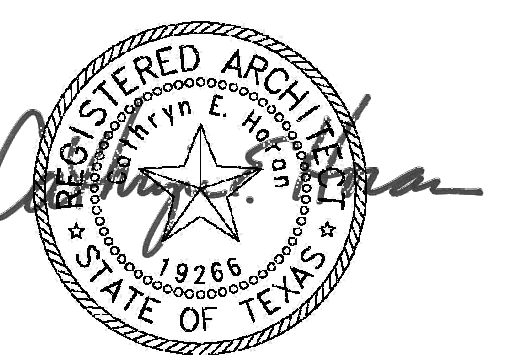
- A. All materials, fixtures, casework and other items removed from the project site are, and shall remain, the property of the Owner. Unless scheduled to be reused in the Work, the Contractor shall consult with the Owner in the disposition of all items.
- B. Equipment indicated to be furnished by the Owner and installed by the Contractor shall be received and stored by the Contractor. The Contractor shall coordinate equipment delivery with the Owner.

SUBMITTALS

- A. Millwork: Submit shop drawings indicating materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessories, hardware and finish.
- B. Aluminum Door Frames: Submit product data including details at each opening, frame profiles, and finishes.
- C. Wood Doors: Provide product data and shop drawings illustrating door elevation, size, type, swing, and finish.
- D. Door Hardware: Submit shop drawings indicating door hardware locations, schedules, and any electrical characteristics and connection requirements.
- E. Finishes: Submit one (1) sample of each finish for verification. Do not submit multiple samples of the same finish material for multiple tenant improvement projects.

ROUGH CARPENTRY

- A. General Requirements
 - 1. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - a. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Dimension Lumber
 - 1. Sizes: Nominal sizes as indicated on drawings, S4S.
 - 2. Moisture Content: S-dry or MC19.
 - 3. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - a. Lumber: S4S, No. 2 or Standard Grade.
- C. Construction Panels
 - 1. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 1/4 inch thick flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E 84.
- D. Factory Wood Treatment
 - 1. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 2. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 - 2. Fire Retardant Treatment:
 - a. Interior Type A: AWWA U1, Use Category I/CFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E 84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. All interior rough carpentry items are to be fire retardant treated.
 - c. Treat rough carpentry items as indicated.
 - d. Do not use treated wood in applications exposed to weather or where the wood may become wet.



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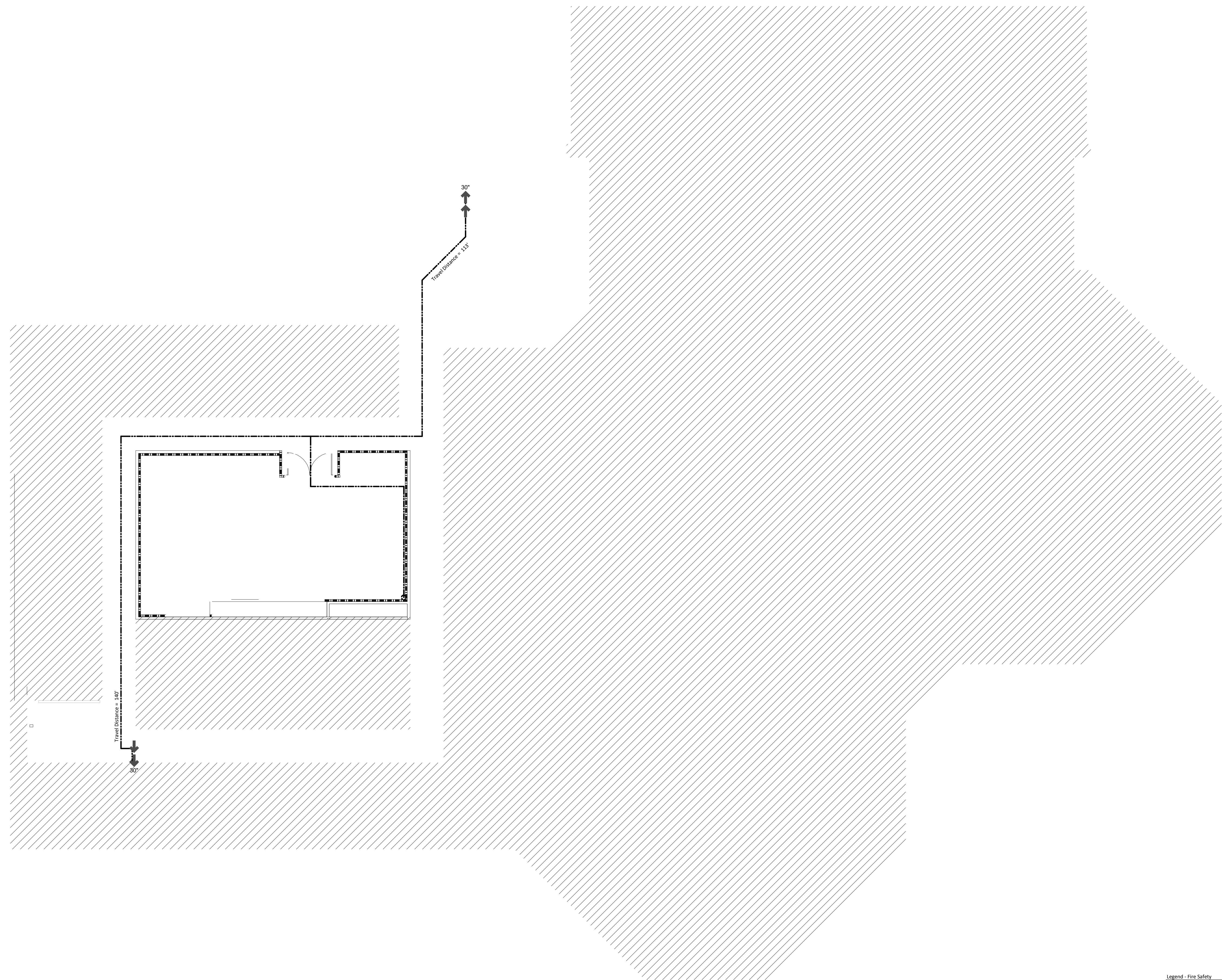
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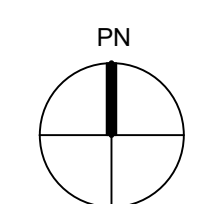
Fire Safety Plan - Level 2

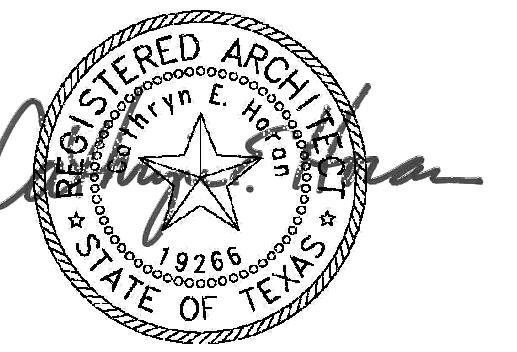
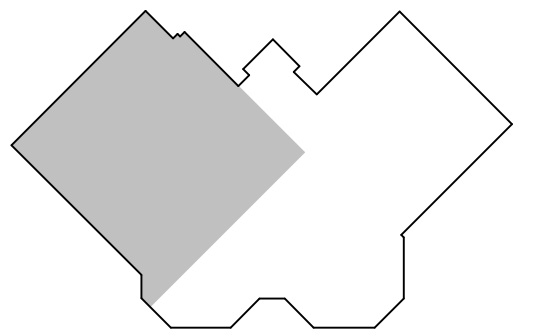
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G-110



- Legend - Fire Safety**
- New 1-hour fire barrier with 45 minute C-label doors. Partition types D, J, L
 - Building exit, clear exit width in inches
 - Fire extinguisher cabinet location
 - Path of longest exit travel
 - Door and frame fire rating in minutes





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Demolition Plan - Level 2

Sheet

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Demolition Notes:

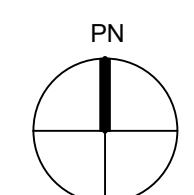
- The Contractor shall be responsible for the protection against vandalism/unauthorized entry, etc. during the removal of and replacement of the interior envelope. Do not leave building components unprotected or uncovered after-hours.
- Contractor to provide protection, as required during construction, at all remaining utilities (clean outs, gas valves, etc.).
- Coordinate with Owner proper access and location for waste disposal and location of dumpsters.
- Contractor to demolish and dispose of all items shown/needed to be removed, verify with owner items to be recycled. Items noted to be reused or returned to Owner shall be cleaned thoroughly by Contractor prior to storage or re-installation.
- Contractor to remove all electrical outlets, voice/data outlets, light switches, and thermostats affected by demolition work. Contractor shall cap all involved wiring and revise any necessary changes on respective electrical panels.
- The building will remain occupied during demolition/renovation. Contractor to coordinate shut-downs and tie-ins to all mechanical, electrical, plumbing, communications, fire alarms, and sprinkler systems to minimize disruptions to building occupants.
- Contractor to protect existing smoke detectors from dust/debris during demolition/renovation to prevent accidental trigger of the alarm system.
- Contractor will be responsible for the protection of existing furniture, equipment, finishes, etc. during demolition/renovation. Items damaged will be repaired or replaced with new at Contractor's expense.
- Contractor to provide and maintain corridor access and fire egress requirements during all demolition/renovation phases.
- Contractor to protect existing doors, frames, or hardware remaining during demolition/renovation. Contractor to paint any existing frames remaining after construction to match existing. Clean and refurbish any salvaged door hardware for re-installation.
- Contractor to remove all existing floor and ceiling finishes in demolition area, unless noted otherwise.
- Coordinate with Owner for removal of all cameras/readers/ etc.
- Contractor shall protect all column/composite deck with existing fireproofing. Contractor will be responsible to ensure that any damaged fire proofing is replaced for approved required rating.
- Contractor to make best effort to salvage doors, frames, hardware, etc. and confirm with O&M if they want to warehouse salvaged items.

Demolition Plan Keyed Notes

- Remove existing partition
- Remove existing millwork
- Relocate existing plumbing in existing chase, see MEP Drawings
- Remove existing floor finishes, ceiling tile, grid, light fixtures and all ceiling accessories
- Remove existing ceiling tile and grid as necessary for installation of equipment.
- Relocate existing electrical panel. See Electrical drawings
- Remove existing ceiling tile as required for above ceiling work. Replace with new ceiling tile to match existing.
- Remove existing glazing, coordinate the location of conduit penetration with MEP

Legend - Floor and Demolition Plan

- Existing to be removed
- Existing to remain
- ===== New Partitions



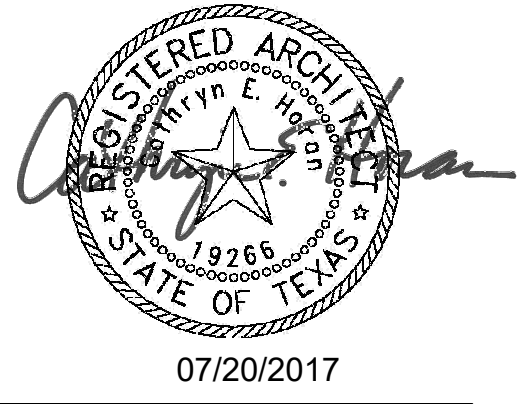
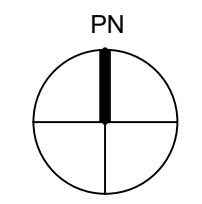
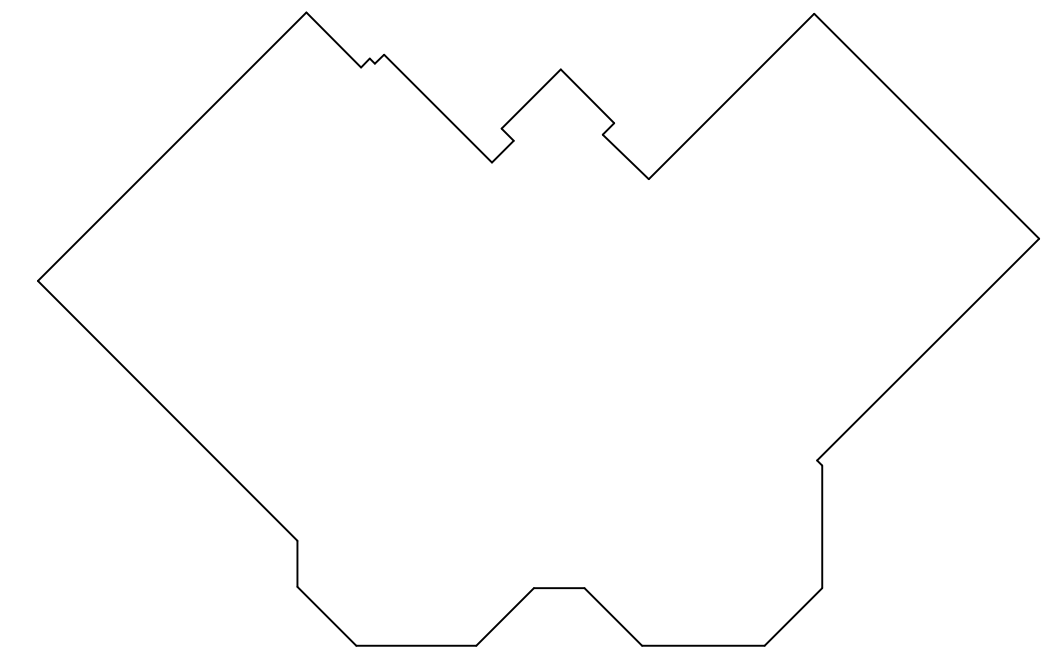


5' CFH

- Keyed Notes:**
1. Infill wall to match existing 2-hour rated wall. See 4 G-101 for U-Design. Coordinate removal of mechanical equipment with MEP.
 2. Remove existing ceiling tile and grid as required to complete mechanical work and reinstall once work is complete. Replace any damaged ceiling tiles with new to match existing. See MEP for scope of mechanical work.
 3. Remove and replace hard ceiling as required to install new air-valve. See MEP for additional details.

- Legend - Floor and Demolition Plan**
- Existing to be removed
 - ===== Existing to remain
 - ==== New Partitions

Key Map



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Floor Plan - Basement



Demolition Notes:

1. The Contractor shall be responsible for the protection against vandalism/unauthorized entry, etc. during the removal of and replacement of the interior envelope. Do not leave building components unprotected or uncovered after-hours.
2. Coordinate with Owner proper access and location for waste disposal and location of dumpsters.
3. Contractor to demolish and dispose of all items shown/noted to be removed, verify with owner items to be recycled.
4. Contractor will be responsible for the protection of existing furniture, equipment, finishes, etc. during demolition/renovation. Items damaged will be repaired or replaced with new at Contractor's expense.
5. Contractor to provide and maintain corridor access and fire egress requirements during all demolition/construction phases.
6. Contractor to protect existing doors, frames, or hardware remaining during demolition/renovation. Contractor to paint any existing frames remaining after construction to match existing.
7. Contractor responsible to inspect existing conditions for all window frames and sills for damage including but not limited to scratches, cracks and dents.

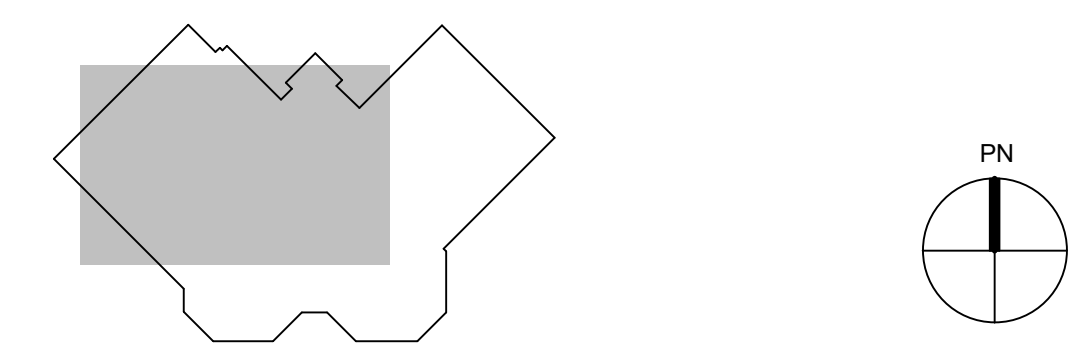
Keyed Notes:

- [1] Demo existing chase wall
- [2] Remove existing ceiling as required to complete scope of work. Patch and repair to match existing. See MEP for scope of work.
- [3] Remove existing ceiling tile and grid as required, coordinate storage of removed ceiling with Owner.
- [4] Remove existing bookshelves. Coordinate storage location with Owner.

Legend - Floor and Demolition Plan

- Existing to be removed
- Existing to remain
- ==== New Partitions

Key Map



Level 1 - Demolition Plan 1/4" = 1'-0" 4

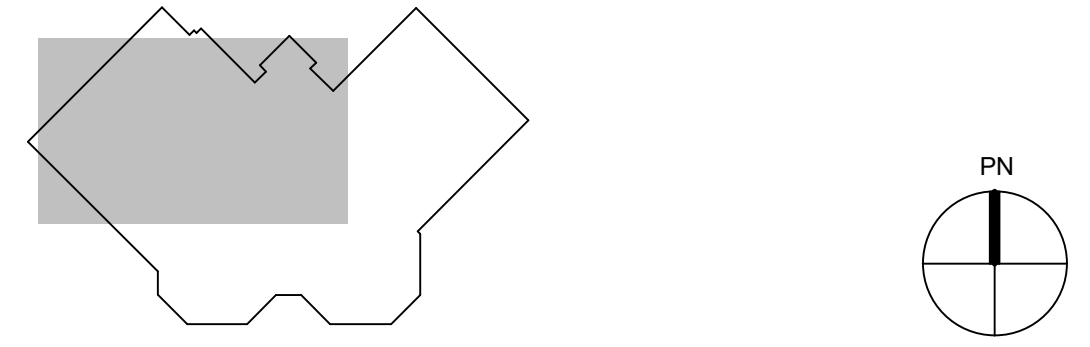
Keyed Notes:

- [1] Reinstall removed ceiling tile and grid. Replace any damaged tile and grid.
- [2] New chase walls

Legend - Floor and Demolition Plan

- Existing to be removed
- Existing to remain
- ==== New Partitions

Key Map



Level 1 - Floor Plan 1/4" = 1'-0" 1



INFRASTRUCTURE ASSOCIATES, INC.
6117 RICHMOND AVENUE, SUITE 200
HOUSTON, TEXAS 77057
TBPB REGISTRATION NO. F-4506
(713) 622-0120 PH (713) 622-0557 FAX
WWW.IAHOUSTON.COM

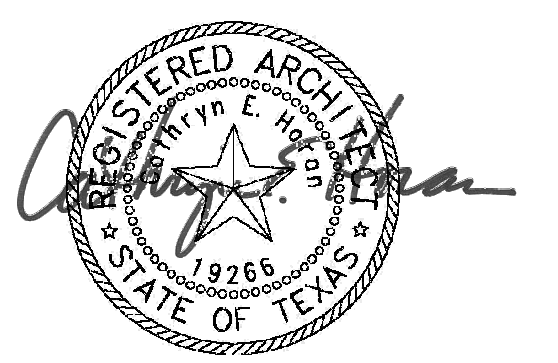


UT Health Science
School of Public
Health
1200 Pressler St.
Houston, TX 77030



Partnership

11276 S. Sam Houston Parkway W.
Suite 200
Houston, Texas 77031
(832) 554-1130
www.pwarch.com



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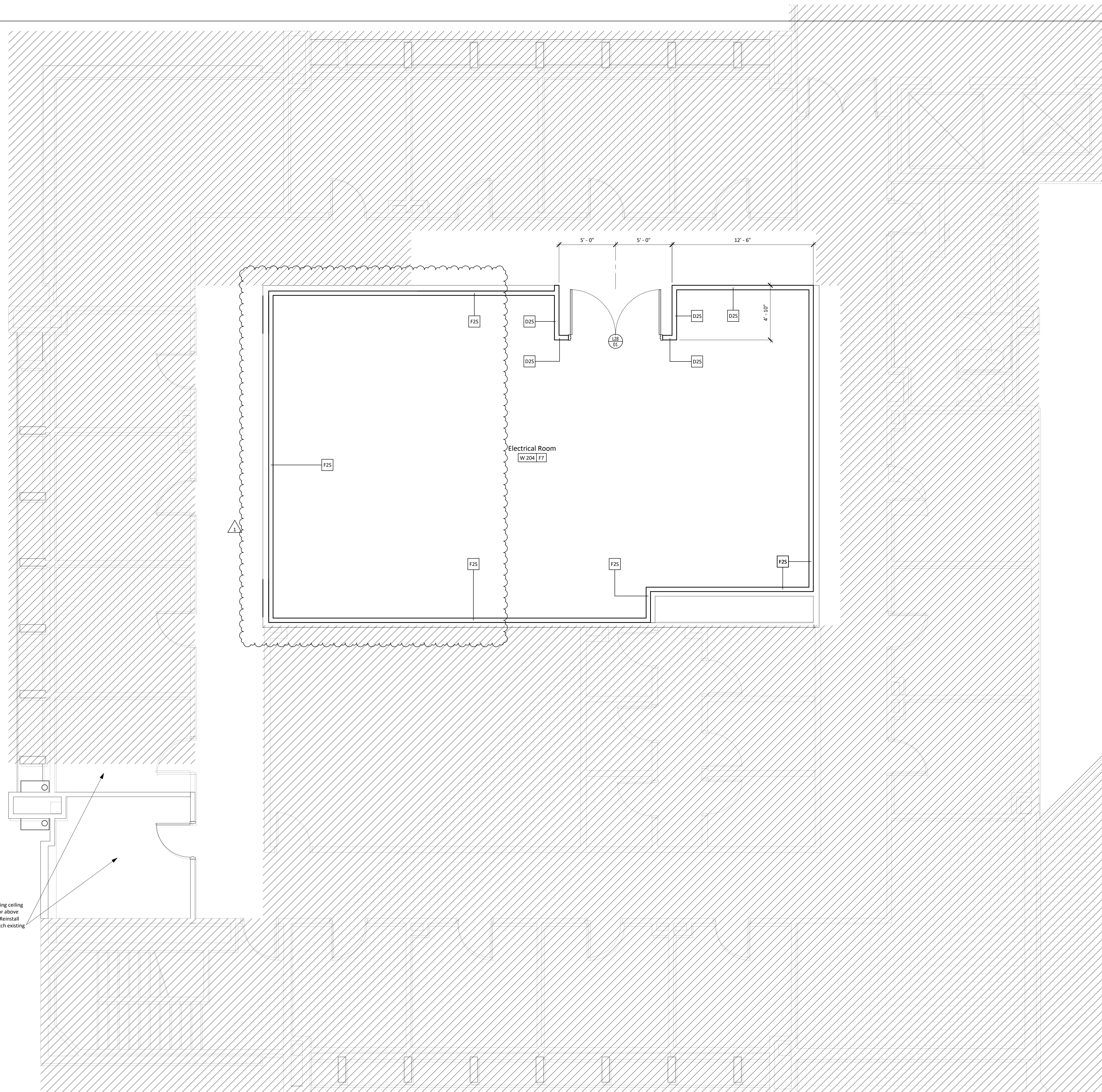
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Floor Plans - Level 1

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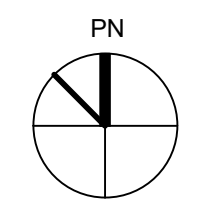
Remove existing ceiling as required for above ceiling work. Reinstall ceiling to match existing

General Notes - Floor Plan

- All new partitions are type "B2" unless noted otherwise.
- All dimensions are to face of gypsum board or face of masonry unless noted otherwise.
- See 1 A-520 for Partition Type Schedule.
- See 1 A-540 for Door Schedule.

Legend - Floor and Demolition Plan

- Existing to be removed
- Existing to remain
- New Partitions



Second Floor - Architectural Plan

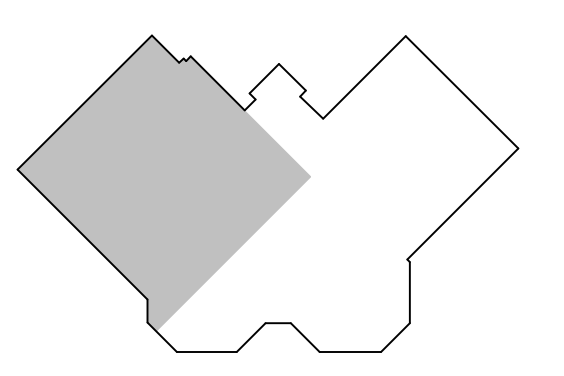
1/4" = 1'-0" 1



INFRASTRUCTURE ASSOCIATES, INC.
6117 RICHMOND AVENUE, SUITE 200
HOUSTON, TEXAS 77057
TBPE REGISTRATION NO. F-4666
(713) 622-0120 PH (713) 622-0557 FAX
WWW.IAHOUSTON.COM



UT Health Science School of Public Health
1200 Pressler St.
Houston, TX 77030



Partnership

11276 S. Sam Houston Parkway W.
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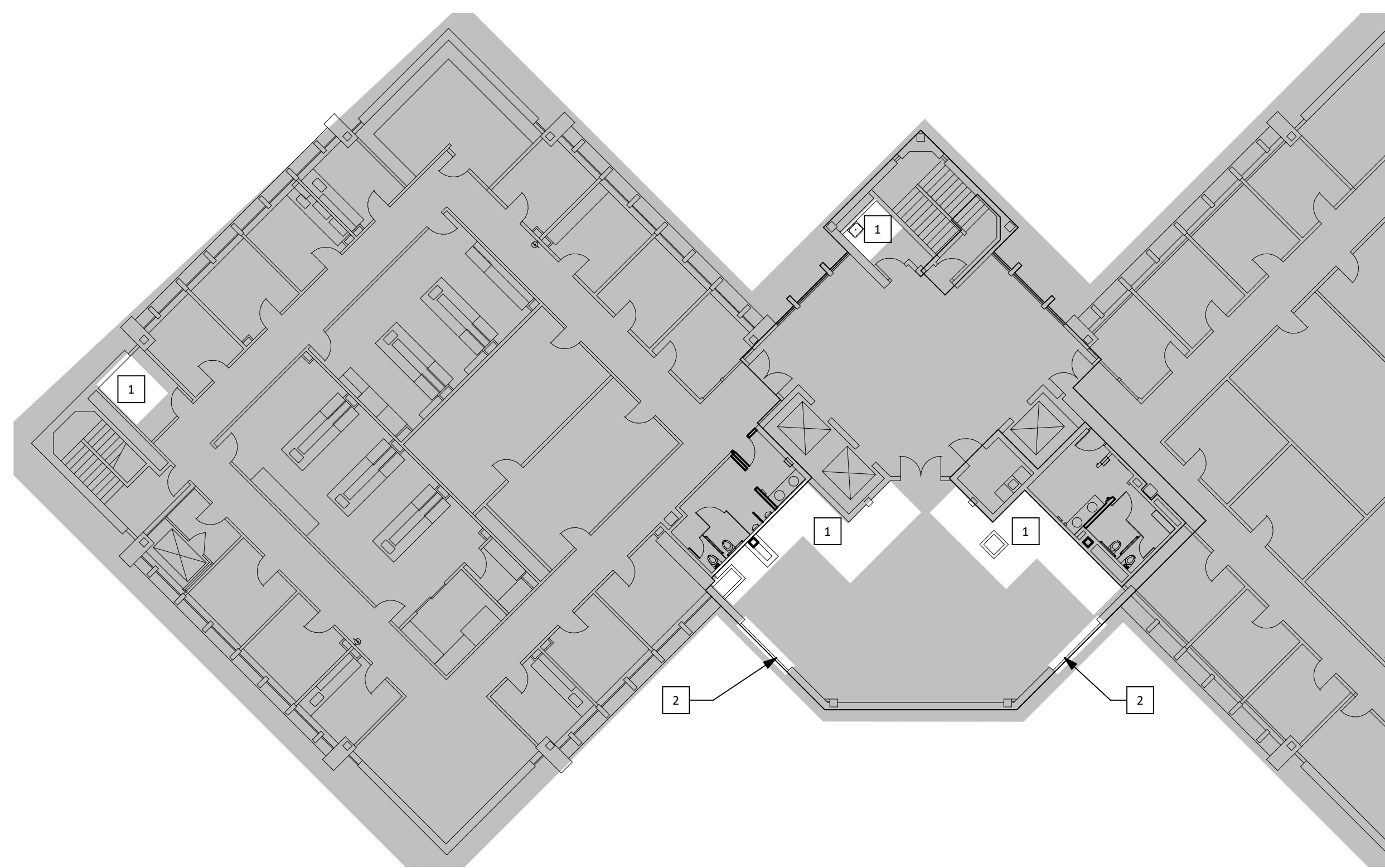
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Floor Plan - Level 2

Sheet

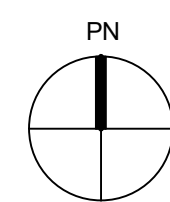
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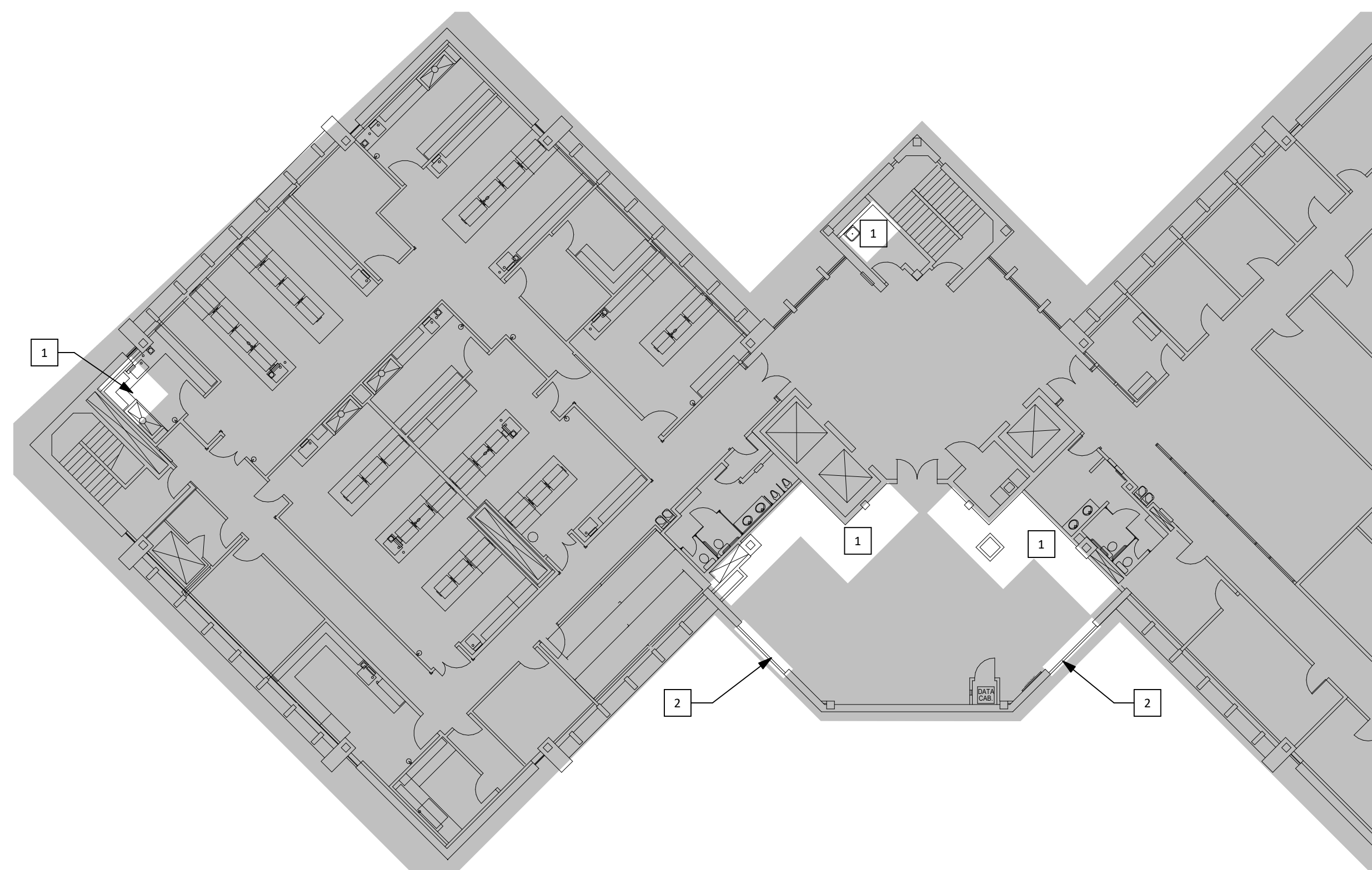
- Keyed Notes:**
- [1] Remove existing ceiling as required to complete scope of work. Patch and repair to match existing. See MEP for scope of work.
 - [2] Remove existing louvers to allow delivery of mechanical equipment. Seal off the opening until the louvers are reinstalled.

Legend:

Area not in work scope



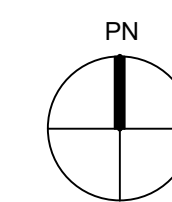
Level 6 - Floor Plan 1/16" = 1'-0" 18



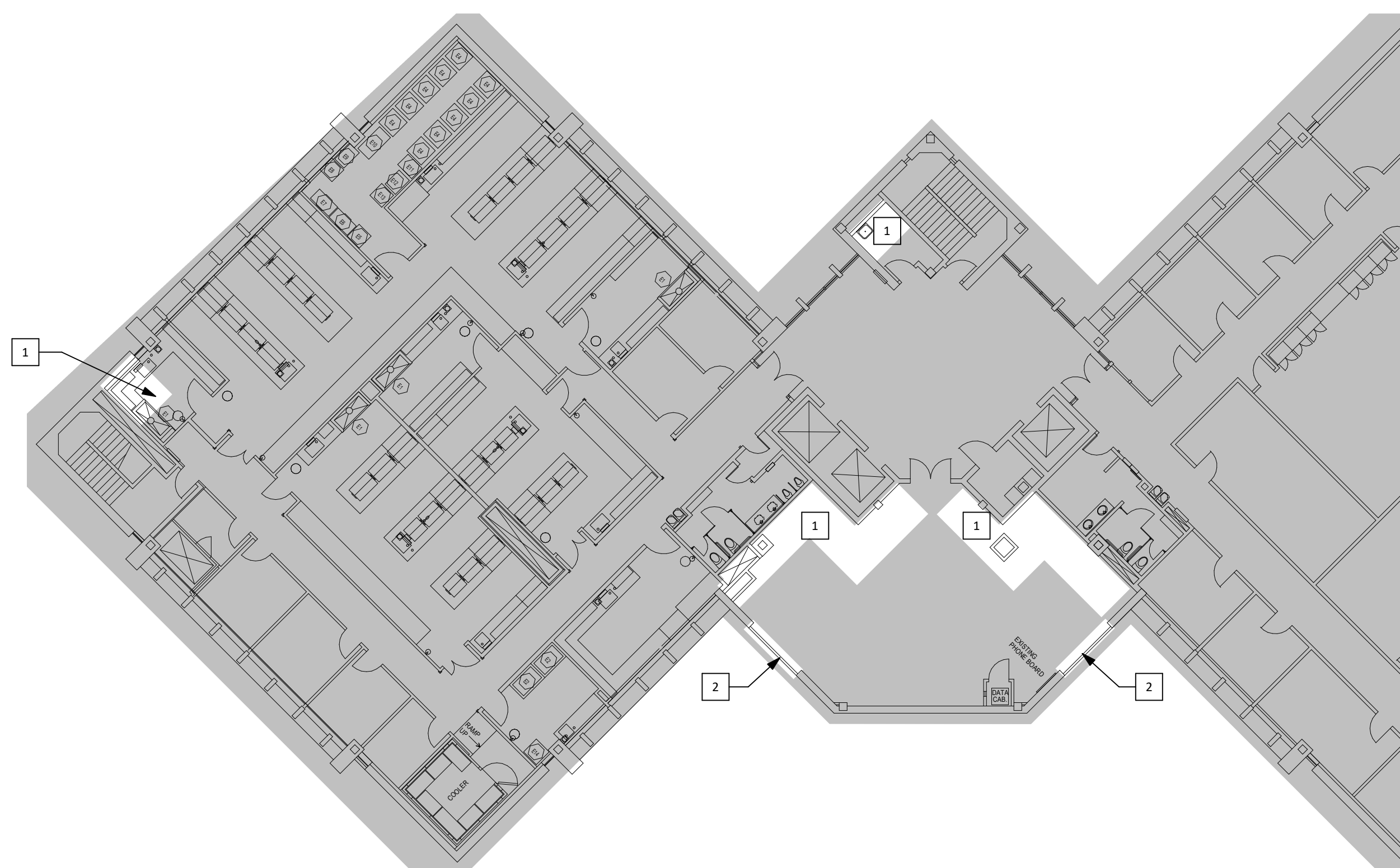
- Keyed Notes:**
- [1] Remove existing ceiling as required to complete scope of work. Patch and repair to match existing. See MEP for scope of work.
 - [2] Remove existing ceiling as required to complete scope of work. Patch and repair to match existing. See MEP for scope of work.

Legend:

Area not in work scope



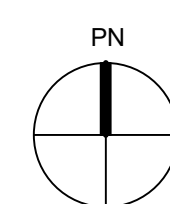
Level 4 - Floor Plan 1/16" = 1'-0" 3



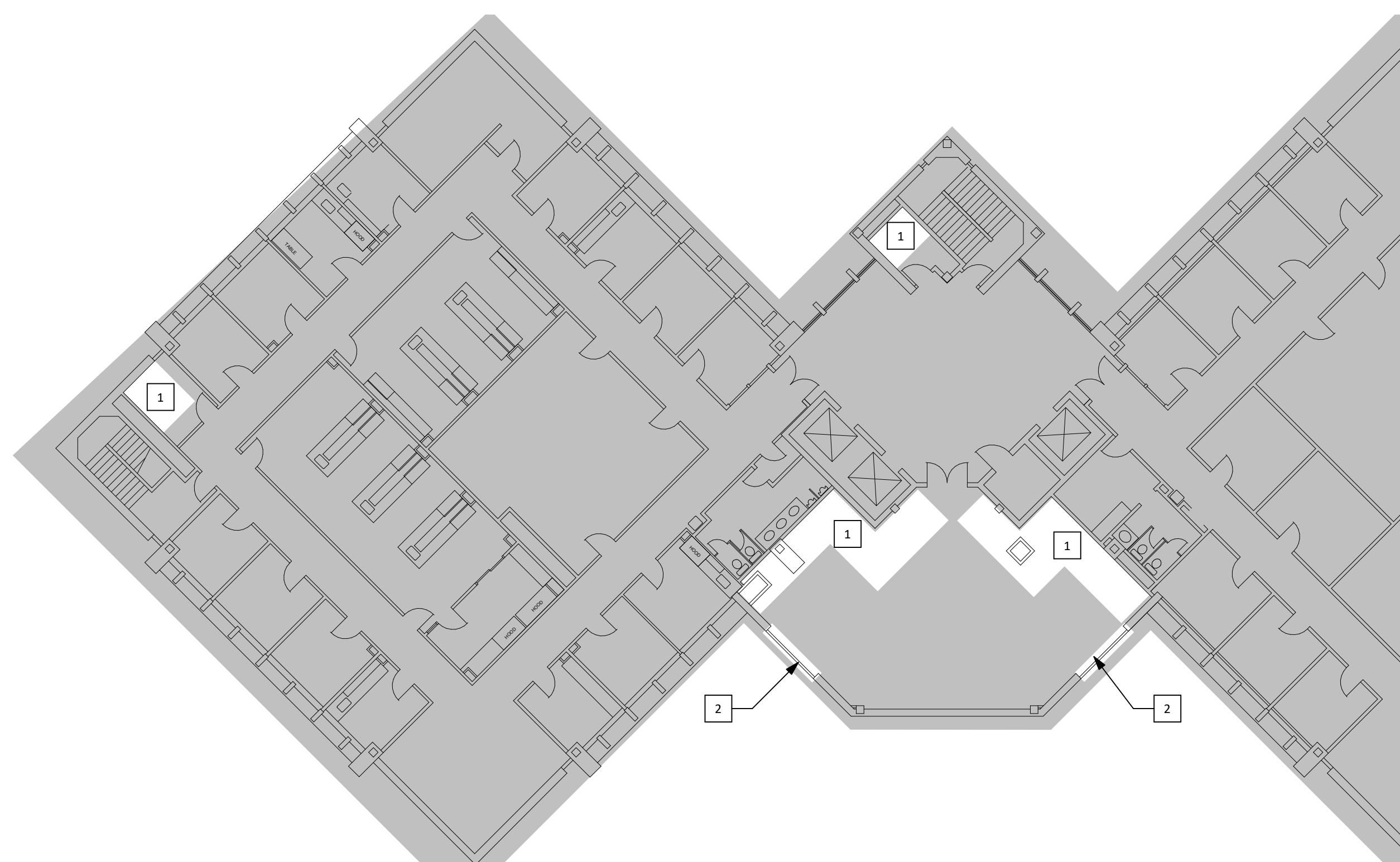
- Keyed Notes:**
- [1] Remove existing ceiling as required to complete scope of work. Patch and repair to match existing. See MEP for scope of work.
 - [2] Remove existing louvers to allow delivery of mechanical equipment. Seal off the opening until the louvers are reinstalled.

Legend:

Area not in work scope



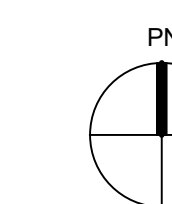
Level 5 - Floor Plan 1/16" = 1'-0" 16



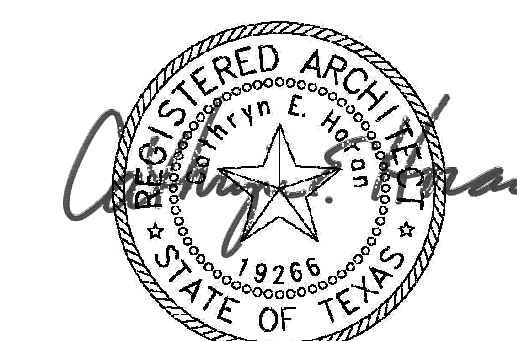
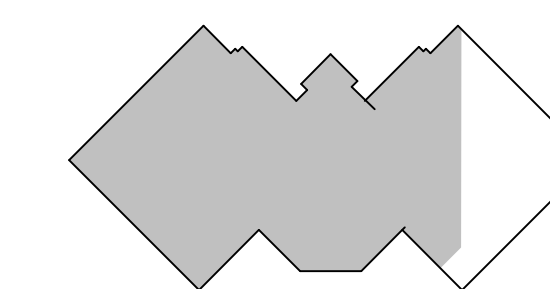
- Keyed Notes:**
- [1] Remove existing ceiling as required to complete above ceiling work. Patch and repair to match existing. See MEP for scope of work.
 - [2] Remove existing louvers to allow delivery of mechanical equipment. Seal off the opening until the louvers are reinstalled.

Legend:

Area not in work scope



Level 3 - Floor Plan 1/16" = 1'-0" 1



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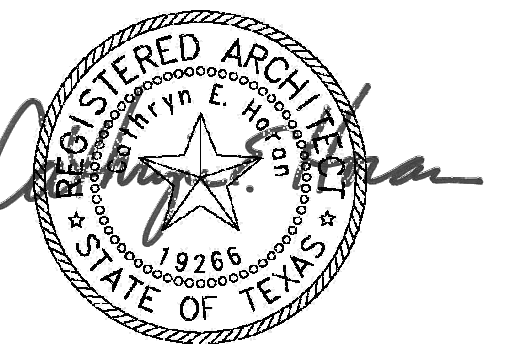
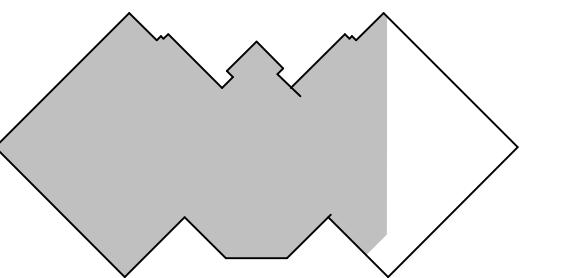
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Floor Plans - Levels
3-6

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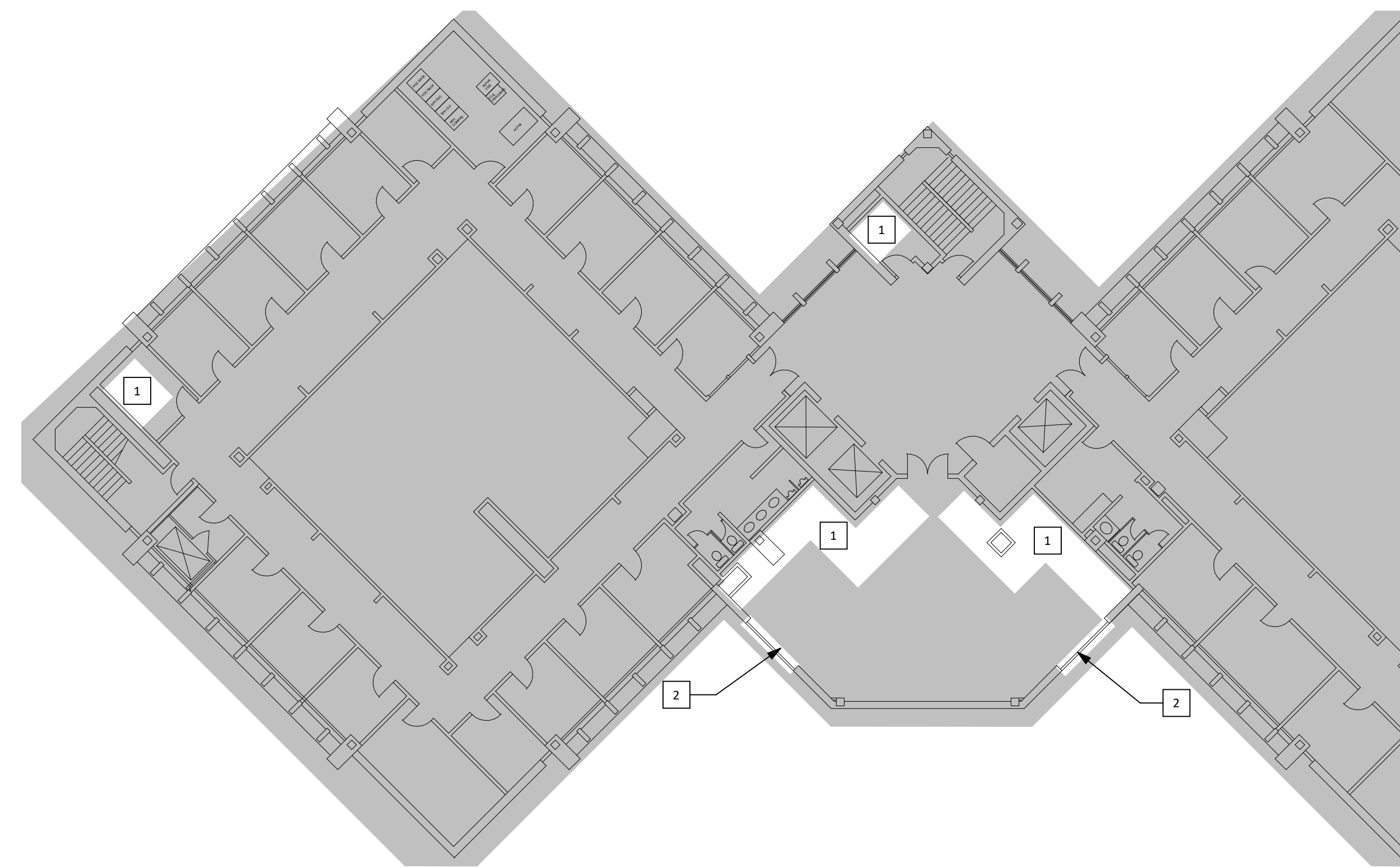
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Floor Plans - Levels
7-10

Sheet

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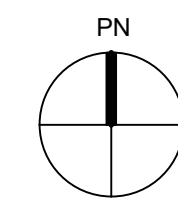


Keyed Notes:

- 1 Remove existing ceiling as required to complete scope of work. Patch and repair to match existing. See MEP for scope of work.
- 2 Remove existing louvers to allow delivery of mechanical equipment. Seal off the opening until the louvers are reinstalled.

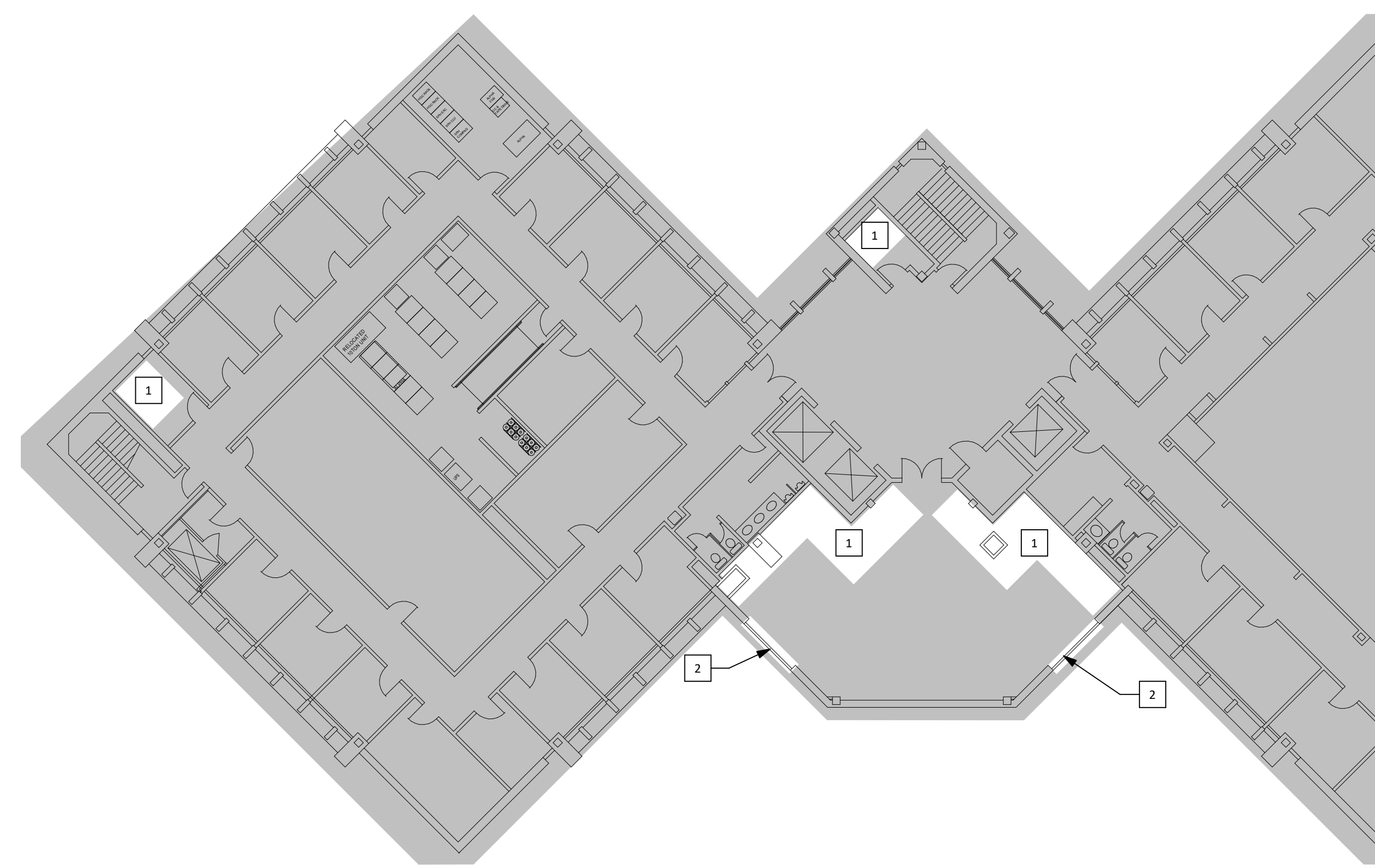
Legend:

Area not in scope



Level 10 - Floor Plan

1/16" = 1'-0" 18

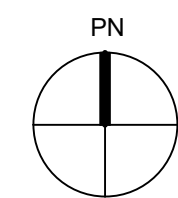


Keyed Notes:

- 1 Remove existing ceiling as required to complete scope of work. Patch and repair to match existing. See MEP for scope of work.
- 2 Remove existing louvers to allow delivery of mechanical equipment. Seal off the opening until the louvers are reinstalled.

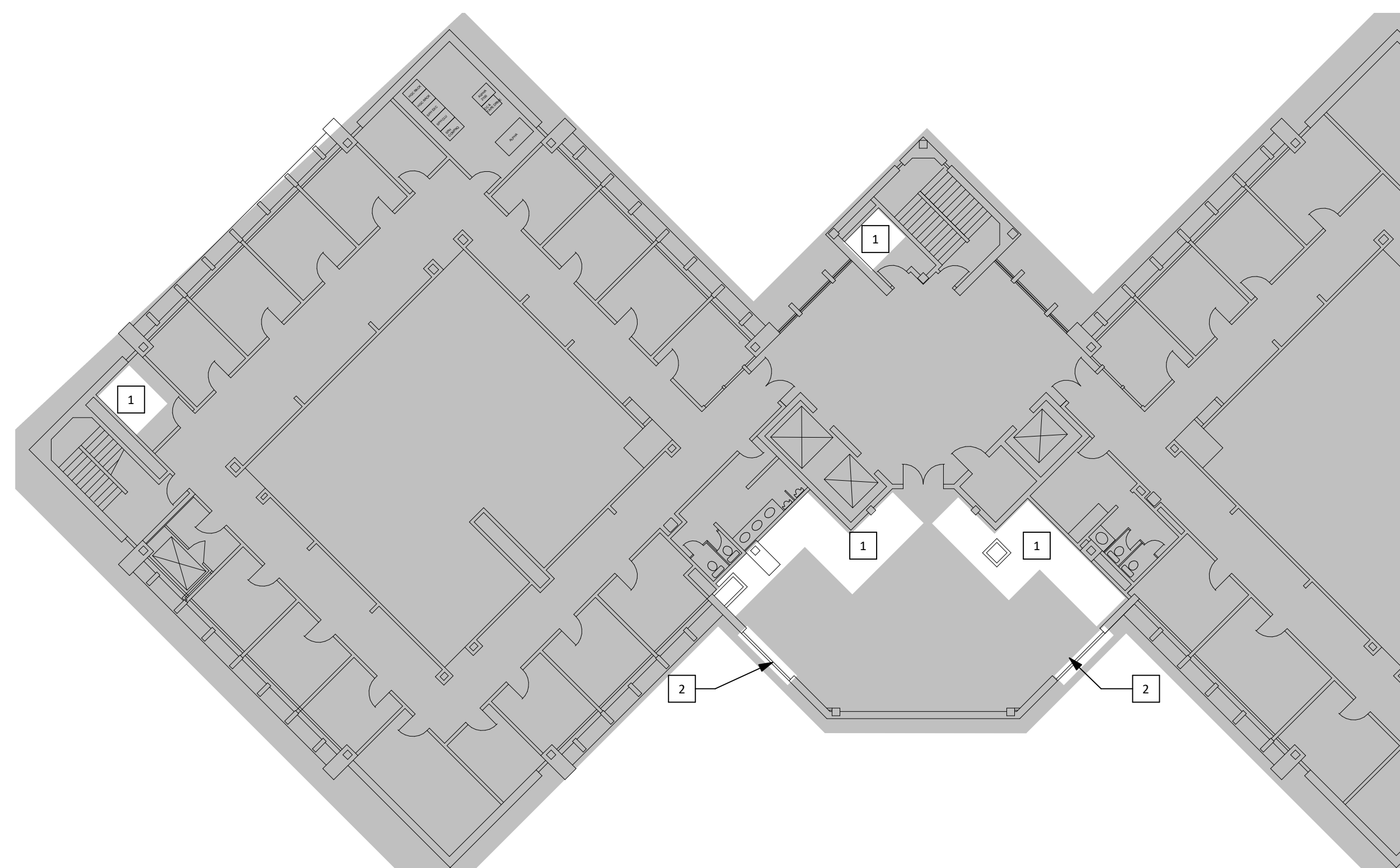
Legend:

Area not in scope



Level 8 - Floor Plan

1/16" = 1'-0" 3

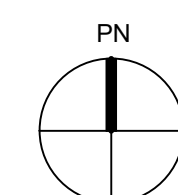


Keyed Notes:

- 1 Remove existing ceiling as required to complete scope of work. Patch and repair to match existing. See MEP for scope of work.
- 2 Remove existing louvers to allow delivery of mechanical equipment. Seal off the opening until the louvers are reinstalled.

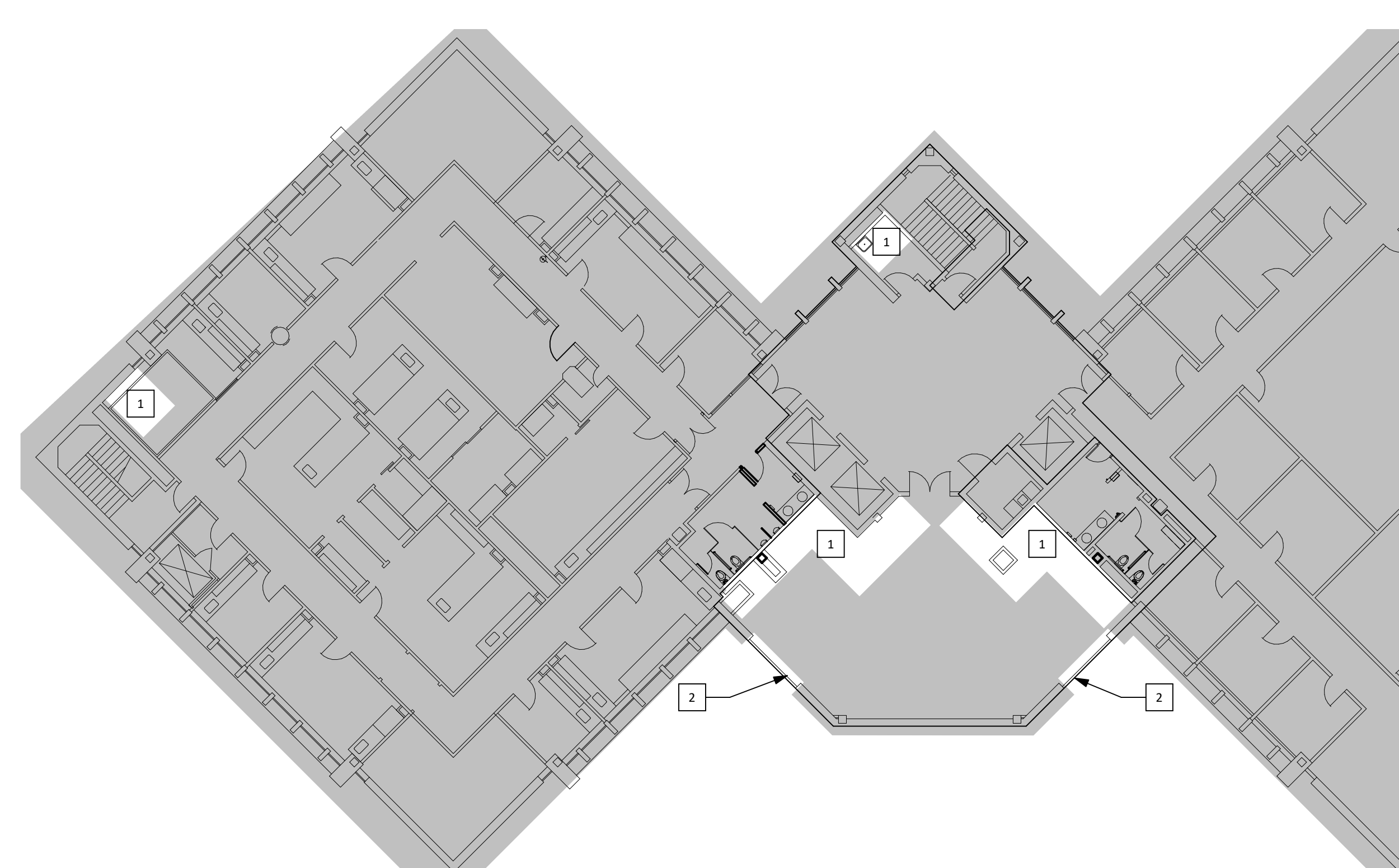
Legend:

Area not in scope



Level 9 - Floor Plan

1/16" = 1'-0" 16

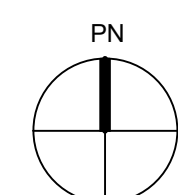


Keyed Notes:

- 1 Remove existing ceiling as required to complete scope of work. Patch and repair to match existing. See MEP for scope of work.
- 2 Remove existing louvers to allow delivery of mechanical equipment. Seal off the opening until the louvers are reinstalled.

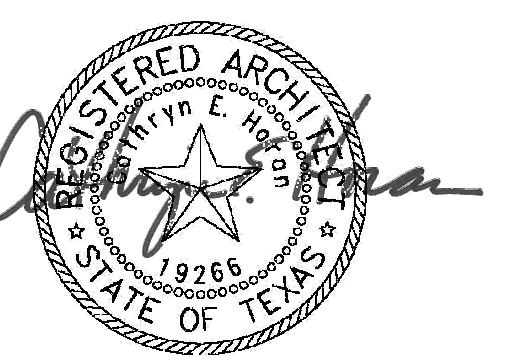
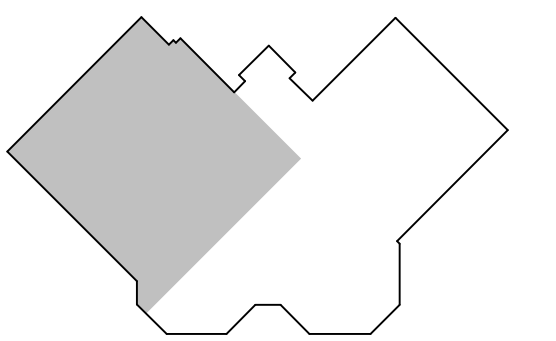
Legend:

Area not in scope



Level 7 - Floor Plan

1/16" = 1'-0" 1



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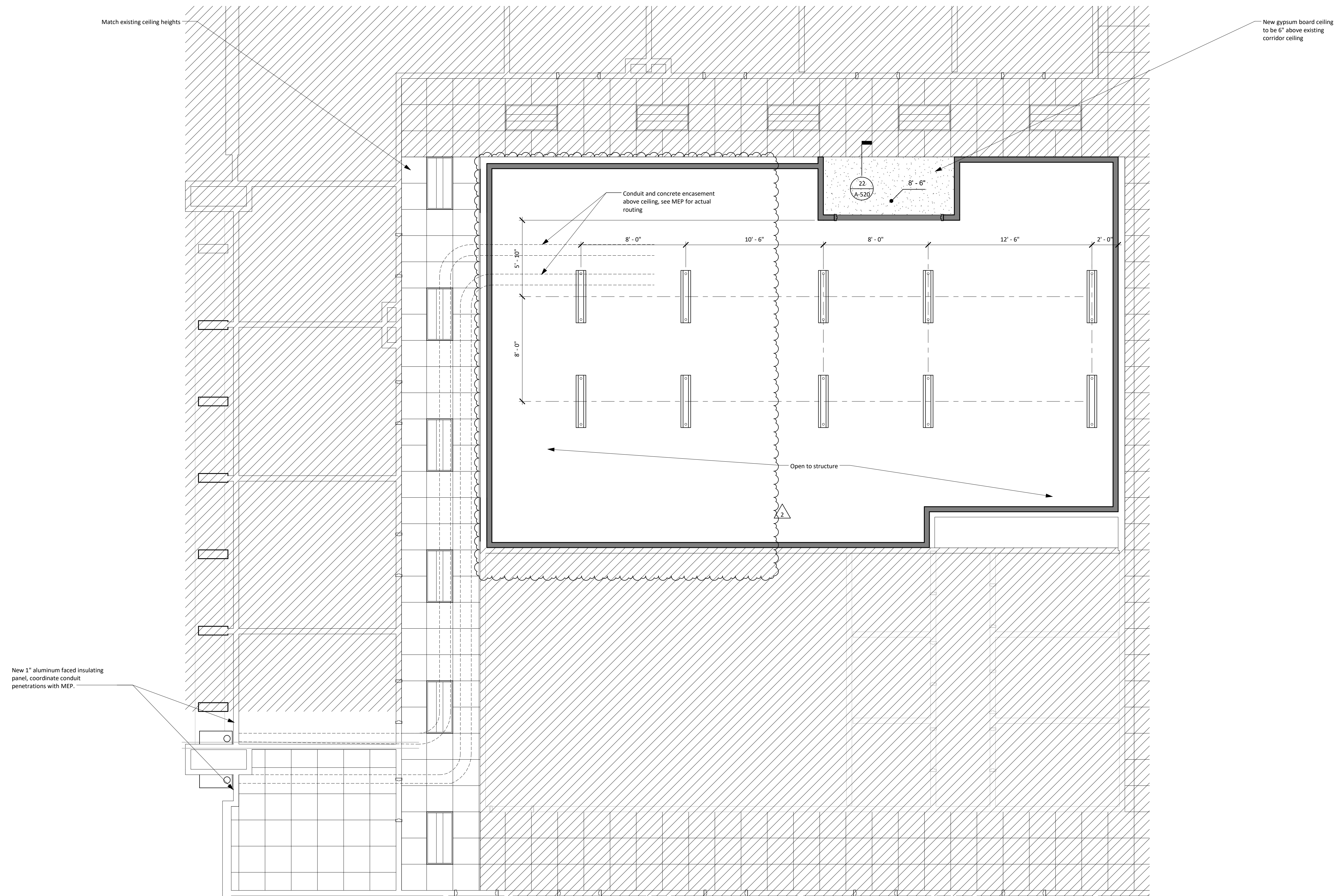
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Reflected Ceiling Plan - Level 2

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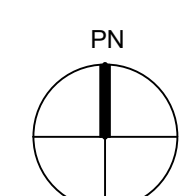


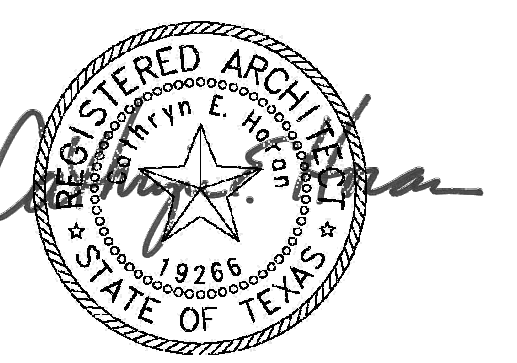
General Notes - Reflected Ceiling Plan

- All new ceilings to be 2' x 2' lay-in acoustical ceiling tile at 9'-0" a.f.f., unless noted otherwise. See Finish Schedule for types.
- See Interior Elevations for furr down heights and dimensions.
- Center all down-lights, sprinkler heads, and wall washers in center of ceiling tile, unless noted otherwise.

Legend - Reflected Ceiling Plan

— New partition to structure. See 1 A-520 for partition schedule.





07/20/2017

REVISIONS

05/31/2017	Issue for Bid
07/20/2017	Addendum 01

Sheet Information

Date	03/31/2017
Job Number	216-159
Drawn	DS
Checked	BL
Approved	BL
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Partition Types and Interior Construction Details

Sheet

A-520

Partition Detail N.T.S. 20

Partition at Ceiling N.T.S. 15

Wall Priority Legend

2-hour fire and smoke barrier wall:	Priority 1 (Highest)
2-hour fire wall:	Priority 2
1-hour fire and smoke barrier wall:	Priority 3
1-hour fire wall:	Priority 4
Non-rated wall:	Priority 5 (Lowest)

Wall Priority Legend N.T.S. 10

Metallic Boxes in Smoke and Fire-Rated Walls N.T.S. 5

Furring at Floor N.T.S. 19

Partition at Ceiling N.T.S. 14

Gypsum Board Partitions at Fluted Metal Deck N.T.S. 9

Typical Partition Details N.T.S. 4

Partition Extension at Ceiling/Structural Deck 12" = 1'-0" 23

Partition at Ceiling/Structural Deck 12" = 1'-0" 18

Partition at Ceiling/Structural Deck N.T.S. 13

X-HOUR FIRE AND SMOKE BARRIER PROTECT ALL OPENINGS

Labeling for Smoke and Fire Walls 3

Design Diagram	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	V	W	X	
Structure																						
Ceiling																						
Floor																						

Gyp. Board Ceiling Transition Detail 3" = 1'-0" 22

Partition Detail N.T.S. 17

Partition Detail N.T.S. 12

Furring at Ceiling/Structural Deck N.T.S. 21

Partition at Floor N.T.S. 16

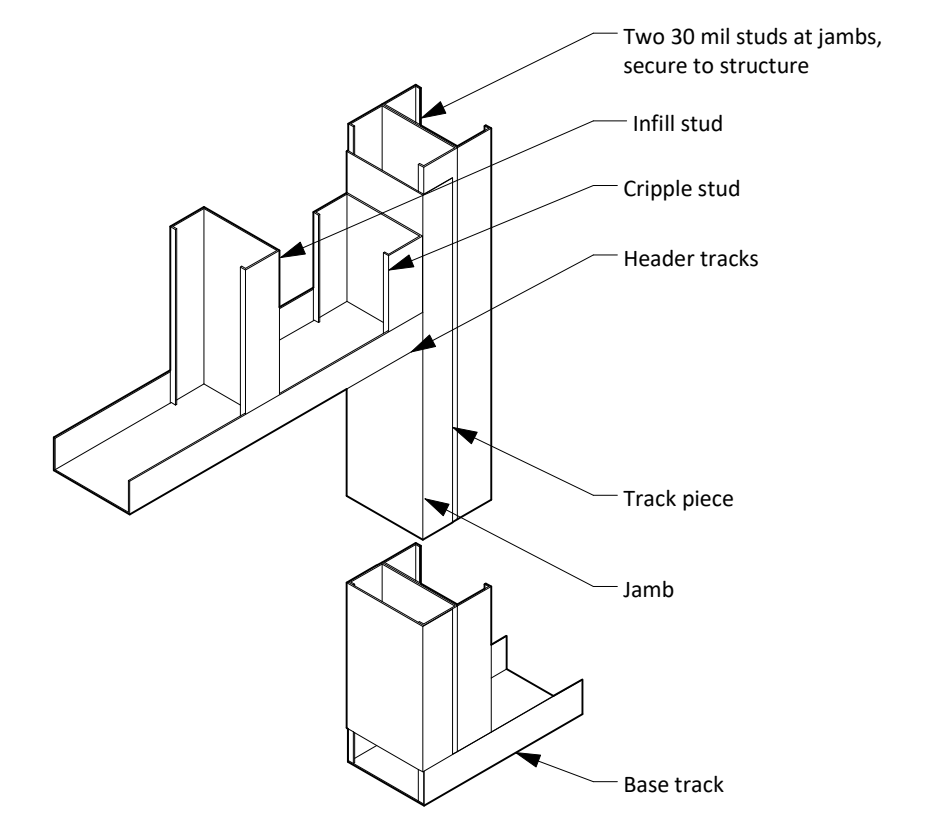
Partition at Floor N.T.S. 11

Partition Type Schedule

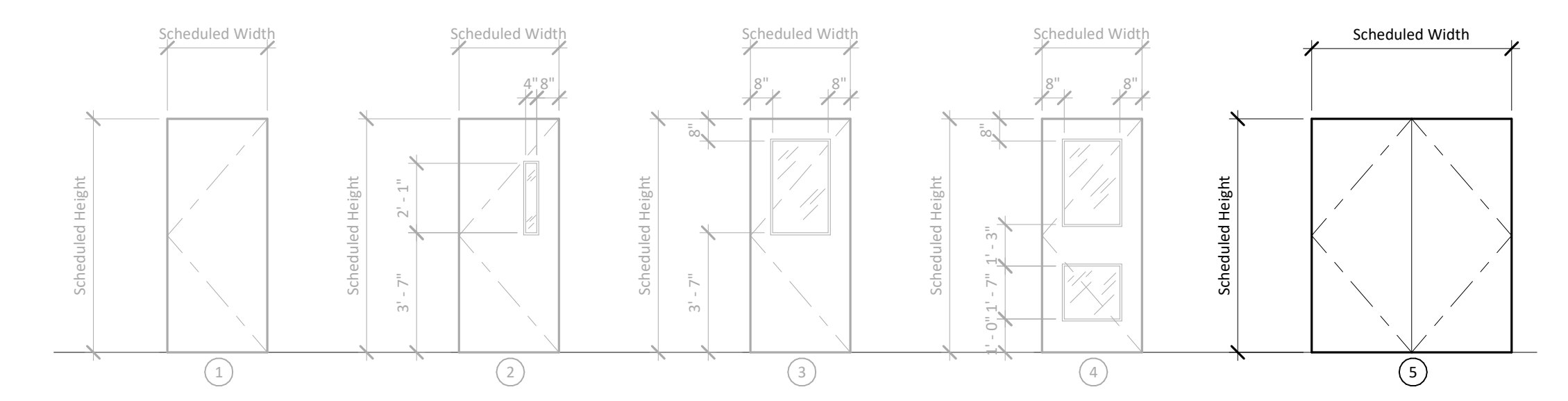
Type Mark	Description	Stud/Block Thickness	Stud Size	Stud Thickness (mil)	Stud Spacing	Limiting Height	Fire Rating			Details			
							Rating	Design	STC	Section at Floor	Ceiling/Structure	Design Test	Notes
	Partition to structure (2-hour rated)	6 3/8"	3 5/8"	30	1'-4"	15'-8"	1-Hour	UL U411	55	24 A-520	23 A-520	16 G-102	
D25	1-hour fire-rated partition	4 7/8"	3 5/8"	30	1'-4"	15'-8"	1-Hour	UL U465	47	11 A-520	12 A-520	13 A-520	1 G-102
F25	Shaft wall (1-hour rated)	4 5/8"	4"	33	2'-0"	17'-2"	1-Hour	UL U415A	40-44	24 A-520	20 A-520	25 A-520	11 G-102
G25	Shaft wall (2-hour rated)	5 1/4"	4"	33	2'-0"	18'-9"	2-Hour	UL U415B	50-55	24 A-520	20 A-520	25 A-520	11 G-102

General Notes

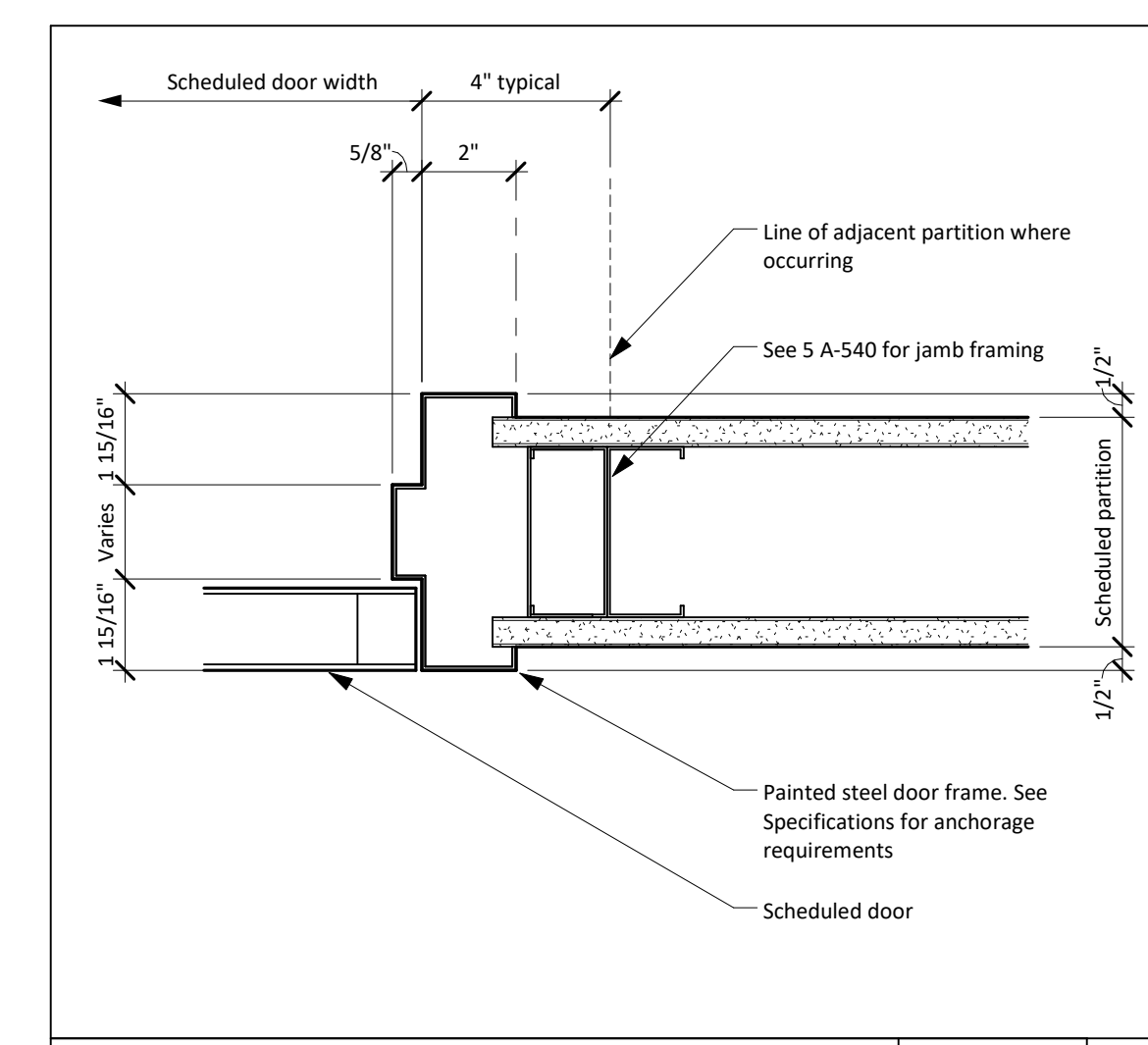
- All interior partitions are Type B2 unless noted otherwise.
- Allowable deflection for all partitions shall be 1/240 with a horizontal load of 5 psf, except as noted in individual partition types. The Contractor shall decrease the stud spacing or increase the stud thickness noted to insure partitions forming the substrate for brittle finishes such as ceramic tile meet an allowable deflection criteria of L/360 with a horizontal load of 5 psf.
- Where partitions are noted to be fire-rated:
 - Provide 5/8" Type X fire-resistive gypsum board.
 - Where partitions meet fluted metal deck or similarly irregular surfaces, seal the partition with saffing insulation and sealant as shown in detail 9 A-520 and in accordance with the reference design.
- Sound-Rated Partitions:
 - Sound-rated partitions and partitions with thermal insulation are indicated with the suffix "S" (Example: A1S). Refer to the floor plans for locations.
 - Provide 1-1/2" thick, glass-fiber sound attenuation blankets unless noted otherwise.
 - Fill all deck voids or similarly irregular surfaces, with insulation and sealant as shown in detail 9 A-520.
 - Seal partition perimeter and all penetrations with acoustic sealant or tape and insulation to fill voids.
 - Arrange back-boxes for electrical, data, telephone, and other outlets as shown in detail 4 A-520.
 - Where sound-rated, seal partition and fill voids as required for fire rating.
- Nails shall comply with ASTM F 547 or ASTM CS14. Screws shall meet the requirements of ASTM C 1002 or ASTM C 954.
- Unless otherwise required by reference designs for fire-rated partitions, fasteners shall be spaced 8" o.c. along at vertical joints and 12" o.c. at floor and ceiling runners and intermediate studs. Space all fasteners in panels that are substrates for brittle finishes, such as ceramic tile or stone, a maximum of 8" o.c.
- Joints in multi-layer gypsum board partitions shall be staggered 24" on each side and on opposite sides.
- Metallic outlet boxes shall be permitted to be installed in walls or partitions classified as having a fire-resistance of two-hours or less. The surface area of individual boxes shall not exceed 16 square inches. The aggregate surface area of the boxes shall not exceed 100 square inches in any 100 square feet. Boxes located on opposite sides of walls or partitions shall be separated by a minimum horizontal distance of 24 inches. See detail 5 A-520.
- Fiberglass-mat faced, siliconized gypsum-core boards shall be installed over or as part of the fire-resistance rated system in shower and tub areas to receive brittle finishes such as ceramic tile or plastic finished wall panels. When fire or sound ratings are indicated, the gypsum board required for the rating shall extend down to the floor behind fixtures.
- Label all fire-rated and smoke compartment walls or partitions above finished ceiling as shown on detail 3 A-520.
- Install penetration seals at all penetrations through fire-rated and smoke compartment walls or partitions in accordance with Specifications Section 07 84 00. See details 16, 17, 19, 21, 23, 26, and 28 G-102 for reference design of penetration seal systems based upon the penetrating element.
- Accurately align new and existing partitions in the same plane when shown on the Floor Plans. See detail 4 A-520.
- Maintain the fire or sound rating of partitions at all intersections. Maintain the construction of the highest rated partition where partitions of two different ratings meet. See the Wall Priority Legend - detail 10 A-520.



Typical Framing at Opening N.T.S. 5



Door Panel Elevations 1/4" = 1'-0" 4



Jamb at Interior Steel Door Frame 3" = 1'-0" 13

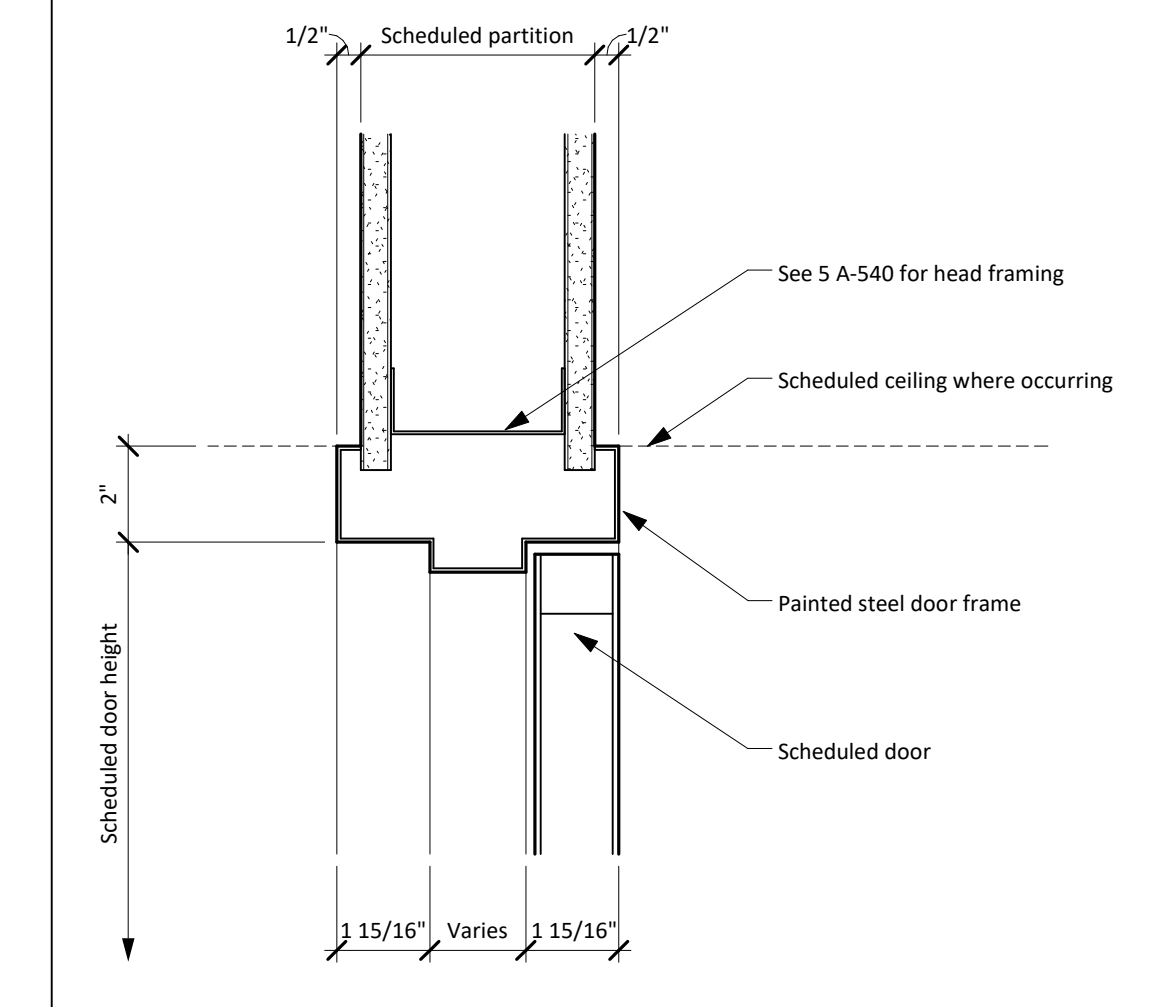
Door Type Schedule														
Type	Description	Door			Frame					Fire		Notes		
		Width	Height	Thick.	Elev. No.	Mat'l	Finish	Mat'l	Finish	Sill Detail	Jamb Detail(s)		Head Detail	Rating (min.)
L28	Interior pair of fire-rated flush doors - 45m	8'-0"	8'-0"	1 3/4"	5	Wood	DPL1	Steel	FPT1	11 A-540	13 A-540	12 A-540	45	

HW Set 1.0
Doors:
Description: Pair - Electrical - Rated

8	Hinge	T4A3786 5" x 4-1/2"	US10B	McKinney
1	Removable Mullion-keyed	12-L980	US10B	Sargent
1	Rim Exit - NL	12 8804 ETP	US10B	Sargent
1	Rim Exit - EO	12 8810 ETP	US10B	Sargent
2	Cylinder/Core	As Required		
2	Door Closer	351 PS	EB	Sargent
2	Kick Plate	K12590 10"x20"LDW B4E CSK	US10B	Rockwood
2	Floor Stop	442	US10B	Rockwood
1	Perimeter Gasketing	S88D		Pemko
1	Mullion Gasket	S88D		Pemko

Notes:

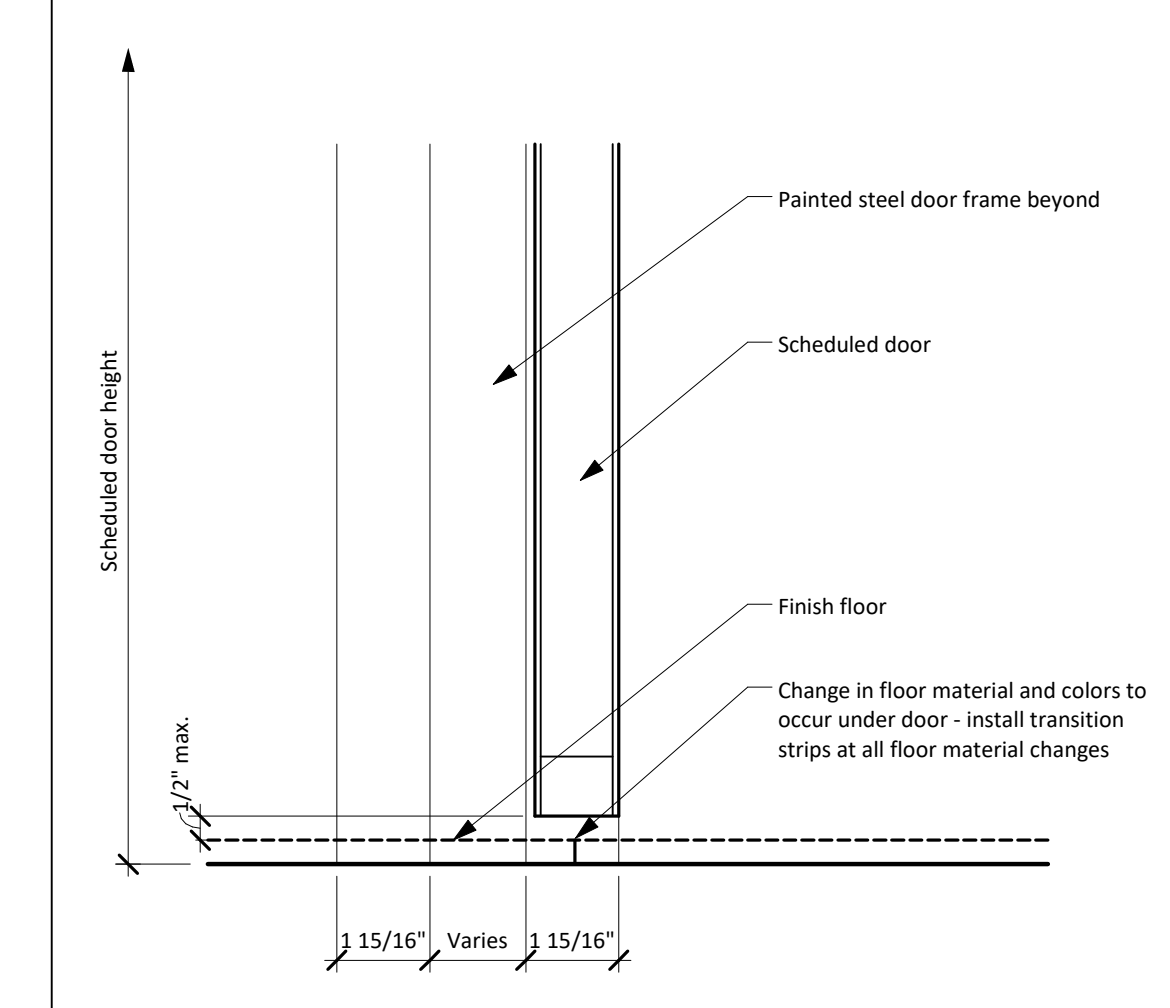
Door Type Schedule 3



Head at Interior Steel Door Frame 3" = 1'-0" 12

Room Finish Type Schedule									
Finish Type Mark	Floor	Base	Wall	Ceiling	Misc/Trim	Door	Frame	Notes	
F2	CPT1	RBS	PT1	ACT1	-	DPL1	FPT1		
F7									

Room Finish Type Schedule 2



Sill at Interior Steel Door Frame 3" = 1'-0" 11

Finish Material Schedule					
Type Mark	Description	Manufacturer	Pattern/Line	Color	Notes
Floors					
CPT1	Carpet				
SC	Sealed Concrete				
Base					
RBC	Rubber base, cove				
Walls					
PT1	Paint				
Ceilings					
ACT1	Acoustical Ceiling Tile				
Doors					
DPL1	Plastic laminate				
Frames					
FPT1	Paint (frame)				

Finish Material Schedule 1

Philo Wilke
Partnership
11276 S. Sam Houston Parkway W.
Suite 200
Houston, Texas 77031
(832) 554-1130
www.pwarch.com



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Date	Description
05/31/2017	Issue for Bid
07/20/2017	Addendum 01

Sheet Information

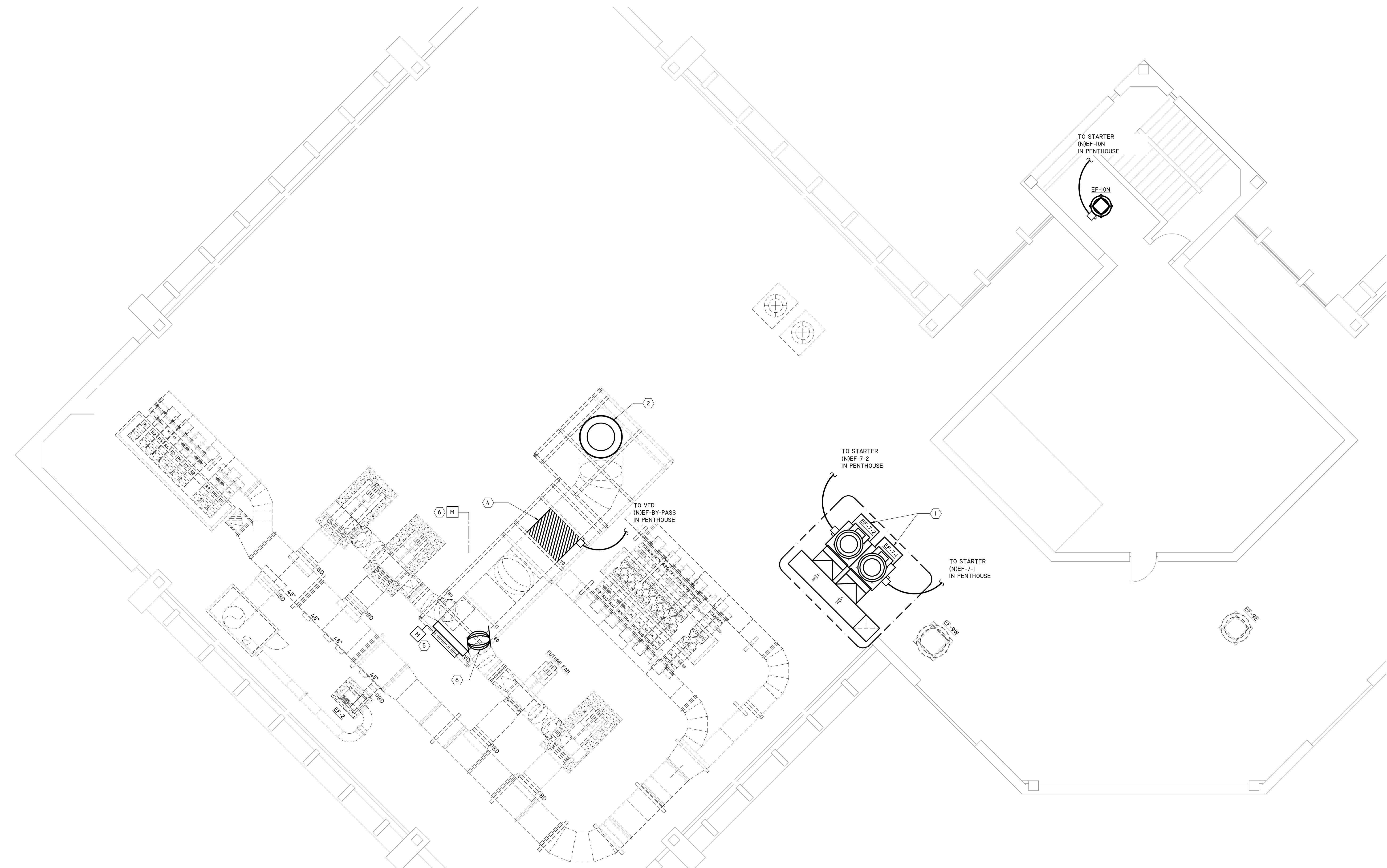
Date	03/31/2017
Job Number	216-159
Drawn	DS
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Door, Window Details, and Schedules

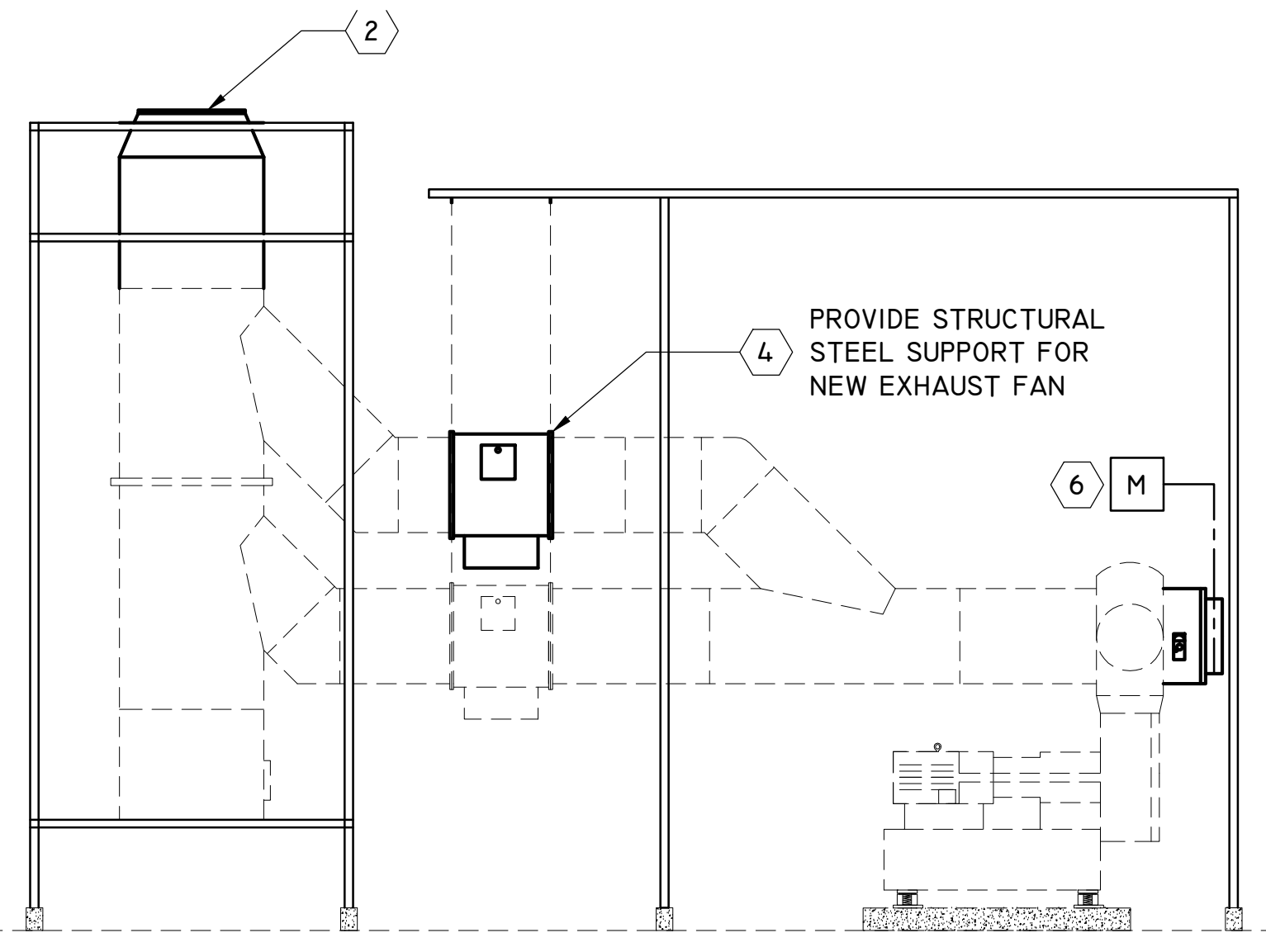
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A-540

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1 1/2
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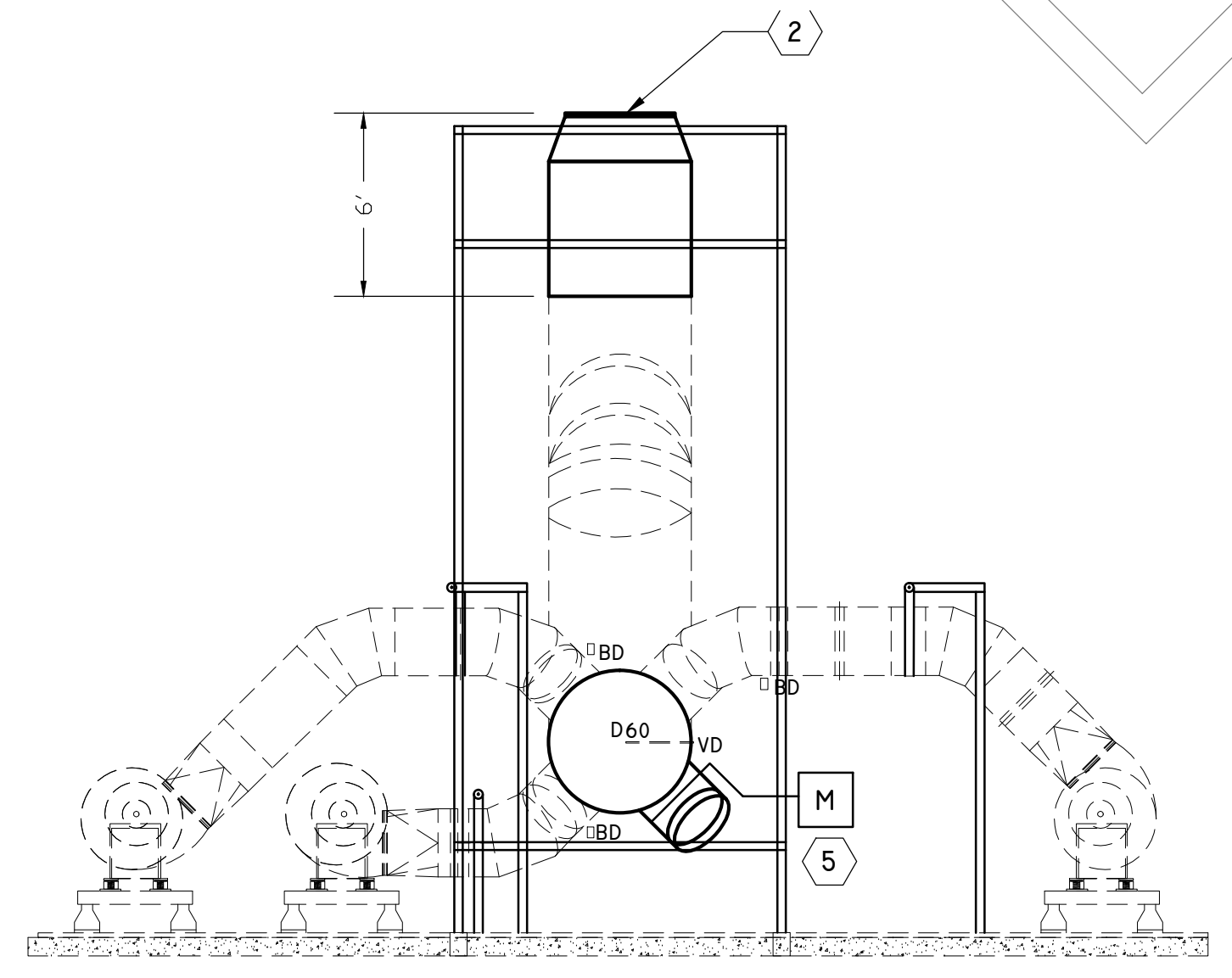


1 **ROOF PLAN - MEP - PROPOSED**
 SCALE: 3/16" = 1'-0"



SIDE-VIEW EXISTING EXHAUST FANS WITH SHOWING NEW EXHAUST FAN, NEW DUCT EXTENSION AND NEW MOTORIZED DAMPERS

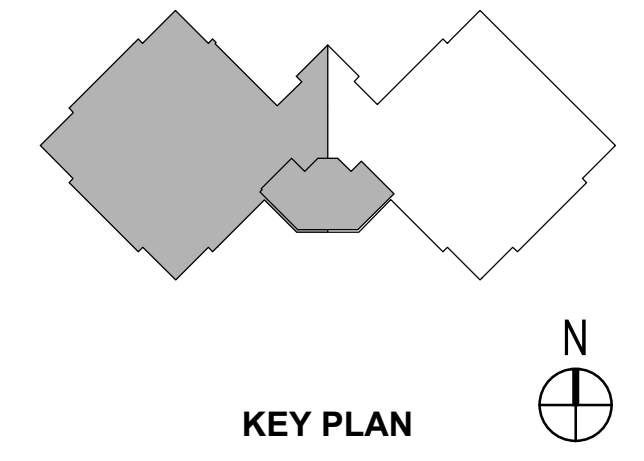
1 **EXHAUST FANS - SIDE VIEW**
 SCALE: 1/4" = 1'-0"



FRONT-VIEW EXISTING EXHAUST FANS WITH SHOWING NEW EXHAUST FAN, NEW DUCT EXTENSION AND NEW MOTORIZED DAMPERS

1 **EXHAUST FANS - FRONT VIEW**
 SCALE: 1/4" = 1'-0"

- KEYED NOTES:**
- 1 REF 2/M803 FOR LABORATORY EXHAUST FANS INSTALLATION DETAIL.
 - 2 PROVIDE 36" DUCT EXTENSION 6' HEIGHT WITH NOZZLE 60"x48".
 - 3 NOT USED
 - 4 PROVIDE NEW EXHAUST FAN IN BYPASS DUCT
 - 5 PROVIDE NEW 32" MOTORIZED DAMPER.
 - 6 PROVIDE NEW 32" MOTORIZED DAMPER & TAP INTO EXISTING 60" DIA DUCT CAP



KEY PLAN

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05/31/2017	ISSUED FOR BID
07/28/2017	ADDENDUM 1

Sheet Information

Date	31 MARCH 2017
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Drawn	KN, KT, CJT
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ROOF PLAN - MEP - NEW

Sheet

MEP100
 ISSUED FOR BID

2
1
Z/A
0

MECHANICAL SYMBOLS LEGEND

- ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH ALL APPLICABLE CODES, STANDARDS AND AUTHORITIES HAVING JURISDICTION.
- RECTANGULAR DUCT SIZES INDICATED ARE ACTUAL SHEET METAL DIMENSIONS IN INCHES ALL ROUND DUCT SIZES INDICATE NET FREE INSIDE DIAMETER AND DO NOT ACCOUNT FOR ANY INSULATION. ROUND DUCTS AND RECTANGULAR DUCTS ARE EXTERNALLY INSULATED PER SPECIFICATIONS UNLESS INDICATED OTHERWISE. ALL DUCTWORK SHALL BE INSTALLED AND MANUFACTURED IN ACCORDANCE WITH LATEST SMACNA STANDARDS.
- SCHEDULED MANUFACTURERS ARE BASIS OF DESIGN. SEE SPECIFICATIONS FOR QUALIFICATION OF ACCEPTABLE MANUFACTURERS.
- MAJOR EQUIPMENT SHOWN ON THE PLANS AND ELEVATIONS ILLUSTRATE GENERAL ARRANGEMENT AND SPACE ALLOCATIONS. FIELD VERIFY EXISTING CONDITIONS AND SPACE REQUIREMENTS FOR EACH SYSTEM COMPONENT USING MANUFACTURER CERTIFIED SHOP DRAWINGS. MAKE ADJUSTMENTS IN EQUIPMENT PLACEMENT AND CONNECTIONS NECESSARY TO INSTALL EQUIPMENT IN EXISTING SPACES.
- REFER TO SPECIFICATIONS FOR SUPPORTS, ANCHOR BOLTS AND HANGERS FOR ALL EQUIPMENT. OTHER MISCELLANEOUS STEEL BRACING, SUPPORTS, AND REINFORCING STEEL REQUIRED TO SUPPORT EQUIPMENT SHALL BE FURNISHED AS PART OF THE SCOPE OF WORK OF DIVISION 23.
- FLEX DUCTS SIZE SHALL BE OF SAME SIZE AS DIFFUSER NECK.
- SEAL ALL PENETRATIONS OF FLOORS, SMOKE WALLS, FIRE WALLS, AND EXTERIOR WALLS.
- DO NOT RUN DUCT OR PIPE OVER ELECTRICAL PANELS. COORDINATE LOCATION OF DUCTS AND EQUIPMENT IN MECHANICAL ROOMS WITH THE ELECTRICAL AND PLUMBING CONTRACTOR BEFORE INSTALLATION.
- PROVIDE MANUAL BALANCE DAMPERS FOR ALL DUCT RUN-OUTS TO SUPPLY AND EXHAUST. AIR DEVICES. PROVIDE YOUNG REGULATORS WITH REMOTE ADJUSTMENT WHERE ABOVE CEILING IS INACCESSIBLE.
- SECURE ALL PERMITS AND PROVIDE TEMPORARY AIR HANDLING UNITS AND TEMPORARY UTILITY CONNECTIONS.
- MAXIMUM LENGTH OF FLEXIBLE DUCT SHALL NOT EXCEED 6'-0". PROVIDE RIGID ROUND INSULATED AIR DUCT RUN-OUT AS REQUIRED. FLEXIBLE DUCT SHALL HAVE THE EQUIVALENT OF ONLY TWO 90 DEG. ELBOWS MAXIMUM. FLEX DUCTS ARE SAME SIZE AS DIFFUSER NECK. PROVIDE RIGID ELBOW AT THE DIFFUSER NECK.
- INSTALL SMOKE DETECTOR FOR ALL UNITS WITH CAPACITY OF 2200 CFM AND HIGHER AS REQUIRED BY CODE. FIRE ALARM CONTRACTOR TO FURNISH AND TERMINATE.
- INSULATE EQUIPMENT, PIPING AND DUCTWORK PER SPECIFICATIONS AND AS INDICATED.
- PROVIDED RECORD DRAWINGS OF THE ACTUAL INSTALLATION TO THE BUILDING OWNER OR THE DESIGNATED REPRESENTATIVE OF THE BUILDING OWNER. THESE MANUALS SHALL BE IN ACCORDANCE WITH INDUSTRY-ACCEPTED STANDARDS, AND SHALL INCLUDE, AT A MINIMUM, THE FOLLOWING:
(A) SUBMITTAL DATA STATING EQUIPMENT SIZE AND SELECTED OPTIONS FOR EACH PIECE OF EQUIPMENT REQUIRING MAINTENANCE.
(B) OPERATION MANUALS AND MAINTENANCE MANUALS FOR EACH PIECE OF EQUIPMENT REQUIRING MAINTENANCE, EXCEPT EQUIPMENT NOT FURNISHED AS PART OF THE PROJECT. REQUIRED ROUTINE MAINTENANCE ACTIONS SHALL BE CLEARLY IDENTIFIED.
(C) NAMES AND ADDRESSES OF AT LEAST ONE SERVICE AGENCY.
(D) HVAC CONTROLS SYSTEM MAINTENANCE AND CALIBRATION INFORMATION, INCLUDING WIRING DIAGRAMS, SCHEMATICS, AND CONTROL SEQUENCE DESCRIPTIONS. DESIRED OR FIELD- DETERMINED SET-POINTS SHALL BE PERMANENTLY RECORDED ON CONTROL DRAWINGS AT CONTROL DEVICES OR, FOR DIGITAL CONTROL SYSTEMS, IN PROGRAMMING COMMENTS.
(E) A COMPLETE NARRATIVE OF HOW EACH SYSTEM IS INTENDED TO OPERATE, INCLUDING SUGGESTED SET-POINTS.
- PRESSURE TEST DUCTWORK PER SPECIFICATIONS.
- DUCTWORK AND PLENUMS SHALL BE SEALED IN ACCORDANCE WITH THE MECHANICAL CODE AND SMACNA METHOD AND ENERGY CONSERVATION CODE. SEAL ALL LONGITUDINAL AND TRAVERSE JOINTS.
- COORDINATE INSTALLATIONS WITH OWNER'S INDEPENDENT TEST AND BALANCE AGENT. PROVIDE ADDITIONAL TEST PORTS AND BALANCING DEVICES AS IDENTIFIED BY TAB AGENCY.
- TEST, COORDINATE, AND ADJUST CONTROL SYSTEMS AND FIELD DEVICES PRIOR TO SYSTEM COMMISSIONING AND DEMONSTRATIONS.
- PROVIDE ROOM SENSOR, T-STATS, ETC. AS SPECIFIED AT INDICATED LOCATIONS. COORDINATED EXACT PLACEMENT WITH OTHER WALL MOUNTED DEVICES SUCH AS LIGHT SWITCHES, ETC.
- FIRE SPRINKLER SHALL BE PROVIDED UNDER ALL DUCT WORK IN MECHANICAL ROOMS FROM 32" DUCT SIZE AND ABOVE.

PRESSURE-TEMPERATURE OPERATING REQUIREMENTS			
SERVICE	MAXIMUM WORKING PRESSURE (MWP)		MINIMUM PRESSURE CLASS
	PSIG	DEG F	
HIGH PRESSURE STEAM (HPS)	250	450	300
MEDIUM PRESSURE STEAM (MPS)	75	405	250
LOW PRESSURE STEAM (LPS)	15	387	150
CHILLED WATER	150	-	125
HOT WATER	150	200	150

MECHANICAL SYMBOLS LEGEND

	SUPPLY AIR DUCT UP (PLAN)		THERMOSTAT OR ROOM SENSOR - MOUNT 45° AFF		STRAINER W/BLOW DOWN VALVE
	SUPPLY AIR DUCT DOWN (PLAN)		HUMIDISTAT		THREE-WAY VALVE (ELECTRIC)
	RETURN OR OUTSIDE AIR DUCT UP (PLAN)		FIRESTAT		TWO-WAY VALVE (ELECTRIC)
	RETURN OR OUTSIDE AIR DUCT DOWN (PLAN)		IONIZATION DETECTOR		FLEXIBLE CONNECTION
	EXHAUST AIR DUCT UP (PLAN)		SMOKE DETECTOR		EXPANSION JOINT
	EXHAUST AIR DUCT DOWN (PLAN)		TEMPERATURE, CO2, HUMIDITY SENSOR		THERMOMETER
	RETURN AIR/TRANSFER AIR BOOT		PIPE UP		THERMOMETER WELL
	CEILING SUPPLY AIR DEVICE		PIPE DOWN		TEST PLUG
	SIDEWALL SUPPLY/EXHAUST REGISTER		CAP OR BLIND FLANGE		PRESSURE GAUGE W/GAUGE COCK
	CEILING RETURN REGISTER		90° ELBOW		MANUAL AIR VENT
	CEILING EXHAUST REGISTER		45° ELBOW		AUTOMATIC AIR VENT
	RETURN AIR GRILLE WITH BOOT		45° DOUBLE OFFSET		SOLENOID VALVE
	BRANCH DUCT TAP		TEE		FLOW SWITCH
	DUCT SPLIT		TEE UP		STEAM TRAP
	DUCT SPLIT		TEE DOWN		STEAM MOISTURE SEPARATOR
	SPLITTER - DIMENSION AS NOTED ON DRAWING		TOP CONNECTION		RED. PRESS BACKFLOW PREVENTER
	BACK DRAFT DAMPER		CROSS		CHILLED WATER RETURN
	ACCESS DOOR		UNION (SCREWED)		CHILLED WATER SUPPLY
	TRANSITION IN DUCT		UNION (FLANGED)		CONDENSER WATER RETURN
	FLEXIBLE DUCT CONN. TO RECTANGULAR DUCT WITH SPIN-IN CONNECTOR		DUCT MOUNTED TEMPERATURE SENSOR		CONDENSER WATER SUPPLY
	ACCESS PANEL		DUCT MOUNTED PRESSURE SENSOR		HOT WATER RETURN
	DUCT ELBOW WITH TURNING VANES		DUCT MOUNTED SMOKE DETECTOR		HOT WATER SUPPLY
	DUCT ELBOW WITHOUT VANES		PIPE BREAK		CONDENSATE DRAIN
	FLEXIBLE CONNECTION, FLEXIBLE DUCT		VOLUME DAMPER		HEAT RECOVERY SUPPLY
	VOLUME DAMPER		CONCENTRIC REDUCER		HEAT RECOVERY RETURN
	MOTORIZED DAMPER		ECCENTRIC REDUCER		STEAM CONDENSATE
	FIRE DAMPER		PUMP		HIGH PRESSURE STEAM
	SMOKE DAMPER		BALL VALVE		MED PRESSURE STEAM
	COMBINATION FIRE/SMOKE DAMPER		BUTTERFLY VALVE		LOW PRESSURE STEAM
	AIR FLOW SWITCH		ISOLATION VALVE OR GATE VALVE		
	RISE IN DUCT ELEVATION		GATE VALVE WITH QUICK DISCONNECT		
	DROP IN DUCT ELEVATION		TWO-WAY VALVE (PNEUMATIC)		
	UNDERCUT DOOR 1'		THREE-WAY VALVE (PNEUMATIC)		
	REFER TO DETAIL #1 ON DRAWING M-801		GLOBE VALVE OR BALANCING VALVE		
	NEW		CHECK VALVE		
	DEMOLISH EXISTING		PRESSURE RELIEF VALVE		
	EXISTING TO REMAIN		PRESSURE REDUCING VALVE		
	DIFFUSER TYPE, CFM		LOCK SHIELD		

NOTE:
NOT ALL ITEMS NOT NECESSARILY USED.



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Health Science Center at Houston
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UT HEALTH
SCIENCE
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HOUSTON, TX 77030



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05/31/2017	ISSUED FOR BID
07/28/2017	ADDENDUM 1

Sheet Information	
Date	31 MARCH 2017
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NOTES AND LEGEND

Sheet
M001
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AIR HANDLING UNIT SCHEDULE (AHU/OAHU)																
TAG	AREA SERVED	LOCATION	SYSTEM TYPE	SUPPLY CFM	O/A CFM	SUPPLY FAN	PRE-COOL COIL	HEAT PIPE COIL	COOLING COIL	PREHEAT COIL	HEATING COIL	O/A FILTER	PRE-FINAL FILTER	FINAL FILTER	MANUFACTURER	NOTES
AHU-0E	BSMT E	BASEMENT	DOUBLE DUCT	13,400	2,000	SP-0E	N/A	N/A	CC-0E	N/A	HC-0E	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-0W	BSMT W	BASEMENT	DOUBLE DUCT	16,800	4,500	SP-0W	N/A	N/A	CC-0W	N/A	HC-0W	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-0S	BSMT S	BASEMENT	VAV REHEAT	8,500	1,500	SP-0S	N/A	N/A	CC-0S	N/A	HC-0S	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-1W	1ST FLOOR W	2ND FLOOR	DOUBLE DUCT	12,250	1,500	SP-1W	N/A	N/A	CC-1W	N/A	HC-1W	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-1E	1ST FLOOR E	2ND FLOOR	DOUBLE DUCT	14,200	1,500	SP-1E	N/A	N/A	CC-1E	N/A	HC-1E	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-1SE	1ST FLOOR SE	2ND FLOOR	DOUBLE DUCT	16,850	3,000	SP-1SE	N/A	N/A	CC-1SE	N/A	HC-1SE	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-1SW	1ST FLOOR SW	2ND FLOOR	DOUBLE DUCT	16,850	2,500	SP-1SW	N/A	N/A	CC-1SW	N/A	HC-1SW	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-2E	2ND FLOOR E	2ND FLOOR	DOUBLE DUCT	15,000	2,500	SP-2E	N/A	N/A	CC-2E	N/A	HC-2E	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-2W	2ND FLOOR W	2ND FLOOR	DOUBLE DUCT	12,250	2,500	SP-2W	N/A	N/A	CC-2W	N/A	HC-2W	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-3E	3RD FLOOR E	3RD FLOOR	DOUBLE DUCT	15,000	2,500	SP-3E	PC-3E	HP-3E	CC-3E	PH-3E	HC-3E	AF-1	AF-1	AF-2	ENERGY LABS	ALL
AHU-3W	3RD FLOOR W	3RD FLOOR	DOUBLE DUCT	15,000	8,000	SP-3W	PC-3W	HP-3W	CC-3W	PH-3W	HC-3W	AF-1	AF-1	AF-2	ENERGY LABS	ALL
AHU-4E	4TH FLOOR E	4TH FLOOR	DOUBLE DUCT	15,000	2,500	SP-4E	PC-4E	HP-4E	CC-4E	PH-4E	HC-4E	AF-1	AF-1	AF-2	ENERGY LABS	ALL
AHU-4W	4TH FLOOR W	4TH FLOOR	DOUBLE DUCT	15,000	8,000	SP-4W	PC-4W	HP-4W	CC-4W	PH-4W	HC-4W	AF-1	AF-1	AF-2	ENERGY LABS	ALL
AHU-5E	5TH FLOOR E	5TH FLOOR	DOUBLE DUCT	15,000	2,500	SP-5E	PC-5E	HP-5E	CC-5E	PH-5E	HC-5E	AF-1	AF-1	AF-2	ENERGY LABS	ALL
AHU-5W	5TH FLOOR W	5TH FLOOR	DOUBLE DUCT	15,000	8,000	SP-5W	PC-5W	HP-5W	CC-5W	PH-5W	HC-5W	AF-1	AF-1	AF-2	ENERGY LABS	ALL
AHU-6E	6TH FLOOR E	6TH FLOOR	DOUBLE DUCT	15,000	2,500	SP-6E	PC-6E	HP-6E	CC-6E	PH-6E	HC-6E	AF-1	AF-1	AF-2	ENERGY LABS	ALL
AHU-6W	6TH FLOOR W	6TH FLOOR	DOUBLE DUCT	15,000	10,000	SP-6W	PC-6W	HP-6W	CC-6W	PH-6W	HC-6W	AF-1	AF-1	AF-2	ENERGY LABS	ALL
AHU-7E	7TH FLOOR E	7TH FLOOR	DOUBLE DUCT	15,000	2,500	SP-7E	PC-7E	HP-7E	CC-7E	PH-7E	HC-7E	AF-1	AF-1	AF-2	ENERGY LABS	ALL
AHU-7W	7TH FLOOR W	7TH FLOOR	DOUBLE DUCT	15,000	10,000	SP-7W	PC-7W	HP-7W	CC-7W	PH-7W	HC-7W	AF-1	AF-1	AF-2	ENERGY LABS	ALL
AHU-8E	8TH FLOOR E	8TH FLOOR	DOUBLE DUCT	15,600	2,500	SP-8E	PC-8E	HP-8E	CC-8E	N/A	HC-8E	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-8W	8TH FLOOR W	8TH FLOOR	DOUBLE DUCT	15,600	2,500	SP-8W	PC-8W	HP-8W	CC-8W	N/A	HC-8W	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-9E	9TH FLOOR E	9TH FLOOR	DOUBLE DUCT	15,600	2,500	SP-9E	PC-9E	HP-9E	CC-9E	N/A	HC-9E	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-9W	9TH FLOOR W	9TH FLOOR	DOUBLE DUCT	15,600	2,500	SP-9W	PC-9W	HP-9W	CC-9W	N/A	HC-9W	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-10E	10TH FLOOR E	10TH FLOOR	DOUBLE DUCT	16,900	2,500	SP-10E	PC-10E	HP-10E	CC-10E	N/A	HC-10E	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-10W	10TH FLOOR W	10TH FLOOR	DOUBLE DUCT	16,900	2,500	SP-10W	PC-10W	HP-10W	CC-10W	N/A	HC-10W	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-11	PENTHOUSE	SINGLE ROOM	SINGLE ROOM	5,000	600	SP-11	N/A	N/A	CC-11	PH-11	N/A	N/A	AF-1	AF-1	ENERGY LABS	ALL
GAU0-1	BSMT TO 2ND FLR	BSMT TO 2ND O/A PRETREAT	O/A PRETREAT	22,000	22,000	SP-0A1	N/A	N/A	CC-0A1	PH-0A1	N/A	AF-1	N/A	N/A	ENERGY LABS	ALL

NOTES:
 1. PROVIDE WITH FACTORY WIRED SERVICE LIGHTING SYSTEM WITH SWITCH ENCLOSURE AND SINGLE POINT 120V, 1PH ELECTRICAL CONNECTION. SEAL INTERIOR & EXTERIOR OF ALL RACEWAY PENETRATIONS.
 2. REFER TO MSX SERIES DRAWINGS FOR CUSTOM AHU DRAWINGS AND CONFIGURATIONS.

AIR HANDLING UNIT FAN SCHEDULE (SF)														
TAG	SYSTEM	LOCATION	CFM	MIN CFM	ESP (IN WG)	TSP (IN WG)	FAN TYPE	DISCHARGE ORIENTATION	FAN CLASS	MOCH EFF	MOTOR HP	MANUFACTURER	NOTES	
SP-0E	AHU-0E	BASEMENT	13,400	4,020	3.20	5.60	OPEN BI	PLENUM	111	65%	25	ENERGY LABS	ALL	
SP-0W	AHU-0W	BASEMENT	16,800	5,040	3.30	5.60	OPEN BI	PLENUM	111	65%	30	ENERGY LABS	ALL	
SP-0S	AHU-0S	BASEMENT	8,500	2,550	2.30	3.75	ROUSED FC	TOP REAR	111	50%	15	ENERGY LABS	ALL	
SP-1E	AHU-1E	2ND FLOOR	14,200	4,260	2.30	4.60	OPEN BI	PLENUM	111	65%	20	ENERGY LABS	ALL	
SP-1W	AHU-1W	2ND FLOOR	12,250	3,675	2.20	4.60	OPEN BI	PLENUM	111	65%	20	ENERGY LABS	ALL	
SP-1SE	AHU-1SE	2ND FLOOR	16,850	5,055	2.70	5.00	OPEN BI	PLENUM	111	65%	25	ENERGY LABS	ALL	
SP-1SW	AHU-1SW	2ND FLOOR	16,850	5,055	2.70	5.00	OPEN BI	PLENUM	111	65%	25	ENERGY LABS	ALL	
SP-2E	AHU-2E	2ND FLOOR	15,000	4,500	2.30	4.60	OPEN BI	PLENUM	111	65%	20	ENERGY LABS	ALL	
SP-2W	AHU-2W	2ND FLOOR	12,250	3,675	2.30	4.60	OPEN BI	PLENUM	111	65%	20	ENERGY LABS	ALL	
SP-3E	AHU-3E	3RD FLOOR	15,000	4,500	3.10	7.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-3W	AHU-3W	3RD FLOOR	15,000	8,000	4.10	8.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-4E	AHU-4E	4TH FLOOR	15,000	4,500	3.10	7.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-4W	AHU-4W	4TH FLOOR	15,000	8,000	4.10	8.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-5E	AHU-5E	5TH FLOOR	15,000	4,500	3.10	7.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-5W	AHU-5W	5TH FLOOR	15,000	8,000	4.10	8.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-6E	AHU-6E	6TH FLOOR	15,000	4,500	3.10	7.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-6W	AHU-6W	6TH FLOOR	15,000	10,000	4.10	8.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-7E	AHU-7E	7TH FLOOR	15,000	4,500	3.10	7.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-7W	AHU-7W	7TH FLOOR	15,000	10,000	4.10	8.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-8E	AHU-8E	8TH FLOOR	15,600	4,500	3.10	7.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-8W	AHU-8W	8TH FLOOR	15,600	4,500	3.10	7.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-9E	AHU-9E	9TH FLOOR	15,600	4,500	3.10	7.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-9W	AHU-9W	9TH FLOOR	15,600	4,500	3.10	7.00	OPEN BI	PLENUM	111	65%	40	ENERGY LABS	ALL	
SP-10E	AHU-10E	10TH FLOOR	16,900	5,070	3.50	6.25	OPEN BI	PLENUM	111	65%	30	ENERGY LABS	ALL	
SP-10W	AHU-10W	10TH FLOOR	16,900	5,070	3.50	6.25	OPEN BI	PLENUM	111	65%	30	ENERGY LABS	ALL	
SP-11	AHU-11	PENTHOUSE	5,000	1,500	1.15	2.50	HOUSED FC	TOP REAR	111	50%	5	ENERGY LABS	ALL	
SP-0A1	GAU0-1	BSMT TO 2ND	22,000	3,000	3.70	5.25	HOUSED AF	FRONT	111	60%	40	ENERGY LABS	ALL	

NOTES:
 1. PROVIDE 460V/3PH/60HZ PREMIUM EFFICIENT FAN MOTORS
 2. PROVIDE INVERTER DUTY MOTOR AND VARIABLE SPEED DRIVE
 3. PROVIDE 24" MIN SECTION WITH DOOR ACCESS TO PLENUM FAN

CHILLED WATER PRECOOLING (PC) & COOLING (CC) COIL SCHEDULE																					
TAG	UNIT	AIR FLOW (CFM)	SENSIBLE (DEG F)	ENTERING AIR DB (DEG F)	ENTERING AIR WB (DEG F)	LEAVING AIR DB (DEG F)	LEAVING AIR WB (DEG F)	CHILLED WATER FLOW (GPM)	MAX LEN (FT)	MAX HEIGHT (IN)	FACE VEL (FPM)	FINNED (IN)	FACE VEL (FPM)	MAX VFD (IN WG)	MANUFACTURER	NOTES					
CC-0E	AHU-0E	13,400	430	346	75.2	62.1	52.0	51.0	42	54	72	15	2	6	8	76	27.0	470	1.31	ENERGY LABS	ALL
CC-0W	AHU-0W	16,800	502	400	73.3	61.4	52.0	51.0	42	54	84	15	2	6	8	76	34.5	463	1.31	ENERGY LABS	ALL
CC-0S	AHU-0S	8,500	234	183	71.3	60.7	52.0	51.0	42	54	39	15	1	6	8	52	43.5	476	1.39	ENERGY LABS	ALL
CC-1E	AHU-1E	14,200	458	368	75.2	62.1	52.0	51.0	42	54	76	15	1	6	8	92	48.0	463	1.31	ENERGY LABS	ALL
CC-1W	AHU-1W	12,250	391	314	75.0	62.1	52.0	51.0	42	54	65	15	1	6	8	76	25.5	455	1.27	ENERGY LABS	ALL
CC-1SE	AHU-1SE	16,850	534	429	74.4	62.0	52.0	51.0	42	54	89	15	2	6	8	90	29.5	473	1.37	ENERGY LABS	ALL
CC-1SW	AHU-1SW	16,850	534	429	74.4	62.0	52.0	51.0	42	54	89	15	2	6	8	90	29.5	473	1.37	ENERGY LABS	ALL
CC-2E	AHU-2E	14,200	439	351	74.1	61.7	52.0	51.0	42	54	73	15	2	6	8	76	30.0	448	1.23	ENERGY LABS	ALL
CC-2W	AHU-2W	12,250	372	297	73.7	61.6	52.0	51.0	42	54	62	15	2	6	8	76	25.5	455	1.27	ENERGY LABS	ALL
PC-3E	AHU-3E	2,500	194	15	81.9	76.0	55.0	53.0	42	54	32	15	1	6	8	48	24.0	313	0.60	ENERGY LABS	ALL
PC-3W	AHU-3W	8,000	620	429	81.9	76.0	55.0	53.0	42	54	103	15	2	6	8	48	36.0	333	0.68	ENERGY LABS	ALL
PC-4E	AHU-4E	2,500	194	15	81.9	76.0	55.0	53.0	42	54	32	15	1	6	8	48	24.0	313	0.60	ENERGY LABS	ALL
PC-4W	AHU-4W	8,000	620	429	81.9	76.0	55.0	53.0	42	54	103	15	2	6	8	48	36.0	333	0.68	ENERGY LABS	ALL
PC-5E	AHU-5E	2,500	194	15	81.9	76.0	55.0	53.0	42	54	32										

STEAM TO HOT WATER HEAT EXCHANGER SCHEDULE (HX)															
TAG	LOCATION	SYSTEM SERVED	LENGTH (IN)	DIA (IN)	PASSES	HEATED WATER (TUBES)				STEAM (SHELL)				ASME PRESS CLASS	MANUFACTURER
						EWT (DEG F)	LWT (DEG F)	FLOW (GPM)	WPD (FT WG)	PRESSURE (PSIG)	TEMP. (F)	HEAT LOAD (BTU/HR)	HEAT LOAD (LB/HR)		
HX-1	CENTER PLANT ROOM BASEMENT	HEATING SYSTEM	94.7	20"	2	150	180	1500	5	60	400	11,250,000	11,250	250	B & G
HX-2	CENTER PLANT ROOM BASEMENT	HEATING SYSTEM	94.7	20"	2	150	180	1500	5	60	400	11,250,000	11,250	250	B & G

NOTES:
1. PROVIDE WITH MARINE WATER BOX CONNECTIONS

STEAM TEMPERATURE REGULATOR SCHEDULE						
MARK	SERVICE	SIZE (IN)	MIN CV	ANSI CLASS	SETPPOINT (°F)	NOTES
STR-1A	HX-1 PRIMARY	2	34	125	155	1.2
STR-1B	HX-1 SECONDARY	4	82	125	165	1.2
STR-2A	HX-2 PRIMARY	2	34	125	170	1.2
STR-2B	HX-2 SECONDARY	4	82	125	180	1.2

NOTES:
1. PROVIDE PILOT OPERATED ADJUSTABLE TEMPERATURE REGULATORS.
2. PROVIDE REGULATORS WITH 115VAC INTEGRAL ELECTRIC OVERRIDE SOLENOID.
3. PROVIDE REGULATORS WITH OUTLET NOISE DIFFUSERS.

STEAM TRAP SCHEDULE							
MARK	SERVICE	TYPE	MIN CAP (PPH)	MIN DIFF. PRES. (PSID)	SIZE (IN)	ANSI CLASS	NOTES
ST-1A	HX-1	FLOT & THERMOSTATIC	24,000	0.5	2 1/2	125	1
ST-1B	HX-1	FLOT & THERMOSTATIC	24,000	0.5	2 1/2	125	1
ST-2A	HX-2	FLOT & THERMOSTATIC	24,000	0.5	2 1/2	125	1
ST-2B	HX-2	FLOT & THERMOSTATIC	24,000	0.5	2 1/2	125	1
ST-MI	MAIN	THERMOSTATIC	384	50	1/2	125	1

NOTES:
1- SELECT FLOT LEVER FOR 50 PSIG MAXIMUM OPERATION INLET PRESSURE.

AIR OUTLET SCHEDULE											
MARK	MAKE	MODEL	TYPE	FACE SIZE (INCH)	NECK SIZE	NUMBER OF SLOTS	SLOT WIDTH (INCH)	MATERIAL	FINISH	MOUNTING	REMARKS
A1	TITUS	OMNI-AA	SUPPLY	24" x 24"	SEE NECK SCHEDULE	N/A	N/A	ALUMINUM	NOTE 4	CEILING	1, 2, 3
B1	TITUS	45F	RETURN	24" x 24"	SEE NECK SCHEDULE	N/A	N/A	ALUMINUM	NOTE 4	CEILING	1, 2, 3
B2	TITUS	45F	RETURN	12" x 12"	SEE NECK SCHEDULE	N/A	N/A	ALUMINUM	NOTE 4	CEILING	1, 2, 3
C1	TITUS	350FS	EXHAUST	18" x 12"	-	N/A	N/A	ALUMINUM	NOTE 4	SURFACE	2
D1	TITUS	272FS	SUPPLY	12" x 6"	-	N/A	N/A	ALUMINUM	NOTE 4	SURFACE	2
D2	TITUS	272FS	SUPPLY	18" x 6"	-	N/A	N/A	ALUMINUM	NOTE 4	SURFACE	2
D3	TITUS	272FS	SUPPLY	24" x 6"	-	N/A	N/A	ALUMINUM	NOTE 4	SURFACE	2
D4	TITUS	272FS	SUPPLY	18" x 10"	-	N/A	N/A	ALUMINUM	NOTE 4	SURFACE	2
D5	TITUS	272FS	SUPPLY	24" x 10"	-	N/A	N/A	ALUMINUM	NOTE 4	SURFACE	2
F1	TITUS	350FS	RETURN	24" x 10"	-	N/A	N/A	ALUMINUM	NOTE 4	SURFACE	2
G1	TITUS	PAR	EXHAUST	24" x 24"	SEE NECK SCHEDULE	N/A	N/A	ALUMINUM	NOTE 4	CEILING	2

NOTES:
1. PROVIDE ROUND NECK ADAPTER WHERE REQUIRED
2. REFER TO PLANS FOR AIR FLOW RATES
3. REFER TO DIFFUSER NECK-DUCT SIZE SCHEDULE FOR TAKE OFF BRANCH SIZES
4. COORDINATE WITH FINISH WITH ARCHITECT
5. PROVIDE VAV DIFFUSER WITH 120V TRANSFORMER, CONTROLLER AND THERMOSTAT
6. PROVIDE LOUVER WITH BIRD SCREEN

CONDENSATION RETURN PUMP SCHEDULE														
MARK	LOCATION	SYSTEM	PUMP TYPE	PUMP			MOTOR			CASING		MANUFACTURER	MODEL	NOTES
				FLOW (GPM)	HEAD (PSIG)	EFFICIENCY (%)	HP	V/PH	RPM	SUCT (IN)	DISCH (IN)			
CRU-1	CENTER PLANT / BASEMENT	BUILDING	DUPLIX	90	50	76	5	480/3/60	3500	4	2	B & G	I20CBE90-50	1, 2, 3
CRU-2	CENTER PLANT / BASEMENT	BUILDING	DUPLIX	90	50	76	5	480/3/60	3500	4	2	B & G	I20CBE90-50	1, 2, 3

NOTES:
1. PROVIDE SELF SENSING PUMPS WITH MOUNTING BASE
2. PROVIDE PUMP WITH WALL MOUNTED VFD
3. PUMPS SHALL BE DUTY STANDBY CONFIGURATION

EXPANSION TANK SCHEDULE (ET)											
MARK	TYPE	LOCATION	SYSTEM SERVED	MINIMUM TANK VOLUME (GAL)	MINIMUM ACCEPT VOLUME (GAL)	INITIAL FILL PRESSURE (PSI)	MAXIMUM PRESSURE (PSI)	TEMPERATURE MAXIMUM (°F)	ASME M.W.P. (PSI)	MAKE AND MODEL	REMARKS
ET-1	BLADDER	PENTHOUSE	HOT WATER	443	380	25	125	180	150	B & G CAI500-125	ALL

NOTES:
1. PROVIDE TANK WITH 50 PSIG RELIEF VALVE
2. EXPANSION TANK SHALL BE VERTICAL CONFIGURATION

COALESCING AIR SEPARATOR SCHEDULE (AS)								
MARK	LOCATION	SYSTEM	PIPE CONNECTIONS		FLOW (GPM)	WPD (FT. W.G.)	MANUFACTURER	MODEL
			INLET (IN)	OUTLET (IN)				
AS-1	MECH ROOM	CHILLED WATER	6	6	480	5	SPIROTHERM	4900 SERIES

NOTES:
1. PROVIDE AIR SEPARATOR WITH 125 PSI RELIEF VALVE.

PUMP SCHEDULE															
MARK	LOCATION	SYSTEM	PUMP TYPE	PUMP			MOTOR			CASING			MANUFACTURER	NOTES	
				FLOW (GPM)	HEAD (FT WG)	EFFICIENCY (%)	HP	V/PH	RPM	SUCT (IN)	DISCH (IN)	IMPEL (IN)			
HWP-1	CENTER PLANT ROOM / BASEMENT	HOT WATER	FRAME MOUNT. END SUCTION	1500	120	77.6	75	480/3/60	1770	8	8	13.5B	B & G	1, 2, 3, 4	
HWP-2	CENTER PLANT ROOM / BASEMENT	HOT WATER	FRAME MOUNT. END SUCTION	1500	120	77.6	75	480/3/60	1770	8	8	13.5B	B & G	1, 2, 3, 4	
OAPH-3E	3RD FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	20	15	70	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	
OAPH-P-5W	3RD FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	20	15	70	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	
OAPH-P-4W	4TH FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	20	15	70	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	
OAPH-P-4E	4TH FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	20	15	70	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	
OAPH-P-5W	5TH FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	20	15	70	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	
OAPH-P-5E	5TH FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	20	15	70	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	
OAPH-P-6W	6TH FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	20	15	70	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	
OAPH-P-6E	6TH FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	20	15	70	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	
OAPH-P-7W	7TH FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	20	15	70	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	
OAPH-P-7E	7TH FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	20	15	70	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	
OAPH-P-8	8TH FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	25	15	80	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	
OAPH-P-9	9TH FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	25	15	80	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	
OAPH-P-10	10TH FLOOR/MECHANICAL ROOM	HOT WATER (FRZ PROT)	CLOSE COUPLED	25	15	80	1/6	115/1/60	1750	1.5	1.5	3	B & G	PL-36 5	

NOTES:
1. PROVIDE WITH PREMIUM HIGH EFFICIENCY TEFC MOTORS
2. PROVIDE PUMP WITH WALL MOUNTED VFD AND INVERTER DUTY MOTOR
3. PUMPS PUMP WITH SUCTION DIFFUSER

EXHAUST FAN SCHEDULE													
FAN TAG	SERVICE	AIR VOLUME CFM	FAN TYPE	DRIVE TYPE	ESP (IN-WC)	FAN SPEED RPM	MOTOR		MANUFACTURER & MODEL	LOCATION	REMARKS		
							HP	V/PH/Hz					
EF-7-1	7TH FLOOR - W	4,000	HI-PLUME LAV EXHAUST	BELT	2.15	2,821	5	460/3/60	3,600	GREENHECK OR EQ	ROOF	1, 2, 3, 4, 5, 8	
EF-7-2	7TH FLOOR - W	4,000	HI-PLUME LAV EXHAUST	BELT	2.15	2,821	5	460/3/60	3,600	GREENHECK OR EQ	ROOF	1, 2, 3, 4, 5, 8	
EF-BY-PASS	LAB	45,000	MEDIUM PRESSURE AXIAL	BELT	3.00	1,226	50	460/3/60	1,725	GREENHECK TBI-FS-SL48-250	ROOF	2, 3, 4, 5, 6	
EF-ION	STAIRWELL	3,850	CENTRIFUGAL	BELT	1.00	1,236	2	208/1/60	1,325	GREENHECK OR EQ	ROOF	4, 5, 6, 7	
EF-PI	PENTHOUSE	5,000	CENTRIFUGAL	BELT	1.00	1,236	5	208/1/60	1,325	GREENHECK OR EQ	ROOF	4, 5, 7, 8	

NOTES:
1. PROVIDE FACTORY ASSEMBLED LAB EXHAUST SYSTEMS INCLUDING FAN DISCHARGE NOZZLE, PLENUM, BYPASS DAMPERS, AND CONTROLLERS & AIR FLOW MONITORING STATION
2. PROVIDE HIGH WIND FAN SYSTEMS CERTIFIED FOR TDI #RV-88 COMPLIANCE
3. PROVIDE FAN WHEEL AND INTERIOR FAN HOUSING COATED WITH HEAT-CURED PHENOLIC HERESITE.
4. PROVIDE FAN SYSTEMS WITH UNIT MOUNTED DISCONNECT SWITCH & SINGLE POINT ELECTRICAL CONNECTION.
5. PROVIDE PREMIUM HIGH EFFICIENCY TEFC FAN MOTOR.
6. PROVIDE UNIT WITH WALL MOUNTED HOA STARTER
7. PROVIDE MOTORIZED DAMPER AND CONTROLS WITH THE FAN
8. PROVIDE UNIT WITH WALL MOUNTED VFD AND INVERTER DUTY FAN MOTOR.

FAN COIL UNIT SCHEDULE																				
MARK	LOCATION	AIRFLOW (CFM)	OUTSIDE AIRFLOW (CFM)	UNIT CONFIGURATION	FAN		CHILLED WATER COIL										MAKE	NOTES		
					E.S.P. (IN. WC.)	MOTOR (HP)	CAPACITY		FACE VELOCITY (FFPM)		ENTERING AIR TEMPERATURE		LEAVING AIR TEMPERATURE		WATER FLOW (GPM)	EWT (°F)			LWT (°F)	MAX PRESSURE DROP WATER (FT)
					TOTAL (MBH)	SENSIBLE (MBH)	DB (°F)	WB (°F)	DB (°F)	WB (°F)	DB (°F)	WB (°F)								
FCU-B-1	BASEMENT	2,000	200	HORIZONTAL	0.5	1	277/1/60	90.0	61.0	5/4	80.0	67.0	52.1	52.0	15.0	42	54	10	TRANE	ALL
FCU-B-2	BASEMENT	2,000	200	HORIZONTAL	0.5	1	277/1/60	90.0	61.0	5/4	80.0	67.0	52.1	52.0	15.0	42	54	10	TRANE	ALL
FCU-2-1A	2ND FLOOR (ELEC. ROOM)	1,500	-	VERTICAL	0.5	1.5	277/1/60	62.3	41.5	450	75.0	62.0	54.4	53.6	10.3	42	54	15	TRANE (TEMPSPEC VUF)	2, 3, 5, 6, 7, 8, 9, 10, 11
FCU-2-1B	2ND FLOOR (ELEC. ROOM)	1,500	-	VERTICAL	0.5	1.5	277/1/60	62.3	41.5	450	75.0	62.0	54.4	53.6	10.3	42	54	15	TRANE (TEMPSPEC VUF)	2, 3, 5, 6, 7, 8, 9, 10, 11
FCUW-1	4TH FLOOR	1,300	-	HORIZONTAL	1.0	1	277/1/60	54.0	35.9	488	75.0	62.0	50.2	50.1	10.8	42	54	10	TRANE	ALL
FCUW-2	4TH FLOOR	1,400	-	HORIZONTAL	1.0	1	277/1/60	54.2	38.7	525	75.0	62.0	50.4	50.4	11.4	42	54	10	TRANE	ALL
FCUW-3	4TH FLOOR	4,150	-	HORIZONTAL	0.5	3	460/3/60	172.3	114.8	900	75.0	62.0	52.0	51.0	13.5	42	54	15	TRANE	ALL
FCUW-4	4TH FLOOR	1,630	-	HORIZONTAL	1.0	1	460/3/60	67.7	45.1	500	75.0	62.0	52.0	51.0	4.8	42	54	15	TRANE	ALL
FCUW-1	5TH FLOOR	1,400	-	HORIZONTAL	1.0	1	460/3/60	35.0	38.7	500	75.0	62.0	52.0	51.0	4.6	42	54	15	TRANE	ALL
FCUW-2	5TH FLOOR	2,500	-	HORIZONTAL	1.0	1	460/3/60	103.9	69.2	500	75.0	62.0	52.0	51.0	8.1	42	54	15	TRANE	ALL
FCUW-3	5TH FLOOR	2,400	-	HORIZONTAL	1.0	1	460/3/60	99.7	66.4	500	75.0	62.0	52.0	51.0	7.8	42	54	15	TRANE	ALL

NOTES:
1. INSTALL AUXILIARY DRAIN PAN UNDER UNIT.
2. PROVIDE NEV-8 (2") DEEP FLAT FILTER WITH THE UNIT.
3. PROVIDE UNIT WITH SINGLE POINT POWER CONNECTION.
4. PROVIDE SUSPENDED UNIT WITH SPRING ISOLATOR.
5. PROVIDE UNIT WITH STAINLESS STEEL DRAIN PAN.
6. PROVIDE WATER SENSING DEVICE IN THE PRIMARY DRAIN PAN.
7. PROVIDE CONDENSATE PUMP WITH THE UNIT.
8. PROVIDE UNIT WITH ECM MOTORS
9. PROVIDE UNIT WITH FACTORY ACOUSTIC PLENUM, IHW FREE DISCHARGE GRILLE
10. PROVIDE 18 GAUGE FACTORY PAINTED UNIT CASING.
11. UNIT CONTROLLER AND CONTROL VALVES PROVIDED BY CONTROLS CONTRACTOR. GACTORY MOUNTED BY UNIT MANUFACTURER.

VARIABLE AIR VOLUME TERMINAL SCHEDULE																	
MARK	LOCATION	INLET SIZE INCHES	SUPPLY AIR FLOW RATE (CFM)		CAPACITY (BTUH)	HOT WATER RE-HEAT COIL						BASIS OF DESIGN		REMARKS			
			MAX	MIN		FLOW (GPM)	EWT (°F)	LWT (°F)	WPD (FT)	ROWS	HPD (IN-WG)	MANUFACTURER	MODEL				
			DESIGN	MIN		DESIGN	DESIGN	DESIGN	DESIGN	DESIGN	DESIGN	DESIGN	DESIGN				
VAV BH-1-1	BASEMENT	14	1500	450	17010.0	1.70	180.0	160	0.33	2	0.2"	TITUS	DESV	1			
VAV BH-1-2	BASEMENT	10	620	186	7030.8	0.70	180.0	160	0.33	2	0.2"	TITUS	DESV	1			
VAV BH-1-3	BASEMENT	10	435	130.5	4932.9	0.49	180.0	160	0.33	2	0.2"	TITUS	DESV	1			
VAV BH-1-4	BASEMENT	10	900	270	10206.0												

AIR HANDLING UNIT SCHEDULE (AHU/OAHU) - ALTERNATE																
TAG	AREA SERVED	LOCATION	SYSTEM TYPE	SUPPLY CFM	O/A CFM	SUPPLY FAN	PRECOOL COIL	HEATPIPE COIL	COOLING COIL	PREHEAT COIL	HEATING COIL	O/A FILTER	PRE-FINAL FILTER	FINAL FILTER	MANUFACTURER	NOTES
AHU-8	8TH FLOOR E	8TH FLOOR	DOUBLE DOCT	15,600	2,500	SP-8E	N/A	N/A	CC-8E	N/A	HC-8E	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-9	9TH FLOOR W	9TH FLOOR	DOUBLE DOCT	15,600	2,500	SP-9W	N/A	N/A	CC-9W	N/A	HC-9W	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-10	10TH FLOOR E	10TH FLOOR	DOUBLE DOCT	16,900	2,500	SP-10E	N/A	N/A	CC-10E	N/A	HC-10E	N/A	AF-1	AF-2	ENERGY LABS	ALL
AHU-10	10TH FLOOR W	10TH FLOOR	DOUBLE DOCT	16,900	2,500	SP-10W	N/A	N/A	CC-10W	N/A	HC-10W	N/A	AF-1	AF-2	ENERGY LABS	ALL
OAHU-8	8TH FLOOR	8TH FLOOR	OA PRETREAT	5,000	5,000	SP-OA8	N/A	N/A	CC-OA8	PH-OA8	N/A	AF-1	N/A	N/A	ENERGY LABS	ALL
OAHU-9	9TH FLOOR	9TH FLOOR	OA PRETREAT	5,000	5,000	SP-OA9	N/A	N/A	CC-OA9	PH-OA9	N/A	AF-1	N/A	N/A	ENERGY LABS	ALL
OAHU-10	10TH FLOOR	10TH FLOOR	OA PRETREAT	5,000	5,000	SP-OA10	N/A	N/A	CC-OA10	PH-OA10	N/A	AF-1	N/A	N/A	ENERGY LABS	ALL

NOTES:
1. PROVIDE WITH FACTORY WIRED SERVICE LIGHTING SYSTEM WITH SWITCH ENCLOSURE AND SINGLE POINT 120V, 1PH ELECTRICAL CONNECTION. SEAL INTERIOR & EXTERIOR OF ALL RACKWAY PENETRATIONS.
2. REFER TO MSXX SERIES DRAWINGS FOR CUSTOM AHU DRAWINGS AND CONFIGURATIONS.

AIR HANDLING UNIT FAN SCHEDULE (SF) - ALTERNATE													
TAG	SYSTEM	LOCATION	MAX CFM	MIN CFM	ESP (IN WG)	TSP (IN WG)	FAN TYPE	DISCHARGE ORIENTATION	FAN CLASS	MECH EFF	MOTOR HP	MANUFACTURER	NOTES
SF-8E	AHU-8	8TH FLOOR	15,600	4,680	3.9	6.25	OPEN BI	PLENUM	III	65%	30	ENERGY LABS	ALL
SF-9W	AHU-9	9TH FLOOR	15,600	4,680	3.9	6.25	OPEN BI	PLENUM	III	65%	30	ENERGY LABS	ALL
SF-10E	AHU-10	10TH FLOOR	16,900	5,070	3.9	6.25	OPEN BI	PLENUM	III	65%	40	ENERGY LABS	ALL
SF-10W	AHU-10	10TH FLOOR	16,900	5,070	3.9	6.25	OPEN BI	PLENUM	III	65%	40	ENERGY LABS	ALL
SP-OA8	OAHU-8	8TH FLOOR	5,000	1,000	1.15	2.50	ROUSED FC	TOP FRONT	III	50%	5	ENERGY LABS	ALL
SP-OA9	OAHU-9	9TH FLOOR	5,000	1,000	1.15	2.50	ROUSED FC	TOP FRONT	III	50%	5	ENERGY LABS	ALL
SP-OA10	OAHU-10	10TH FLOOR	5,000	1,000	1.15	2.50	ROUSED FC	TOP FRONT	III	50%	5	ENERGY LABS	ALL

NOTES:
1. PROVIDE 460V/3PH/60HZ PREMIUM EFFICIENCY FAN MOTORS
2. PROVIDE INVERTER DUTY MOTOR AND VARIABLE SPEED DRIVE
3. PROVIDE 24" MIN SECTION WITH DOOR ACCESS TO PLENUM FAN

CHILLED WATER PRECOOLING (PC) & COOLING (CC) COIL SCHEDULE - ALTERNATE																					
TAG	UNIT	AIR FLOW (CFM)	CAPACITY (TONS)	ENTERING AIR (DEG F)	LEAVING AIR (DEG F)	CHILLED WATER (DEG F)	COIL (DEG F)	FINNED (DEG F)	FACE VEL (FPM)	MAX APD (IN WG)	MANUFACTURER	NOTES									
CC-8E	AHU-8	15,600	498	40.3	75.2	62.1	52.0	51.0	42	54	83	15	2	6	8	82	30.0	457	1.28	ENERGY LABS	ALL
CC-9W	AHU-9	15,600	498	40.3	75.2	62.1	52.0	51.0	42	54	83	15	2	6	8	82	30.0	457	1.28	ENERGY LABS	ALL
CC-10E	AHU-10	16,900	573	46.9	76.8	62.7	52.0	51.0	42	54	96	15	2	6	8	82	30.0	495	1.50	ENERGY LABS	ALL
CC-10W	AHU-10	16,900	573	46.9	76.8	62.7	52.0	51.0	42	54	96	15	2	6	8	82	30.0	495	1.50	ENERGY LABS	ALL
CC-OA8	OAHU-8	5,000	475	22.8	58.0	50.0	55.0	54.0	42	54	14	15	1	6	8	38	48.0	395	0.96	ENERGY LABS	ALL
CC-OA9	OAHU-9	5,000	475	22.8	58.0	50.0	55.0	54.0	42	54	14	15	1	6	8	38	48.0	395	0.96	ENERGY LABS	ALL
CC-OA10	OAHU-10	5,000	475	22.8	58.0	50.0	55.0	54.0	42	54	14	15	1	6	8	38	48.0	395	0.96	ENERGY LABS	ALL

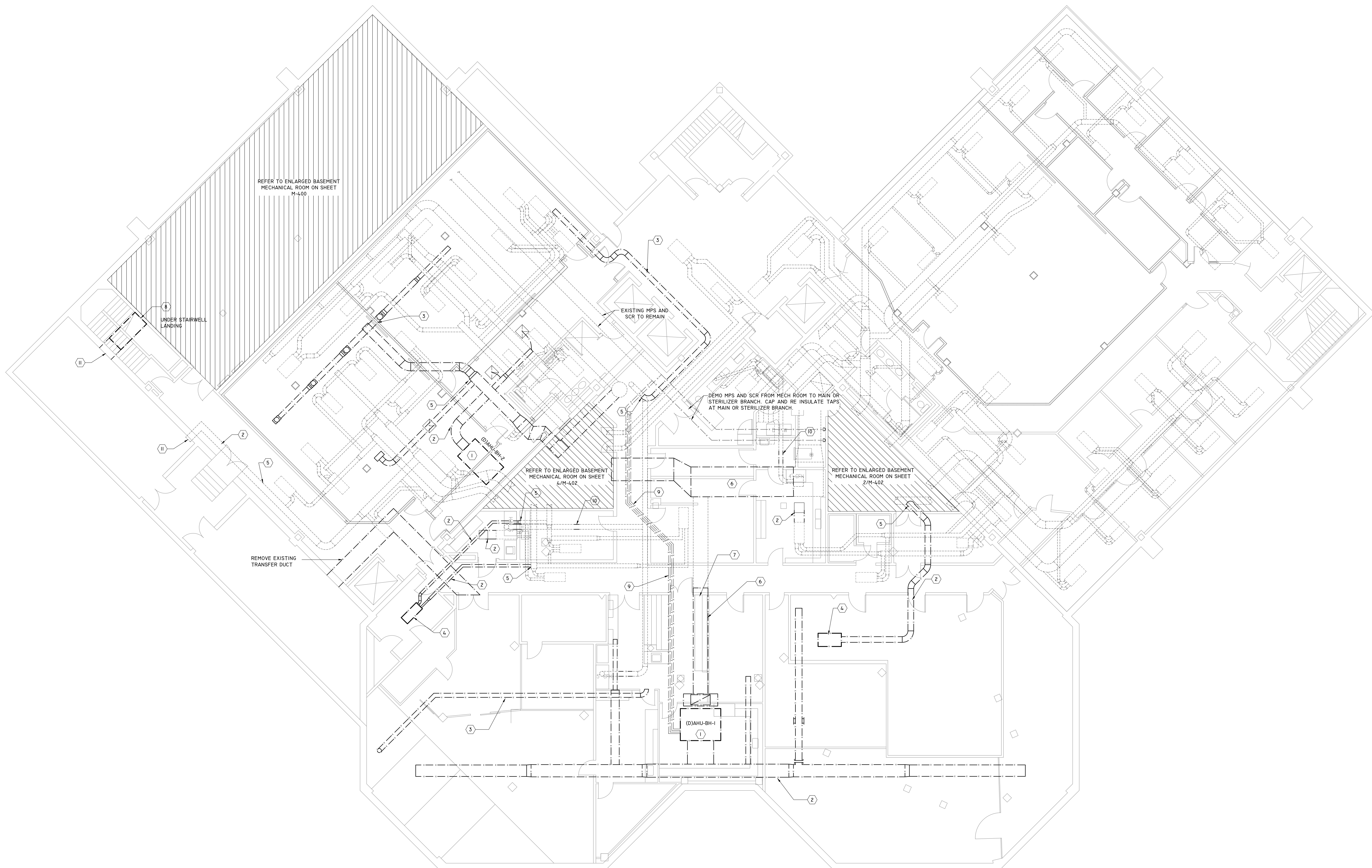
NOTES:
1. PROVIDE 300 SERIES STAINLESS STEEL COIL FRAMING, SUPPORTS, AND MOUNTING HARDWARE
2. CONFIGURE TUBE CIRCUITING FOR HIGH TURNDOWN RATIO

HOT WATER PREHEAT (PH) & HEATING (HC) COIL SCHEDULE - ALTERNATE																		
TAG	UNIT	AIR FLOW (CFM)	HEATING CAP (MBH)	AIR TEMP (DEG F)	HOT WATER (DEG F)	COIL (DEG F)	FINNED (DEG F)	FACE VEL (FPM)	MAX APD (IN WG)	MANUFACTURER	NOTES							
HC-8E	AHU-8	11,750	316	65.1	90.0	180	150	21.1	5	1	1	8	60	45.0	627	0.14	ENERGY LABS	ALL
HC-9W	AHU-9	11,750	316	65.1	90.0	180	150	21.1	5	1	1	8	60	45.0	627	0.14	ENERGY LABS	ALL
HC-10E	AHU-10	12,750	340	65.3	90.0	180	150	22.6	5	1	1	8	60	45.0	680	0.17	ENERGY LABS	ALL
HC-10W	AHU-10	12,750	340	65.3	90.0	180	150	22.6	5	1	1	8	60	45.0	680	0.17	ENERGY LABS	ALL
PH-OA8	OAHU-8	5,000	216	20.0	60.0	180	150	14.4	5	1	1	8	34	36.0	597	0.13	ENERGY LABS	ALL
PH-OA9	OAHU-9	5,000	216	20.0	60.0	180	150	14.4	5	1	1	8	34	36.0	597	0.13	ENERGY LABS	ALL
PH-OA10	OAHU-10	5,000	216	20.0	60.0	180	150	14.4	5	1	1	8	34	36.0	597	0.13	ENERGY LABS	ALL

NOTES:
1. PROVIDE 300 SERIES STAINLESS STEEL COIL FRAMING, SUPPORTS, AND HARDWARE
2. PROVIDE REDUCED FACE HEATING COIL AND BLANK-OFF PLATE AS REQUIRED TO ACHIEVE MINIMUM COIL FACE VELOCITY

AIR VALVE SCHEDULE										
MARK	LOCATION	SERVICE	VALVE TYPE	INLET SIZE	DESIGN AIRFLOW (CFM)	MINIMUM AIRFLOW (CFM)	MANUFACTURER	MODEL	NOTES	
SAV-B-1	BASEMENT	SUPPLY ROOM	VAV	10"	260	0	PHOENIX	EXV C 110 M	1, 2	
SAV-B-2	BASEMENT	SUPPLY ROOM	VAV	10"	440	0	PHOENIX	EXV C 110 M	1, 2	
SAV-B-3	BASEMENT	SUPPLY ROOM	VAV	10"	440	0	PHOENIX	EXV C 110 M	1, 2	
EAV-B-1	BASEMENT	FUME HOOD	VAV	10"	660	150	PHOENIX	EXV C 110 M	1, 2	
EAV-B-2	BASEMENT	GENERAL EXHAUST	VAV	10"	150	0	PHOENIX	EXV C 110 M	1, 2	
EAV-B-3	BASEMENT	FUME HOOD	VAV	10"	660	150	PHOENIX	EXV C 110 M	1, 2	
EAV-B-4	BASEMENT	FUME HOOD	VAV	10"	660	150	PHOENIX	EXV C 110 M	1, 2	
SAV-3-1	3RD FLOOR	SUPPLY ROOM	VAV	10"	1700	350	PHOENIX	EXV C 110 M	1, 2	
SAV-3-2	3RD FLOOR	SUPPLY ROOM	VAV	10"	300	0	PHOENIX	EXV C 110 M	1, 2	
SAV-3-3	3RD FLOOR	SUPPLY ROOM	VAV	10"	300	0	PHOENIX	EXV C 110 M	1, 2	
EAV-3-1	3RD FLOOR	FUME HOOD	VAV	10"	800	160	PHOENIX	EXV C 110 M	1, 2	
EAV-3-2	3RD FLOOR	FUME HOOD	VAV	10"	500	100	PHOENIX	EXV C 110 M	1, 2	
EAV-3-3	3RD FLOOR	FUME HOOD	VAV	10"	800	160	PHOENIX	EXV C 110 M	1, 2	
EAV-3-4	3RD FLOOR	GENERAL EXHAUST	VAV	10"	150	0	PHOENIX	EXV C 110 M	1, 2	
EAV-3-5	3RD FLOOR	FUME HOOD	VAV	10"	500	150	PHOENIX	EXV C 110 M	1, 2	
SAV-4-1	4TH FLOOR	SUPPLY ROOM	VAV	10"	400	50	PHOENIX	EXV C 110 M	1, 2	
EAV-4-1	4TH FLOOR	GENERAL EXHAUST	VAV	10"	500	150	PHOENIX	EXV C 110 M	1, 2	
EAV-4-2	4TH FLOOR	GENERAL EXHAUST	VAV	10"	600	250	PHOENIX	EXV C 110 M	1, 2	
SAV-6-1	6TH FLOOR	SUPPLY ROOM	VAV	10"	1700	350	PHOENIX	EXV C 110 M	1, 2	
SAV-6-2	6TH FLOOR	SUPPLY ROOM	VAV	10"	300	0	PHOENIX	EXV C 110 M	1, 2	
EAV-6-1	6TH FLOOR	FUME HOOD	VAV	10"	800	160	PHOENIX	EXV C 110 M	1, 2	
EAV-6-2	6TH FLOOR	FUME HOOD	VAV	10"	500	100	PHOENIX	EXV C 110 M	1, 2	
EAV-6-3	6TH FLOOR	FUME HOOD	VAV	10"	800	160	PHOENIX	EXV C 110 M	1, 2	
EAV-6-4	6TH FLOOR	GENERAL EXHAUST	VAV	10"	1500	0	PHOENIX	EXV C 110 M	1, 2	
EAV-6-5	6TH FLOOR	FUME HOOD	VAV	10"	500	100	PHOENIX	EXV C 110 M	1, 2	
EAV-6-6	6TH FLOOR	FUME HOOD	VAV	10"	800	160	PHOENIX	EXV C 110 M	1, 2	
EAV-6-7	6TH FLOOR	GENERAL EXHAUST	VAV	10"	1500	0	PHOENIX	EXV C 110 M	1, 2	
EAV-6-8	6TH FLOOR	FUME HOOD	VAV	10"	500	100	PHOENIX	EXV C 110 M	1, 2	
SAV-7-1	7TH FLOOR	SUPPLY ROOM	VAV	10"	100	0	PHOENIX	EXV C 110 M	1, 2	
SAV-7-2	7TH FLOOR	SUPPLY ROOM	VAV	10"	100	0	PHOENIX	EXV C 110 M	1, 2	
SAV-7-3	7TH FLOOR	SUPPLY ROOM	VAV	10"	100	0	PHOENIX	EXV C 110 M	1, 2	
SAV-7-4	7TH FLOOR	SUPPLY ROOM	VAV	10"	850	350	PHOENIX	EXV C 110 M	1, 2	
SAV-7-5	7TH FLOOR	SUPPLY ROOM	VAV	10"	100	0	PHOENIX	EXV C 110 M	1, 2	
SAV-7-6	7TH FLOOR	SUPPLY ROOM	VAV	10"	100	0	PHOENIX	EXV C 110 M	1, 2	
SAV-7-7	7TH FLOOR	SUPPLY ROOM	VAV	10"	320	0	PHOENIX	EXV C 110 M	1, 2	
SAV-7-8	7TH FLOOR	SUPPLY ROOM	VAV	10"	700	180	PHOENIX	EXV C 110 M	1, 2	
SAV-7-9	7TH FLOOR	SUPPLY ROOM	VAV	10"	100	0	PHOENIX	EXV C 110 M	1, 2	
SAV-7-10	7TH FLOOR	SUPPLY ROOM	VAV	10"	180	0	PHOENIX	EXV C 110 M	1, 2	
SAV-7-11	7TH FLOOR	SUPPLY ROOM	VAV	10"	100	0	PHOENIX	EXV C 110 M	1, 2	
SAV-7-12	7TH FLOOR	SUPPLY ROOM	VAV	10"	400	0	PHOENIX	EXV C 110 M	1, 2	
SAV-7-13	7TH FLOOR	SUPPLY ROOM	VAV	10"	340	100	PHOENIX	EXV C 110 M	1, 2	
SAV-7-14	7TH FLOOR	SUPPLY ROOM	VAV	10"	100	0	PHOENIX	EXV C 110 M	1, 2	
SAV-7-15	7TH FLOOR	SUPPLY ROOM	VAV	10"	100	0	PHOENIX	EXV C 110 M	1, 2	
EAV-7-1	7TH FLOOR	FUME HOOD	VAV	10"	670	150	PHOENIX	EXV C 110 M	1, 2	
EAV-7-2	7TH FLOOR	GENERAL EXHAUST	VAV	10"	520	50	PHOENIX	EXV C 110 M	1, 2	
EAV-7-3	7TH FLOOR	GENERAL EXHAUST	VAV	10"	175	100	PHOENIX	EXV C 110 M	1, 2	
EAV-7-4	7TH FLOOR	GENERAL EXHAUST	VAV	10"	175	100	PHOENIX	EXV C 110 M	1, 2	
EAV-7-5	7TH FLOOR	GENERAL EXHAUST	VAV	10"	1800	700	PHOENIX	EXV C 110 M	1, 2	
EAV-7-6	7TH FLOOR	FUME HOOD	VAV	10"	950	150	PHOENIX	EXV C 110 M	1, 2	
EAV-7-7	7TH FLOOR	FUME HOOD	VAV	10"	650	150	PHOENIX	EXV C 110 M	1, 2	
EAV-7-8	7TH FLOOR	GENERAL EXHAUST	VAV	10"	750	50	PHOENIX	EXV C 110 M	1, 2	
EAV-7-9	7TH FLOOR	FUME HOOD	VAV	10"	525	150	PHOENIX	EXV C 110 M	1, 2	
EAV-7-10	7TH FLOOR	FUME HOOD	VAV	10"	525	150	PHOENIX	EXV C 110 M	1, 2	
EAV-7-11	7TH FLOOR	GENERAL EXHAUST	VAV	10"	250	125	PHOENIX	EXV C 110 M	1, 2	
EAV-7-12	7TH FLOOR	FUME HOOD	VAV	10"	520	150	PHOENIX	EXV C 110 M	1, 2	
EAV-7-13	7TH FLOOR	FUME HOOD	VAV	10"	900	180	PHOENIX	EXV C 110 M	1, 2	
EAV-7-14	7TH FLOOR	GENERAL EXHAUST	VAV							

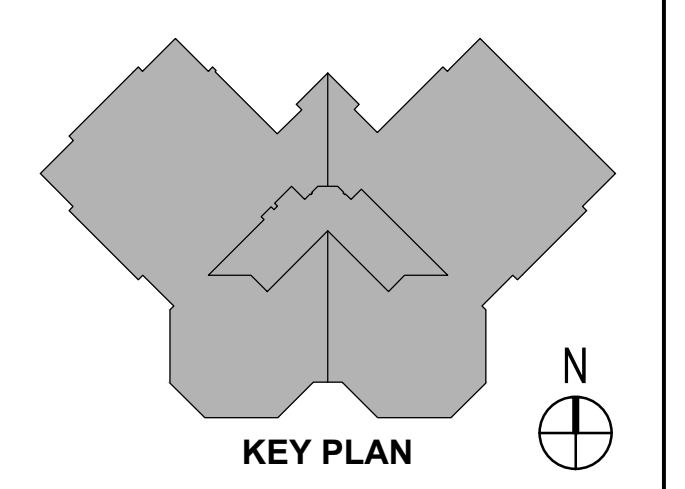
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1 BASEMENT FLOOR PLAN - DEMO
SCALE: 1/8" = 1'-0"

DEMO KEYED NOTES:

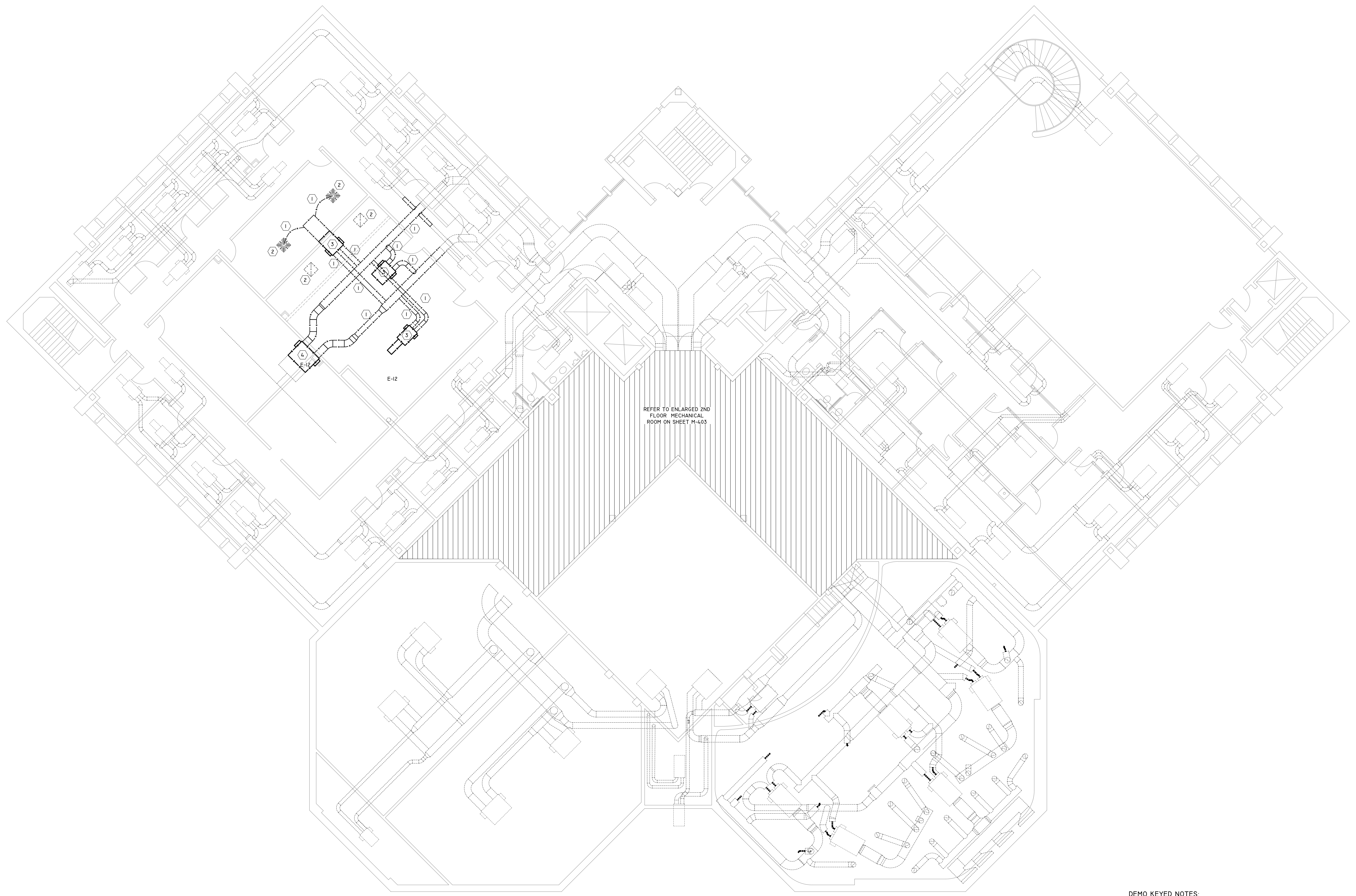
- ① REMOVE EXISTING AIR HANDLING UNITS (AHU-BH-1 AND AHU-BH-2).
- ② REMOVE EXISTING SUPPLY DUCTS AND AIR DEVICES.
- ③ REMOVE EXISTING EXHAUST DUCT AND EXHAUST GRILLES.
- ④ REMOVE EXISTING TERMINAL UNITS AND DOWNSTREAM AIR DISTRIBUTION COMPONENTS.
- ⑤ CAP AND REINSULATE REMAINING DUCT CONNECTION.
- ⑥ REMOVE EXISTING OUTSIDE AIR DUCT.
- ⑦ EXISTING OUTSIDE AIR DUCT SHALL REMAIN UP TO THIS POINT FOR RECONNECTION TO NEW DUCTWORK. REF 1/M201.
- ⑧ REMOVE EXISTING FAN COIL UNIT SUPPORTS, CONTROLS, PIPING, AND DUCT CONNECTIONS. CAP PIPING AT BRANCH CONNECTIONS AND REINSULATE.
- ⑨ REMOVE EXISTING CHW PIPING. COORDINATE CHW DEMO WITH RECONNECTION TO NEW AHU. REF 1/M2.01. REMOVE STEAM AND COND RET PIPING BACK TO MAINS. CAP AND REINSULATE BRACH CONNECTION.
- ⑩ REMOVE PORTION OF EXHAUST DUCT AS REQUIRED TO ACCOMMODATE NEW AIR VALVE. RE 1/M201.
- ⑪ PATCH EXISTING WALL OPENING. REF ARCHITECTURAL.



REVISIONS	
05/31/2017	ISSUED FOR BID
07/28/2017	ADDENDUM 1

Sheet Information	
Date	31 MARCH 2017
Job Number	-
Drawn	KN, KT, CJT
Checked	IT, SK
Approved	MAF, SK
	Title

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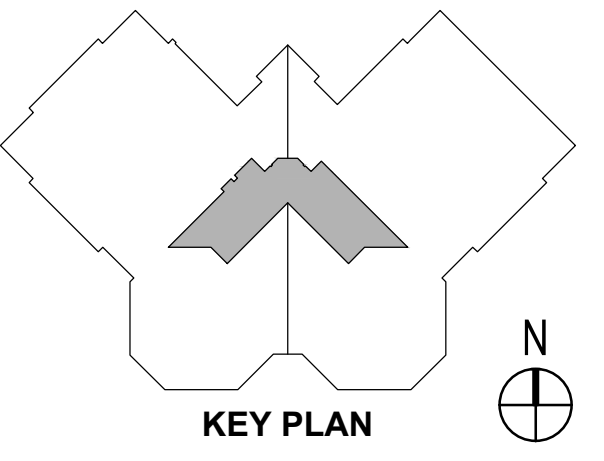


1 2RD FLOOR PLAN - HVAC - DEMO
SCALE: 1/8" = 1'-0"

- DEMO KEYED NOTES:**
- ① REMOVE SUPPLY AIR DUCTS UP AS REQUIRED. REFER M202 FOR PROPOSED WORK
 - ② REMOVE SUPPLY AIR AND RETURN AIR DIFFUSERS.
 - ③ REMOVE MIXING BOX AND ALL DOWNSTREAM DUCTWORK AND AIR DISTRIBUTION COMPONENTS.
 - ④ REMOVE THE MIXING BOX FOR RELOCATING TO NEW LOCATION. REFER M202 FOR PROPOSED WORK

Infrastructure Associates
 INFRASTRUCTURE ASSOCIATES, INC.
 617 RICHMOND AVENUE, SUITE 200
 HOUSTON, TEXAS 77057
 TYPE REGISTRATION NO. F-4506
 (713) 622-0120 PH (713) 622-0557 FAX
 WWW.IAHOUSTON.COM

UTHealth
 The University of Texas
 Health Science Center at Houston
School of Public Health
**UT HEALTH
 SCIENCE
 SCHOOL OF
 PUBLIC HEALTH**
 1200 PRESSLER ST.
 HOUSTON, TX 77030



REVISIONS

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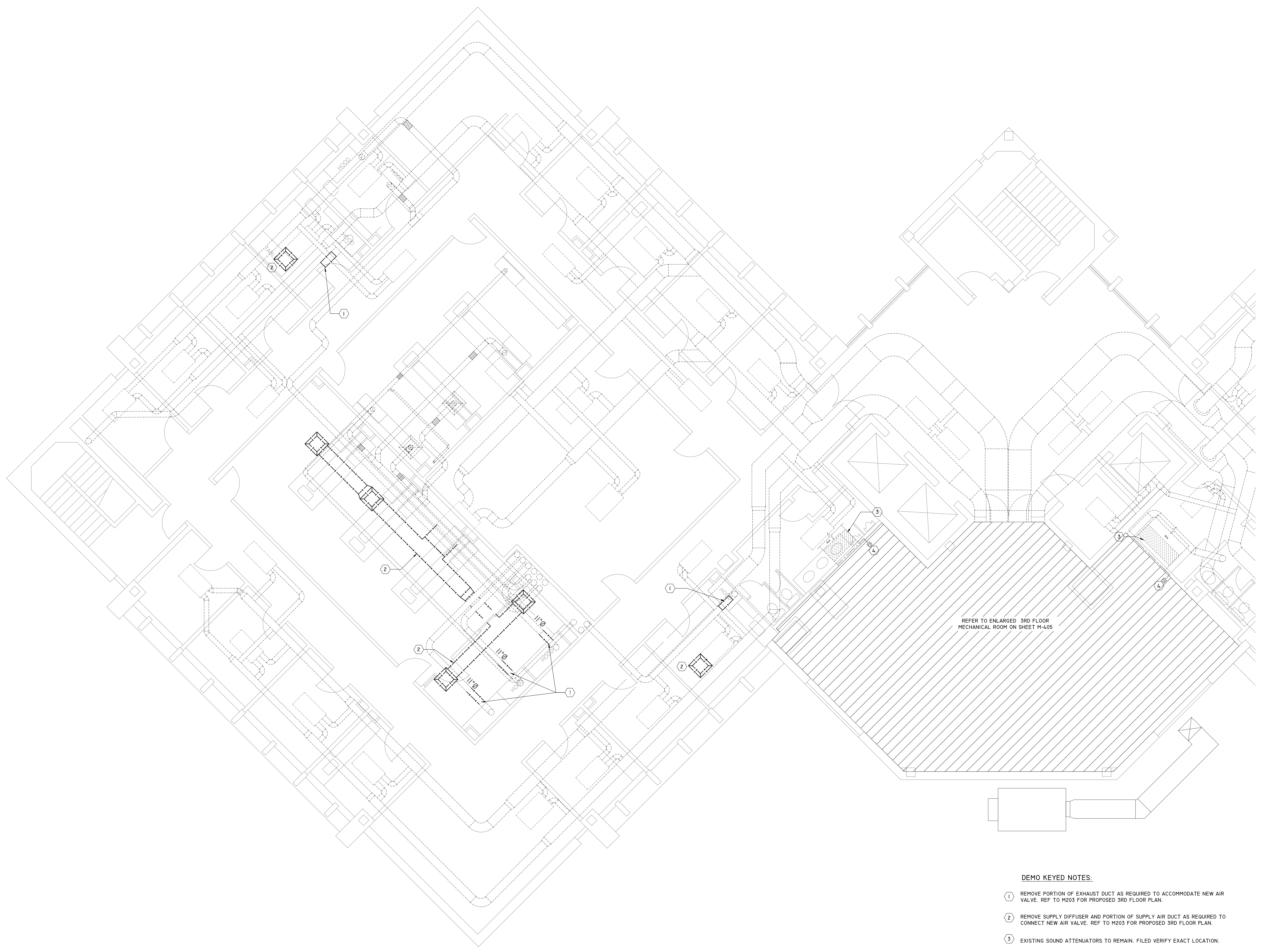
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2ND FLOOR PLAN -
 HVAC - DEMO

Sheet

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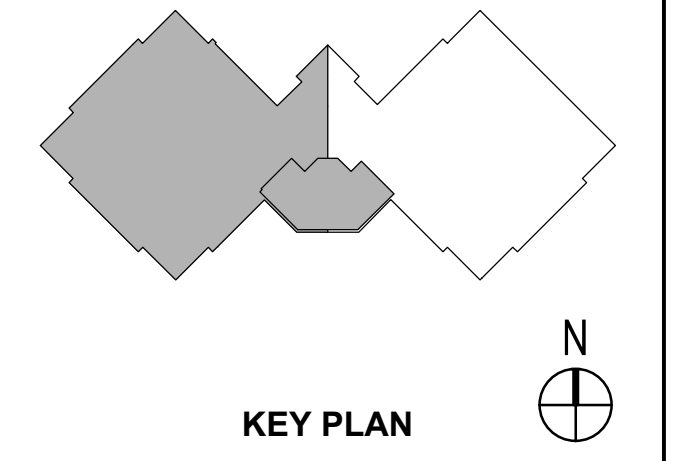


1 PARTIAL 3RD FLOOR PLAN - HVAC - DEMO
SCALE: 3/16" = 1'-0"

- DEMO KEYED NOTES:**
- ① REMOVE PORTION OF EXHAUST DUCT AS REQUIRED TO ACCOMMODATE NEW AIR VALVE. REF TO M203 FOR PROPOSED 3RD FLOOR PLAN.
 - ② REMOVE SUPPLY DIFFUSER AND PORTION OF SUPPLY AIR DUCT AS REQUIRED TO CONNECT NEW AIR VALVE. REF TO M203 FOR PROPOSED 3RD FLOOR PLAN.
 - ③ EXISTING SOUND ATTENUATORS TO REMAIN. FILED VERIFY EXACT LOCATION.
 - ④ REMOVE EXISTING FIRE SMOKE DAMPER.

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STATE OF TEXAS
 MATT A. FLUNKINGER
 119970
 LICENSED PROFESSIONAL ENGINEER
 7-28-17

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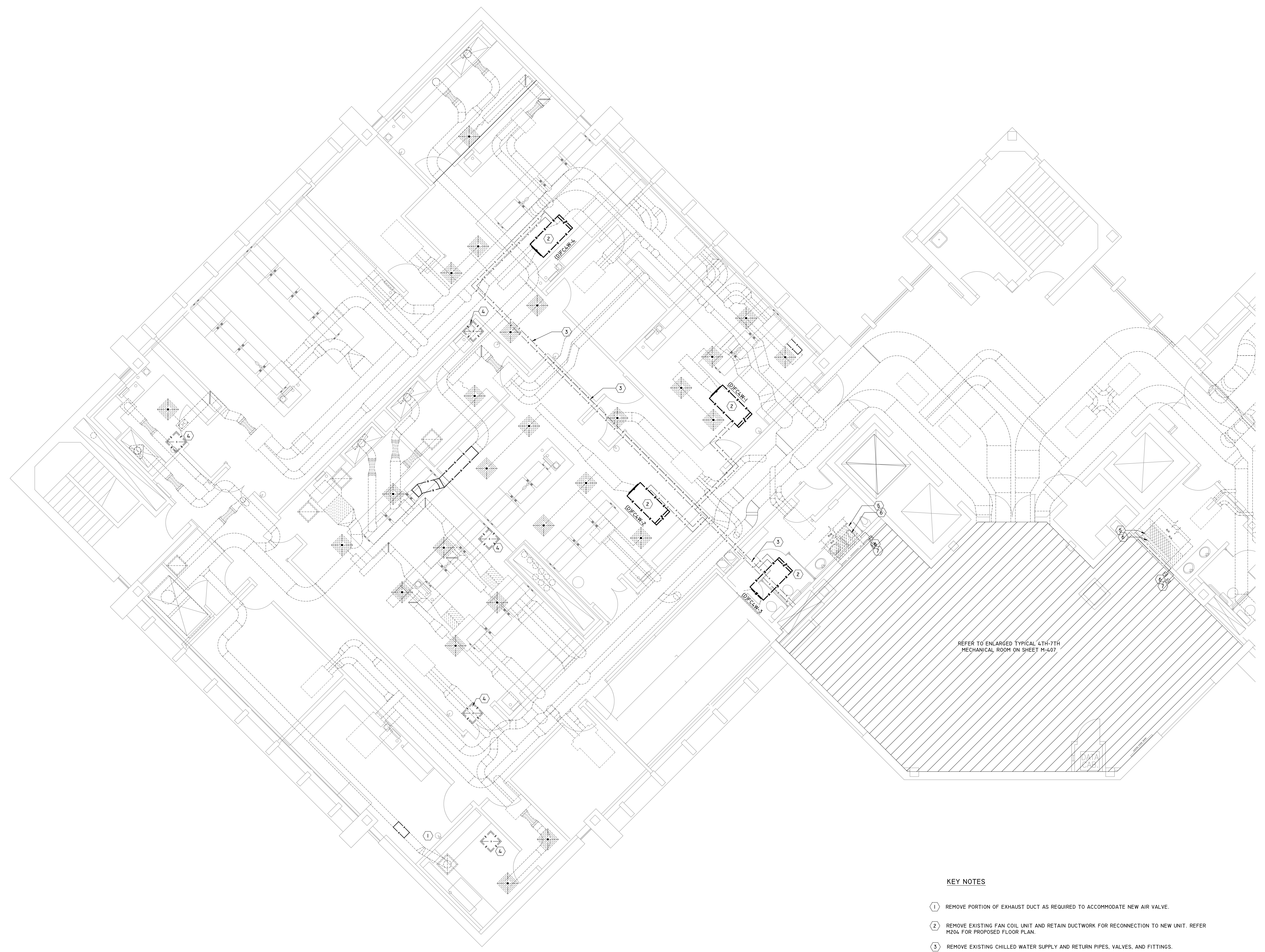
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3RD FLOOR PLAN - HVAC - DEMO
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M103
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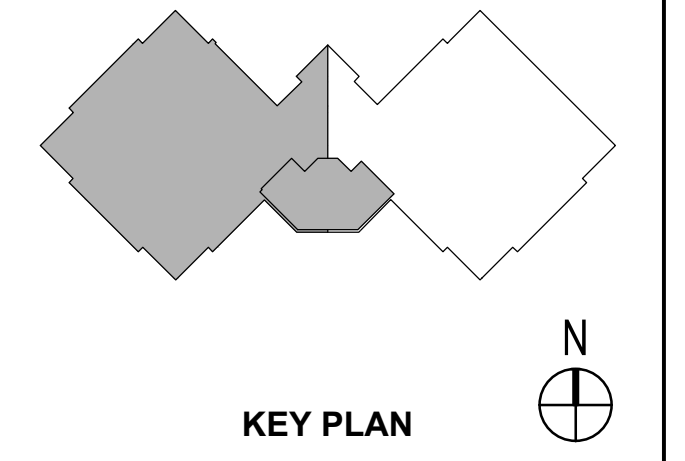
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1 PARTIAL 4TH FLOOR PLAN - HVAC - DEMO
SCALE: 3/16" = 1'-0"

KEY NOTES

- ① REMOVE PORTION OF EXHAUST DUCT AS REQUIRED TO ACCOMMODATE NEW AIR VALVE.
- ② REMOVE EXISTING FAN COIL UNIT AND RETAIN DUCTWORK FOR RECONNECTION TO NEW UNIT. REFER M204 FOR PROPOSED FLOOR PLAN.
- ③ REMOVE EXISTING CHILLED WATER SUPPLY AND RETURN PIPES, VALVES, AND FITTINGS.
- ④ REMOVE PORTION OF SUPPLY DUCT AS REQUIRED TO ACCOMMODATE THE NEW AIR VALVE. REFER M205 FOR PROPOSED FLOOR PLAN.
- ⑤ RELOCATE EXISTING TERMINAL UNIT AS REQUIRED FOR INSTALLATION OF NEW AIR VALVE. REFER M205 FOR PROPOSED FLOOR PLAN.
- ⑥ EXISTING SOUND ATTENUATORS TO REMIN. FIELD VERIFY EXACT LOCATION.
- ⑦ REMOVE EXISTING FIRE SMOKE DAMPERS.



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**4TH FLOOR PLAN -
HVAC - DEMO**

Sheet

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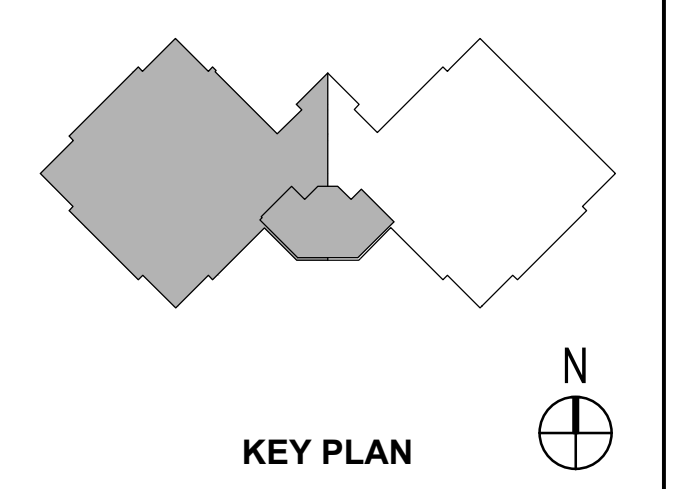


1 PARTIAL 5TH FLOOR PLAN - HVAC - DEMO
SCALE: 3/16" = 1'-0"

- DEMO KEYED NOTES:**
- ① EXISTING SOUND ATTENUATORS TO REMAIN.
 - ② REMOVE EXISTING FAN COIL UNIT AND RETAIN DUCTWORK FOR RECONNECTION TO NEW UNIT. REFER M206 FOR PROPOSED 5TH FLOOR PLAN.
 - ③ REMOVE EXISTING CHILLED WATER SUPPLY AND RETURN PIPES, VALVES, DRAIN PIPES AND FITTINGS ASSOCIATED WITH EXISTING FCU.
 - ④ REMOVE EXISTING FIRE SMOKE DAMPER.
 - ⑤ REMOVE EXISTING EXHAUST GRILLE & PATCH CEILING.

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STATE OF TEXAS
MATT A. FLUKINGER
118970
LICENSED PROFESSIONAL ENGINEER
Matt A. Flukinger
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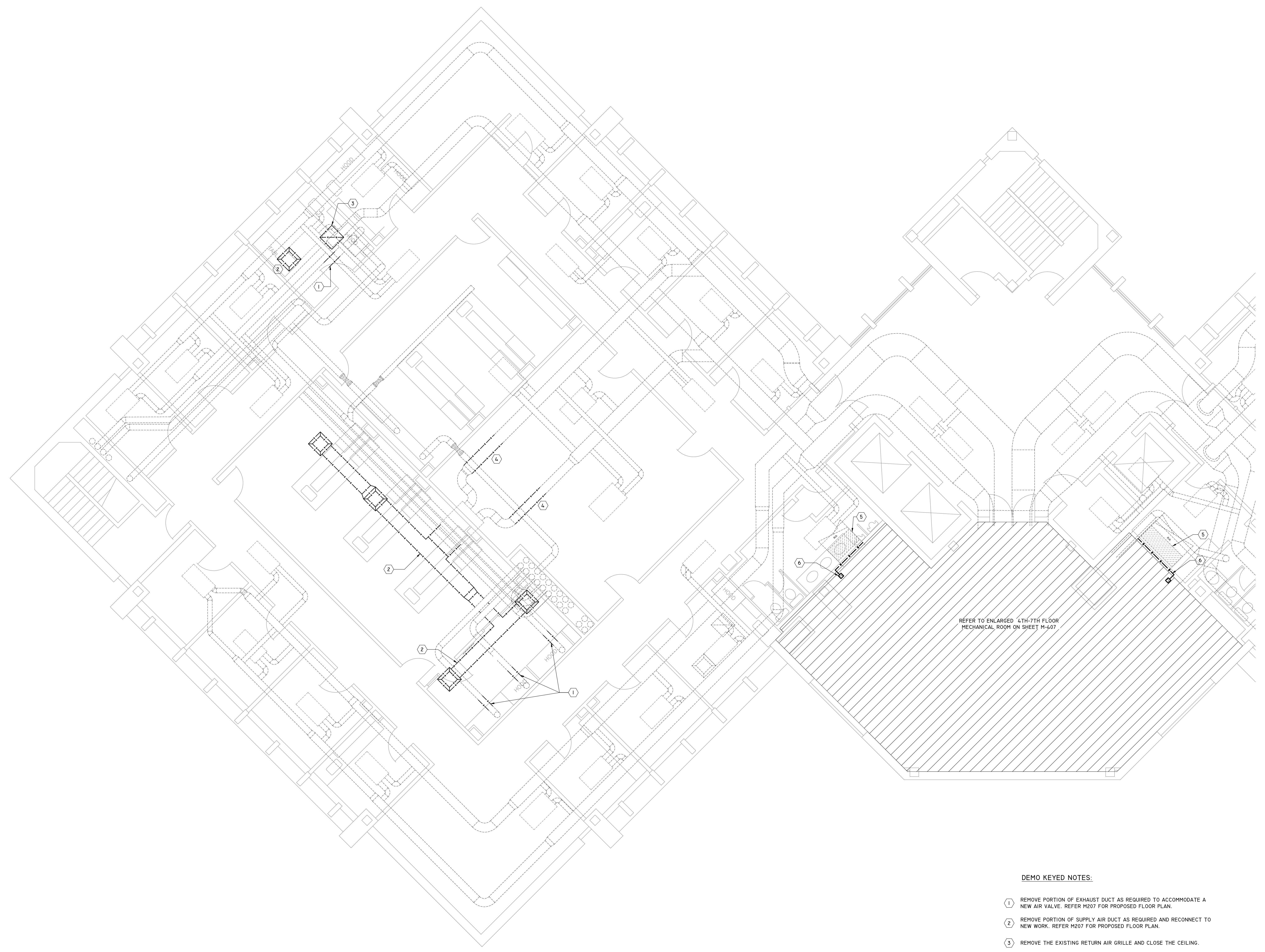
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5TH FLOOR PLAN -
HVAC - DEMO

Sheet

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1 PARTIAL 6TH FLOOR PLAN - HVAC - DEMO
SCALE: 3/16" = 1'-0"

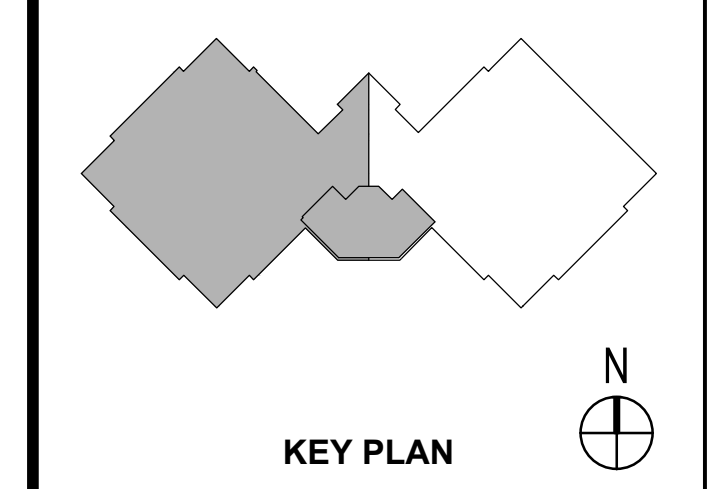
REFER TO ENLARGED 4TH-7TH FLOOR MECHANICAL ROOM ON SHEET M-407

DEMO KEYED NOTES:

- ① REMOVE PORTION OF EXHAUST DUCT AS REQUIRED TO ACCOMMODATE A NEW AIR VALVE. REFER M207 FOR PROPOSED FLOOR PLAN.
- ② REMOVE PORTION OF SUPPLY AIR DUCT AS REQUIRED AND RECONNECT TO NEW WORK. REFER M207 FOR PROPOSED FLOOR PLAN.
- ③ REMOVE THE EXISTING RETURN AIR GRILLE AND CLOSE THE CEILING.
- ④ REMOVE PORTION OF SUPPLY AIR BRANCH DUCTS AS REQUIRED TO RELOCATE EXISTING TERMINAL BOX. REFER M207 FOR PROPOSED FLOOR PLAN.
- ⑤ EXISTING SOUND ATTENUATORS TO REMAIN. FIELD VERIFY EXACT LOCATION.
- ⑥ REMOVE EXISTING FIRE SMOKE DAMPER.

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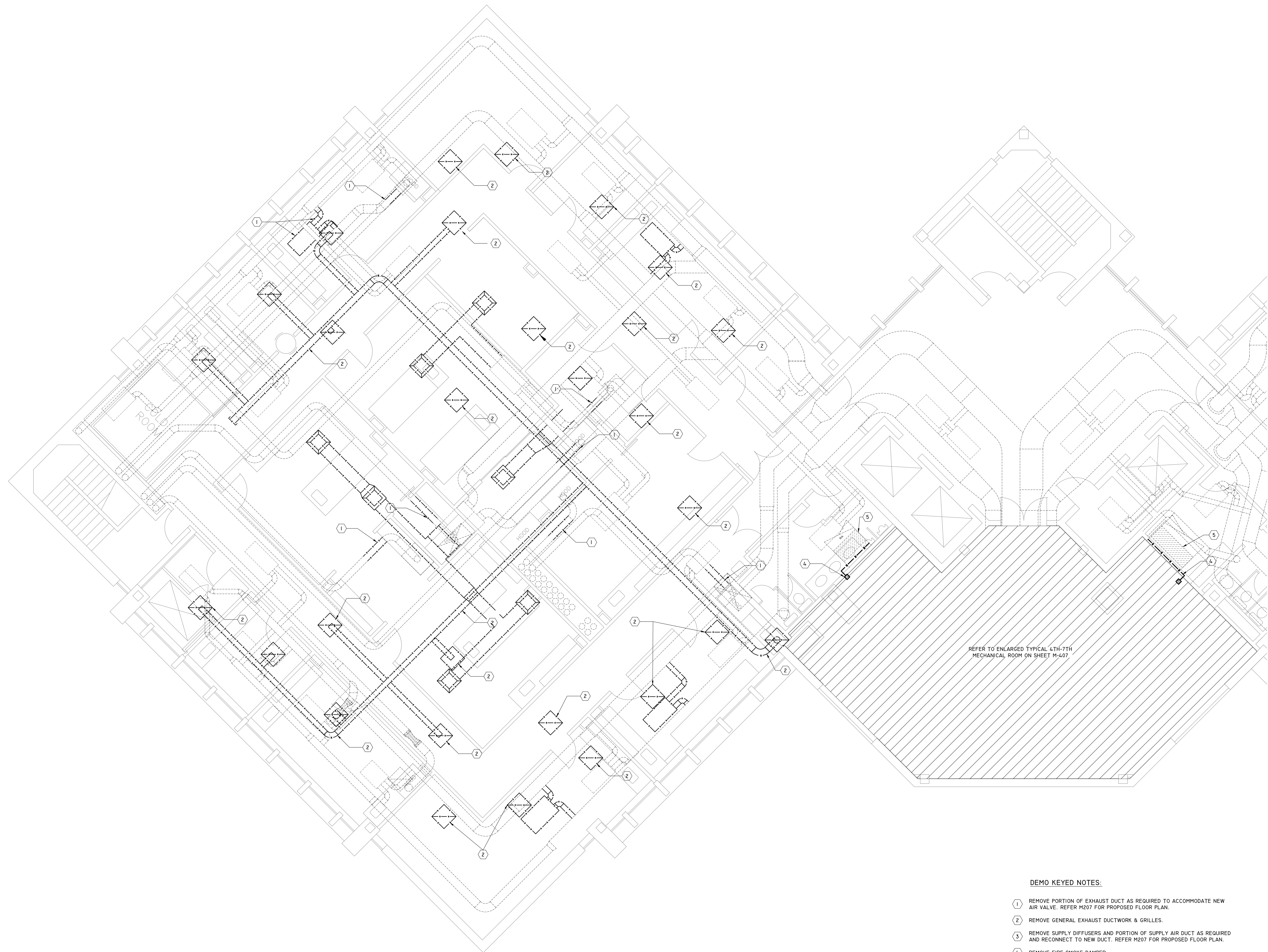
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6TH FLOOR PLAN - DEMO

Sheet

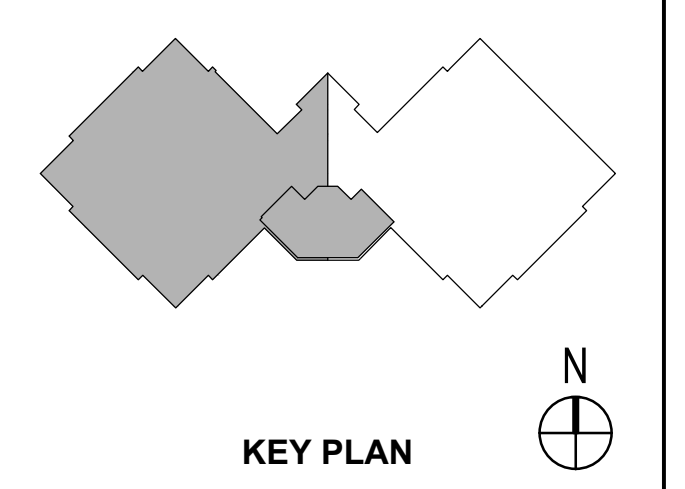
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1 7TH FLOOR PLAN - HVAC - DEMO
SCALE: 3/16" = 1'-0"

- DEMO KEYED NOTES:**
- ① REMOVE PORTION OF EXHAUST DUCT AS REQUIRED TO ACCOMMODATE NEW AIR VALVE. REFER M207 FOR PROPOSED FLOOR PLAN.
 - ② REMOVE GENERAL EXHAUST DUCTWORK & GRILLES.
 - ③ REMOVE SUPPLY DIFFUSERS AND PORTION OF SUPPLY AIR DUCT AS REQUIRED AND RECONNECT TO NEW DUCT. REFER M207 FOR PROPOSED FLOOR PLAN.
 - ④ REMOVE FIRE SMOKE DAMPER.
 - ⑤ EXISTING SOUND ATTENUATORS TO REMAIN. FIELD VERIFY EXACT LOCATION.



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118970
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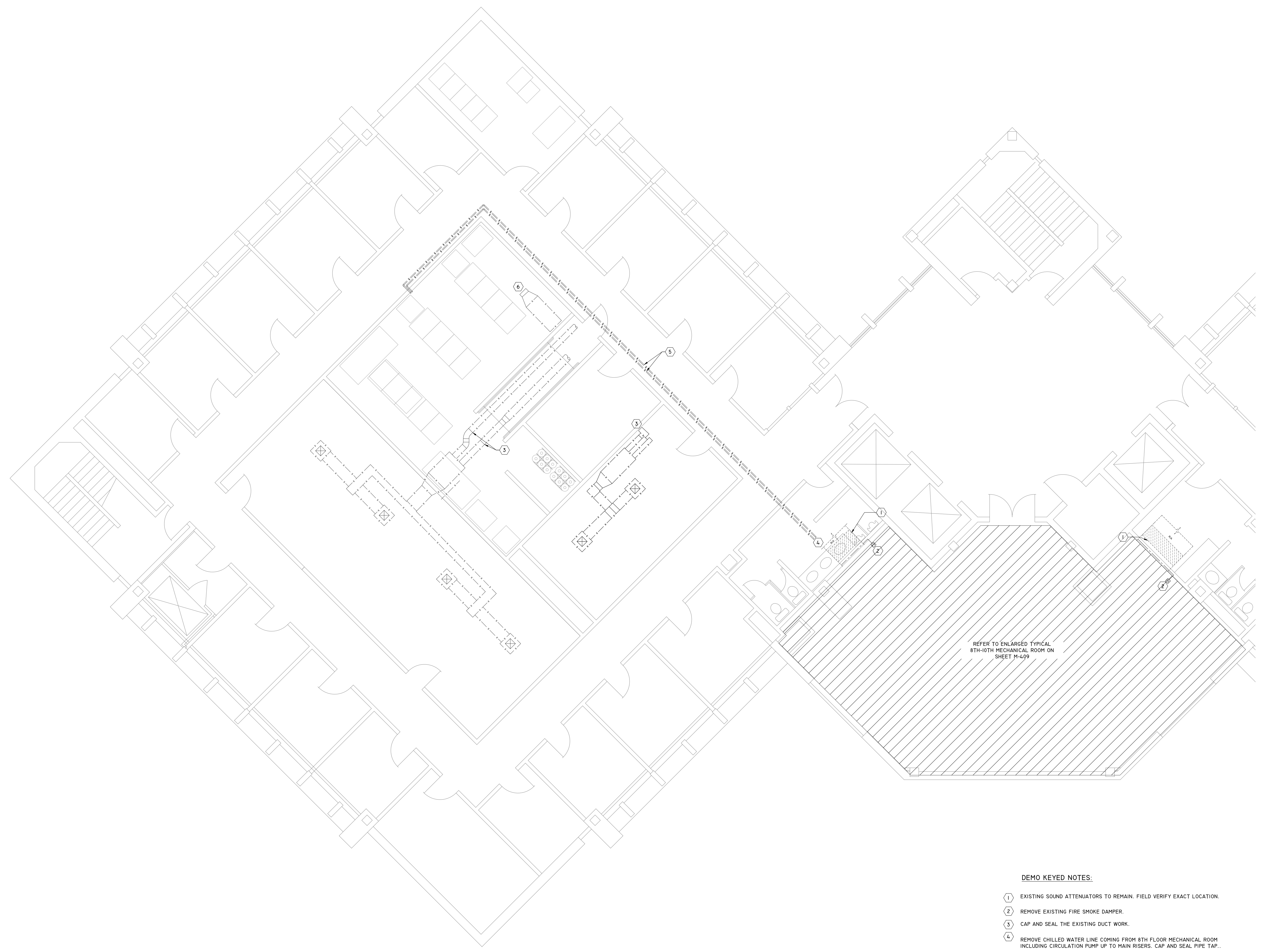
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7TH FLOOR PLAN -
HVAC - DEMO

Sheet

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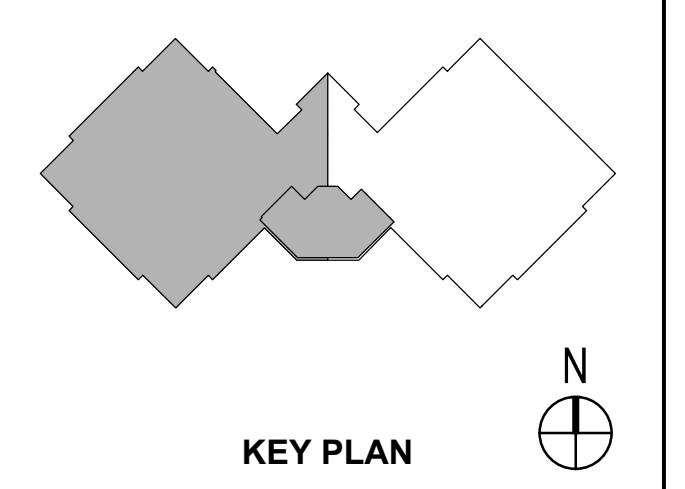


1 8TH FLOOR PLAN - HVAC - DEMO
SCALE: 3/16" = 1'-0"

REFER TO ENLARGED TYPICAL
8TH-10TH MECHANICAL ROOM ON
SHEET M-449

DEMO KEYED NOTES:

- 1 EXISTING SOUND ATTENUATORS TO REMAIN. FIELD VERIFY EXACT LOCATION.
- 2 REMOVE EXISTING FIRE SMOKE DAMPER.
- 3 CAP AND SEAL THE EXISTING DUCT WORK.
- 4 REMOVE CHILLED WATER LINE COMING FROM 8TH FLOOR MECHANICAL ROOM INCLUDING CIRCULATION PUMP UP TO MAIN RISERS. CAP AND SEAL PIPE TAP.
- 5 DEMO EXISTING 1-1/2" CHWS&R LINE SERVING TO SERVER ROOM AC UNIT.
- 6 REMOVE EXISTING MIXING BOX AND RELOCATE IT IN NEW LOCATION. REFER TO SHEET M208



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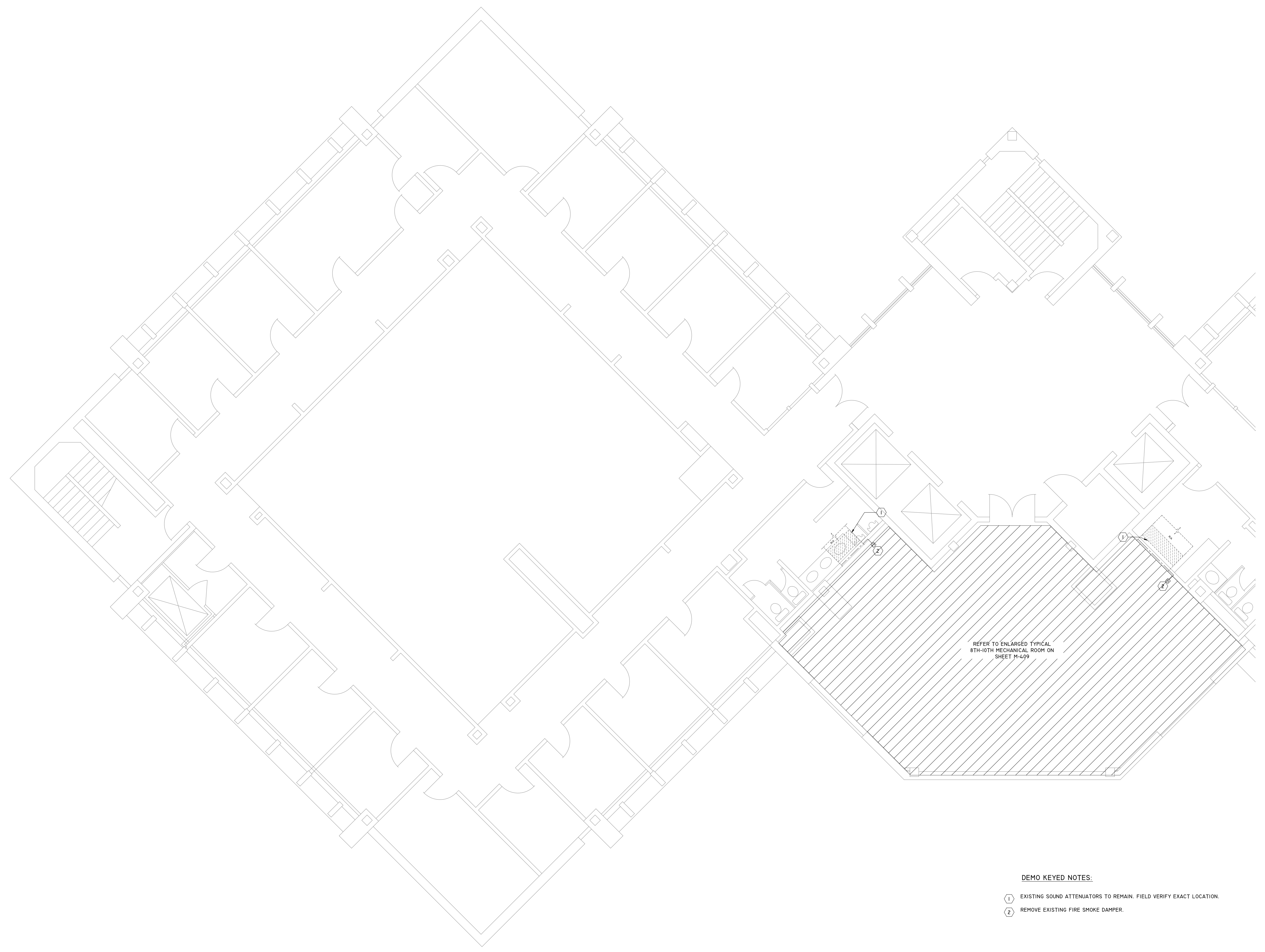
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8TH FLOOR PLAN -
 HVAC - DEMO

Sheet

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REFER TO ENLARGED TYPICAL
8TH-10TH MECHANICAL ROOM ON
SHEET M-409

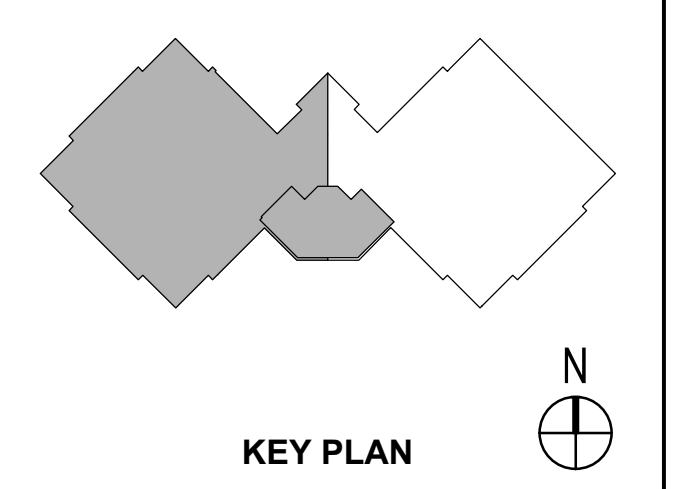
DEMO KEYED NOTES:

- ① EXISTING SOUND ATTENUATORS TO REMAIN. FIELD VERIFY EXACT LOCATION.
- ② REMOVE EXISTING FIRE SMOKE DAMPER.

1 9TH FLOOR PLAN - HVAC - DEMO
SCALE: 3/16" = 1'-0"

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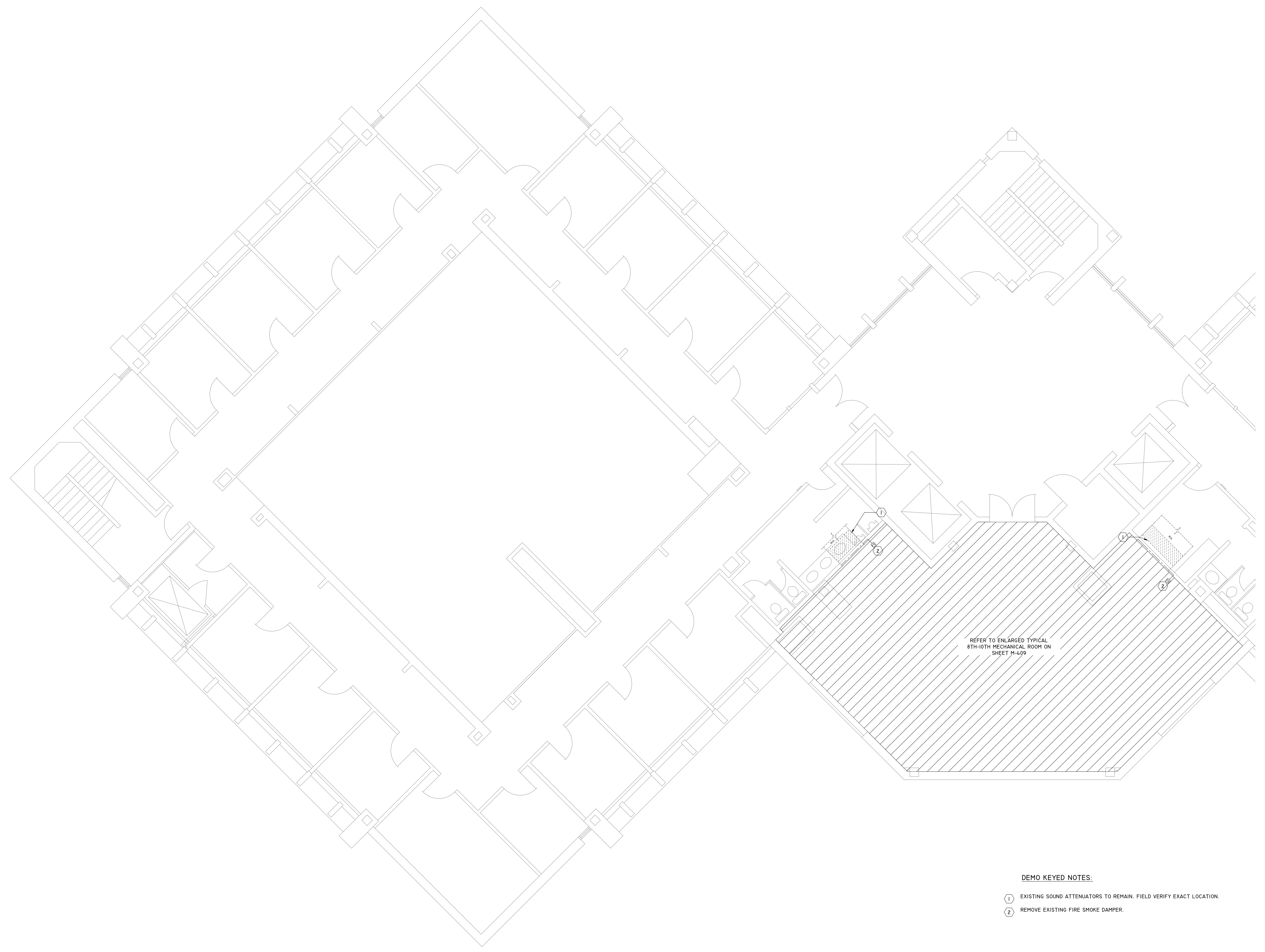
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9TH FLOOR PLAN -
HAVC - DEMO

Sheet

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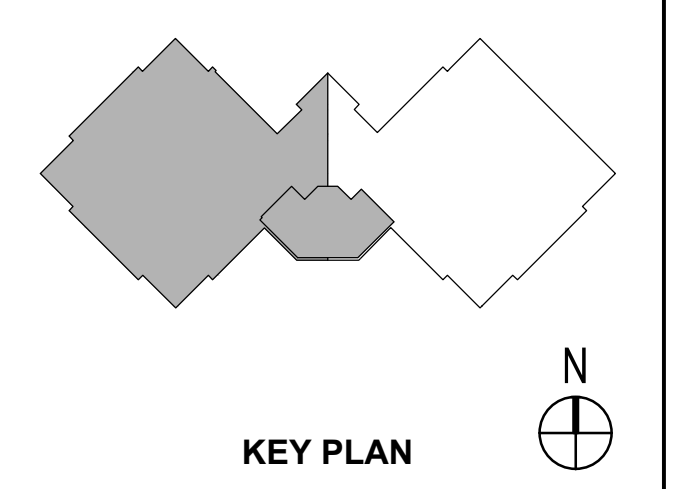


- DEMO KEYED NOTES:**
- ① EXISTING SOUND ATTENUATORS TO REMAIN. FIELD VERIFY EXACT LOCATION.
 - ② REMOVE EXISTING FIRE SMOKE DAMPER.

1 10TH FLOOR PLAN - HVAC - DEMO
SCALE: 3/16" = 1'-0"

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 MATT A. FLUNKINGER
 118970
 LICENSED PROFESSIONAL ENGINEER
 7-28-17

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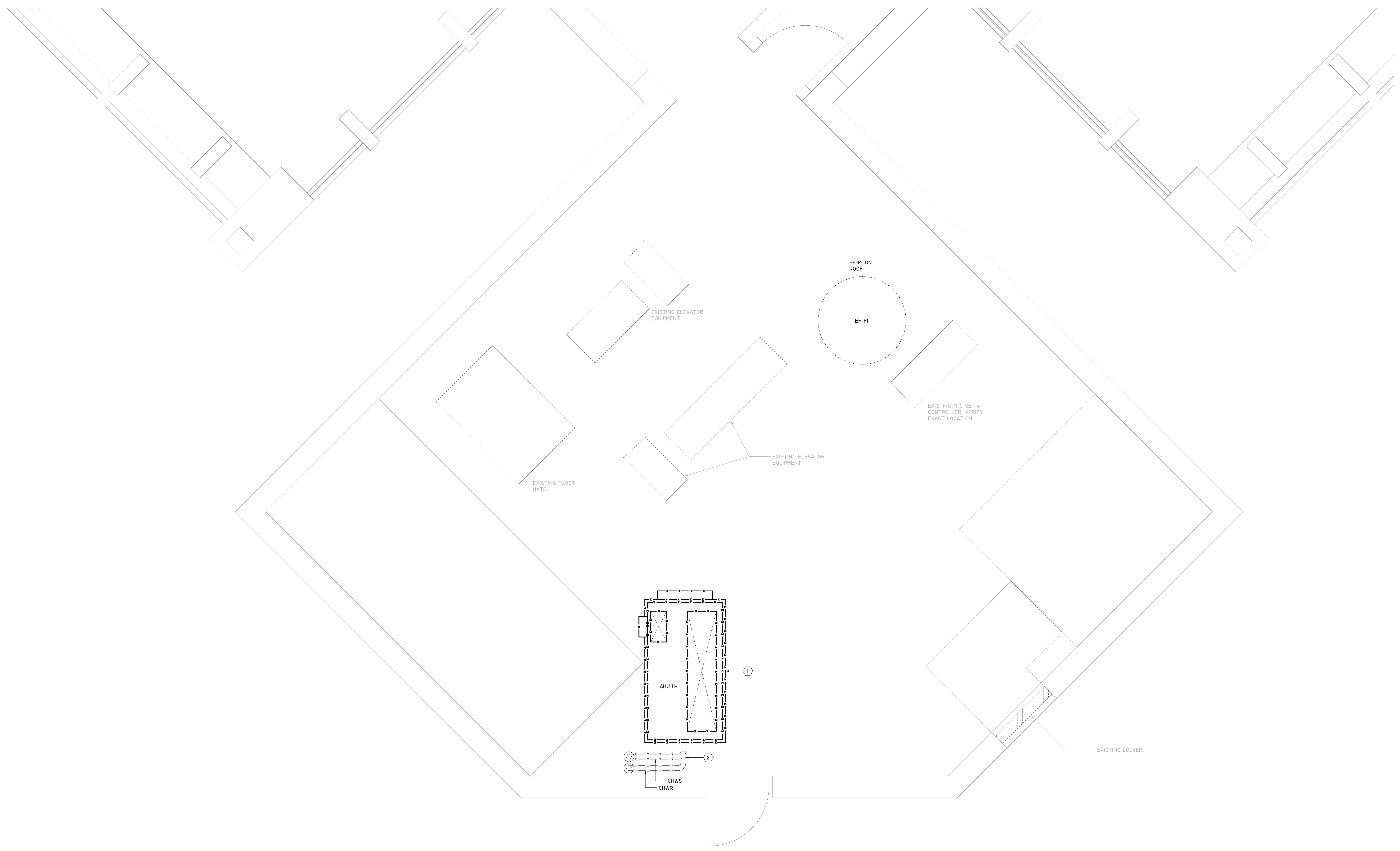
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10TH FLOOR PLAN -
 HVAC - DEMO

Sheet

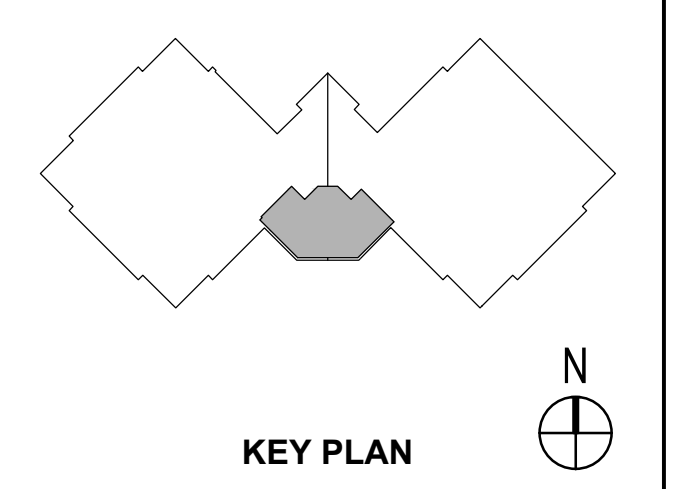
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1 PENTHOUSE FLOOR PLAN - HVAC - DEMO
SCALE: 1/2" = 1'-0"

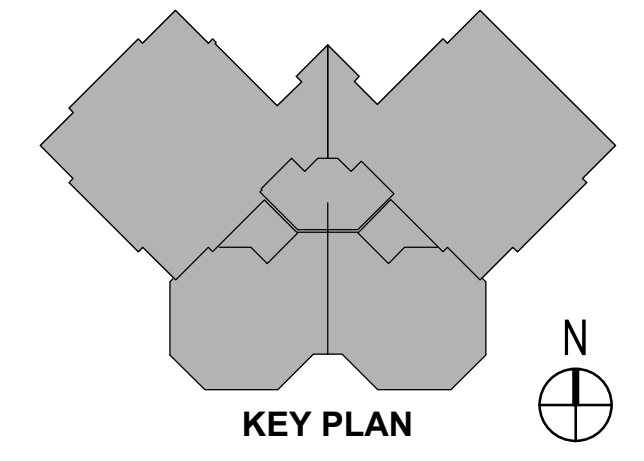
- DEMO KEYED NOTES:**
- ① REMOVE EXISTING AHU AND HOUSE KEEPING PAD
 - ② REMOVE EXISTING CHILLED WATER DRAIN PIPES, VALVES AND FITTINGS BACK TO RISER, RECONNECT TO NEW WORK. REFER I/M208.



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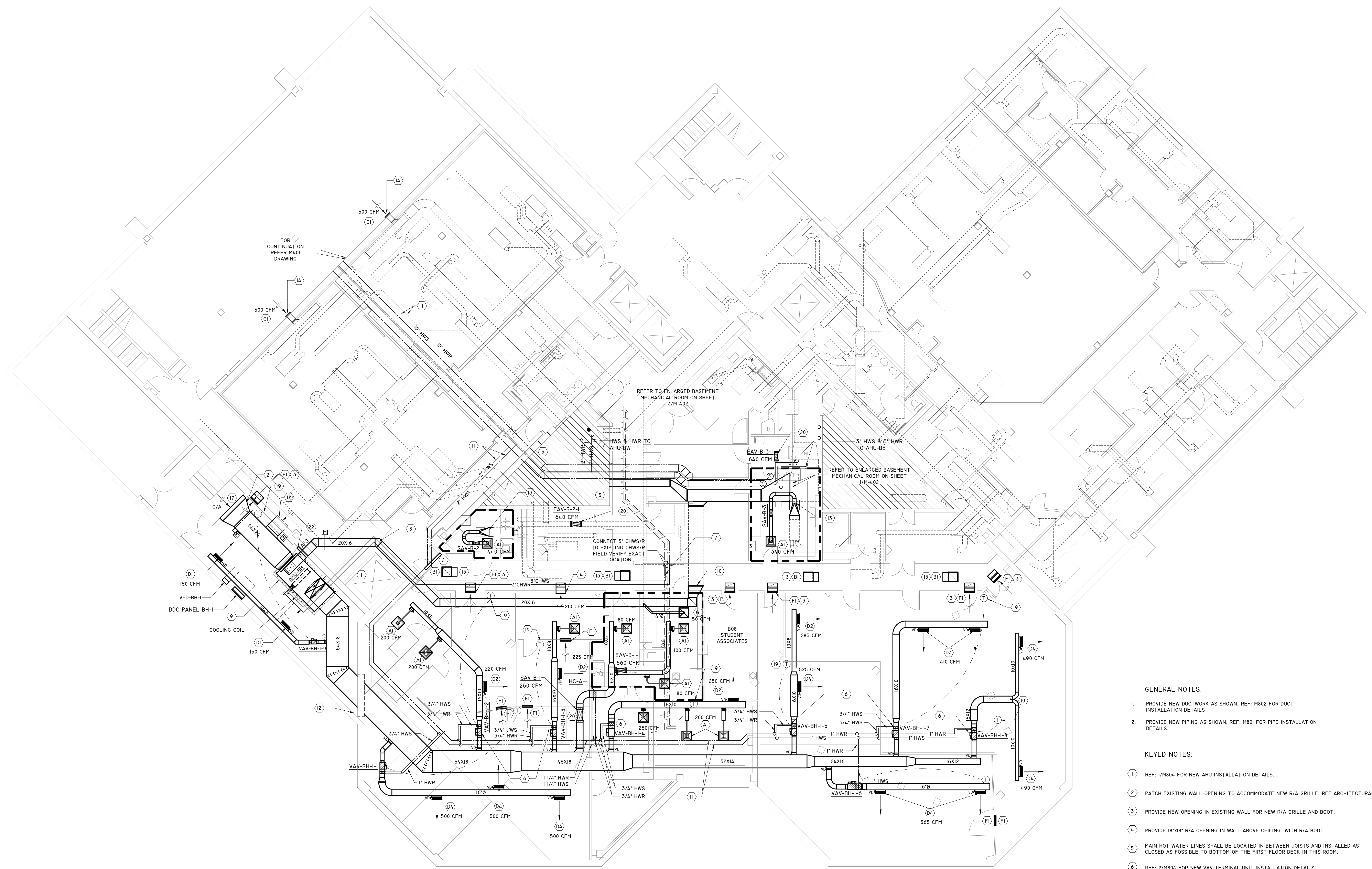


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BASEMENT FLOOR PLAN - HVAC - PROPOSED

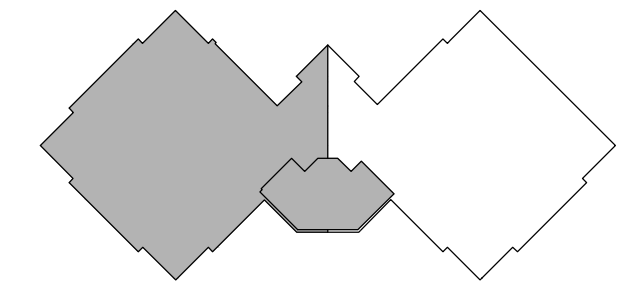
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- GENERAL NOTES:**
1. PROVIDE NEW DUCTWORK AS SHOWN. REF: M802 FOR DUCT INSTALLATION DETAILS.
 2. PROVIDE NEW PIPING AS SHOWN. REF: M801 FOR PIPE INSTALLATION DETAILS.
- KEYED NOTES:**
1. REF: 1/M804 FOR NEW AHU INSTALLATION DETAILS.
 2. PATCH EXISTING WALL OPENING TO ACCOMMODATE NEW R/A GRILLE. REF ARCHITECTURAL.
 3. PROVIDE NEW OPENING IN EXISTING WALL FOR NEW R/A GRILLE AND BOOT.
 4. PROVIDE 18"x18" R/A OPENING IN WALL ABOVE CEILING. WITH R/A BOOT.
 5. MAIN HOT WATER LINES SHALL BE LOCATED IN BETWEEN JOISTS AND INSTALLED AS CLOSED AS POSSIBLE TO BOTTOM OF THE FIRST FLOOR DECK IN THIS ROOM.
 6. REF: 2/M804 FOR NEW VAV TERMINAL UNIT INSTALLATION DETAILS.
 7. PROVIDE NEW CHS & CHR PIPING TO AHU-BH-1. COORDINATE CONNECTION TO EXISTING PIPING WITH PIPING DEMOLITION.
 8. PROVIDE NEW 20"x16" OUTSIDE AIR DUCT.
 9. PROVIDE 6" HOUSEKEEPING PAD FOR NEW AHU.
 10. TRANSITION NEW 20"x16" OUTSIDE AIR DUCT AND CONNECT TO EXISTING 36"x24" OUTSIDE AIR DUCT. COORDINATE WITH DUCT DEMOLITION.
 11. PROVIDE NEW HWS & HWR PIPING.
 12. ENLARGE EXISTING WALL OPENING TO PROVIDE 9.0 S.F. FREE AREA. COORDINATE ASPECT RATIO WITH EXISTING CONDITIONS. TRANSITION R/A DUCT TO FINAL OPENING AS REQUIRED.
 13. PROVIDE NEW AIR VALVE & DUCTWORK. RECONNECT TO EXISTING TERMINAL UNIT. REFER TO 1/M805 FOR INSTALLATION DETAIL.
 14. PROVIDE NEW 18"x12" HEEL TAP WITH BALANCE DAMPER IN EXISTING EXHAUST. DUCT & EXTEND THROUGH MECH ROOM WALL.
 15. PROVIDE NEW 6" CONCRETE HOUSEKEEPING PAD. REFER TO SHEET M505 FOR AHU INSTALLATION.
 16. REF: 3/M803 FOR FCU INSTALLATION DETAILS.
 17. PROVIDE 80X60 DRAINABLE LOUVER SIMILAR TO RUSKIN MODEL ELF4275. PATCH AND SEAL THE WALL AFTER LOUVER INSTALLATION. REFER TO ARCHITECTURAL DRAWINGS.
 18. PROVIDE NEW VFD AND DDC PANELS AND LOCATE THEM AS SHOWN.

19. PROVIDE NEW ROOM TEMP SENSOR AT WALL LOCATION SHOWN.
20. PROVIDE NEW AIR VALVE AND CONNECT TO EXISTING DUCT. RE: XXX FOR INSTALLATION.
21. TRANSITION OUTSIDE AIR DUCT TO NEW LOUVERED OPENING. COORDINATE WITH ARCHITECTURAL.
22. PROVIDE NEW AIR FLOW STATION (AFS) AT OUTSIDE AIR DUCT.

1 BASEMENT FLOOR PLAN - PROPOSED
 SCALE: 1/8" = 1'-0"



KEY PLAN



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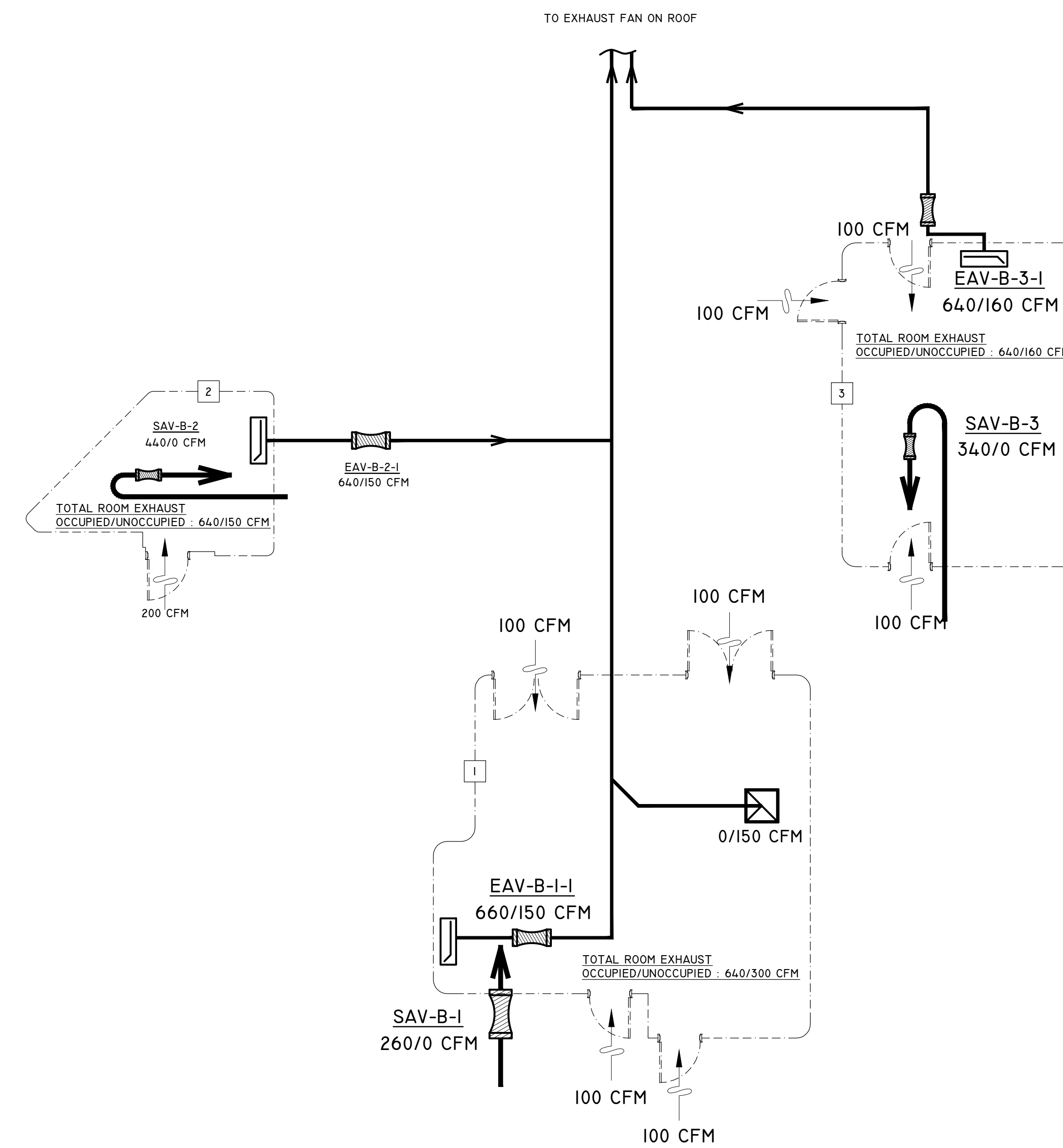
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BASEMENT FLOOR
PLAN - AIR FLOW
DIAGRAM

Sheet

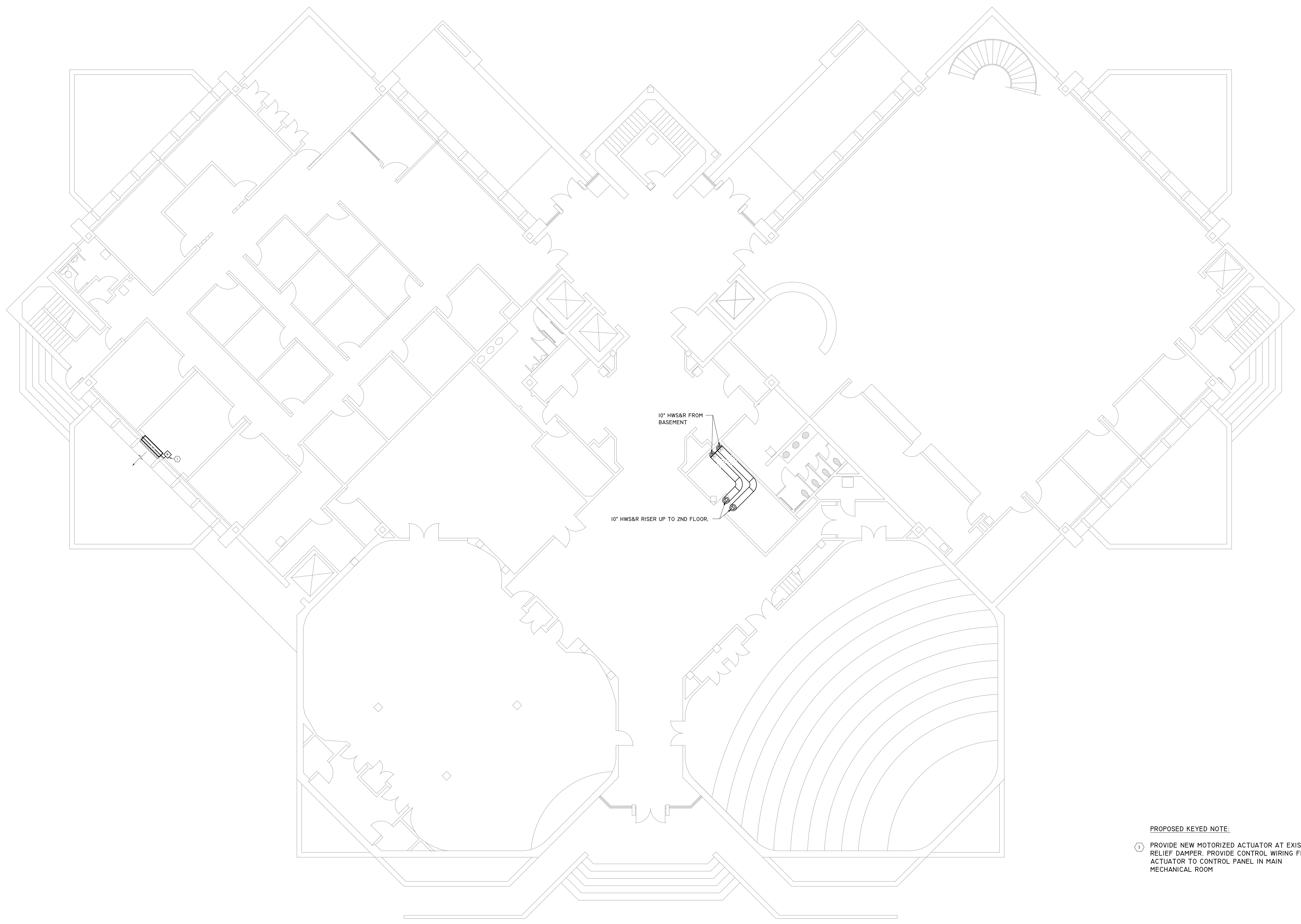
M200A
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1 BASEMENT FLOOR PLAN - AIR FLOW DIAGRAM
SCALE: NTS

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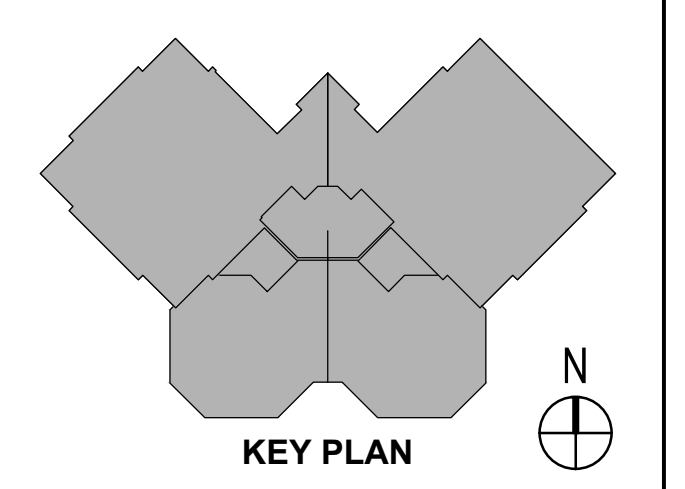
10" HWS&R FROM BASEMENT

10" HWS&R RISER UP TO 2ND FLOOR.

PROPOSED KEYED NOTE:

- ① PROVIDE NEW MOTORIZED ACTUATOR AT EXISTING RELIEF DAMPER. PROVIDE CONTROL WIRING FROM ACTUATOR TO CONTROL PANEL IN MAIN MECHANICAL ROOM

1 1ST FLOOR PLAN - PROPOSED
SCALE: 1/8" = 1'-0"



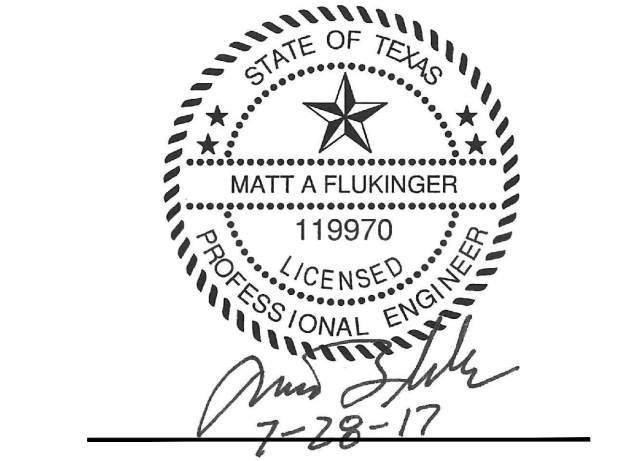
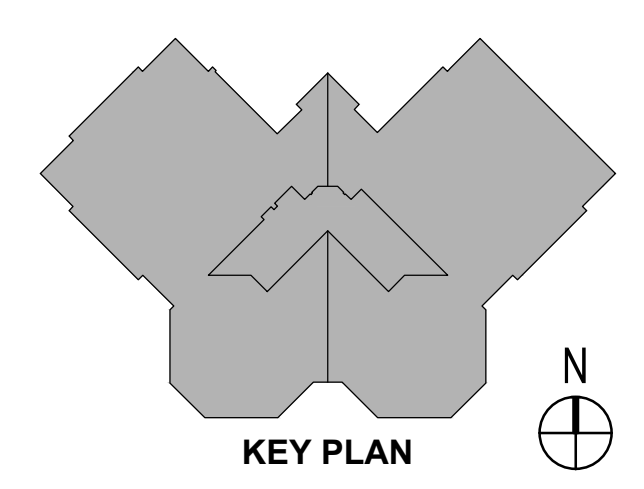
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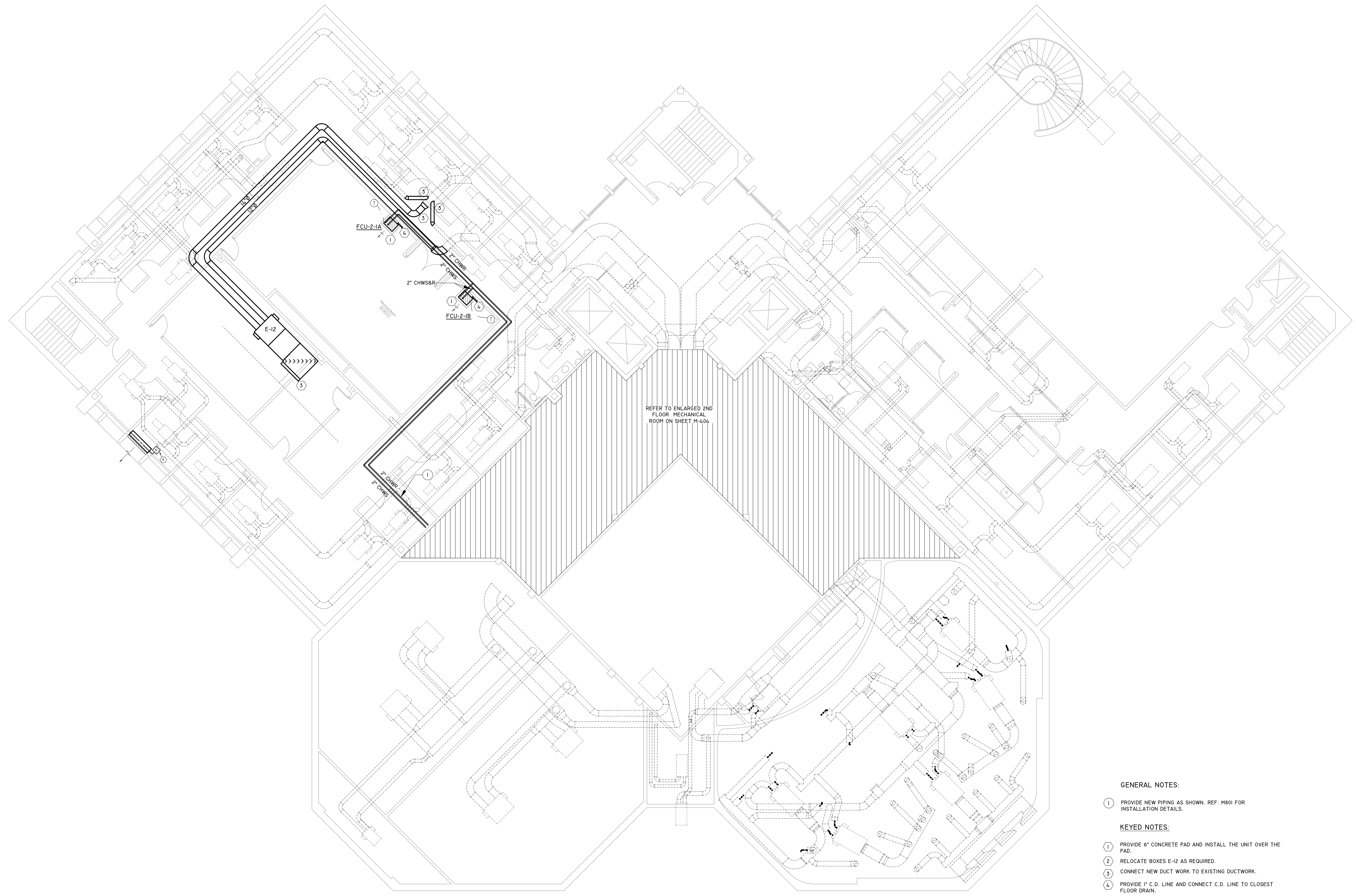
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2ND FLOOR PLAN - HVAC - PROPOSED

Sheet

M202

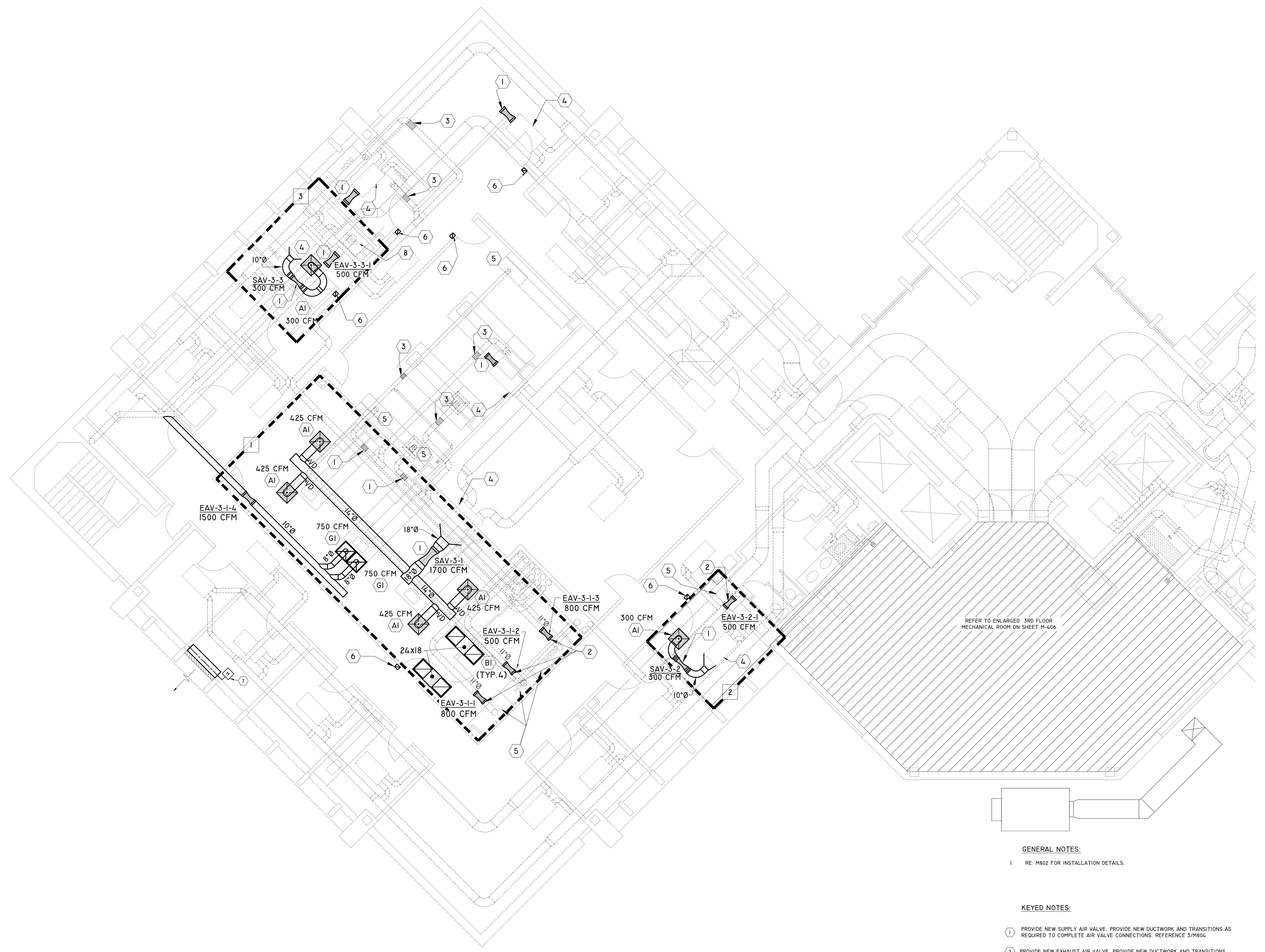
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- GENERAL NOTES:
- 1 PROVIDE NEW PIPING AS SHOWN. REF. MBOI FOR INSTALLATION DETAILS.
- KEYED NOTES:
- 1 PROVIDE 6" CONCRETE PAD AND INSTALL THE UNIT OVER THE PAD.
 - 2 RELOCATE BOXES E-12 AS REQUIRED.
 - 3 CONNECT NEW DUCT WORK TO EXISTING DUCTWORK.
 - 4 PROVIDE 1" C.D. LINE AND CONNECT C.D. LINE TO CLOSEST FLOOR DRAIN.
 - 5 PROVIDE NEW MOTORIZED ACTUATOR AT EXISTING RELIEF DAMPER. PROVIDE CONTROL WIRING FROM ACTUATOR TO CONTROL PANEL IN MAIN MECHANICAL ROOM

1 2ND FLOOR PLAN - HVAC - PROPOSED
 SCALE: 1/8" = 1'-0"

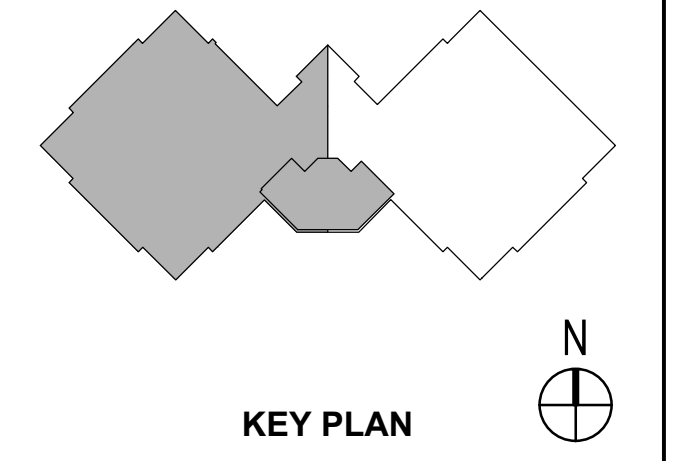
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1 3RD FLOOR PLAN - HVAC - PROPOSED
SCALE: 3/16" = 1'-0"

GENERAL NOTES:
1. RE: M802 FOR INSTALLATION DETAILS.

- KEYED NOTES:**
- ① PROVIDE NEW SUPPLY AIR VALVE. PROVIDE NEW DUCTWORK AND TRANSITIONS AS REQUIRED TO COMPLETE AIR VALVE CONNECTIONS. REFERENCE 3/M804.
 - ② PROVIDE NEW EXHAUST AIR VALVE. PROVIDE NEW DUCTWORK AND TRANSITIONS AS REQUIRED TO COMPLETE AIR VALVE CONNECTIONS. REFERENCE 3/M804.
 - ③ RETROFIT EXISTING AIR VALVE WITH NEW CONTROLS. REFERENCE 3/M703.
 - ④ RETROFIT EXISTING DUAL DUCT TERMINAL UNIT WITH NEW CONTROLS. REFERENCE 2/M703.
 - ⑤ RETROFIT EXISTING FUME HOOD WITH NEW SASH POSITION SENSOR AND NEW CONTROLS. REFERENCE 4/M703.
 - ⑥ PROVIDE NEW DIFFERENTIAL PRESSURE SENSOR AND ROOM CONTROL MONITORING PANEL. REFERENCE 3/M703.
 - ⑦ PROVIDE NEW MOTORIZED ACTUATOR AT EXISTING RELIEF DAMPER. PROVIDE CONTROL WIRING FROM ACTUATOR TO CONTROL PANEL IN MAIN MECHANICAL ROOM.

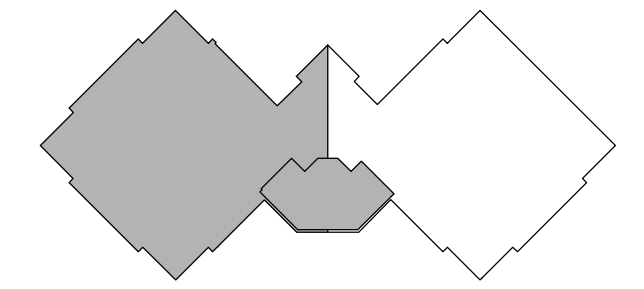


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KEY PLAN



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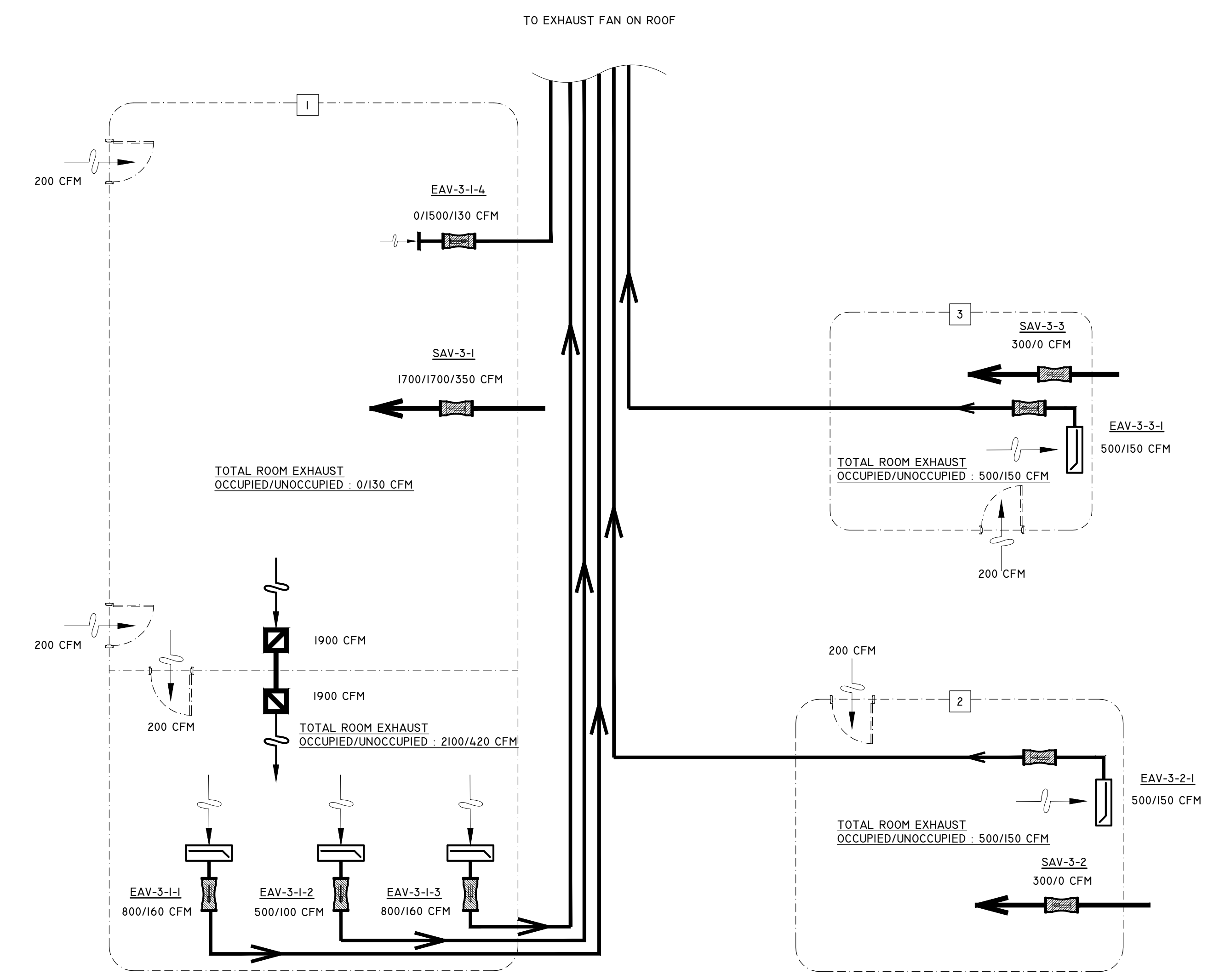
Sheet Information

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3RD FLOOR PLAN -
AIR FLOW
DIAGRAM

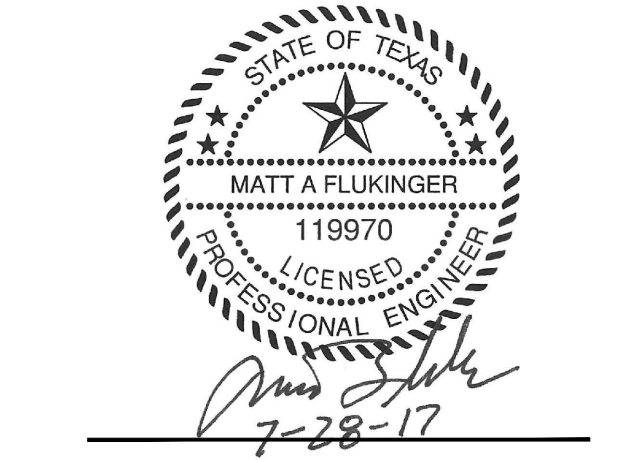
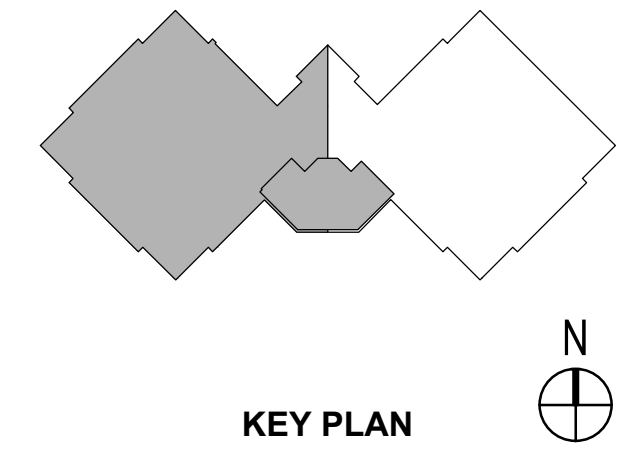
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M203A
ISSUED FOR BID



1 3RD FLOOR PLAN - AIR FLOW DIAGRAM
SCALE: NTS

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1/2
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REVISIONS

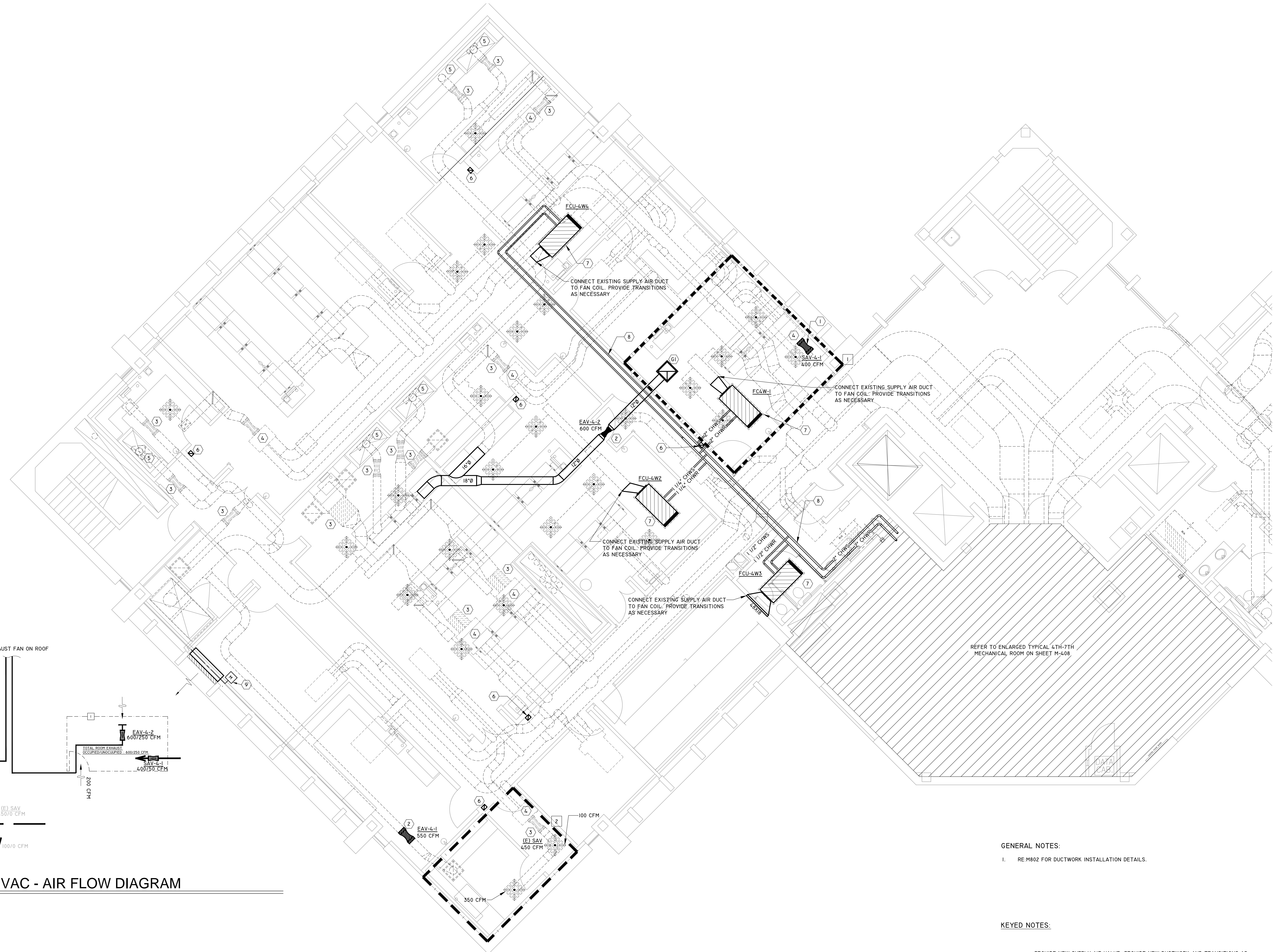
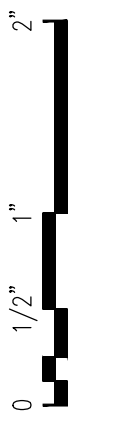
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4TH FLOOR PLAN - HVAC - PROPOSED

Sheet
M204
 ISSUED FOR BID

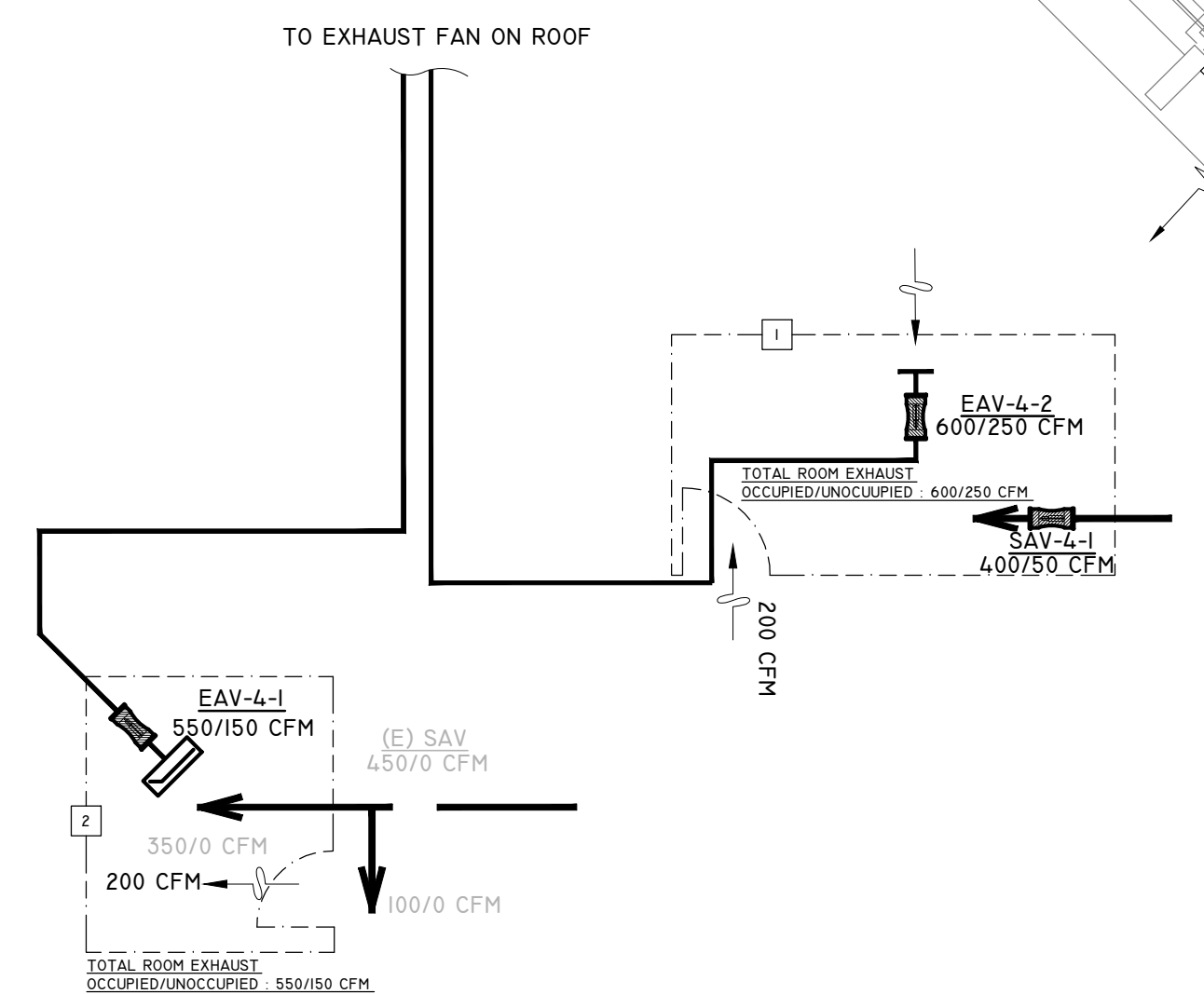


GENERAL NOTES:

- RE:M802 FOR DUCTWORK INSTALLATION DETAILS.

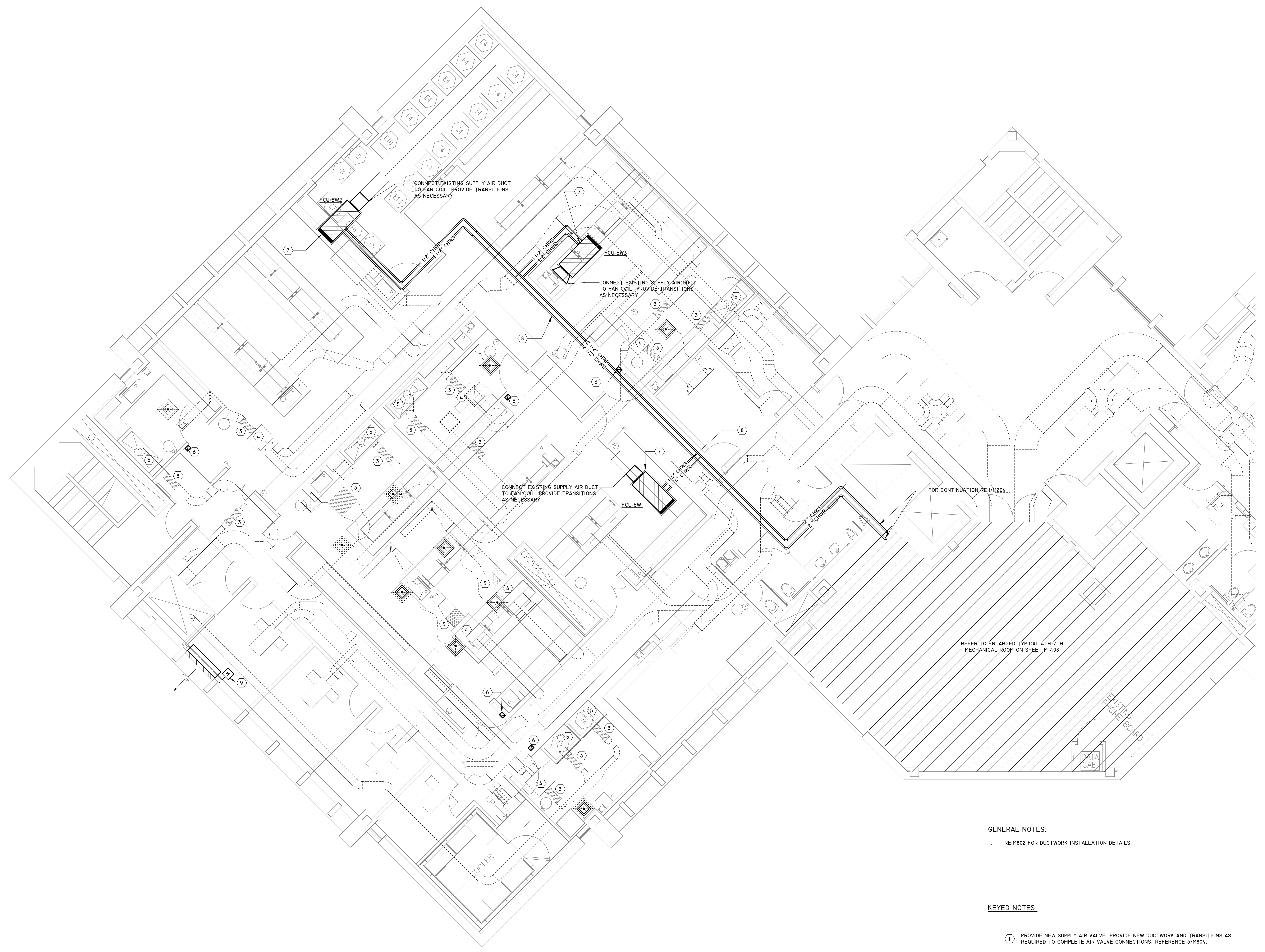
- KEYED NOTES:
- PROVIDE NEW SUPPLY AIR VALVE. PROVIDE NEW DUCTWORK AND TRANSITIONS AS REQUIRED TO COMPLETE AIR VALVE CONNECTIONS. REFERENCE 3/M804.
 - PROVIDE NEW EXHAUST AIR VALVE. PROVIDE NEW DUCTWORK AND TRANSITIONS AS REQUIRED TO COMPLETE AIR VALVE CONNECTIONS. REFERENCE 3/M804.
 - RETROFIT EXISTING AIR VALVE WITH NEW CONTROLS. REFERENCE 3/M703.
 - RETROFIT EXISTING DUAL DUCT TERMINAL UNIT WITH NEW CONTROLS. REFERENCE 4/M703.
 - RETROFIT EXISTING FUME HOOD WITH NEW SASH POSITION SENSOR AND NEW CONTROLS. REFERENCE 4/M703.
 - PROVIDE NEW DIFFERENTIAL PRESSURE SENSOR AND ROOM CONTROL MONITORING PANEL. REFERENCE 3/M703.
 - NEW REPLACEMENT FAN COIL UNIT. INSTALL FAN COIL ON THE LOCATION SHOWN AND RECONNECT TO EXISTING DUCTWORK. PROVIDE NEW CONDENSATE P-TRAP AND CONNECT TO EXISTING CONDENSATE DRAIN LINE. RE: 4/M804 FOR INSTALLATION DETAILS.
 - PROVIDE NEW CHILLED WATER PIPING. RE: 10/M801 FOR INSTALLATION DETAILS.
 - PROVIDE NEW MOTORIZED ACTUATOR AT EXISTING RELIEF DAMPER. PROVIDE CONTROL WIRING FROM ACTUATOR TO CONTROL PANEL IN MAIN MECHANICAL ROOM.

2 4TH FLOOR PLAN - HVAC - AIR FLOW DIAGRAM
 SCALE: NTS



1 4TH FLOOR PLAN - HVAC - PROPOSED
 SCALE: 3/16" = 1'-0"

2'
1"
1/2"
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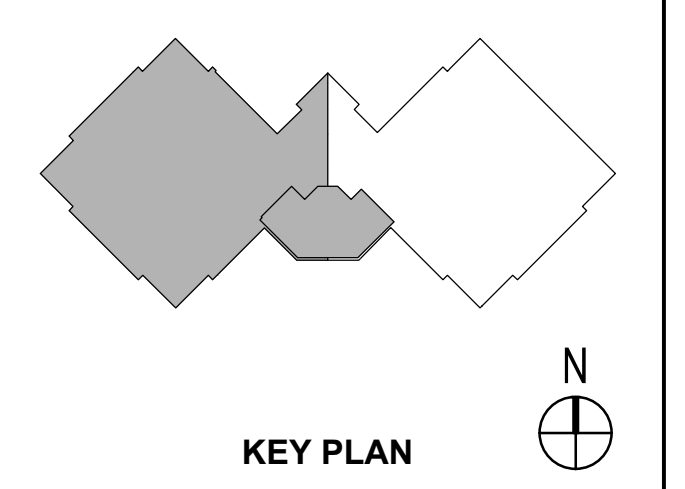


1 5TH FLOOR PLAN - HVAC - PROPOSED
SCALE: 3/16" = 1'-0"

GENERAL NOTES:
1. RE:M802 FOR DUCTWORK INSTALLATION DETAILS.

- KEYED NOTES:
- ① PROVIDE NEW SUPPLY AIR VALVE. PROVIDE NEW DUCTWORK AND TRANSITIONS AS REQUIRED TO COMPLETE AIR VALVE CONNECTIONS. REFERENCE 3/M804.
 - ② PROVIDE NEW EXHAUST AIR VALVE. PROVIDE NEW DUCTWORK AND TRANSITIONS AS REQUIRED TO COMPLETE AIR VALVE CONNECTIONS. REFERENCE 3/M804.
 - ③ RETROFIT EXISTING AIR VALVE WITH NEW CONTROLS. REFERENCE 3/M703.
 - ④ RETROFIT EXISTING DUAL DUCT TERMINAL UNIT WITH NEW CONTROLS. REFERENCE 2/M703.
 - ⑤ RETROFIT EXISTING FUME HOOD WITH NEW SASH POSITION SENSOR AND NEW CONTROLS. REFERENCE 4/M703.
 - ⑥ PROVIDE NEW DIFFERENTIAL PRESSURE SENSOR AND ROOM CONTROL MONITORING PANEL. REFERENCE 3/M703.
 - ⑦ NEW REPLACEMENT FAN COIL UNIT. INSTALL FAN COIL ON THE LOCATION SHOWN AND RECONNECT TO EXISTING DUCTWORK. PROVIDE NEW CONDENSATE P-TRAP AND CONNECT TO EXISTING CONDENSATE DRAIN LINE. RE: 4/M804 FOR INSTALLATION DETAILS.
 - ⑧ PROVIDE NEW CHILLED WATER PIPING. RE: 10/M801 FOR INSTALLATION DETAILS.
 - ⑨ PROVIDE NEW MOTORIZED ACTUATOR AT EXISTING RELIEF DAMPER. PROVIDE CONTROL WIRING FROM ACTUATOR TO CONTROL PANEL IN MAIN MECHANICAL ROOM.

REFER TO ENLARGED TYPICAL 4TH-7TH MECHANICAL ROOM ON SHEET M-408



STATE OF TEXAS
MATT A. FLUKINGER
118970
LICENSED PROFESSIONAL ENGINEER
7-28-17

REVISIONS

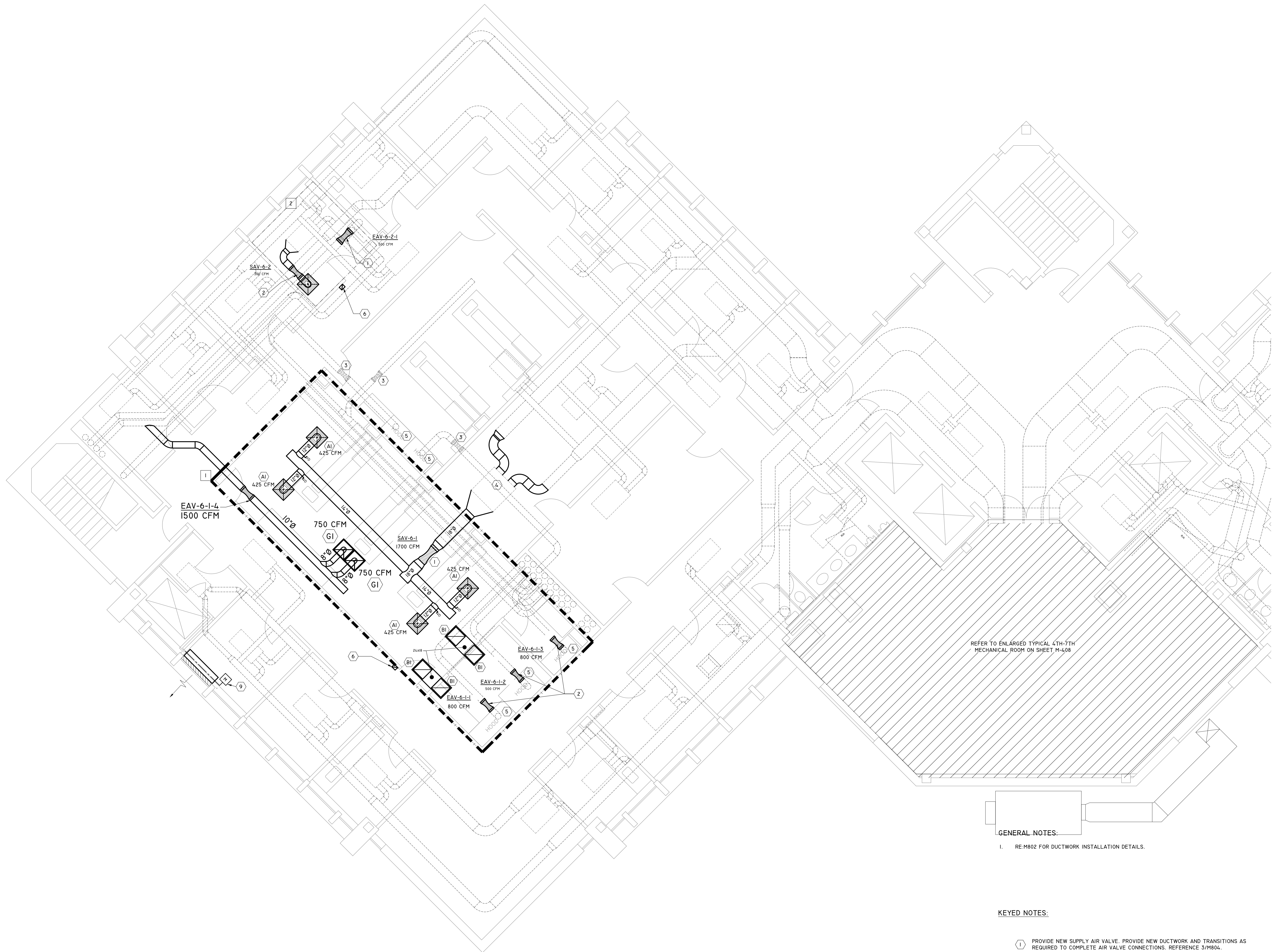
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**5TH FLOOR PLAN -
HVAC - PROPOSED**
Sheet
M205
ISSUED FOR BID

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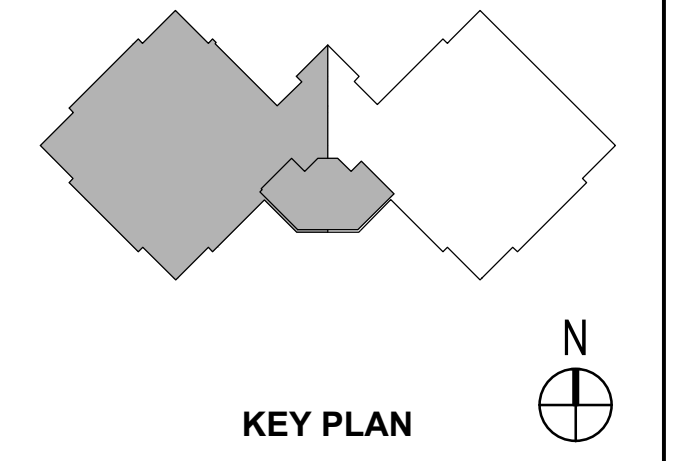


REFER TO ENLARGED TYPICAL 4TH-7TH MECHANICAL ROOM ON SHEET M-408

GENERAL NOTES:
1. RE:M802 FOR DUCTWORK INSTALLATION DETAILS.

- KEYED NOTES:**
- ① PROVIDE NEW SUPPLY AIR VALVE. PROVIDE NEW DUCTWORK AND TRANSITIONS AS REQUIRED TO COMPLETE AIR VALVE CONNECTIONS. REFERENCE 3/M804.
 - ② PROVIDE NEW EXHAUST AIR VALVE. PROVIDE NEW DUCTWORK AND TRANSITIONS AS REQUIRED TO COMPLETE AIR VALVE CONNECTIONS. REFERENCE 3/M804.
 - ③ RETROFIT EXISTING AIR VALVE WITH NEW CONTROLS. REFERENCE 3/M703.
 - ④ RETROFIT EXISTING DUAL DUCT TERMINAL UNIT WITH NEW CONTROLS. REFERENCE 2/M703.
 - ⑤ RETROFIT EXISTING FUME HOOD WITH NEW SASH POSITION SENSOR AND NEW CONTROLS. REFERENCE 4/M703.
 - ⑥ PROVIDE NEW DIFFERENTIAL PRESSURE SENSOR AND ROOM CONTROL MONITORING PANEL. REFERENCE 3/M703.
 - ⑦ REPLACE EXISTING FAN COIL UNIT. FIELD VERIFY EXISTING CONDITION AND COORDINATE REPLACEMENT FCU SELECTION. FOR BEST POSSIBLE SERVICE ACCESS, RECONNECT EXISTING DUCTWORK TO REPLACE FCU. RE: 4/M804 FOR INSTALLATION DETAILS.
 - ⑧ PROVIDE NEW CHILLED WATER PIPING. RE: 10/M801 FOR INSTALLATION DETAILS.
 - ⑨ PROVIDE NEW MOTORIZED ACTUATOR AT EXISTING RELIEF DAMPER. PROVIDE CONTROL WIRING FROM ACTUATOR TO CONTROL PANEL IN MAIN MECHANICAL ROOM

1 6TH FLOOR PLAN - HVAC - PROPOSED
SCALE: 3/16" = 1'-0"



STATE OF TEXAS
MATT A. FLUKINGER
118970
LICENSED PROFESSIONAL ENGINEER
7-28-17

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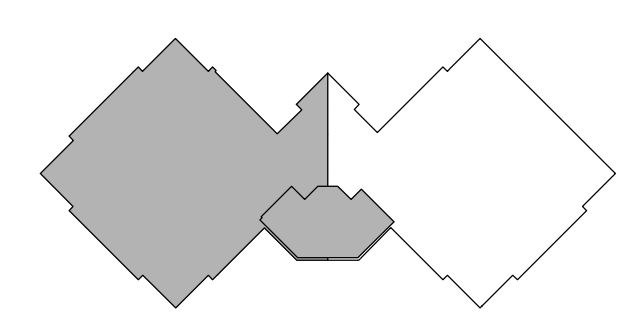
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6TH FLOOR PLAN - HVAC - PROPOSED
Sheet
M206
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KEY PLAN



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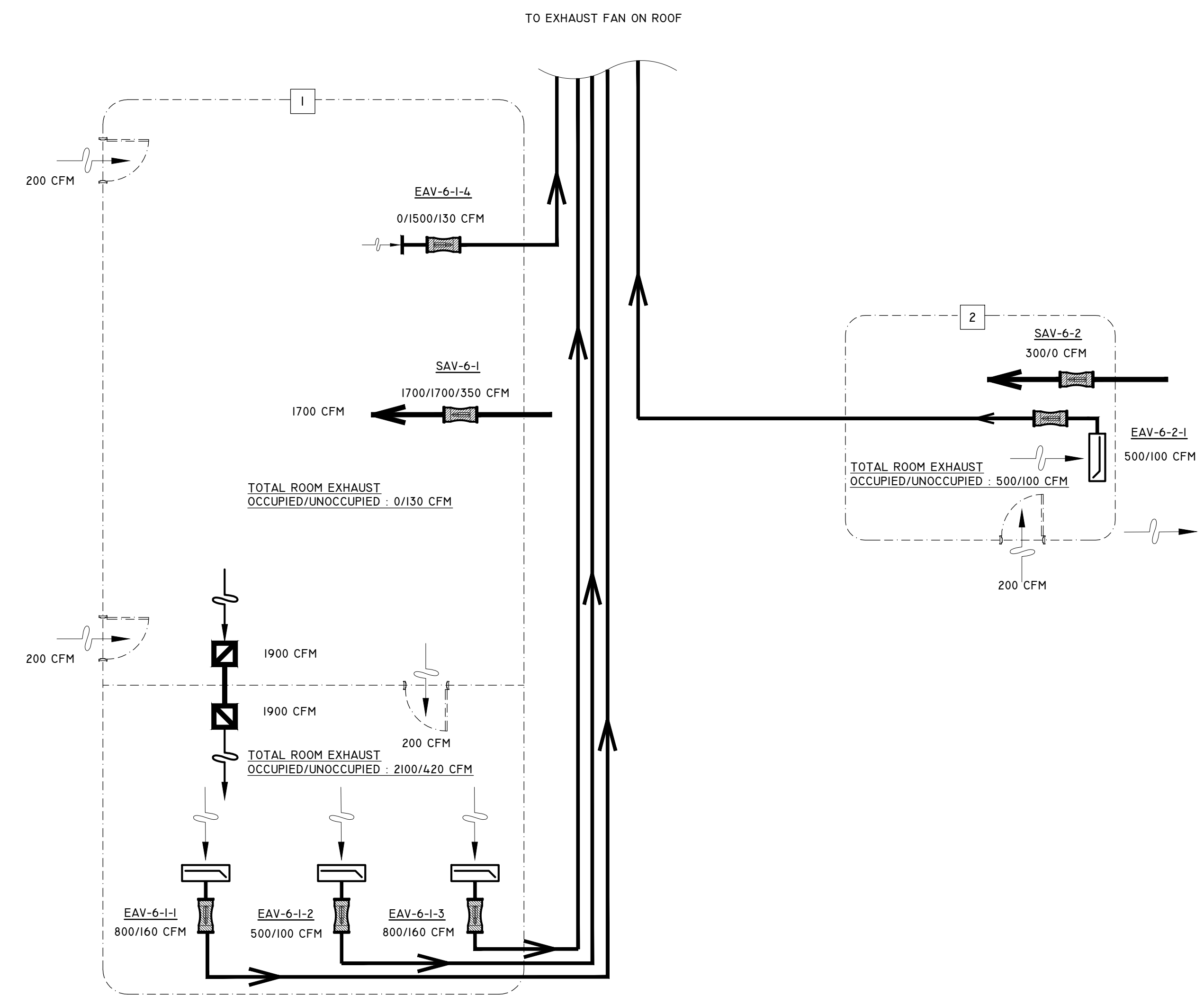
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Title	

6TH FLOOR PLAN - AIR FLOW DIAGRAM

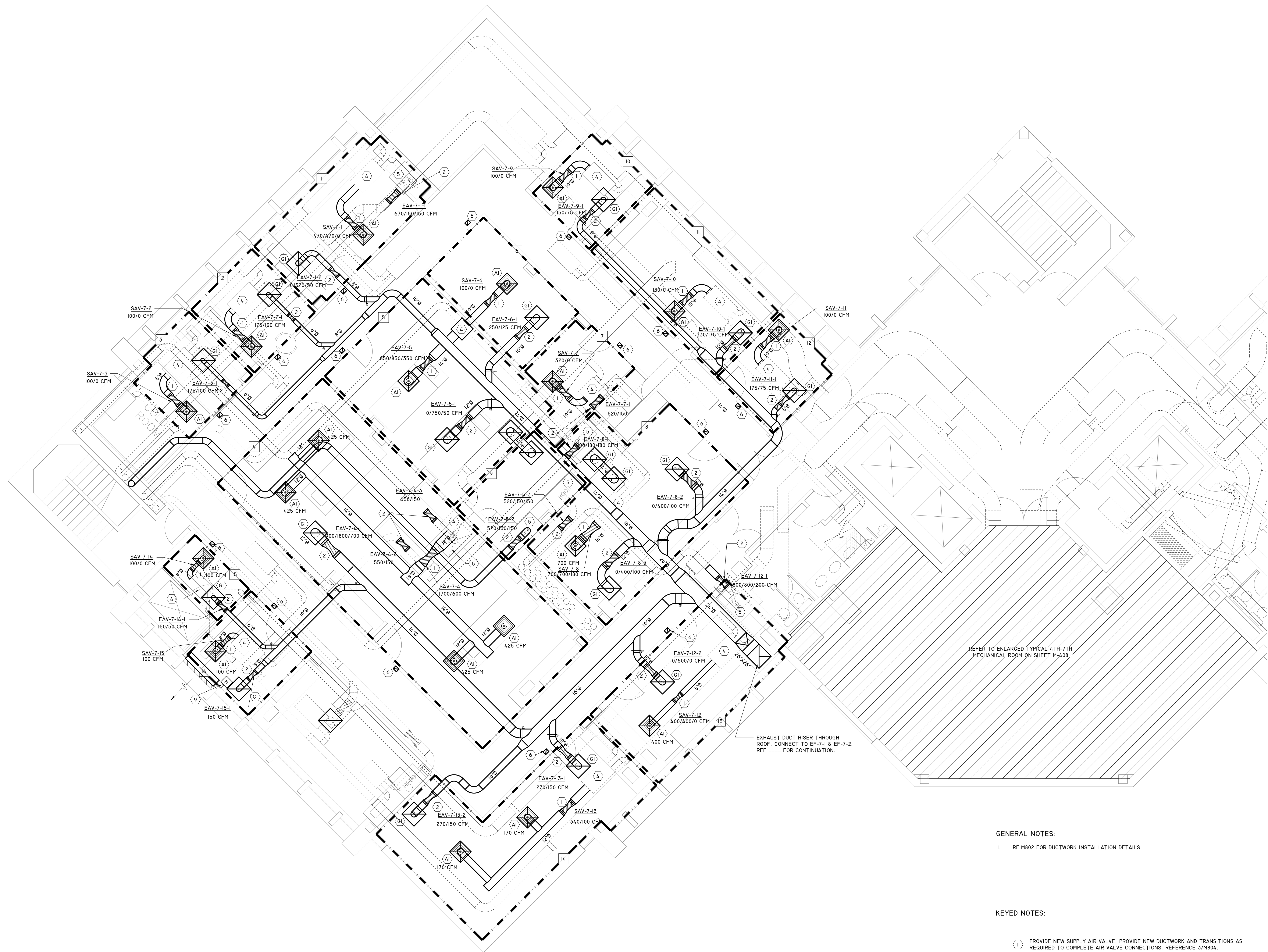
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M206A
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1 6TH FLOOR PLAN - AIR FLOW DIAGRAM
 SCALE: NTS

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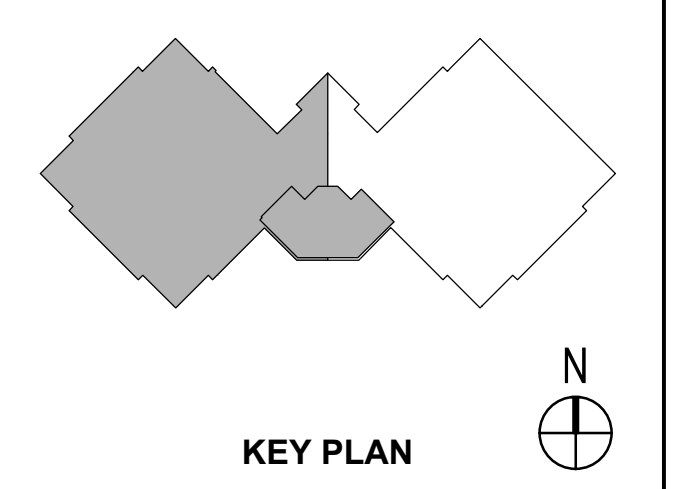
1 7TH WEST FLOOR PLAN - HVAC - PROPOSED
SCALE: 3/16" = 1'-0"

REFER TO ENLARGED TYPICAL 4TH-7TH MECHANICAL ROOM ON SHEET M-408

EXHAUST DUCT RISER THROUGH ROOF. CONNECT TO EF-7-1 & EF-7-2. REF. --- FOR CONTINUATION.

GENERAL NOTES:
1. RE:M802 FOR DUCTWORK INSTALLATION DETAILS.

- KEYED NOTES:
- 1 PROVIDE NEW SUPPLY AIR VALVE. PROVIDE NEW DUCTWORK AND TRANSITIONS AS REQUIRED TO COMPLETE AIR VALVE CONNECTIONS. REFERENCE 3/M804.
 - 2 PROVIDE NEW EXHAUST AIR VALVE. PROVIDE NEW DUCTWORK AND TRANSITIONS AS REQUIRED TO COMPLETE AIR VALVE CONNECTIONS. REFERENCE 3/M804.
 - 3 RETROFIT EXISTING AIR VALVE WITH NEW CONTROLS. REFERENCE 3/M703.
 - 4 RETROFIT EXISTING DUAL DUCT TERMINAL UNIT WITH NEW CONTROLS. REFERENCE 4/M703.
 - 5 RETROFIT EXISTING FUME HOOD WITH NEW SASH POSITION SENSOR AND NEW CONTROLS. REFERENCE 4/M703.
 - 6 PROVIDE NEW DIFFERENTIAL PRESSURE SENSOR AND ROOM CONTROL MONITORING PANEL. REFERENCE 3/M703.
 - 7 NOT USED.
 - 8 PROVIDE NEW CHILLED WATER PIPING. RE: 10/M801 FOR INSTALLATION DETAILS.
 - 9 PROVIDE NEW MOTORIZED ACTUATOR AT EXISTING RELIEF DAMPER. PROVIDE CONTROL WIRING FROM ACTUATOR TO CONTROL PANEL IN MAIN MECHANICAL ROOM

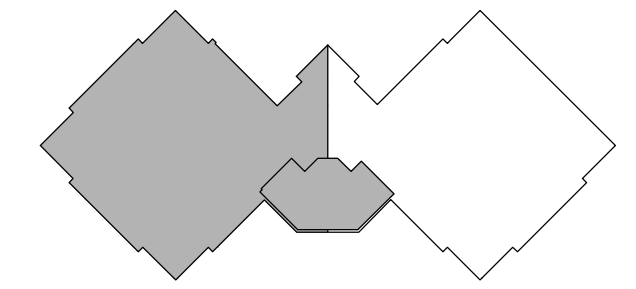


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KEY PLAN



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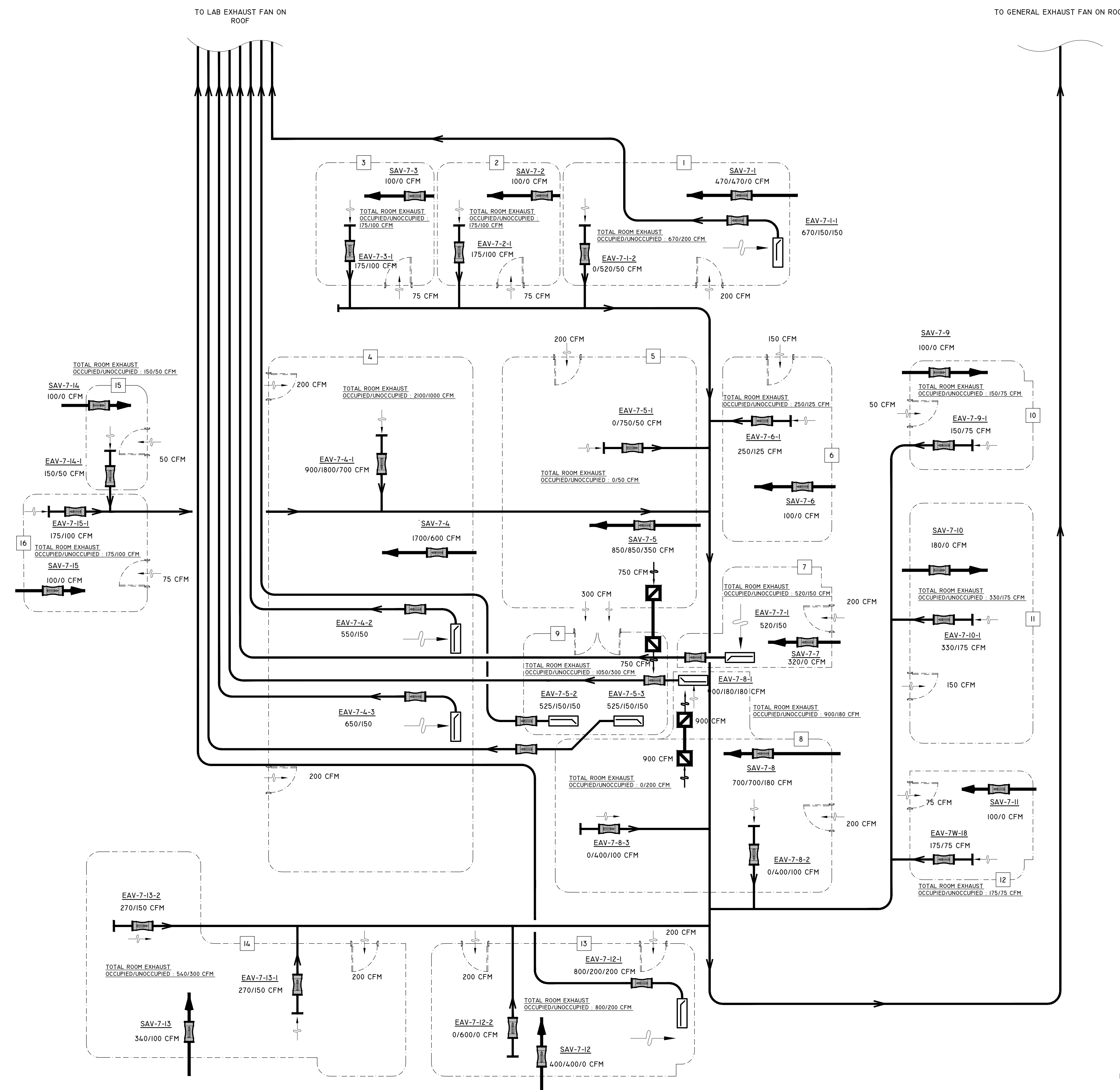
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Job Number	-
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7TH WEST FLOOR PLAN
- AIR FLOW DIAGRAM

Sheet

M207A

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1 7TH WEST FLOOR PLAN - AIR FLOW DIAGRAM
SCALE: NTS

GENERAL NOTES:

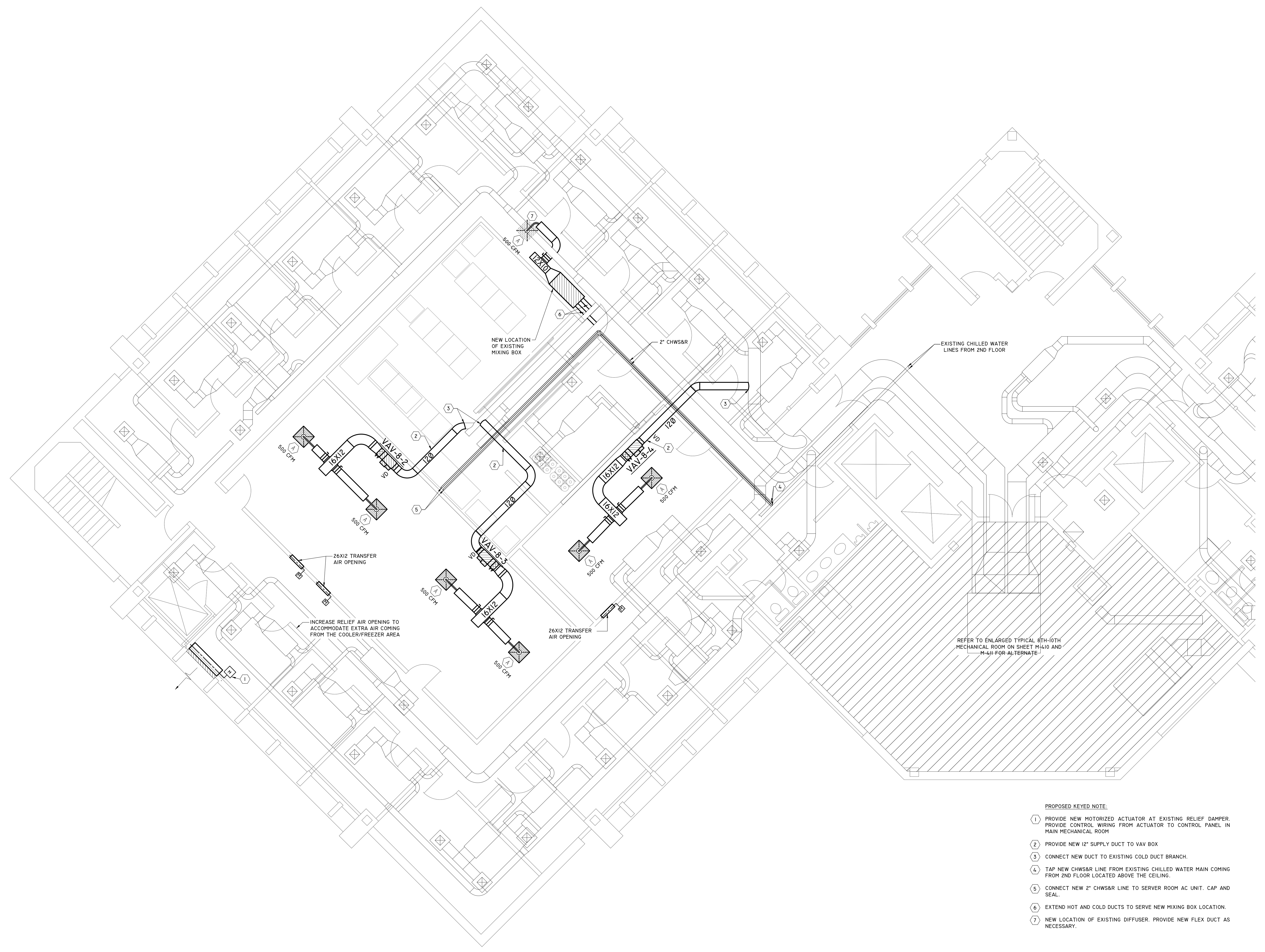
- REF _____ FOR DUCTWORK INSTALLATION DETAILS.

KEYED NOTES:

- PHOENIX NEW AIR VALVE AND RECONNECT TO EXISTING DUCTWORK. REF _____ FOR INSTALLATION DETAILS.
- PROVIDE NEW AIR VALVE AND DUCTWORK. REF _____ FOR INSTALLATION DETAILS.
- PROVIDE NEW WALL MOUNTED MONITOR PANEL REF _____

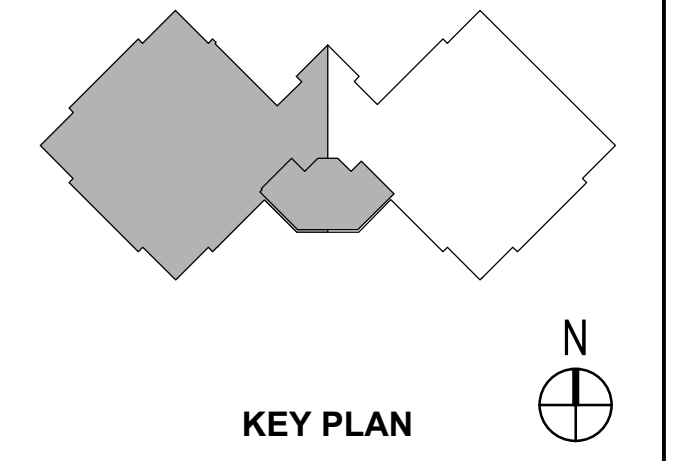
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1 8TH WEST FLOOR PLAN - HVAC - PROPOSED
SCALE: 3/16" = 1'-0"

- PROPOSED KEYED NOTE:
- ① PROVIDE NEW MOTORIZED ACTUATOR AT EXISTING RELIEF DAMPER. PROVIDE CONTROL WIRING FROM ACTUATOR TO CONTROL PANEL IN MAIN MECHANICAL ROOM.
 - ② PROVIDE NEW 12" SUPPLY DUCT TO VAV BOX.
 - ③ CONNECT NEW DUCT TO EXISTING COLD DUCT BRANCH.
 - ④ TAP NEW CHWS&R LINE FROM EXISTING CHILLED WATER MAIN COMING FROM 2ND FLOOR LOCATED ABOVE THE CEILING.
 - ⑤ CONNECT NEW 2" CHWS&R LINE TO SERVER ROOM AC UNIT. CAP AND SEAL.
 - ⑥ EXTEND HOT AND COLD DUCTS TO SERVE NEW MIXING BOX LOCATION.
 - ⑦ NEW LOCATION OF EXISTING DIFFUSER. PROVIDE NEW FLEX DUCT AS NECESSARY.



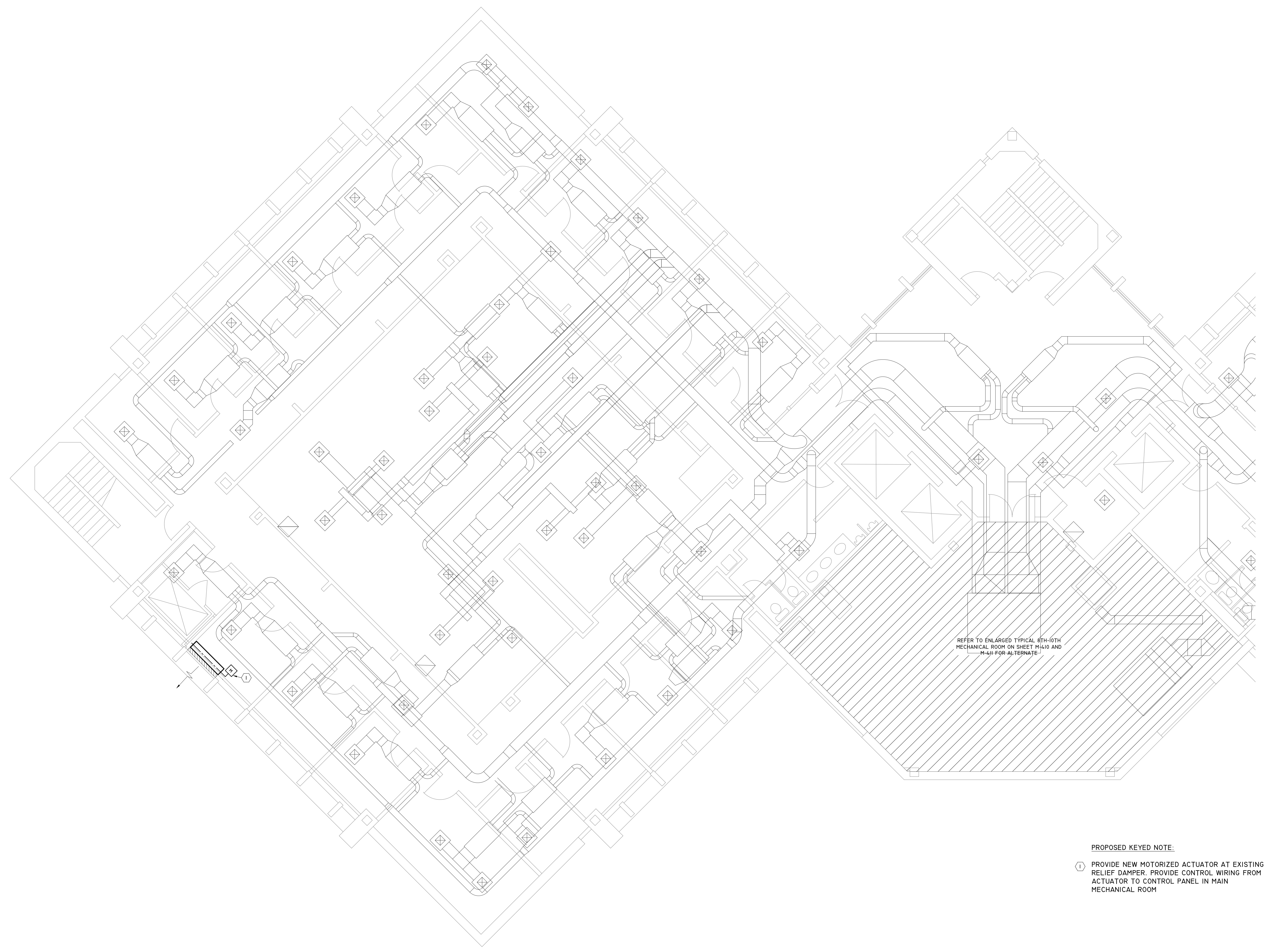
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REFER TO ENLARGED TYPICAL 8TH-10TH
MECHANICAL ROOM ON SHEET M410 AND
M-411 FOR ALTERNATE

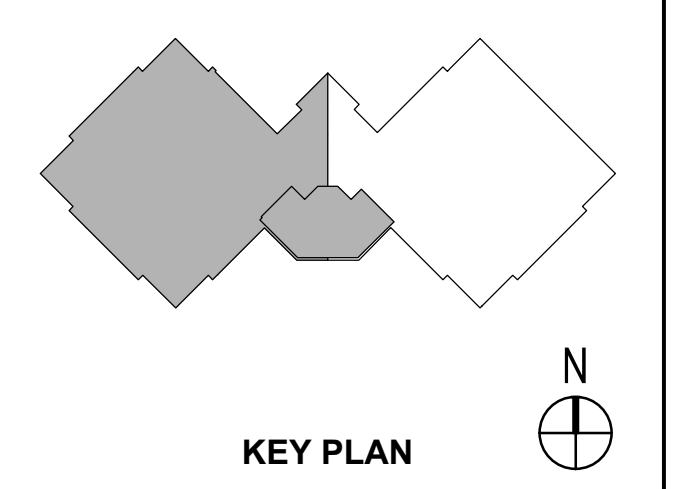
PROPOSED KEYED NOTE:

- ① PROVIDE NEW MOTORIZED ACTUATOR AT EXISTING RELIEF DAMPER. PROVIDE CONTROL WIRING FROM ACTUATOR TO CONTROL PANEL IN MAIN MECHANICAL ROOM

1 9TH WEST FLOOR PLAN - HVAC - PROPOSED
SCALE: 3/16" = 1'-0"

Infrastructure Associates
INFRASTRUCTURE ASSOCIATES, INC.
617 RICHMOND AVENUE, SUITE 200
HOUSTON, TEXAS 77057
TYPE REGISTRATION NO. F-4506
(713) 622-0120 PH (713) 622-0557 FAX
WWW.IAHOUSTON.COM

UTHealth
The University of Texas
Health Science Center at Houston
School of Public Health
**UT HEALTH
SCIENCE
SCHOOL OF
PUBLIC HEALTH**
1200 PRESSLER ST.
HOUSTON, TX 77030



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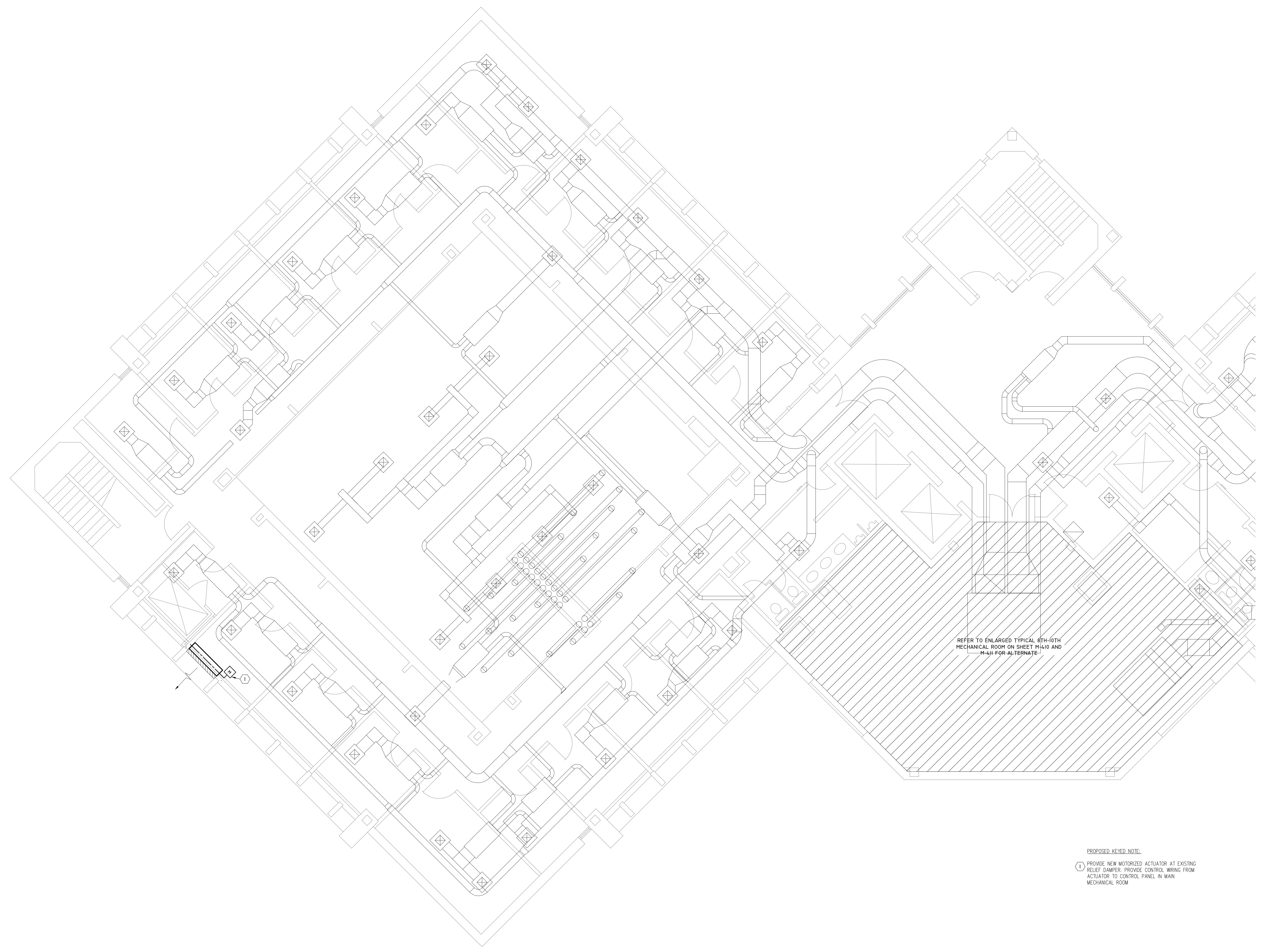
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Job Number	-
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9TH WEST FLOOR PLAN
- HVAC - PROPOSED

Sheet

M209
ISSUED FOR BID

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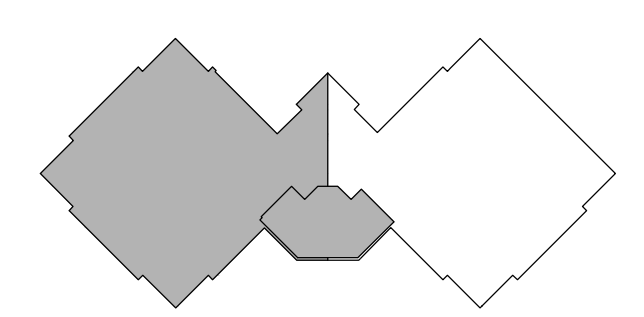
REFER TO ENLARGED TYPICAL 8TH-10TH MECHANICAL ROOM ON SHEET M410 AND M-411 FOR ALTERNATE

PROPOSED KEYED NOTE:
Ⓢ PROVIDE NEW MOTORIZED ACTUATOR AT EXISTING RELIEF DAMPER. PROVIDE CONTROL WIRING FROM ACTUATOR TO CONTROL PANEL IN MAIN MECHANICAL ROOM

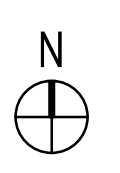
1 10TH WEST FLOOR PLAN - HVAC - PROPOSED
SCALE: 3/16" = 1'-0"

Infrastructure Associates
INFRASTRUCTURE ASSOCIATES, INC.
617 RICHMOND AVENUE, SUITE 200
HOUSTON, TEXAS 77057
TYPE REGISTRATION NO. F-4506
(713) 622-0120 PH (713) 622-0557 FAX
WWW.IAHOUSTON.COM

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HOUSTON, TX 77030



KEY PLAN



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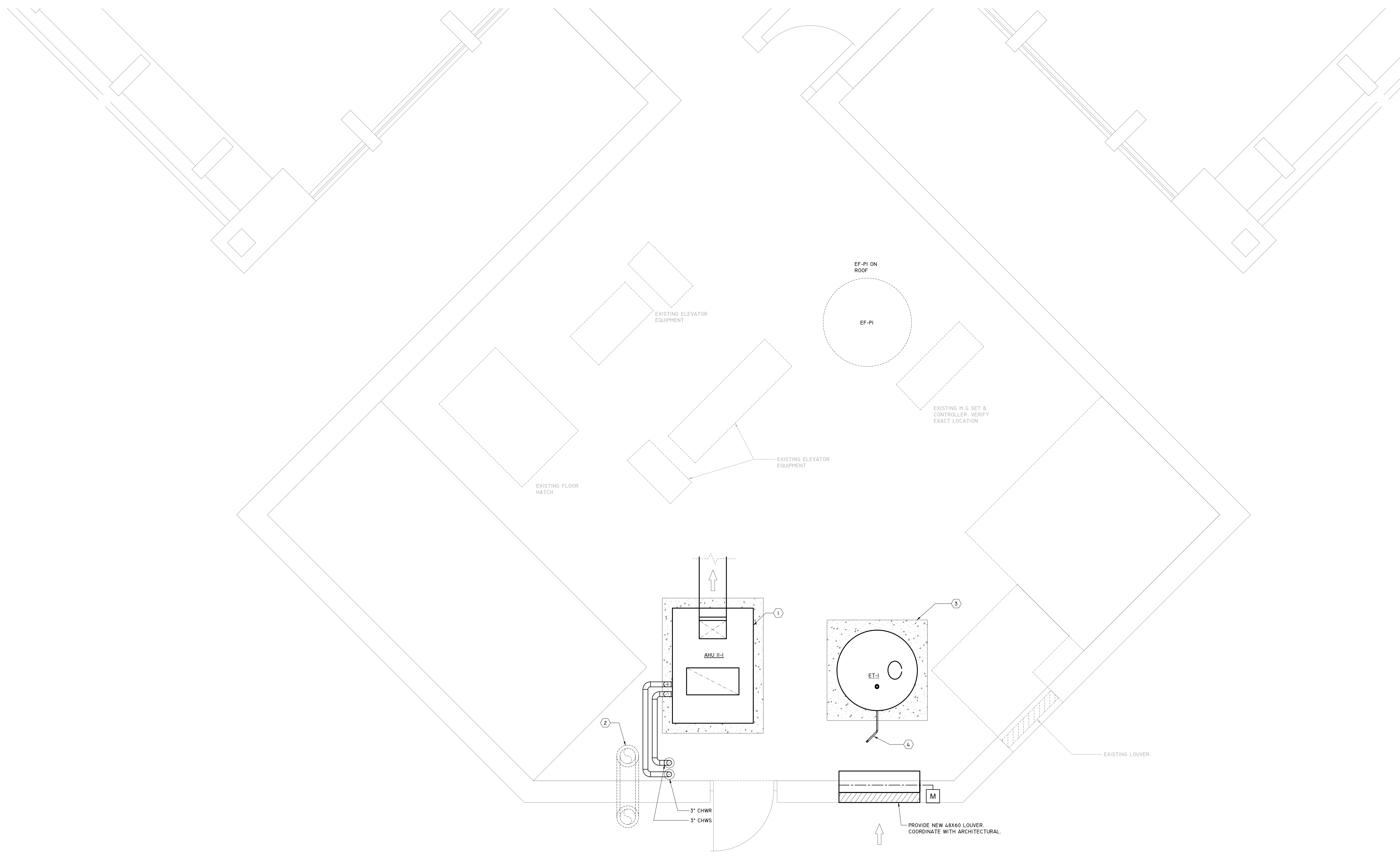
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Title	

10TH WEST FLOOR PLAN - HVAC - PROPOSED

Sheet

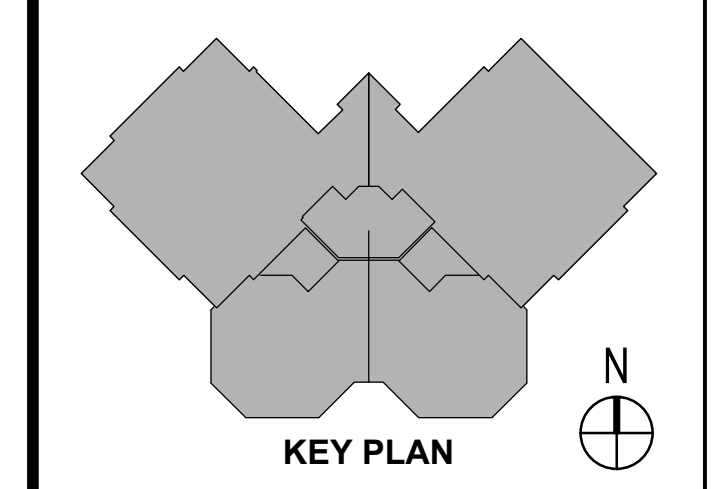
M210
ISSUED FOR BID

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1 PENTHOUSE FLOOR PLAN - HVAC - PROPOSED
SCALE: 1/2" = 1'-0"

- KEYED NOTES:**
- ① REFER I/M804 FOR NEW AHU INSTALLATION.
 - ② REPLACE EXISTING MEDIUM PRESSURE STEAM RELIEF VALVE. RECONNECT TO EXISTING PIPING. REF 7/M804.
 - ③ PROVIDE NEW EXPANSION TANK FOR HOT WATER SYSTEM. REF I/M801.
 - ④ PROVIDE 3/4" PIPE AND CONNECT IT TO HOT WATER RETURN RISER AT 10TH FLOOR.

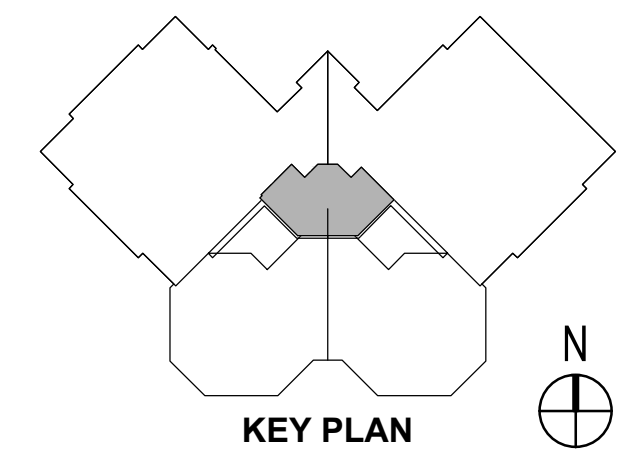


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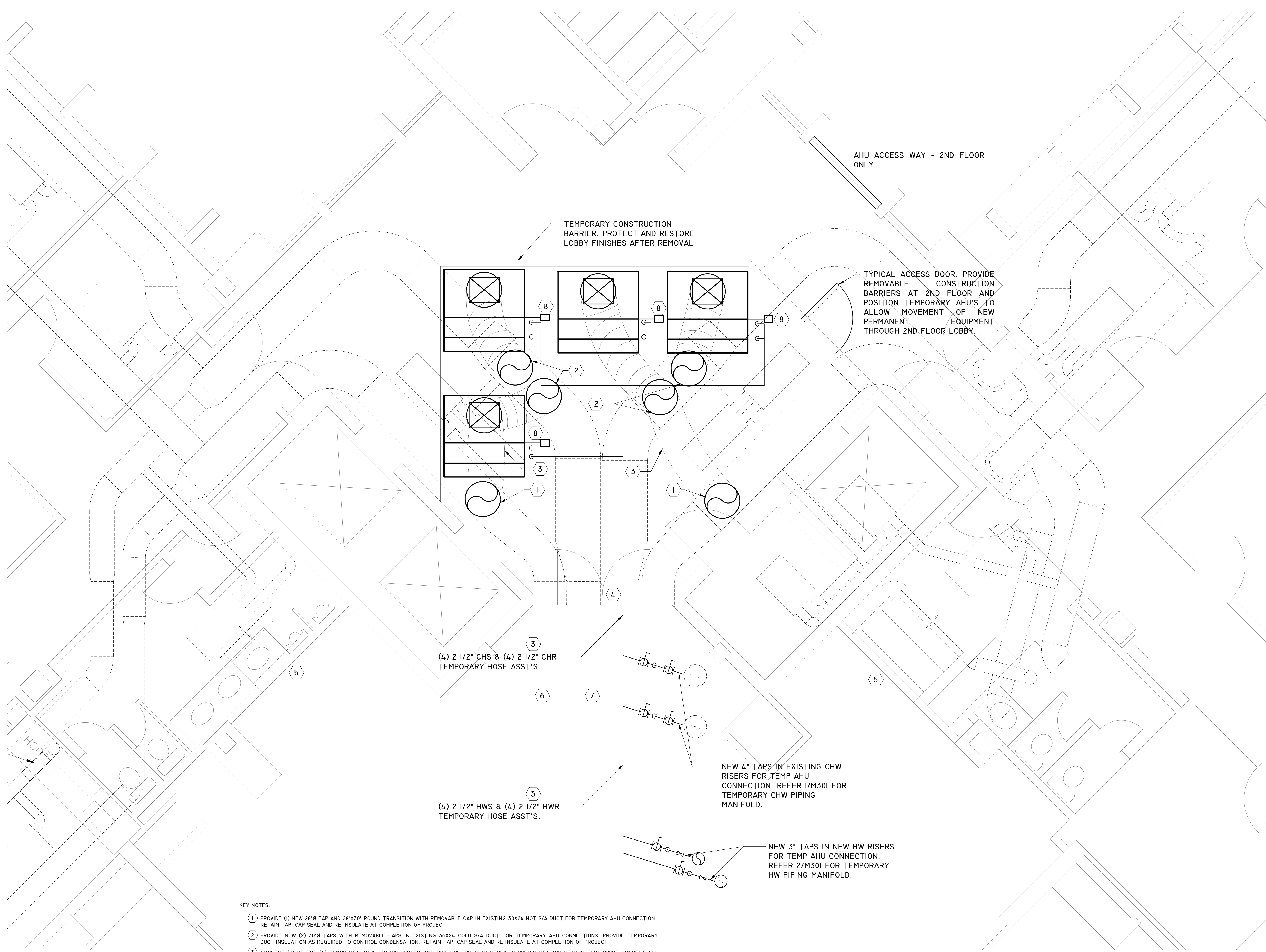


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**ENLARGED PLAN -
TYPICAL 2ND-10TH
FLOOR - LOBBY -
TEMPORARY AHU
INSTALLATION**

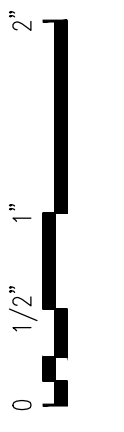
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M300
ISSUED FOR BID



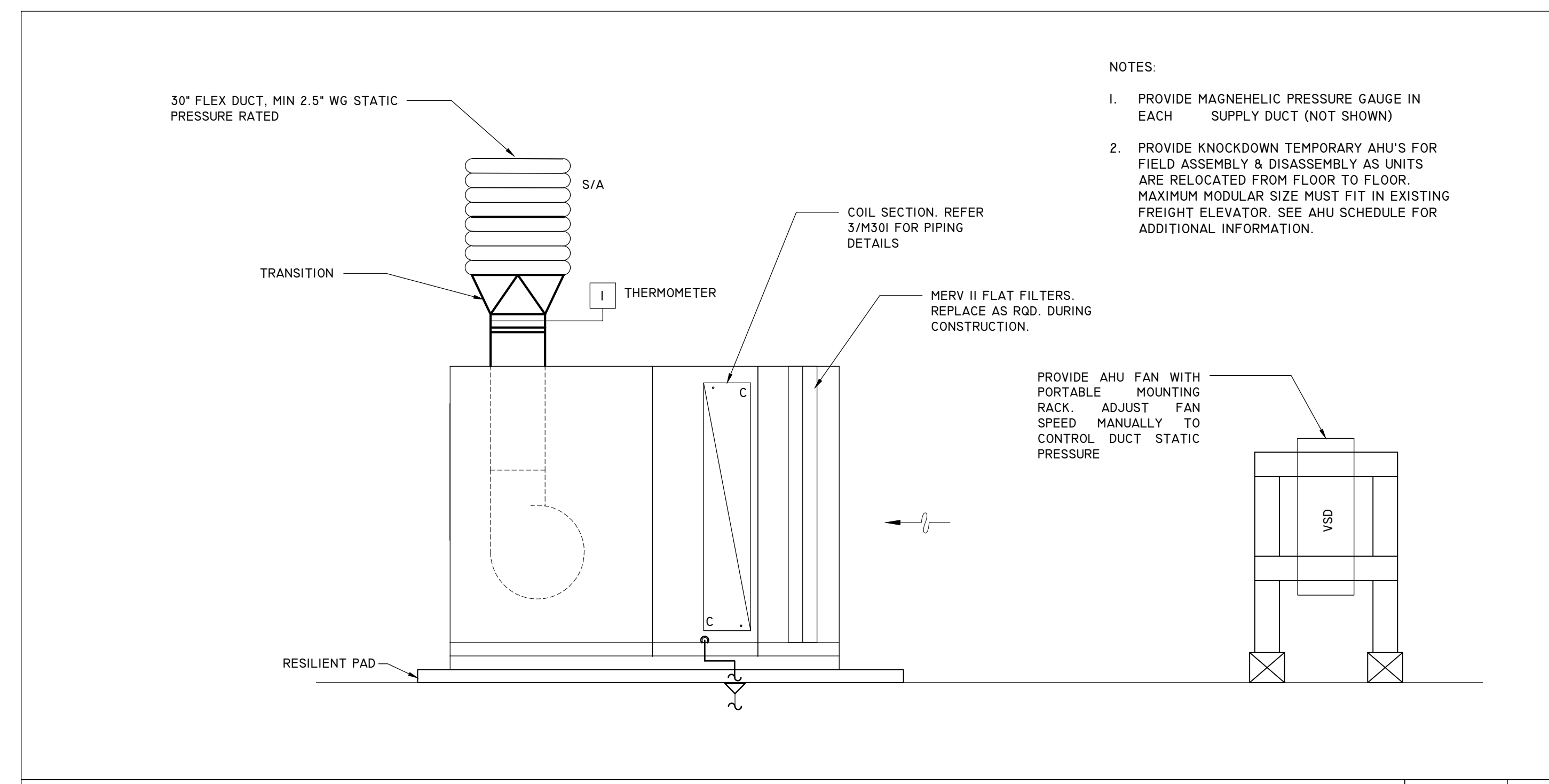
- KEY NOTES.**
- PROVIDE (1) NEW 28"Ø TAP AND 28"x30" ROUND TRANSITION WITH REMOVABLE CAP IN EXISTING 30x24 HOT S/A DUCT FOR TEMPORARY AHU CONNECTION. RETAIN TAP, CAP SEAL AND RE INSULATE AT COMPLETION OF PROJECT.
 - PROVIDE NEW (2) 30"Ø TAPS WITH REMOVABLE CAPS IN EXISTING 36x24 COLD S/A DUCT FOR TEMPORARY AHU CONNECTIONS. PROVIDE TEMPORARY DUCT INSULATION AS REQUIRED TO CONTROL CONDENSATION. RETAIN TAP, CAP SEAL AND RE INSULATE AT COMPLETION OF PROJECT.
 - CONNECT (2) OF THE (4) TEMPORARY AHU'S TO HW SYSTEM AND HOT S/A DUCTS AS REQUIRED DURING HEATING SEASON. OTHERWISE CONNECT ALL TEMPORARY AHU'S TO CHW SYSTEM AND COLD S/A DUCTS FOR TEMPORARY COOLING.
 - MECHROOM DOORS TO REMAIN OPEN DURING TEMPORARY AHU OPERATION TO ALLOW RETURN AND OUTSIDE MAKEUP AIR FLOWS TO THE UNITS.
 - DISCONNECT R/A DUCTWORK WITHIN MECHANICAL ROOM AND MAINTAIN UNRESTRICTED R/A OPENINGS DURING TEMPORARY AHU OPERATION.
 - DISCONNECT O/A DUCTWORK FROM EXISTING O/A LOUVER (NOT SHOWN) WITHIN MECHANICAL ROOM AND MAINTAIN UNRESTRICTED O/A OPENINGS DURING TEMPORARY AHU OPERATION.
 - PROVIDE TEMPORARY WELDING FUME FILTRATION UNITS WHEN WELDING IN MECHANICAL ROOMS DURING OCCUPIED HOURS.
 - PROVIDE TEMPORARY CONDENSATE PUMPING UNIT AT EACH TEMPORARY AHU. PROVIDE DISCHARGE HOSE & ROUTE TO MECH ROOM FLOOR DRAIN. INSULATE AS REQUIRED TO PREVENT CONDENSATION. PROVIDE TEMPORARY POWER TO CONDENSATE UNITS FROM EXISTING 110 VAC. CONVENIENCE OUTLETS.
 - PROVIDE TEMPORARY 30/3 480 VAC, 3Ø BREAKERS IN AVAILABLE ELECTRICAL PANEL WITH 100/4 SOOW TO EACH TEMPORARY AHU VFD.

- GENERAL NOTES.**
- COORDINATE TEMPORARY AHU OPERATION WITH PROJECT PHASING REQUIREMENTS & OWNER PROJECT MANAGER.
 - IN GENERAL, INSTALL TEMPORARY AHU PRIOR TO REMOVAL AND REPLACEMENT OF PERMANENT AHU SYSTEMS. REMOVE TEMPORARY AHU'S UPON COMPLETION & COMMISSIONING OF PERMANENT SYSTEMS AND RELOCATE TO NEXT FLOOR, ETC..
 - FOR 2ND FLOOR MECH ROOM ONLY, PHASE CONSTRUCTION TO RENOVATE ONLY ONE BUILDING WING AT A TIME. UTILIZE (2) TEMPORARY AHU'S TO FEED 2ND FLOOR SINGLE WING FROM LOBBY SIMILAR TO ARRANGEMENT SHOWN. UTILIZE REMAINING (2) TEMPORARY AHU'S TO FEED 1ST FLOOR DUCT CONNECTION WITH IN MECHANICAL ROOM (NOT SHOWN). PROVIDE TEMPORARY DUCT TRANSITIONS AS REQUIRED.

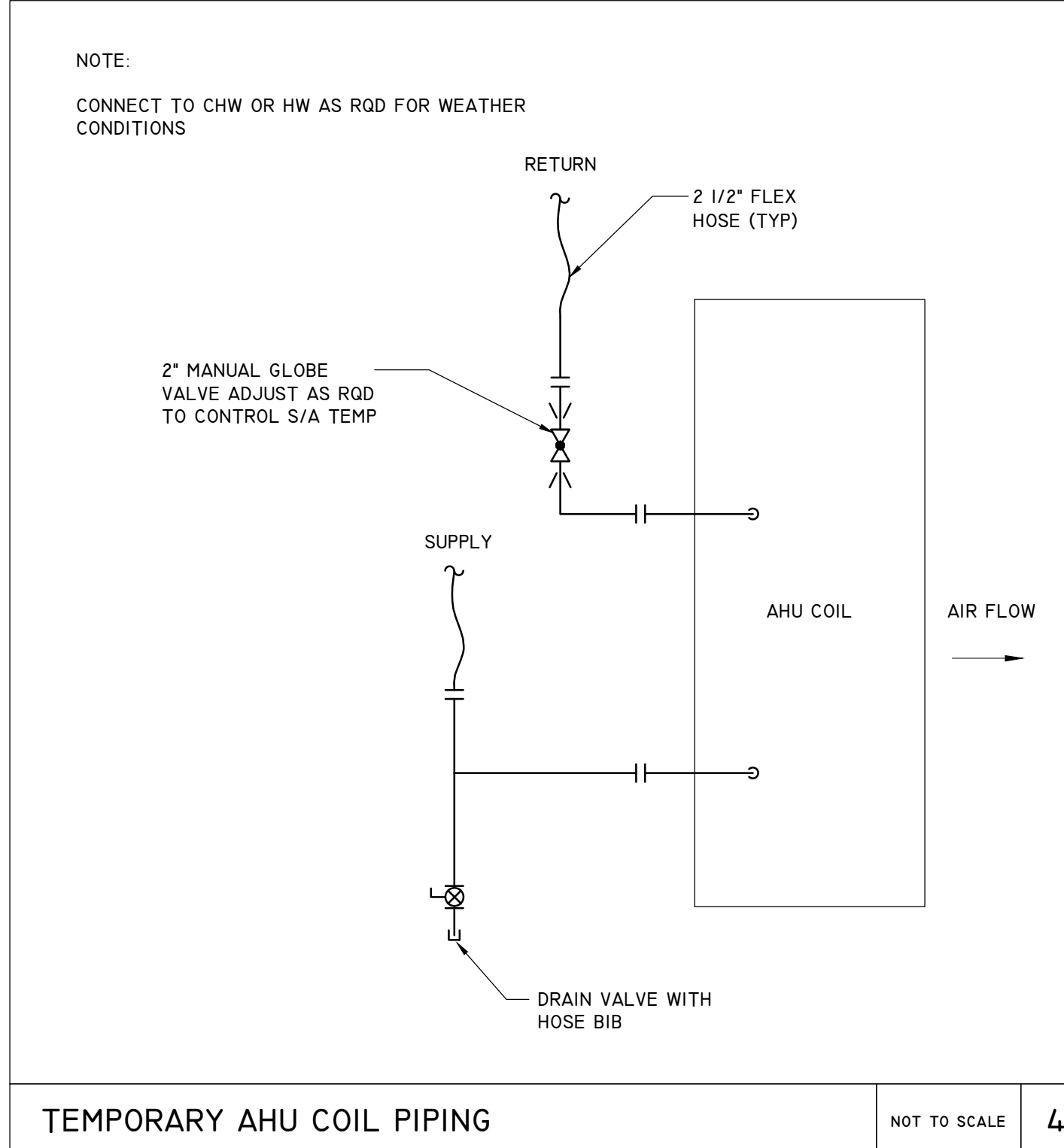
1 ENLARGED PLAN - TYPICAL 2ND-10TH FLOOR - LOBBY - TEMPORARY AHU INSTALLATIONS
SCALE: 1/4" = 1'-0"



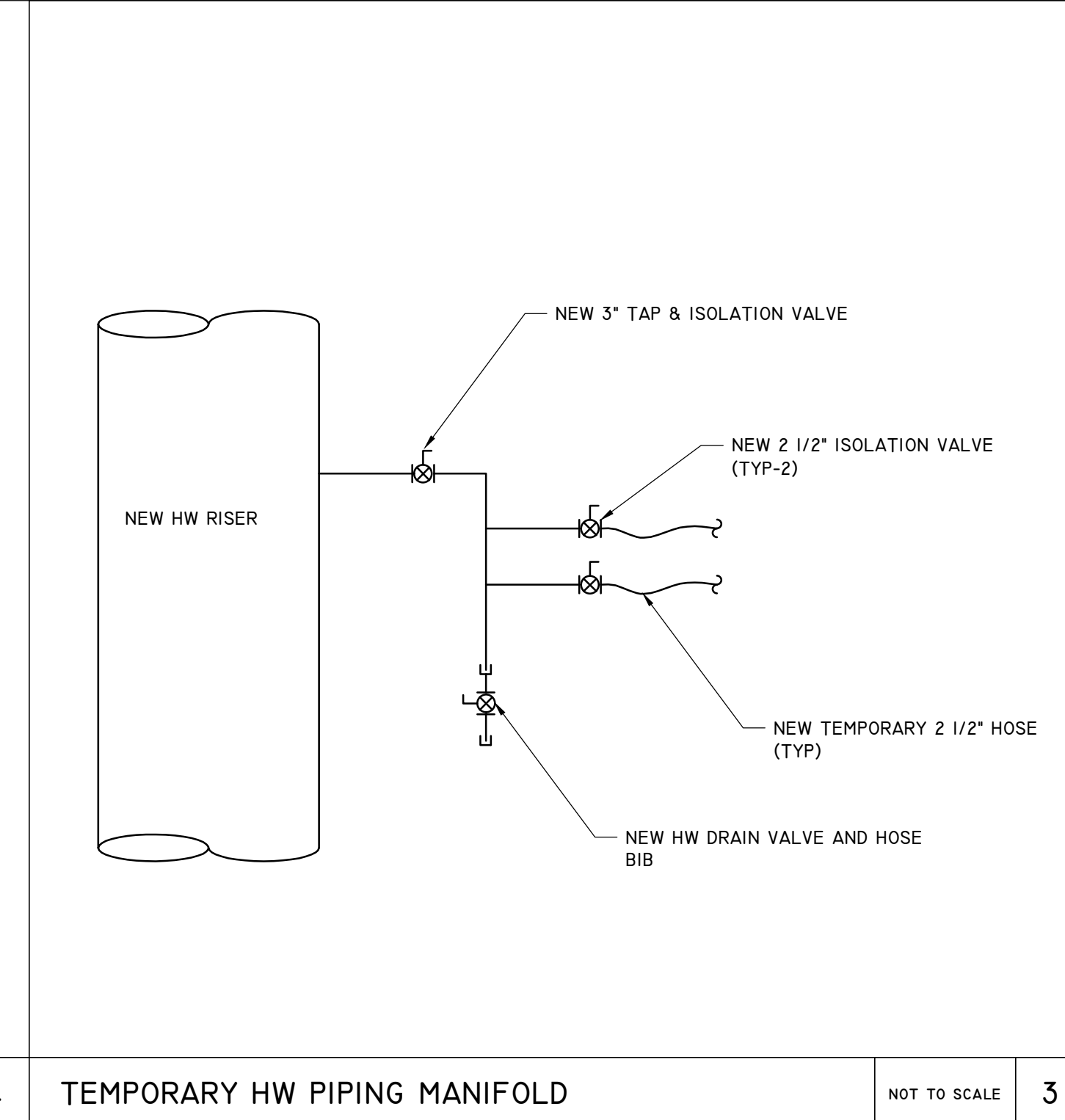
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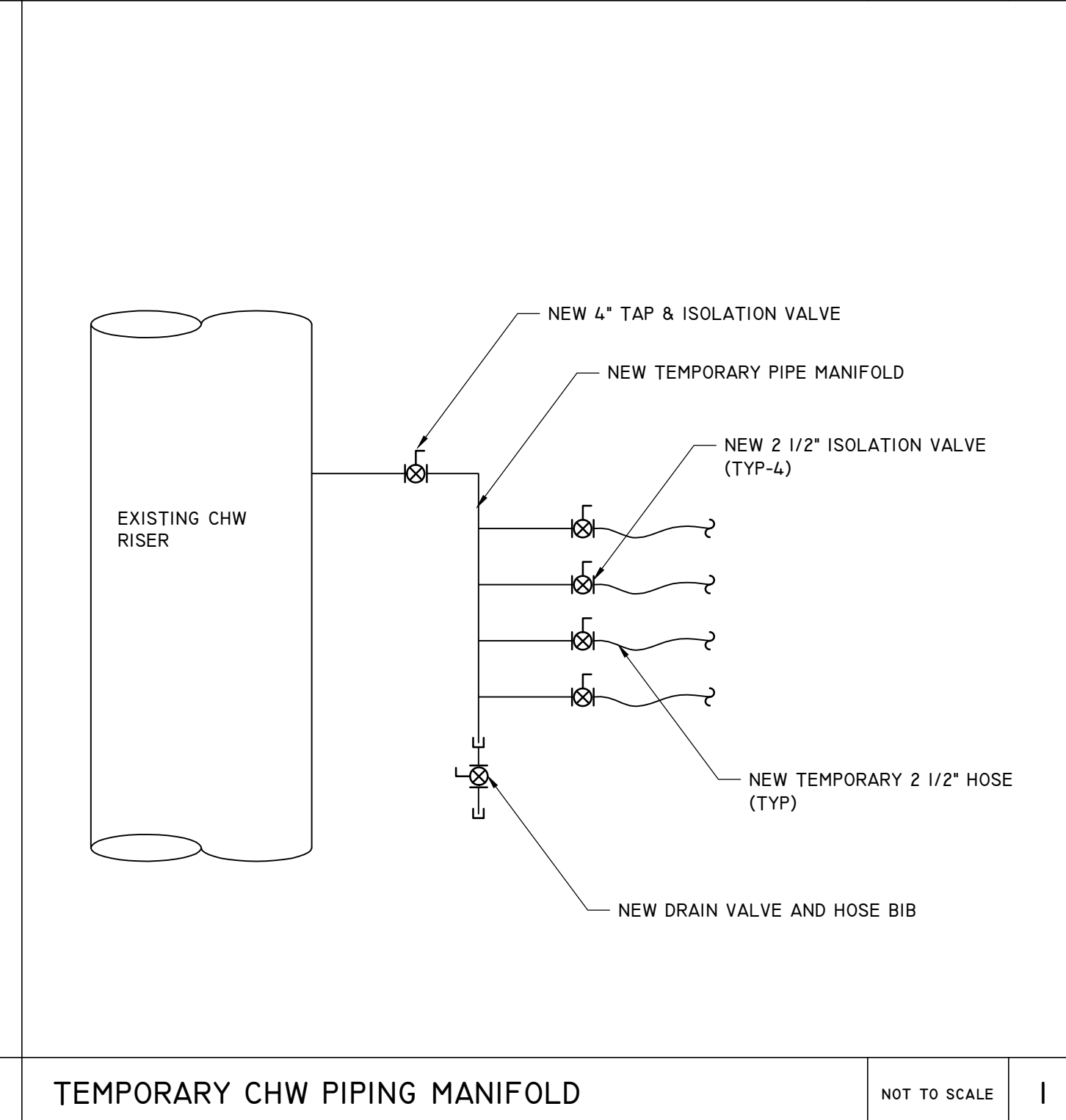
TEMPORARY AHU INSTALLATION NOT TO SCALE 2



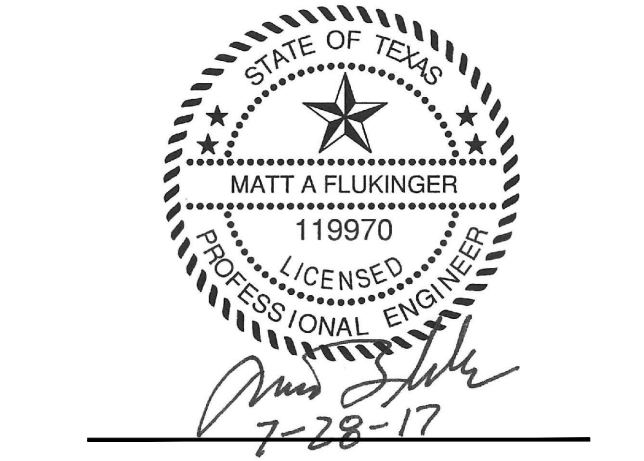
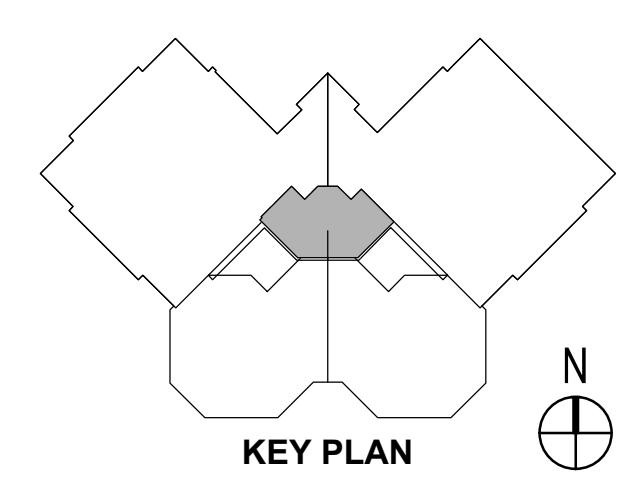
TEMPORARY AHU COIL PIPING NOT TO SCALE 4



TEMPORARY HW PIPING MANIFOLD NOT TO SCALE 3



TEMPORARY CHW PIPING MANIFOLD NOT TO SCALE 1

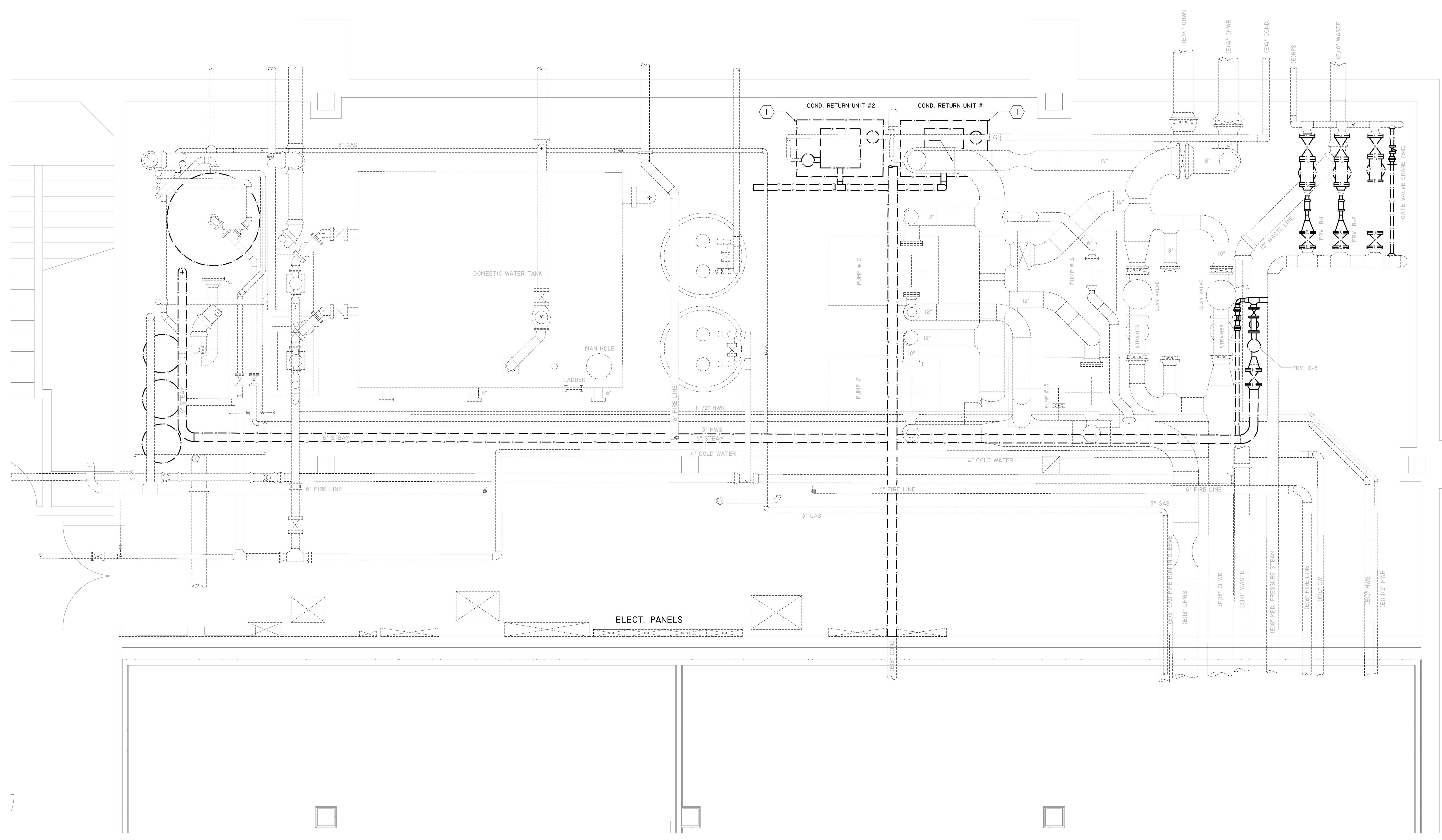


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Sheet Information	
Date	31 MARCH 2017
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ENLARGED PLAN - TYPICAL 2ND-10TH FLOOR - LOBBY- TEMPORARY AHU INSTALLATION DETAILS	

Sheet
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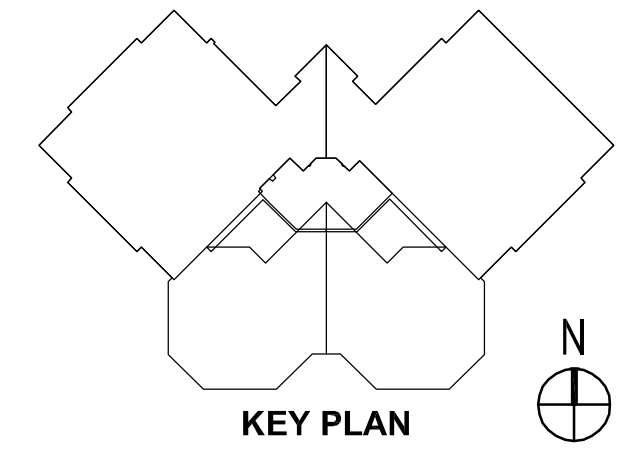
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1 ENLARGED CENTRAL PLANT - BASEMENT FLOOR PLAN - DEMO
 SCALE: 3/8" = 1'-0"

GENERAL NOTES:
 1- MAINTAIN ONE CONDENSATE RETURN SYSTEM OPERATING AT ALL TIMES.

DEMO KEYED NOTES:
 ① REMOVE EXISTING CONDENSATE RETURN UNIT AND PROVIDE NEW CONDENSATE UNIT IN PHASED SEQUENCE.



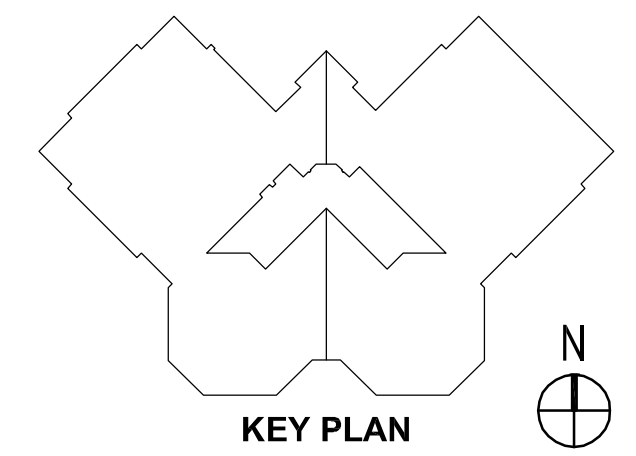
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ENLARGED CENTRAL
 PLANT - BASEMENT
 FLOOR PLAN - DEMO

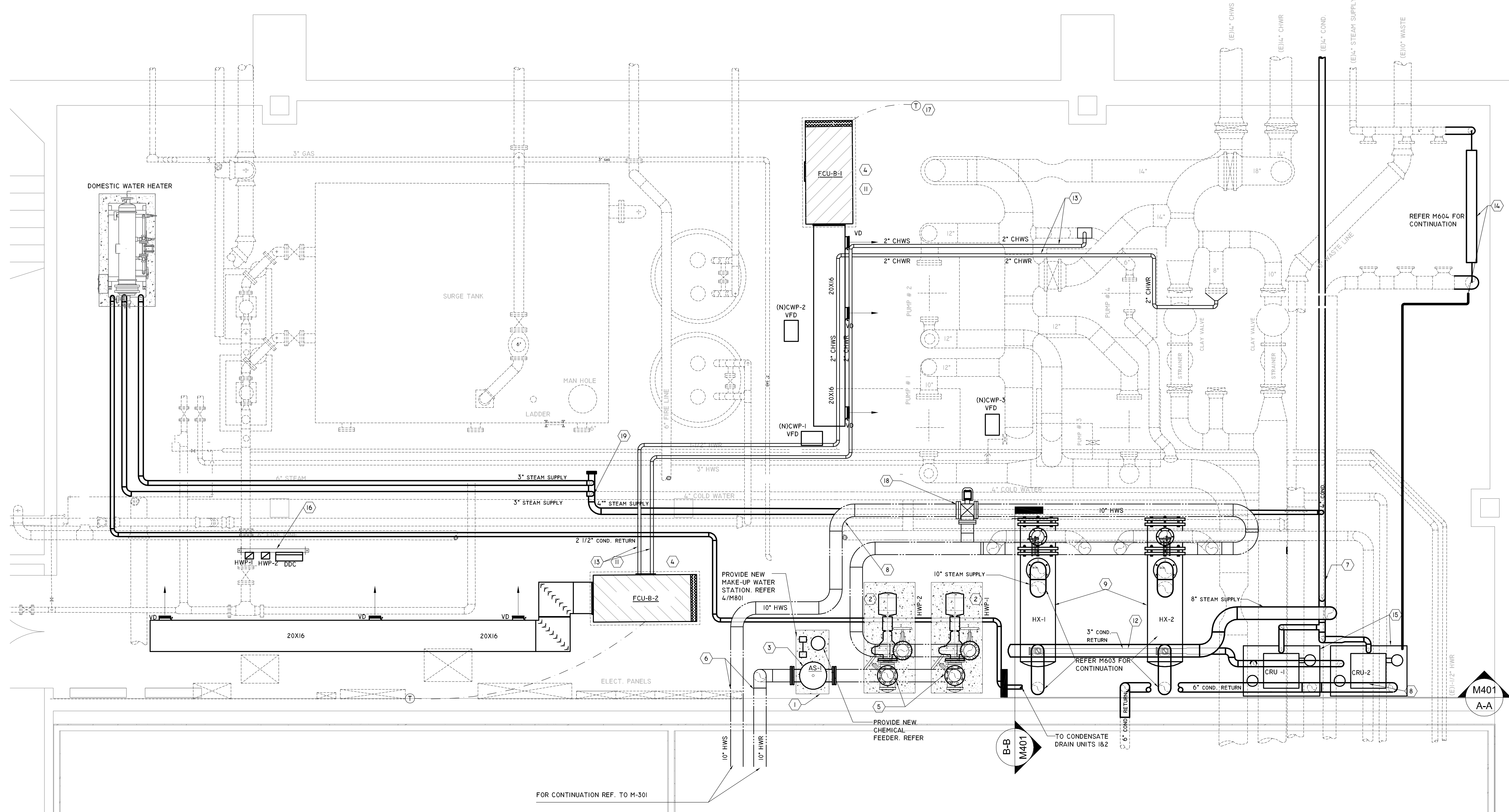


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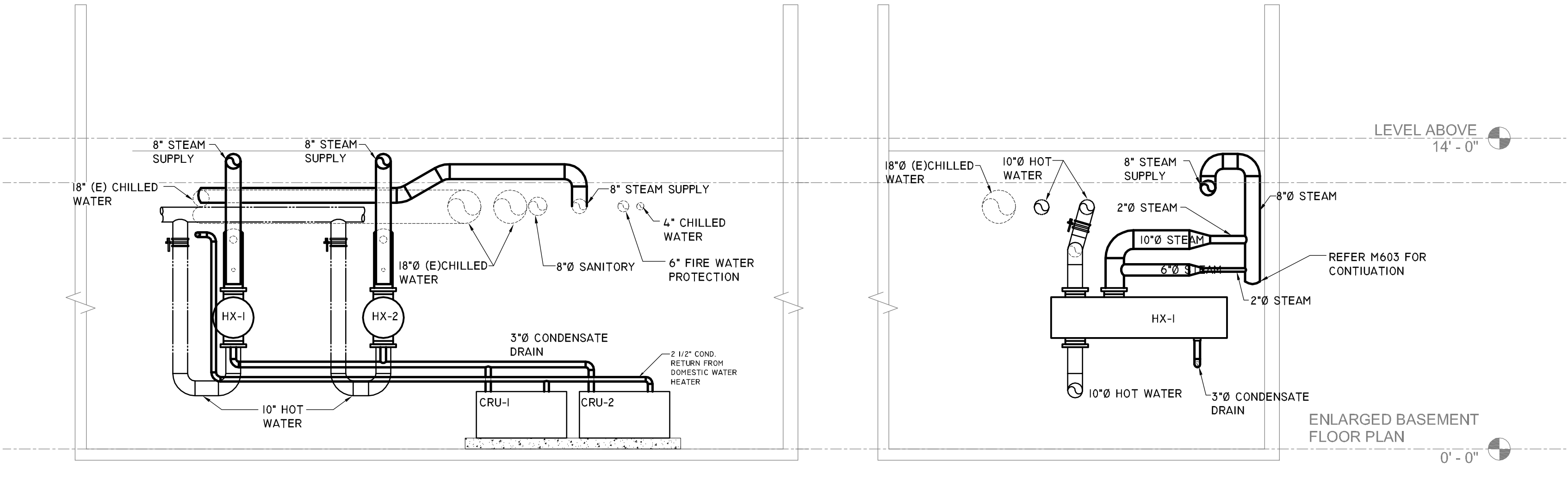
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ENLARGED CENTRAL PLANT - BASEMENT FLOOR PLAN - PROPOSED

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1 ENLARGED CENTRAL PLANT - BASEMENT FLOOR PLAN - PROPOSED
SCALE: 3/8" = 1'-0"



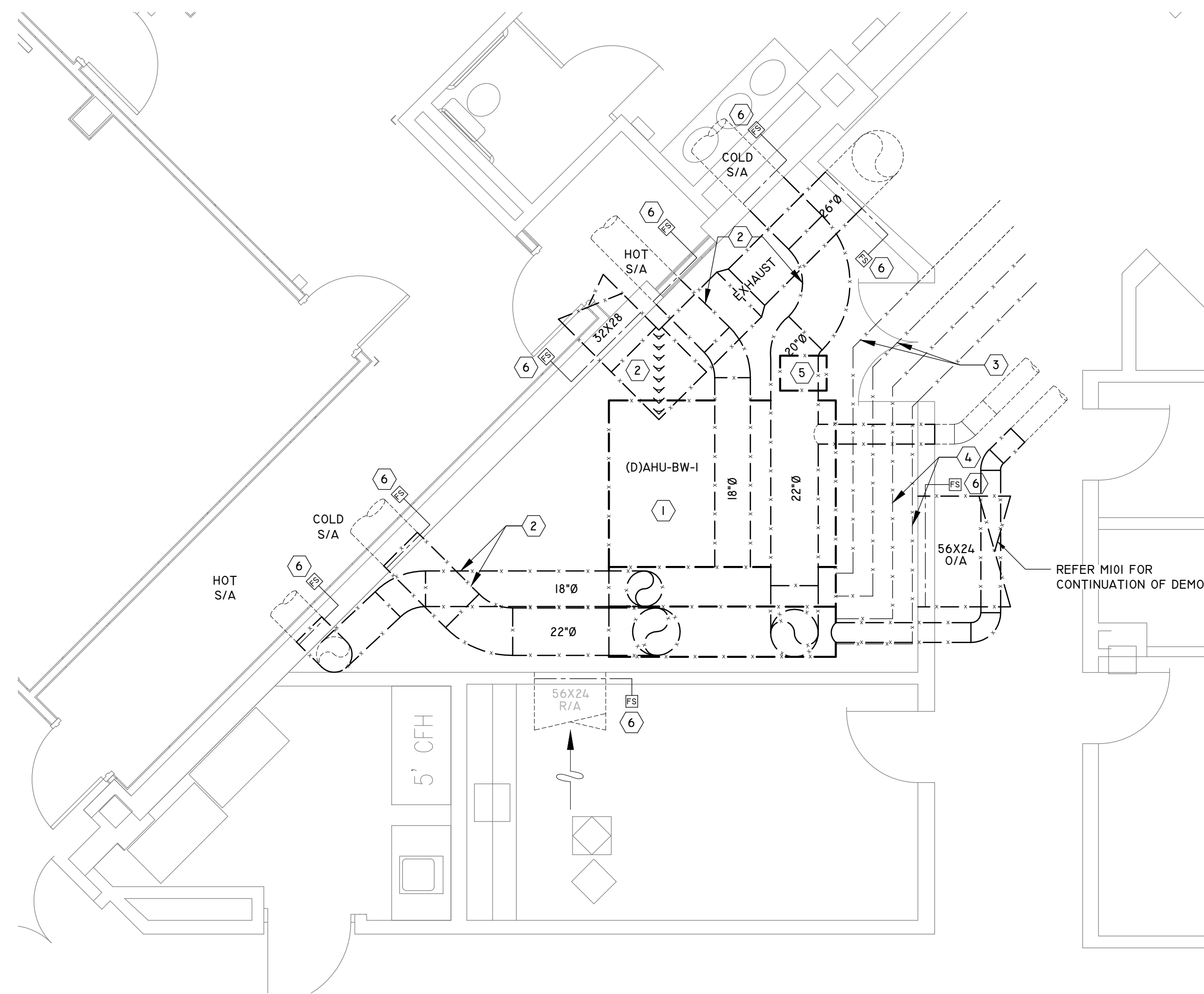
1 SECTION A-A
SCALE: 1/4" = 1'-0"

2 SECTION B-B
SCALE: 1/4" = 1'-0"

KEYED NOTES:

- ① PROVIDE 6" HOUSE KEEPING PAD
- ② PROVIDE INERTIA BASE FOR HOT WATER PUMPS RE: 6/M801.
- ③ PROVIDE AIR SEPARATOR.
- ④ SUSPEND FAN COIL UNITS FROM STRUCTURE WITH VIBRATION ISOLATORS. PROVIDE AUXILIARY DRAIN FAN UNDER UNIT WITH FLOAT SWITCH. RE: 4/M803 FOR MORE INFORMATION.
- ⑤ RE: 6/M801 FOR PUMP INSTALLATION.
- ⑥ PROVIDE 2 1/2" STEAM CONDENSATE RETURN PIPING FROM RETURN UNIT TO EXISTING 4" PLANT RETURN.
- ⑦ PROVIDE NEW 4" STEAM CONDENSATE RETURN PIPING FROM RETURN UNIT TO EXISTING 4" PLANT RETURN.
- ⑧ NOT USED.
- ⑨ RE: M1/801 FOR HEAT EXCHANGER INSTALLATION.
- ⑩ PROVIDE 8" MEDIUM PRESSURE STEAM SUPPLY LINE TO NEW HEAT EXCHANGERS.
- ⑪ PROVIDE NEW CONDENSATE DRAIN PIPING FROM FCU TO NEAREST FLOOR DRAIN. (FIELD VERIFY).
- ⑫ PROVIDE 3" STEAM CONDENSATE PIPING FROM HEAT EXCHANGER TO NEW CONDENSATE RETURN UNIT (FIELD VERIFIED).
- ⑬ PROVIDE 2" CHILLED WATER PIPE (SUPPLY & RETURN) FOR NEW FCU'S.
- ⑭ PROVIDE NEW PRV STATION. REFER M604.
- ⑮ PROVIDE NEW CONDENSATION RETURN UNITS PER SCHEDULE.
- ⑯ PROVIDE VFD AND DDC PANELS FOR NEW HOT WATER PUMPS AS SHOWN.
- ⑰ PROVIDE NEW THERMOSTAT FOR NEW A/C EQUIPMENTS AS SHOWN.
- ⑱ PROVIDE NEW 8" MOTORIZED MIXING VALVE. REFER CONTROLS.
- ⑲ PROVIDE NEW 4" MEDIUM PRESSURE STEAM PIPING TO NEW DOMESTIC WATER SYSTEM.

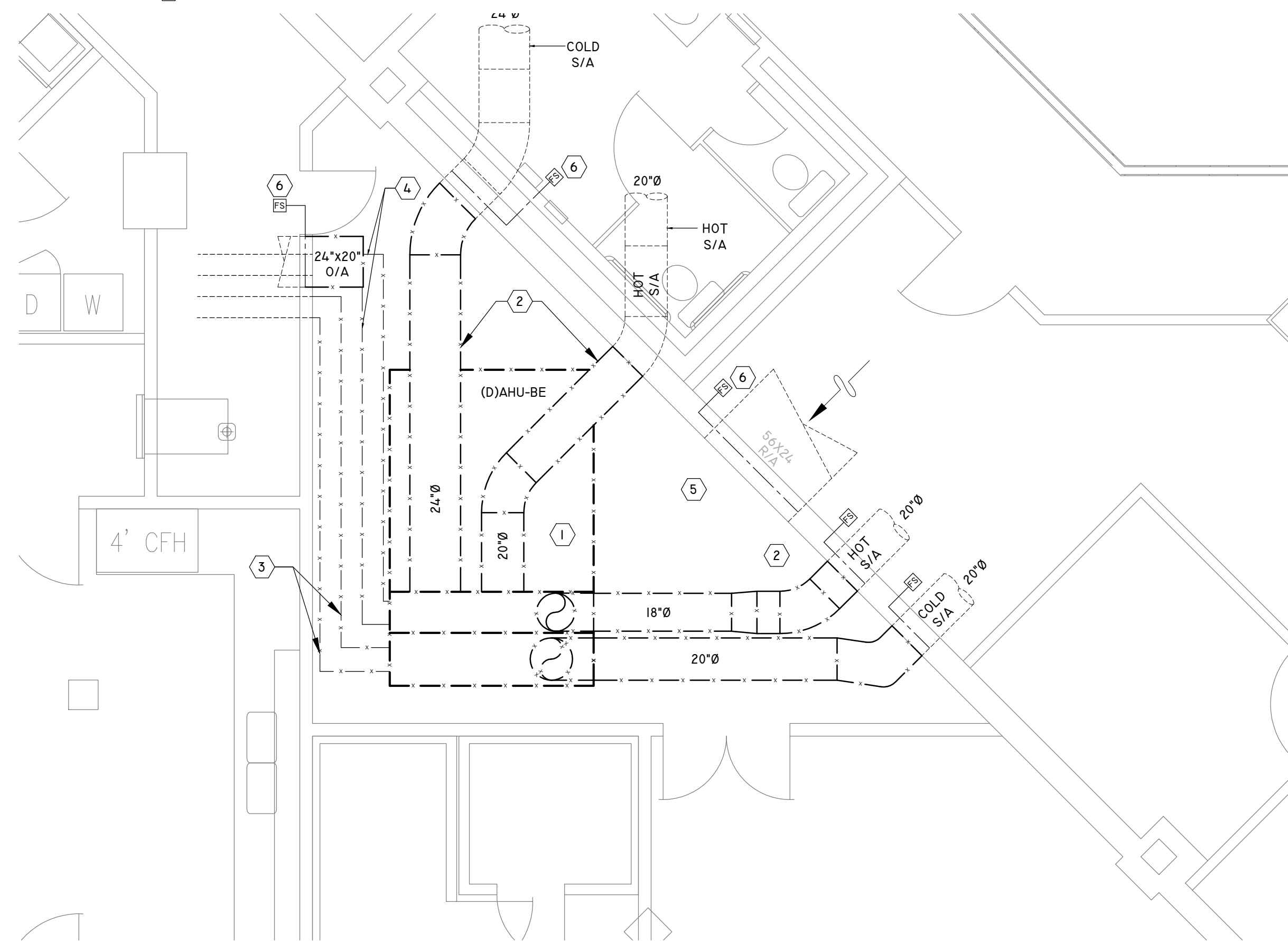
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4 ENLARGED BASEMENT FLOOR PLAN - MECHANICAL ROOM (B02) WEST - DEMO
SCALE: 1/4" = 1'-0"

DEMO KEYED NOTES:

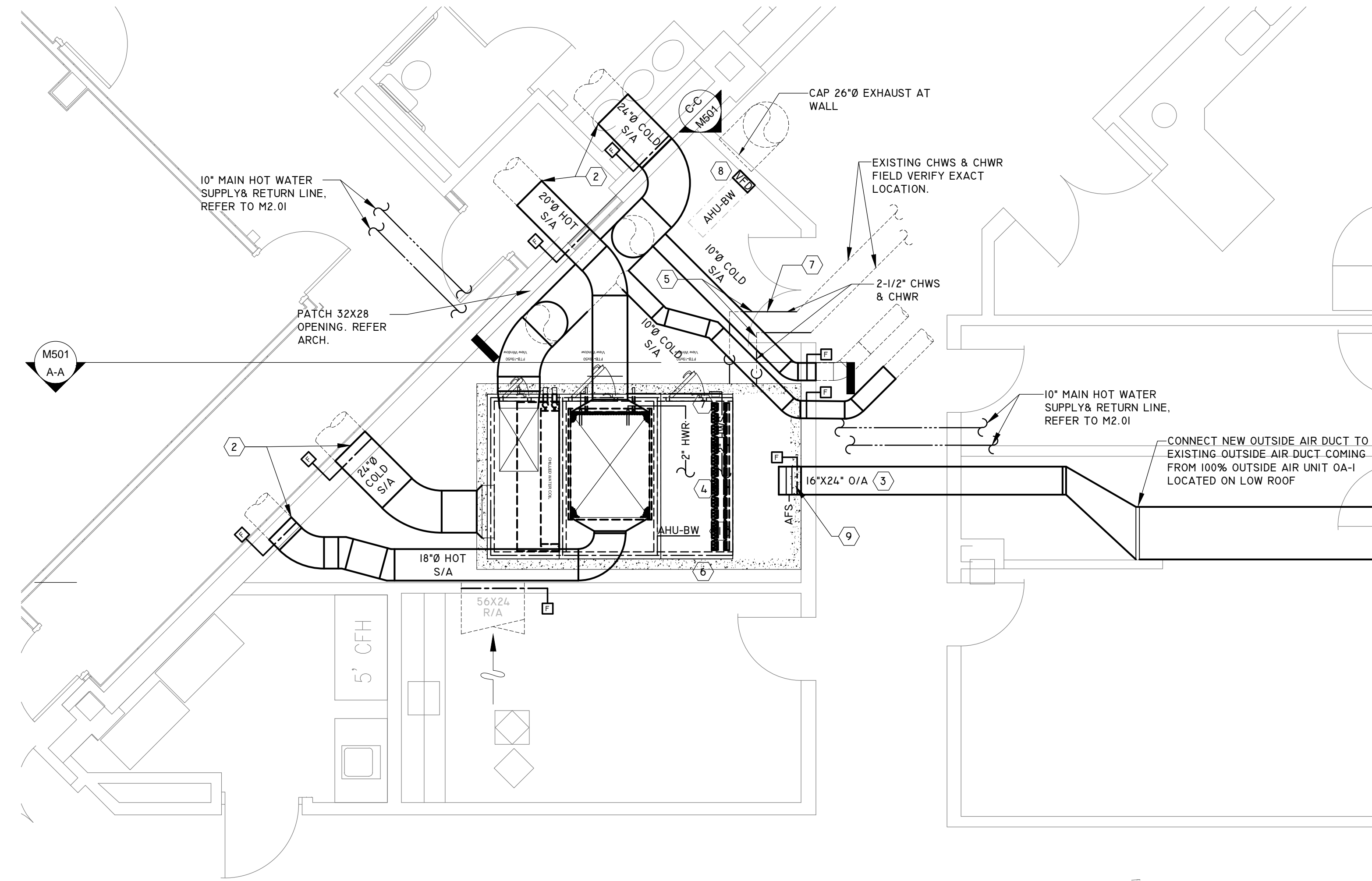
- 1 REMOVE EXISTING AIR HANDLING UNIT.
- 2 REMOVE DUCTS AS WITHIN MECHANICAL ROOM.
- 3 REMOVE CHILLED WATER PIPES AS REQUIRED FOR AHU REPLACEMENT.
- 4 REMOVE STEAM & CONDENSATE PIPING FROM AHU BACK TO MAIN. REF: M101.
- 5 REMOVE EXISTING STEAM CONDENSATE RETURN UNIT.
- 6 REMOVE EXISTING FIRE/SMOKE DAMPER.



2 ENLARGED BASEMENT FLOOR PLAN - MECHANICAL ROOM (B10A) EAST - HVAC - DEMO
SCALE: 1/4" = 1'-0"

DEMO KEYED NOTES:

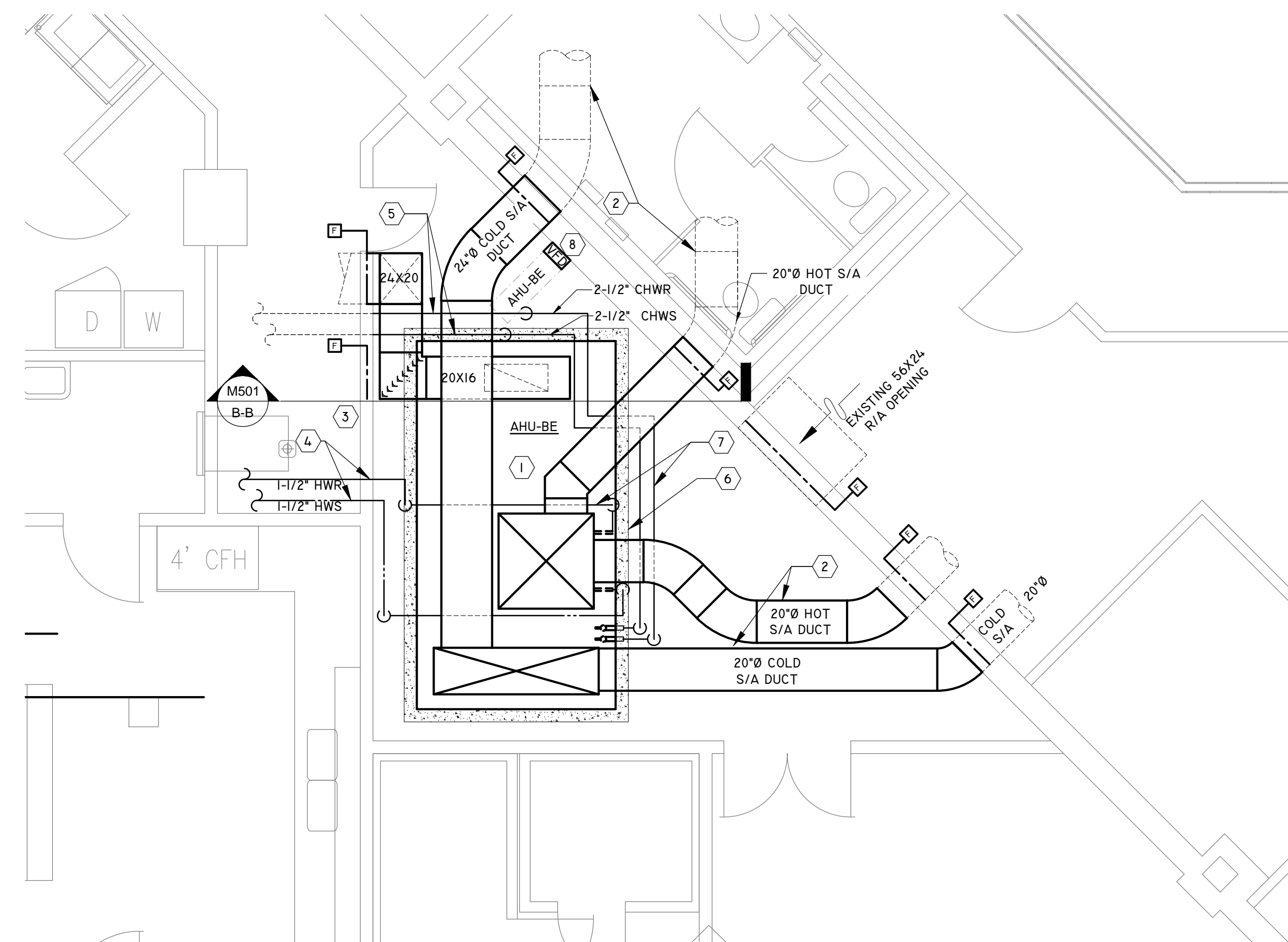
- 1 REMOVE EXISTING AIR HANDLING UNIT
- 2 REMOVE COLD & HOT SUPPLY AIR DUCTS SHOWN AS REQUIRED FOR REPLACEMENT.
- 3 REMOVE CHILLED WATER PIPES AS REQUIRED FOR REPLACEMENT
- 4 REMOVE STEAM & CONDENSATE PIPING FROM AHU BACK TO MAIN. REF: M101.
- 5 REMOVE EXISTING STEAM & CONDENSATE RETURN UNIT.
- 6 REMOVE EXISTING FIRE/SMOKE DAMPER.



3 ENLARGED BASEMENT FLOOR PLAN - MECHANICAL ROOM (B02) WEST - NEW
SCALE: 1/4" = 1'-0"

KEYED NOTES:

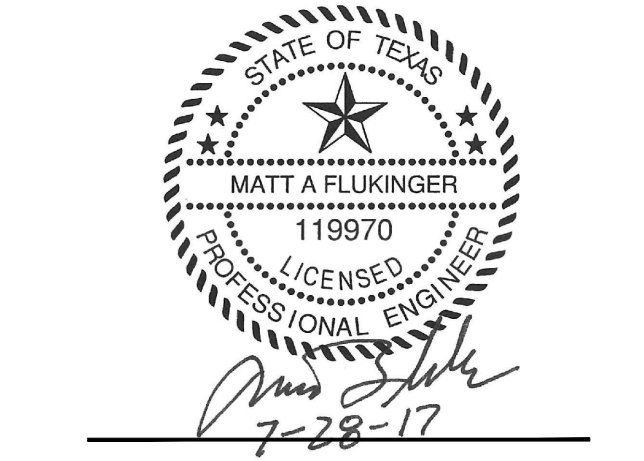
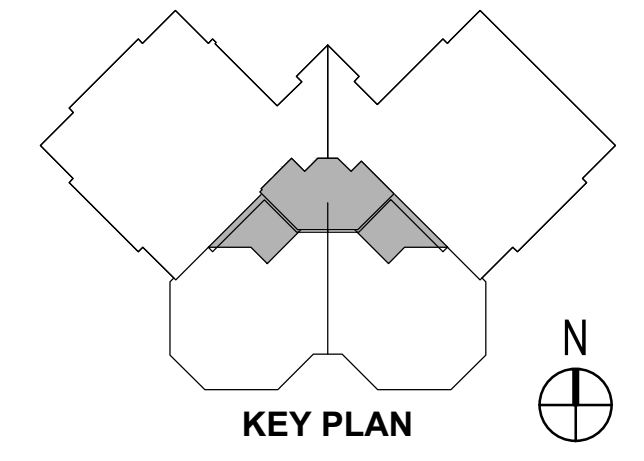
- 1 REF M505 FOR AHU INSTALLATION DETAIL.
- 2 PROVIDE NEW COLD & HOT DUCTS AND CONNECT TO EXISTING.
- 3 PROVIDE NEW OUTSIDE AIR DUCT.
- 4 NEW HOT WATER SUPPLY & RETURN BRANCH LINE TO 10" MAIN HOT WATER SUPPLY & RETURN. REFER TO SHEET M2.01 MAIN HOT WATER LINE ROUTE.
- 5 PROVIDE NEW CHILLED WATER SUPPLY & RETURN AND RECONNECT TO EXISTING.
- 6 MODIFY EXISTING HOUSE KEEPING PAD AS REQUIRED TO ACCOMMODATE NEW AHU
- 7 REF. M801 FOR PIPING INSTALLATION DETAIL.
- 8 PROVIDE NEW VFD FOR AHU FAN MOTOR. COORDINATE WITH ELECTRICAL.
- 9 PROVIDE NEW AIR FLOW STATION.



1 ENLARGED BASEMENT FLOOR PLAN - MECHANICAL ROOM (B10A) EAST - HVAC - NEW
SCALE: 1/4" = 1'-0"

KEYED NOTES:

- 1 REF M505 FOR AHU INSTALLATION DETAIL.
- 2 PROVIDE NEW COLD & HOT DUCTS AND CONNECT TO EXISTING
- 3 PROVIDE NEW OUTSIDE AIR DUCT
- 4 PROVIDE NEW HOT WATER SUPPLY & RETURN
- 5 PROVIDE NEW CHILLED WATER SUPPLY & RETURN AND RECONNECT TO EXISTING.
- 6 MODIFY EXISTING HOUSE KEEPING PAD AS REQUIRED TO ACCOMMODATE NEW AHU
- 7 REF. M801 FOR PIPING INSTALLATION DETAIL.
- 8 PROVIDE NEW VFD FOR AHU FAN MOTOR. COORDINATE WITH ELECTRICAL.
- 9 AIR FLOW STATION. REFERENCE 6/M703.



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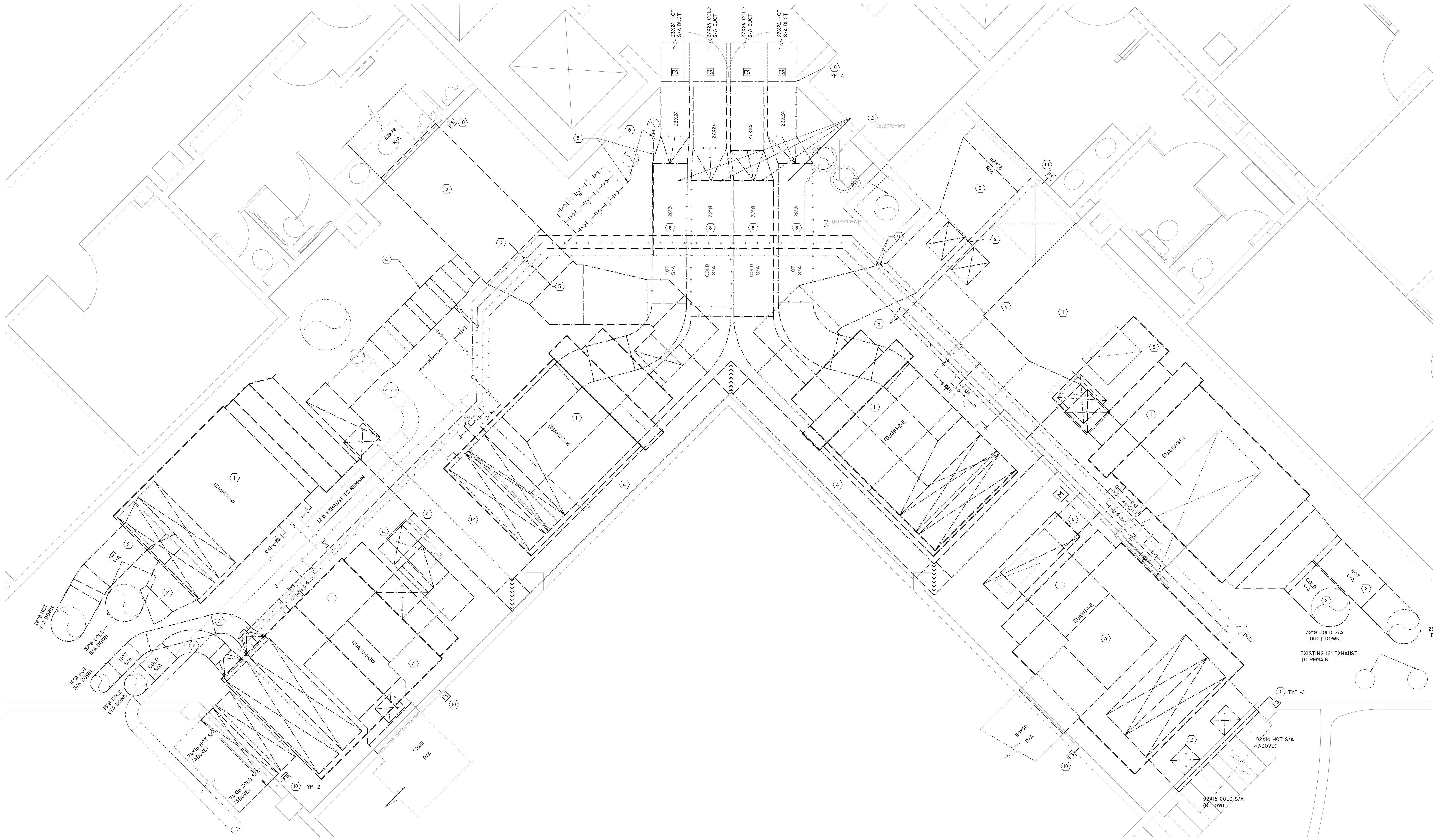
ENLARGED BASEMENT FLOOR PLAN - MECHANICAL ROOMS

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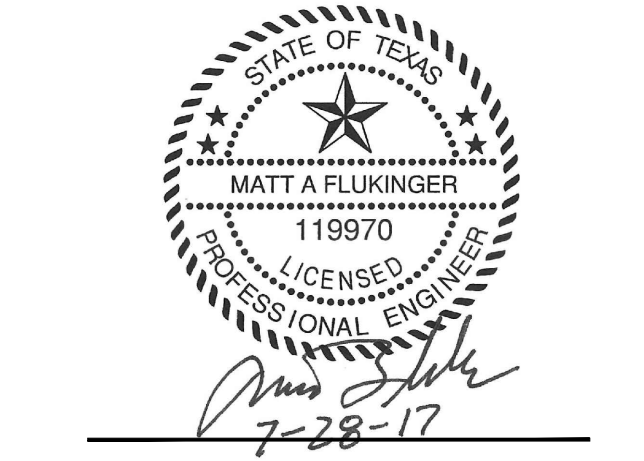
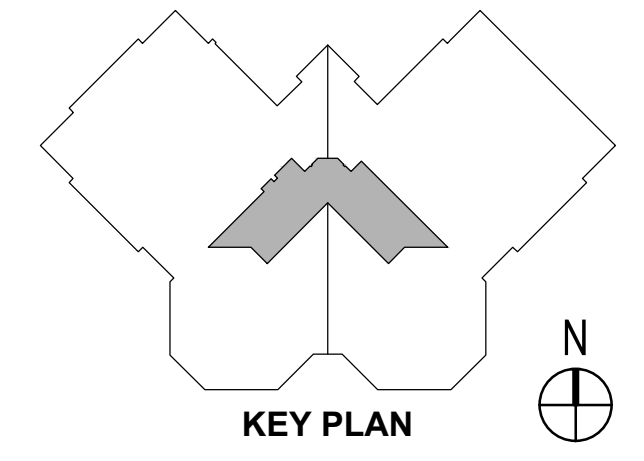
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DEMO KEYED NOTES:

- ① DEMO AIR HANDLING UNIT
- ② DEMO COLD AND HOT SUPPLY AIR DUCT AS REQUIRED FOR REPLACEMENT
- ③ DEMO RETURN AIR DUCT AS REQUIRED FOR REPLACEMENT.
- ④ DEMO O/A DUCT AS REQUIRED FOR REPLACEMENT.
- ⑤ DEMO EXISTING STEAM & CONDENSATE RETURN BRANCH PIPING.
- ⑥ CAP STEAM SUPPLY & CONDENSATE RETURN PIPES AT EXISTING ISOLATION VALVE.
- ⑦ RETAIN EXISTING EXHAUST DUCTWORK IN PLACE.
- ⑧ DEMO EXISTING DUCT SILENCERS.
- ⑨ DEMO CHILLED WATER SUPPLY AND RETURN PIPING AS REQUIRED FOR REPLACEMENT.
- ⑩ DEMO EXISTING FIRE/SMOKE DAMPER.
- ⑪ COORDINATE WORK WITH DEMO OF EXISTING ABANDONED TELECOM EQUIPMENT & CABLING BY OWNER IN THIS AREA
- ⑫ COORDINATE WORK WITH DEMO OR EXISTING ELECTRICAL BUS DUCT IN THIS AREA. REF ELECTRICAL.



1 ENLARGED PLAN - 2ND FLOOR - MECHANICAL ROOM - DEMO
SCALE: 3/8" = 1'-0"



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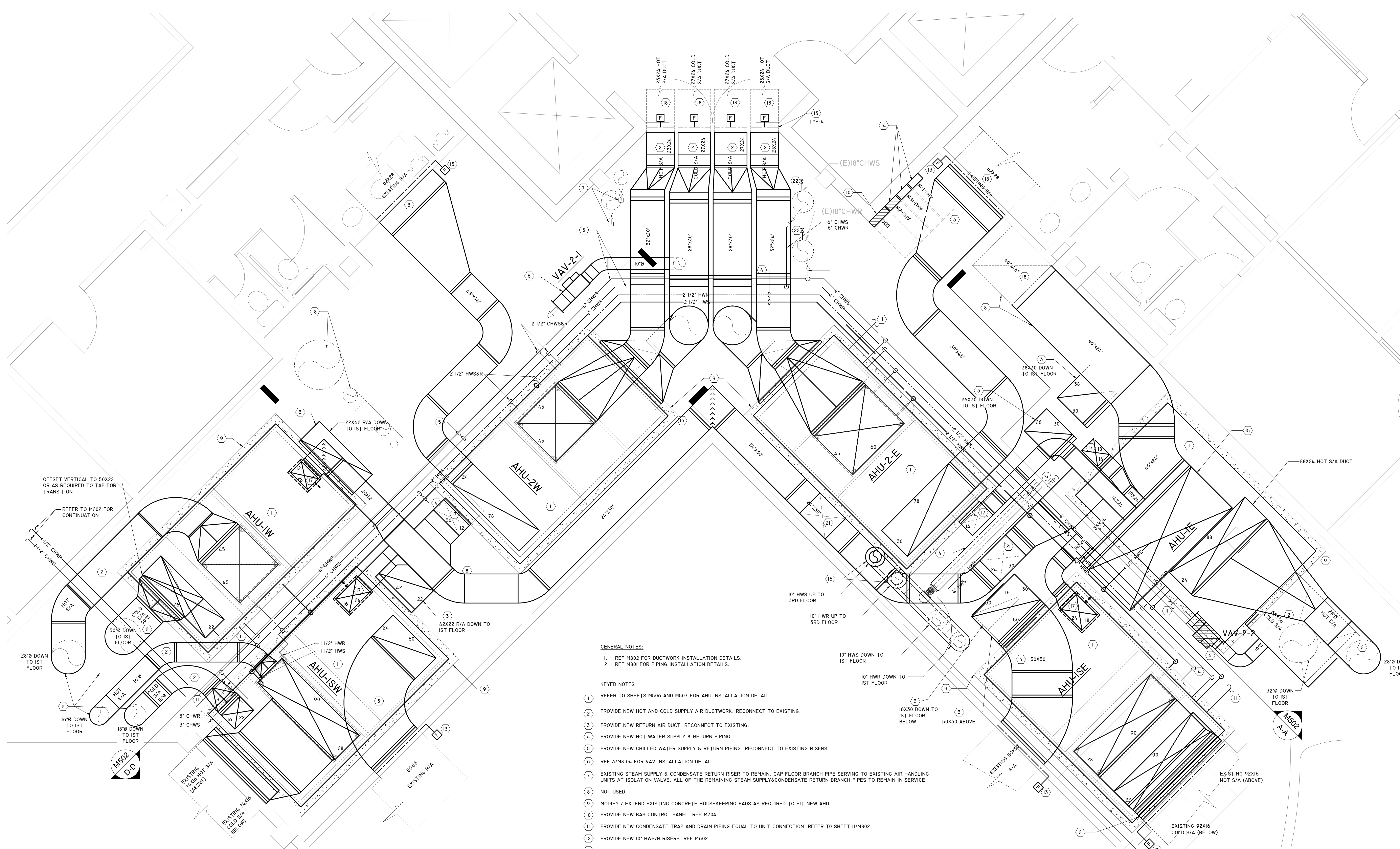
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ENLARGED PLAN -
2ND FLOOR -
MECHANICAL ROOM -
DEMO

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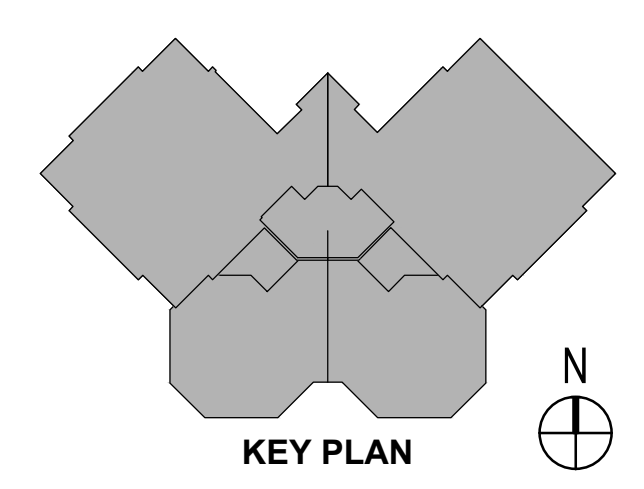
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GENERAL NOTES:
 1. REF M802 FOR DUCTWORK INSTALLATION DETAILS.
 2. REF M801 FOR PIPING INSTALLATION DETAILS.

- KEYED NOTES:**
- 1 REFER TO SHEETS M506 AND M507 FOR AHU INSTALLATION DETAIL.
 - 2 PROVIDE NEW HOT AND COLD SUPPLY AIR DUCTWORK. RECONNECT TO EXISTING.
 - 3 PROVIDE NEW RETURN AIR DUCT. RECONNECT TO EXISTING.
 - 4 PROVIDE NEW HOT WATER SUPPLY & RETURN PIPING.
 - 5 PROVIDE NEW CHILLED WATER SUPPLY & RETURN PIPING. RECONNECT TO EXISTING RISERS.
 - 6 REF 3/M8.04 FOR VAV INSTALLATION DETAIL.
 - 7 EXISTING STEAM SUPPLY & CONDENSATE RETURN RISER TO REMAIN. CAP FLOOR BRANCH PIPE SERVING TO EXISTING AIR HANDLING UNITS AT ISOLATION VALVE. ALL OF THE REMAINING STEAM SUPPLY/CONDENSATE RETURN BRANCH PIPES TO REMAIN IN SERVICE.
 - 8 NOT USED.
 - 9 MODIFY / EXTEND EXISTING CONCRETE HOUSEKEEPING PADS AS REQUIRED TO FIT NEW AHU.
 - 10 PROVIDE NEW BAS CONTROL PANEL. REF M704.
 - 11 PROVIDE NEW CONDENSATE TRAP AND DRAIN PIPING EQUAL TO UNIT CONNECTION. REFER TO SHEET 11/M802
 - 12 PROVIDE NEW 10" HWS/R RISERS. REF M602.
 - 13 PROVIDE NEW FIRE DAMPER & ACCESS DOOR
 - 14 PROVIDE NEW VFD'S FOR AHU FAN MOTORS. COORDINATE WITH ELECTRICAL.
 - 15 PROVIDE NEW 48X120 O/A DUCT UP THRU ROOF. REF 6/M802 FOR ROOF PENETRATION DETAIL.
 - 16 NEW 10" HWS & HWR RISERS. CORE DRILL EXISTING SLAB. PROVIDE SUPPORT AT EACH FLOOR AT THE BOTTOM OF THE RISER. REF 5/M802.
 - 17 PROVIDE NEW AIR FLOW STATION IN O/A DUCT DROP TO AHU.
 - 18 EXISTING DUCTWORK TO REMAIN.
 - 19 NOT USED.
 - 20 NOT USED.
 - 21 OFFSET 24X36 O/A DUCTWORK BELOW NEW 10" HW RISER PENETRATIONS TO 3RD FLOOR.
 - 22 PROVIDE 1" HOT TAPS ON RISERS WITH FULL PORT GATE VALVES FOR TEMPORARY AHU SERVICE. PROVIDE BLIND FLANGE & REMOVABLE INSULATION UPON COMPLETION OF WORK.

1 ENLARGED PLAN - 2ND FLOOR - MECHANICAL ROOM - PROPOSED
 SCALE: 3/8" = 1'-0"



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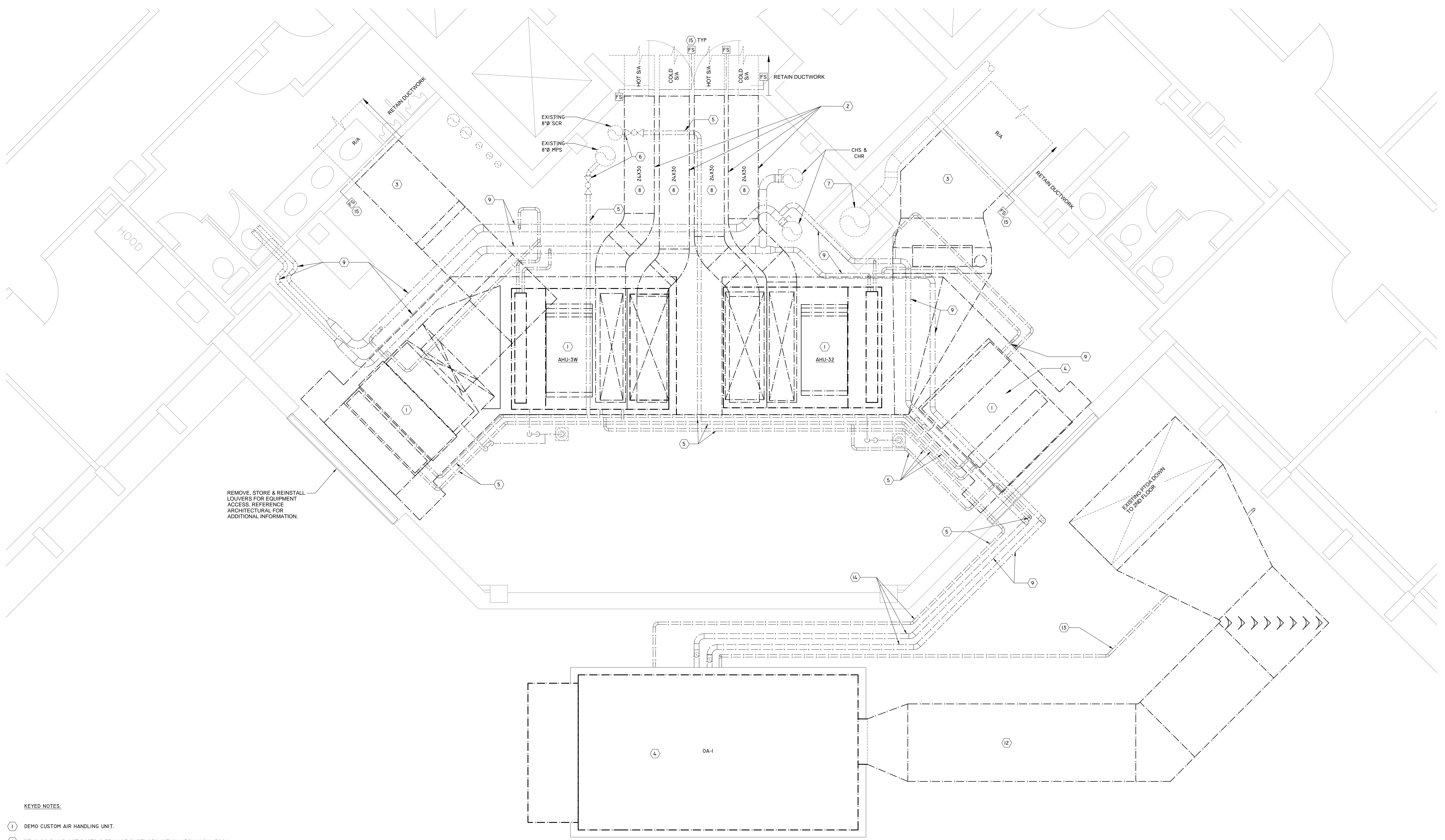
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**ENLARGED PLAN -
 2ND FLOOR -
 MECHANICAL ROOM -
 PROPOSED**

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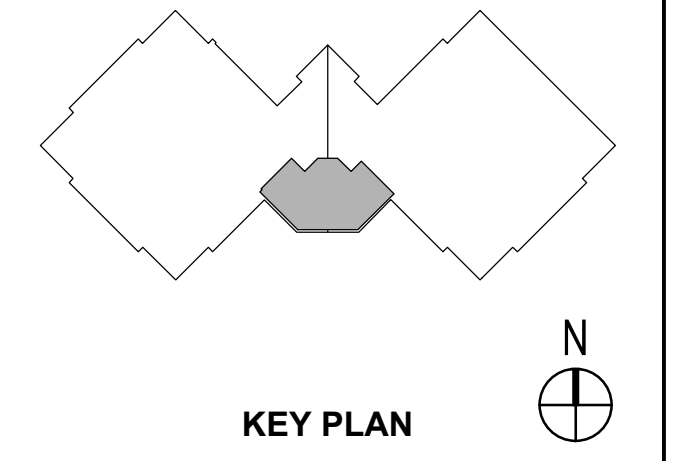


REMOVE, STORE & REINSTALL LOUVERS FOR EQUIPMENT ACCESS. REFERENCE ARCHITECTURAL FOR ADDITIONAL INFORMATION.

EXISTING PIPING DOWN TO 2ND FLOOR

- KEYED NOTES:**
- ① DEMO CUSTOM AIR HANDLING UNIT.
 - ② DEMO COLD AND HOT DUCTS SUPPLY AIR DUCTWORK WITHIN MECHANICAL ROOM.
 - ③ DEMO RETURN AIR DUCTWORK WITHIN MECHANICAL ROOM.
 - ④ DEMO OUTSIDE AIR HANDLING UNIT AT 2ND FLOOR.
 - ⑤ DEMO STEAM & CONDENSATE RETURN PIPING BACK TO RISER.
 - ⑥ CAP STEAM SUPPLY & CONDENSATE RETURN PIPES AT ISOLATION VALVE.
 - ⑦ RETAIN EXISTING EXHAUST DUCTWORK.
 - ⑧ DEMO DUCT SILENCERS.
 - ⑨ DEMO EXISTING CHILLED WATER SUPPLY AND RETURN PIPING TO COOLING COILS.
 - ⑩ NOT USED.
 - ⑪ NOT USED.
 - ⑫ DEMO EXISTING OUTSIDE AIR SUPPLY DUCT AT ROOF UP TO THE ROOF PENETRATION.
 - ⑬ DEMO EXISTING CONDENSATE DRAIN PIPING AT 2ND FLOOR ROOF.
 - ⑭ RETAIN EXISTING PIPING SUPPORT STRUCTURE FOR REUSE.
 - ⑮ DEMO EXISTING FIRE/SMOKE DAMPERS IN PLACE.

2 ENLARGED PLAN - 3RD FLOOR - MECHANICAL ROOM - DEMO
SCALE: 3/8" = 1'-0"



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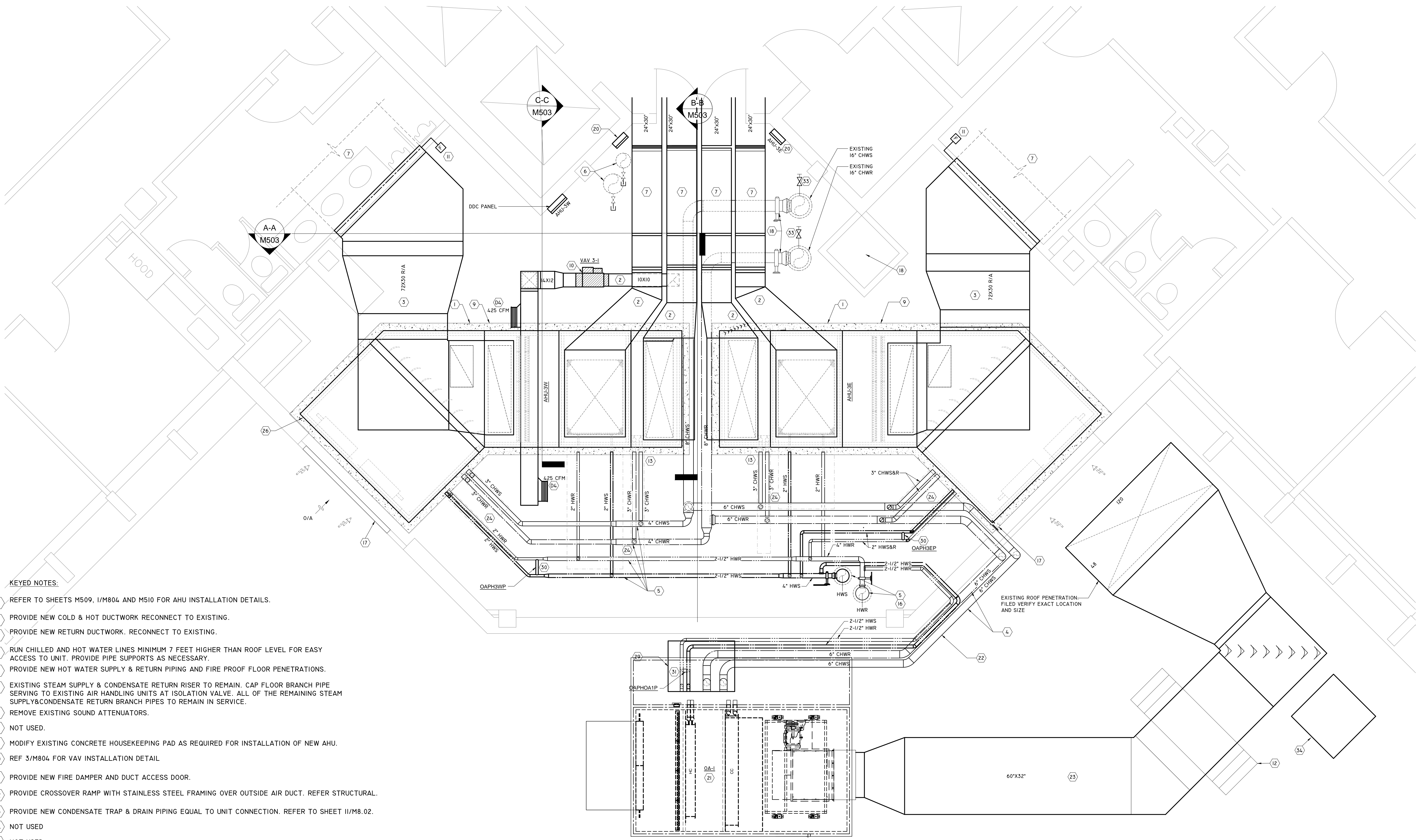
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**ENLARGED PLAN -
3RD FLOOR -
MECHANICAL ROOM -
DEMO**
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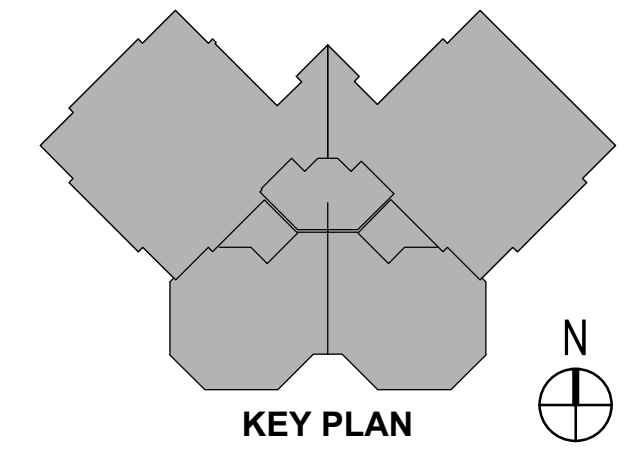
KEYED NOTES:

- 1 REFER TO SHEETS M509, I/M804 AND M510 FOR AHU INSTALLATION DETAILS.
- 2 PROVIDE NEW COLD & HOT DUCTWORK RECONNECT TO EXISTING.
- 3 PROVIDE NEW RETURN DUCTWORK. RECONNECT TO EXISTING.
- 4 RUN CHILLED AND HOT WATER LINES MINIMUM 7 FEET HIGHER THAN ROOF LEVEL FOR EASY ACCESS TO UNIT. PROVIDE PIPE SUPPORTS AS NECESSARY.
- 5 PROVIDE NEW HOT WATER SUPPLY & RETURN PIPING AND FIRE PROOF FLOOR PENETRATIONS.
- 6 EXISTING STEAM SUPPLY & CONDENSATE RETURN RISER TO REMAIN. CAP FLOOR BRANCH PIPE SERVING TO EXISTING AIR HANDLING UNITS AT ISOLATION VALVE. ALL OF THE REMAINING STEAM SUPPLY & CONDENSATE RETURN BRANCH PIPES TO REMAIN IN SERVICE.
- 7 REMOVE EXISTING SOUND ATTENUATORS.
- 8 NOT USED.
- 9 MODIFY EXISTING CONCRETE HOUSEKEEPING PAD AS REQUIRED FOR INSTALLATION OF NEW AHU.
- 10 REF 3/M804 FOR VAV INSTALLATION DETAIL.
- 11 PROVIDE NEW FIRE DAMPER AND DUCT ACCESS DOOR.
- 12 PROVIDE CROSSOVER RAMP WITH STAINLESS STEEL FRAMING OVER OUTSIDE AIR DUCT. REFER STRUCTURAL.
- 13 PROVIDE NEW CONDENSATE TRAP & DRAIN PIPING EQUAL TO UNIT CONNECTION. REFER TO SHEET II/M8.02.
- 14 NOT USED.
- 15 NOT USED.
- 16 NEW 10" HWS & HWR RISERS. CORE DRILL EXISTING SLAB. PROVIDE SUPPORT AT EACH FLOOR AT THE BOTTOM OF THE RISER. REF 5/M804.
- 17 PROVIDE FLEX CONNECTION TO CONNECT OUTDOOR NEW UNIT INTAKE TO EXISTING LOUVER.
- 18 RETAIN EXISTING DUCT WORK IN PLACE.
- 19 NOT USED.
- 20 PROVIDE NEW VFD FOR AHU FAN MOTORS. COORDINATE WITH ELECTRICAL.
- 21 PROVIDE NEW OUTSIDE AHU ON EXISTING STRUCTURAL STEEL RACK. MODIFY STRUCTURAL STEEL RACK AS REQUIRED FOR INSTALLATION.
- 22 PROVIDE NEW CHW & HW PIPING ON EXISTING PIPE SUPPORT STRUCTURE. MODIFY AS REQUIRED.
- 23 PROVIDE NEW PRE-FABRICATED AND PRE-INSULATED EXTERIOR DUCTWORK PER SPECIFICATIONS. RECONNECT TO EXISTING ROOF PENETRATION.
- 24 COIL PULL SPACE.
- 25 NOT USED.
- 26 NOT USED.
- 27 NOT USED.
- 28 NOT USED.
- 29 PROVIDE COIL PIPING, CONTROLS, AND CIRCULATION PUMP IN AHU PIPING VESTIBULE. PROVIDE ACCESS DOORS ON BOTH SIDES.
- 30 PROVIDE INLINE HOT WATER FREEZE PROTECTION PUMP. PUMP FLOW SHALL HAVE 20FT HEAD AND FLOW SHALL BE EQUAL TO TOTAL COIL FLOW.
- 31 PROVIDE INLINE HOT WATER FREEZE PROTECTION PUMP IN THE PIPE CABINET. PUMP FLOW SHALL HAVE 20FT HEAD AND FLOW SHALL BE EQUAL TO TOTAL COIL FLOW.
- 32 NOT USED.
- 33 PROVIDE 4" HOT TAPS ON RISERS WITH FULL PORT GATE VALVES FOR TEMPORARY AHU SERVICE. PROVIDE BLIND FLANGE AND REMOVABLE INSULATION UPON COMPLETION OF WORK.
- 34 PROVIDE 48"X48" RELIEF HOOD WITH 18" ROOF CURB AND MOTORIZED BACK-DRAFT DAMPER. CUT AND PATCH ROOF AS REQUIRED FOR INSTALLATION. COORDINATE EXACT LOCATION TO AVOID STRUCTURE BELOW. REFERENCE 6/M804 FOR INSTALLATION DETAILS.

1 ENLARGED PLAN - 3RD FLOOR - MECHANICAL ROOM - PROPOSED
SCALE: 3/8" = 1'-0"

GENERAL NOTES:

1. REF M509 & M510 FOR AHU INSTALLATION.
2. REF M801 FOR PIPING INSTALLATION DETAILS.



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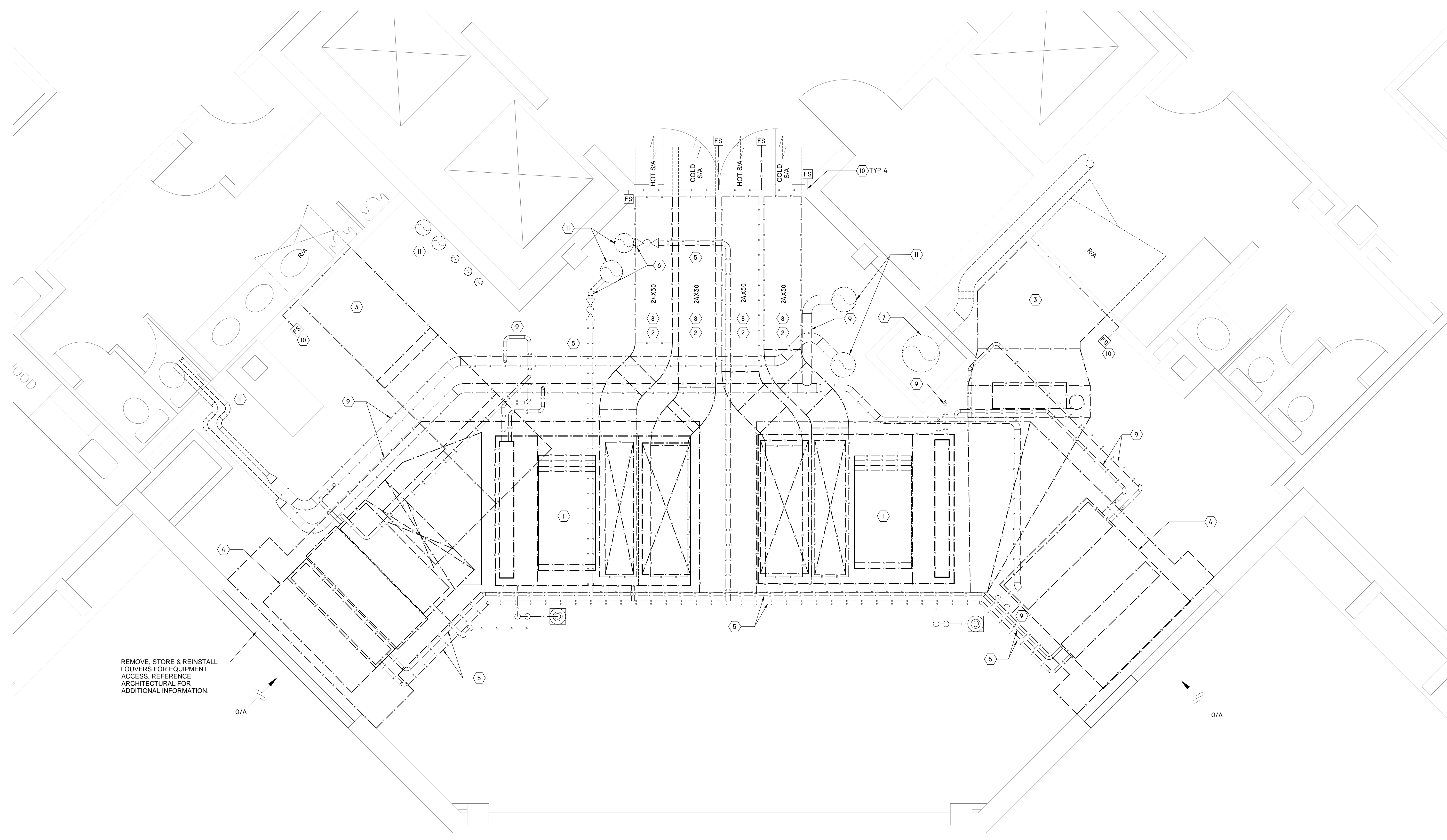
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**ENLARGED PLAN -
3RD FLOOR -
MECHANICAL ROOM -
PROPOSED**

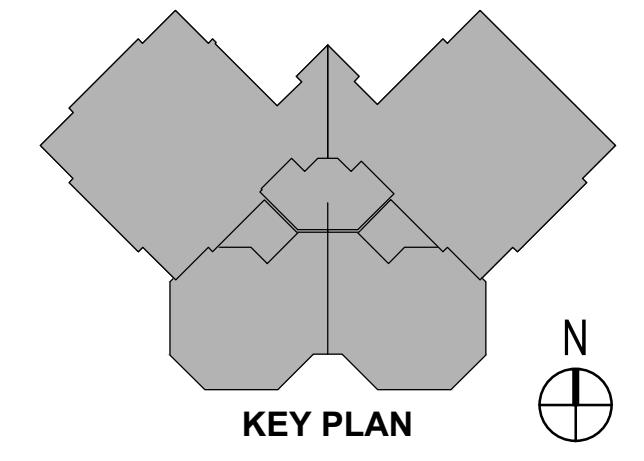
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1 ENLARGED PLAN - TYPICAL 4TH-7TH FLOOR - MECHANICAL ROOM - DEMO
SCALE: 3/8" = 1'-0"

KEYED NOTES :

- ① DEMO CUSTOM AIR HANDLING UNIT.
- ② DEMO COLD AND HOT SUPPLY AIR DUCTWORKS WITHIN MECHANICAL ROOM.
- ③ DEMO RETURN AIR DUCTWORK WITHIN MECHANICAL ROOM.
- ④ DEMO PRE-TREATMENT COILS AND OUTSIDE AIR DUCTWORK UP TO OUTSIDE AIR LOUVER.
- ⑤ DEMO STEAM & CONDENSATE RETURN PIPING BACK TO RISERS.
- ⑥ CAP STEAM SUPPLY & CONDENSATE RETURN PIPES AT ISOLATION VALVES.
- ⑦ RETAIN EXISTING EXHAUST DUCTWORK.
- ⑧ DEMO DUCT SILENCERS.
- ⑨ DEMO EXISTING CHILLED WATER SUPPLY AND RETURN BRANCH PIPING TO COOLING COILS.
- ⑩ DEMO FIRE/SMOKE DAMPERS.
- ⑪ RETAIN EXISTING RISER PIPING IN PLACE.



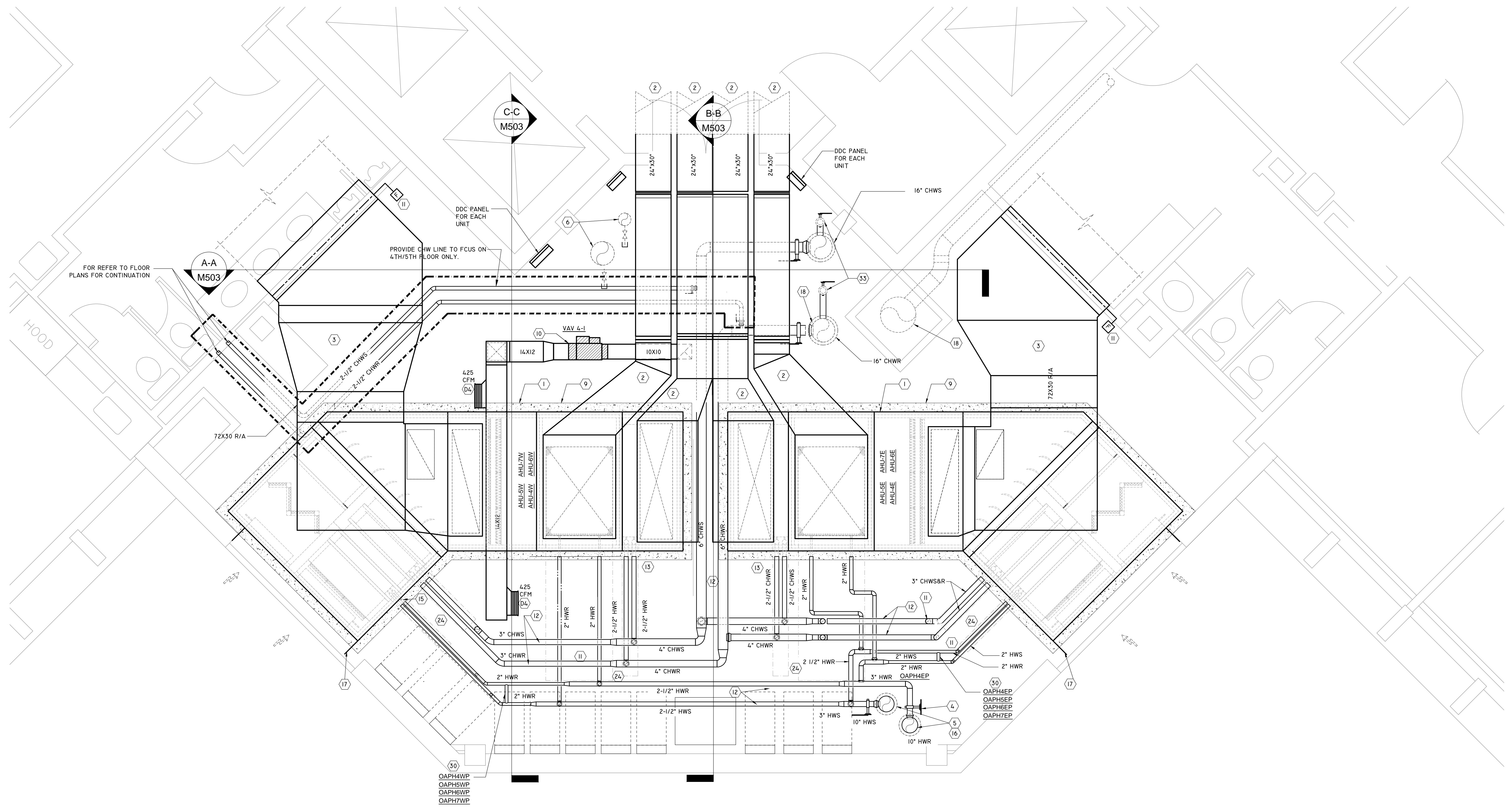
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Date	31 MARCH 2017
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**ENLARGED PLAN -
TYPICAL 4TH-7TH
FLOOR - MECHANICAL
ROOM - DEMO**

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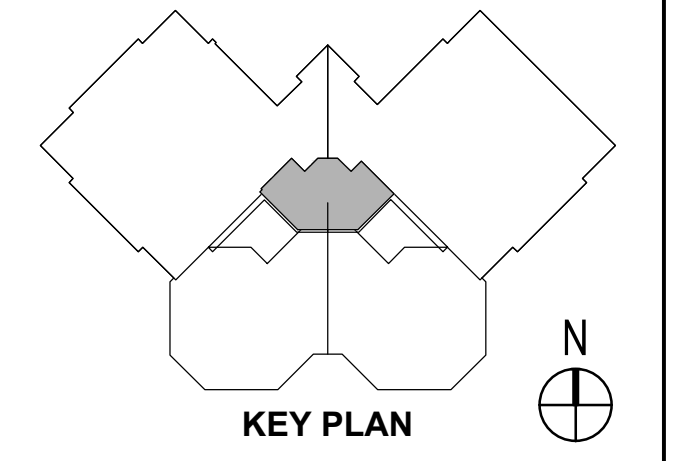
GENERAL NOTES:

1. REF M509 & M510 FOR AHU INSTALLATION.
2. REF M801 FOR PIPING INSTALLATION DETAILS.

KEYED NOTES:

- 1 REFER TO SHEETS M509, 1/M804 AND M510 FOR AHU INSTALLATION DETAILS.
- 2 PROVIDE NEW COLD & HOT DUCTWORK RECONNECT TO EXISTING.
- 3 PROVIDE NEW RETURN DUCTWORK. RECONNECT TO EXISTING.
- 4 NOT USED.
- 5 PROVIDE NEW HOT WATER SUPPLY & RETURN PIPING AND FIRE PROOF FLOOR PENETRATIONS.
- 6 EXISTING STEAM SUPPLY & CONDENSATE RETURN RISER TO REMAIN. CAP FLOOR BRANCH PIPE SERVING TO EXISTING AIR HANDLING UNITS AT ISOLATION VALVE. ALL OF THE REMAINING STEAM SUPPLY & CONDENSATE RETURN BRANCH PIPES TO REMAIN IN SERVICE.
- 7 NOT USED.
- 8 NOT USED.
- 9 MODIFY EXISTING CONCRETE HOUSEKEEPING PAD AS REQUIRED FOR INSTALLATION OF NEW AHU.
- 10 REF 3/M8.04 FOR VAV INSTALLATION DETAIL
- 11 PROVIDE NEW FIRE DAMPER AND DUCT ACCESS DOOR.
- 12 NOT USED.
- 13 PROVIDE NEW CONDENSATE TRAP & DRAIN PIPING EQUAL TO UNIT CONNECTION. REFER TO SHEET 11/M8.02.
- 14 NOT USED.
- 15 NOT USED.
- 16 NEW 10" HWS & HWR RISERS. CORE DRILL EXISTING SLAB. PROVIDE SUPPORT AT EACH FLOOR AT THE BOTTOM OF THE RISER. REF 5/M804.
- 17 PROVIDE FLEX CONNECTION TO CONNECT OUTDOOR NEW UNIT INTAKE TO EXISTING LOUVER.
- 18 RETAIN EXISTING DUCT WORK IN PLACE.
- 19 NOT USED.
- 20 PROVIDE NEW VFD FOR AHU FAN MOTORS. COORDINATE WITH ELECTRICAL.
- 21 NOT USED.
- 22 PROVIDE NEW CHW & HW PIPING ON EXISTING PIPE SUPPORT STRUCTURE. MODIFY AS REQUIRED.
- 23 NOT USED.
- 24 COIL PULL SPACE.
- 25 NOT USED.
- 26 NOT USED.
- 27 NOT USED.
- 28 NOT USED.
- 29 PROVIDE COIL PIPING, CONTROLS, AND CIRCULATION PUMP IN AHU PIPING VESTIBULE. PROVIDE ACCESS DOORS ON BOTH SIDES.
- 30 PROVIDE INLINE HOT WATER FREEZE PROTECTION PUMP. PUMP FLOW SHALL HAVE 20FT HEAD AND FLOW SHALL BE EQUAL TO TOTAL COIL FLOW.
- 31 NOT USED.
- 32 NOT USED.
- 33 PROVIDE 4" HOT TAPS ON RISERS WITH FULL PORT GATE VALVES FOR TEMPORARY AHU SERVICE. PROVIDE BLIND FLANGE AND REMOVABLE INSULATION UPON COMPLETION OF WORK.

1 ENLARGED PLAN - TYPICAL 4TH-7TH FLOOR - MECHANICAL ROOM - PROPOSED
SCALE: 1/4" = 1'-0"



REVISIONS

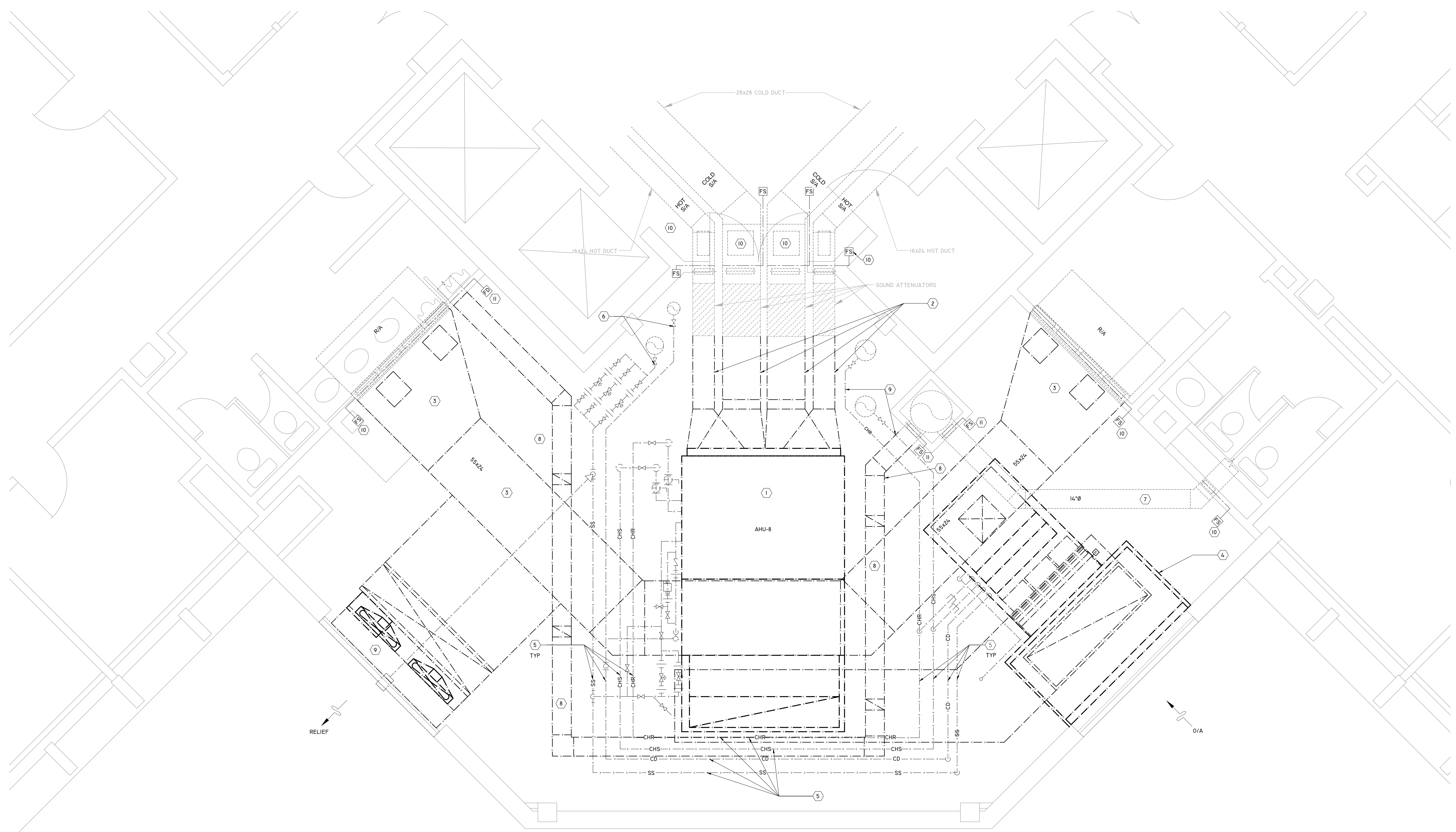
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ENLARGED PLAN -
TYPICAL 4TH-7TH
FLOOR - MECHANICAL
ROOM - PROPOSED

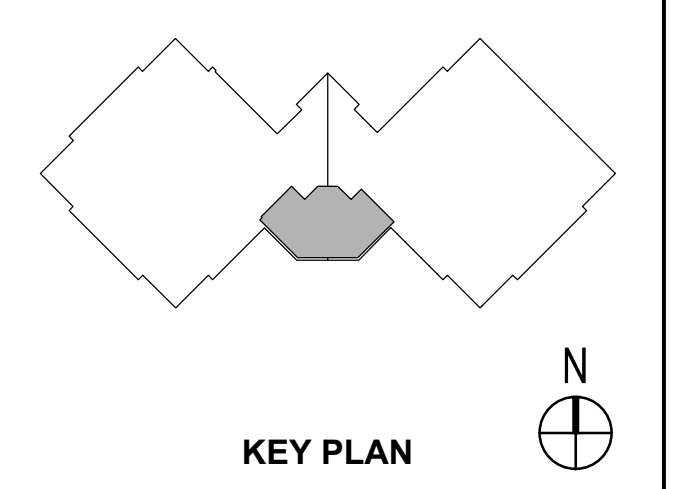
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KEYED NOTES:

- ① REMOVE EXISTING AIR HANDLING UNIT.
- ② REMOVE COLD & HOT SUPPLY DUCTS WITHIN MECHANICAL ROOM.
- ③ REMOVE RETURN AIR DUCT WITHIN MECHANICAL ROOM.
- ④ REMOVE EXISTING OUTSIDE AIR PRE-TREATMENT UNIT AND ASSOCIATED DUCTWORK.
- ⑤ REMOVE EXISTING CHILLED WATER, STEAM AND CONDENSATE RETURN BRANCH PIPING BACK TO RISERS.
- ⑥ CAP STEAM SUPPLY & CONDENSATE RETURN PIPES AT ISOLATION VALVES.
- ⑦ RETAIN EXISTING EXHAUST DUCTWORK IN PLACE.
- ⑧ REMOVE EXISTING EXHAUST DUCTWORK.
- ⑨ REMOVE EXISTING RELIEF FANS & REUSE DUCTWORK. RETAIN RELIEF LOUVER IN PLACE.
- ⑩ RETAIN EXISTING FIRE/SMOKE DAMPERS IN PLACE.
- ⑪ RETAIN EXISTING FIRE DAMPER IN PLACE.

1 ENLARGED PLAN - TYPICAL 8TH-10TH FLOOR - MECHANICAL ROOM - DEMO
SCALE: 3/8" = 1'-0"



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05/31/2017	ISSUED FOR BID
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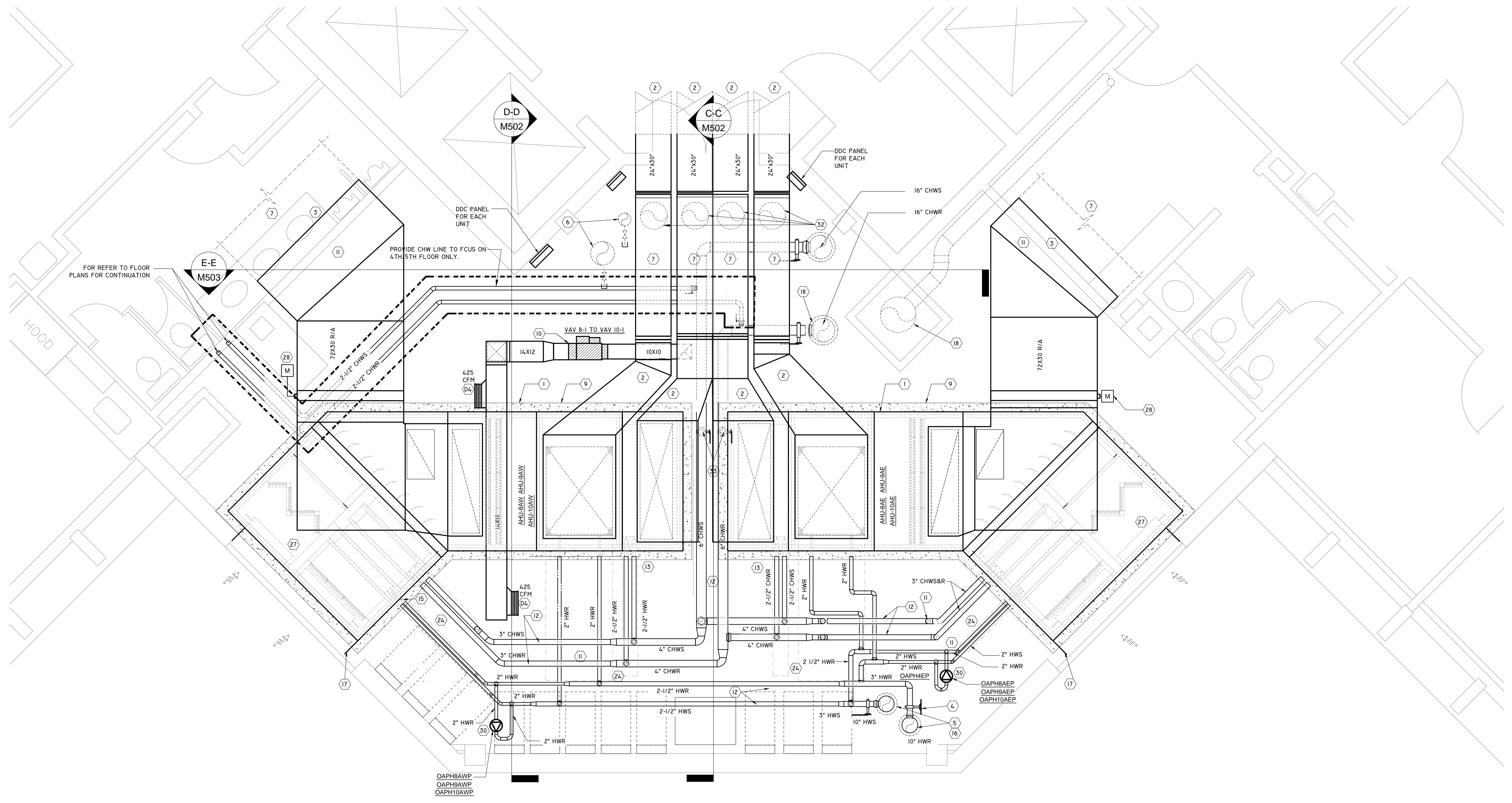
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ENLARGED PLAN -
TYPICAL 8TH-10TH
FLOOR - MECHANICAL
ROOM - DEMO

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GENERAL NOTES:

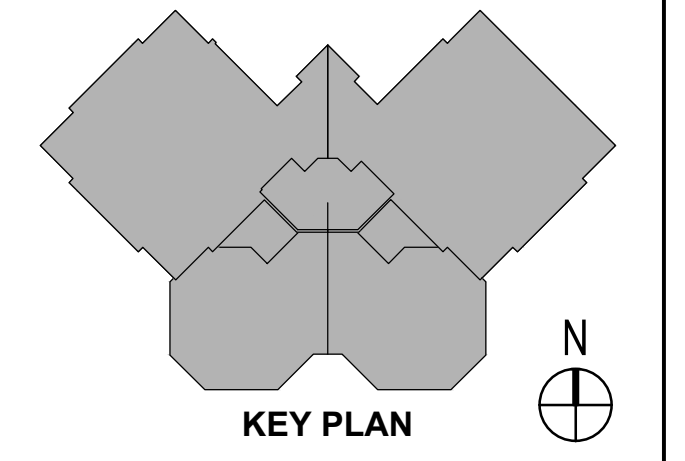
1. REF M509, I/M804 & M510 FOR AHU INSTALLATION.
2. REF M801 FOR PIPING INSTALLATION DETAILS.

KEYED NOTES:

- 1 REFER TO SHEETS M509 AND M510 FOR AHU INSTALLATION DETAILS.
- 2 PROVIDE NEW COLD & HOT DUCTWORK RECONNECT TO EXISTING.
- 3 PROVIDE NEW RETURN DUCTWORK. RECONNECT TO EXISTING.
- 4 NOT USED.
- 5 PROVIDE NEW HOT WATER SUPPLY & RETURN PIPING AND FIRE PROOF FLOOR PENETRATIONS.
- 6 EXISTING STEAM SUPPLY & CONDENSATE RETURN RISER TO REMAIN. CAP FLOOR BRANCH PIPE SERVING TO EXISTING AIR HANDLING UNITS AT ISOLATION VALVE. ALL OF THE REMAINING STEAM SUPPLY & CONDENSATE RETURN BRANCH PIPES TO REMAIN IN SERVICE.
- 7 REMOVE EXISTING SOUND ATTENUATORS.
- 8 NOT USED.
- 9 MODIFY EXISTING CONCRETE HOUSEKEEPING PAD AS REQUIRED FOR INSTALLATION OF NEW AHU.
- 10 REF 3/M8.04 FOR VAV INSTALLATION DETAIL
- 11 PROVIDE NEW DUCT ACCESS DOORS FOR EXISTING FIRE/SMOKE DAMPERS.
- 12 NOT USED.
- 13 PROVIDE NEW CONDENSATE TRAP & DRAIN PIPING EQUAL TO UNIT CONNECTION. REFER TO SHEET II/M8.02.
- 14 NOT USED.
- 15 NOT USED.

- 16 NEW 10" HWS & HWR RISERS. CORE DRILL EXISTING SLAB. PROVIDE SUPPORT AT EACH FLOOR AT THE BOTTOM OF THE RISER. REF 5/M804.
- 17 PROVIDE FLEX CONNECTION TO CONNECT OUTDOOR NEW UNIT INTAKE TO EXISTING LOUVER.
- 18 RETAIN EXISTING DUCT WORK IN PLACE.
- 19 NOT USED.
- 20 PROVIDE NEW VFD FOR AHU FAN MOTORS. COORDINATE WITH ELECTRICAL.
- 21 NOT USED.
- 22 PROVIDE NEW CHW & HW PIPING ON EXISTING PIPE SUPPORT STRUCTURE. MODIFY AS REQUIRED.
- 23 NOT USED.
- 24 COIL PULL SPACE.
- 25 NOT USED.
- 26 NOT USED.
- 27 PROVIDE FULLY MODULATING BYPASS DAMPERS WITH AHU FOR ECONOMIZER CYCLE CONTROLS.
- 28 PROVIDE FULLY MODULATING RETURN AIR DAMPERS FOR ECONOMIZER CYCLE CONTROLS.
- 29 PROVIDE COIL PIPING, CONTROLS, AND CIRCULATION PUMP IN AHU PIPING VESTIBULE. PROVIDE ACCESS DOORS ON BOTH SIDES.
- 30 PROVIDE INLINE HOT WATER FREEZE PROTECTION PUMP. PUMP FLOW SHALL HAVE 20FT HEAD AND FLOW SHALL BE EQUAL TO TOTAL COIL FLOW.
- 31 NOT USED.
- 32 PROVIDE 22" DIA TAPS IN EXISTING DUCTWORK FOR CONNECTION OF TEMPORARY AHU SERVICE. COORDINATE TAP LOCATIONS WITH EXISTING CONDITIONS. PROVIDE REMOVABLE CAPS AND INSULATION UPON COMPLETION OF WORK. REF M500 FOR INSTALLATION DETAILS.
- 33 PROVIDE 4" HOT TAPS ON RISERS WITH FULL PORT GATE VALVES FOR TEMPORARY AHU SERVICE. PROVIDE BLIND FLANGE AND REMOVABLE INSULATION UPON COMPLETION OF WORK.

1 ENLARGED PLAN - TYPICAL 8TH-10TH FLOOR - MECHANICAL ROOM - PROPOSED
SCALE: 1/4" = 1'-0"



REVISIONS

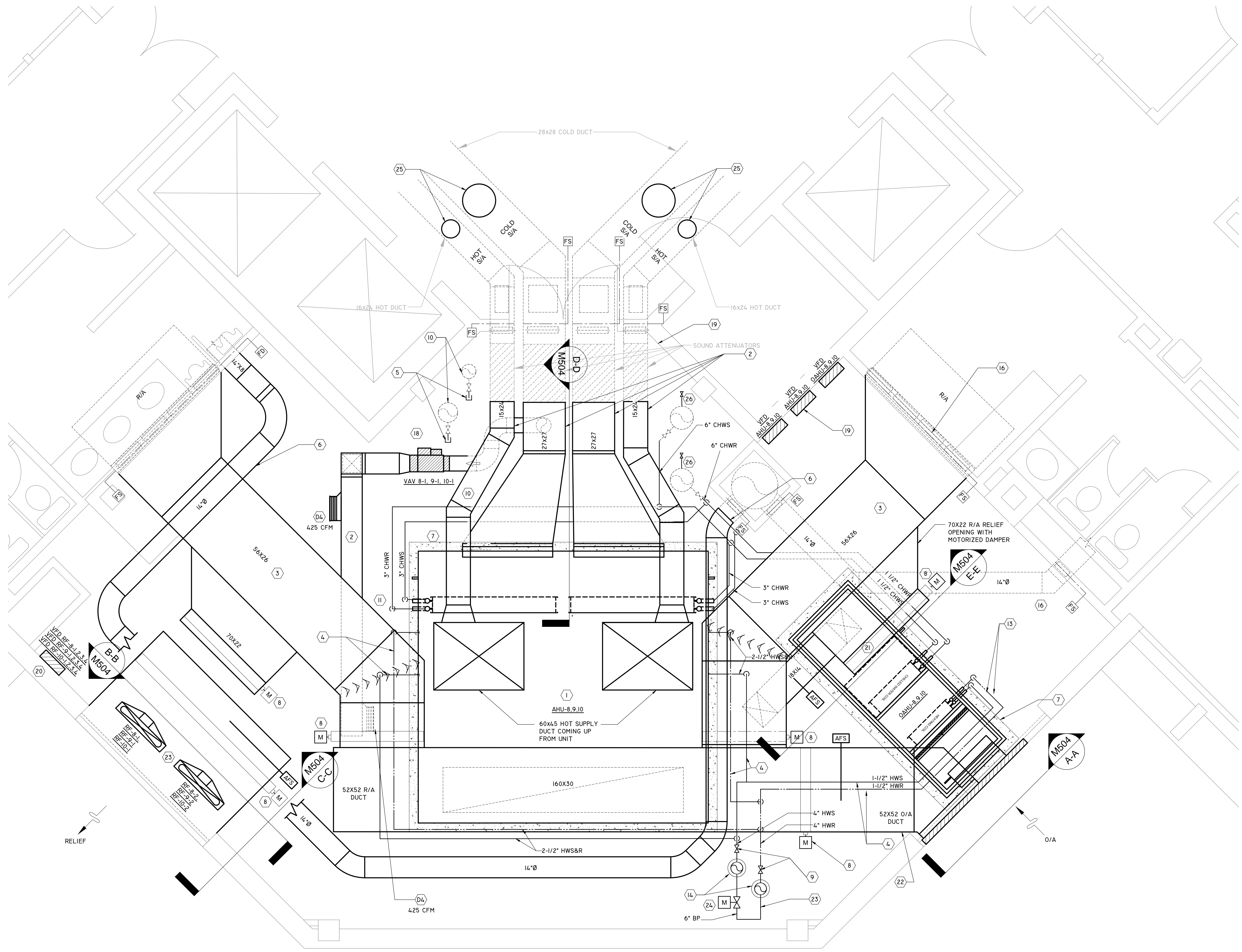
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ENLARGED PLAN -
TYPICAL 8TH-10TH
FLOOR - MECHANICAL
ROOM - PROPOSED

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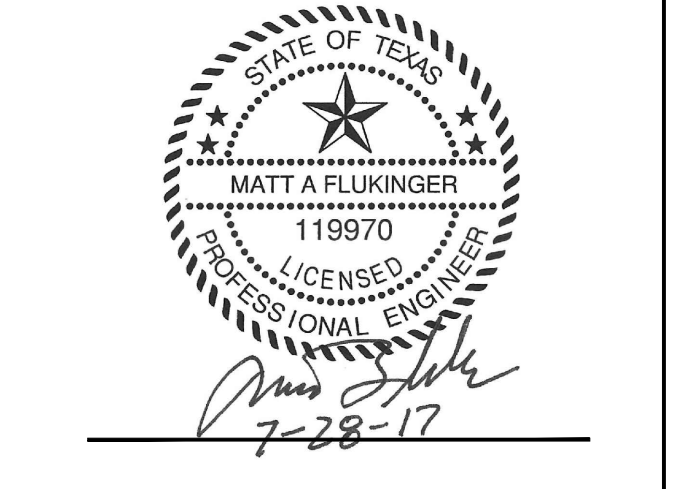
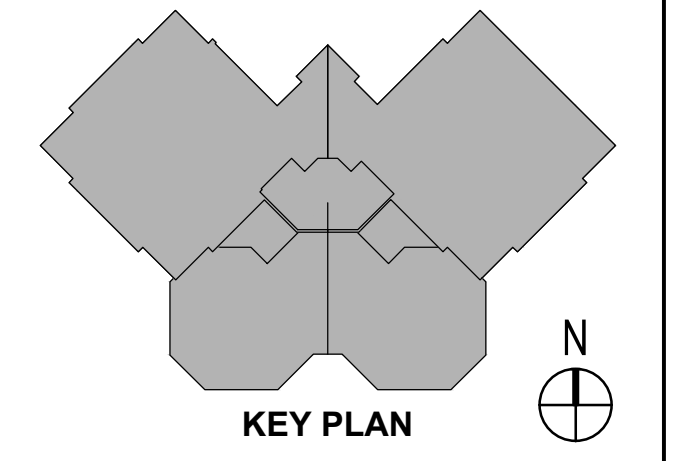
GENERAL NOTES

1. REF M802 FOR DUCT INSTALLATION DETAILS.
2. REF M801 FOR PIPING INSTALLATION DETAILS.

KEYED NOTES

- 1 REFER TO M5.11 & I/M804 FOR AHU INSTALLATION DETAILS
- 2 PROVIDE NEW COLD & HOT SUPPLY AIR DUCTWORK. RECONNECT TO EXISTING.
- 3 PROVIDE NEW RETURN AIR DUCTWORK. RECONNECT TO EXISTING.
- 4 PROVIDE NEW HOT WATER SUPPLY & RETURN PIPING.
- 5 STEAM SUPPLY & CONDENSATE PIPES SHALL BE CAPPED AFTER THE VALVE
- 6 PROVIDE NEW EXHAUST DUCTWORK. RECONNECT TO EXISTING.
- 7 PROVIDE 6" HIGH CONCRETE PAD WHERE REQUIRED ACCORDING TO THE NEW AHU'S.
- 8 PROVIDE NEW MOTORIZED DAMPER.
- 9 NOT USED.
- 10 EXISTING STEAM SUPPLY AND CONDENSATE RETURN RISER TO REMAIN.
- 11 PROVIDE NEW CONDENSATE TRAP & DRAIN PIPING EQUAL TO UNIT CONNECTION. REF M802.
- 12 NOT USED.
- 13 NOT USED.
- 14 NEW HOT WATER S/R RISERS. REF 5/M804.
- 15 NOT USED.
- 16 RETAIN EXISTING EXHAUST DUCTWORK IN PLACE.
- 17 NOT USED.
- 18 REFER I/M803 FOR VAV INSTALLATION.
- 19 PROVIDE NEW VFD FOR AHU SUPPLY FAN. COORDINATE WITH ELECTRICAL.
- 20 PROVIDE NEW VFD FOR RELIEF FAN. COORDINATE WITH ELECTRICAL.
- 21 PROVIDE NEW O/A SUPPLY DUCT FROM OAHU-8 DISCHARGE & TRANSITION TO NEW RETURN AIR DUCT. SEE SECTION.
- 22 PROVIDE NEW OUTSIDE AIR DUCT. RECONNECT TO EXISTING 72X52 O/A LOUVER.
- 23 PROVIDE NEW RELIEF AIR DUCT WITH INLINE FANS. RECONNECT TO EXISTING <SIZE> RELIEF LOUVER
- 24 PROVIDE NEW LINE SIZE MOTORIZED BYPASS CONTROL VALVE AT 9TH FLOOR ONLY.
- 25 PROVIDE 22" OUTSIDE AIR TAPS IN EXISTING DUCTWORK FOR CONNECTION OF TEMPORARY AHU SERVICE. COORDINATE TAP LOCATIONS WITH EXISTING CONDITIONS. PROVIDE REMOVABLE CAPS & INSTALLATION UPON COMPLETION OF WORK. REFER M300 FOR INSTALLATION DETAILS.
- 26 PROVIDE 4" HOT TAPS ON RISERS WITH FULL PORT GATE VALVES FOR TEMPORARY AHU SERVICE. PROVIDE BLIND FLANGE & REMOVABLE INSULATION UPON COMPLETION OF WORK.
- 27 PROVIDE 2" HOT TAPS ON RISERS WITH FULL PORT BALL VALVES FOR PERMANENT SERVICE TO 8TH FLOOR CRAC UNITS (8TH FLOOR ONLY).

1 ALTERNATE ENLARGED PLAN - TYPICAL 8TH-10TH FLOOR - MECHANICAL ROOM - PROPOSED
SCALE: 3/8" = 1'-0"



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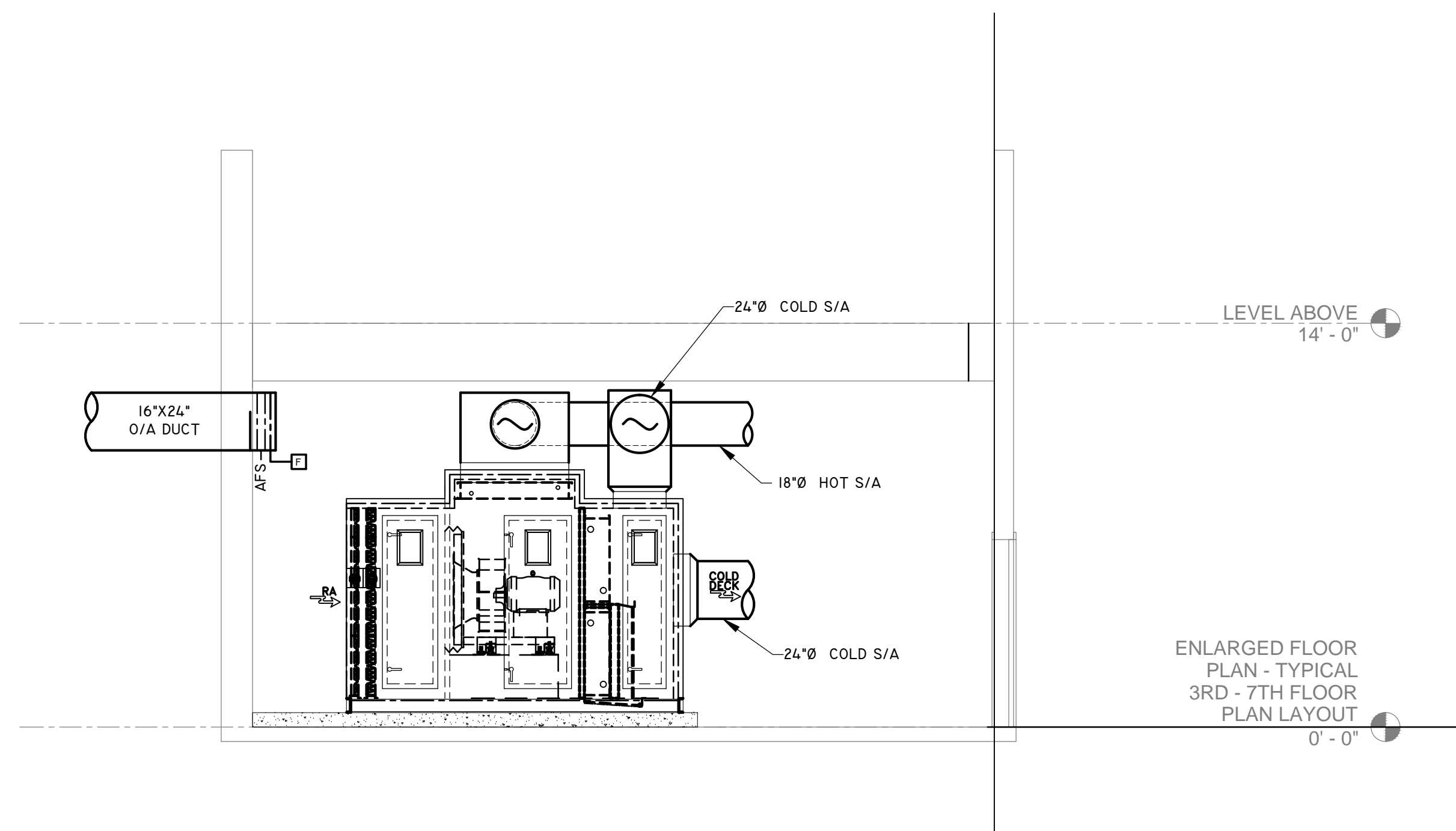
Date	31 MARCH 2017
Job Number	-
Drawn	KN, KT, CJT
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Approved	MAF, SK
Title	

ALTERNATE
ENLARGED PLAN -
TYPICAL 8TH-10TH
FLOOR - MECHANICAL
ROOM - PROPOSED

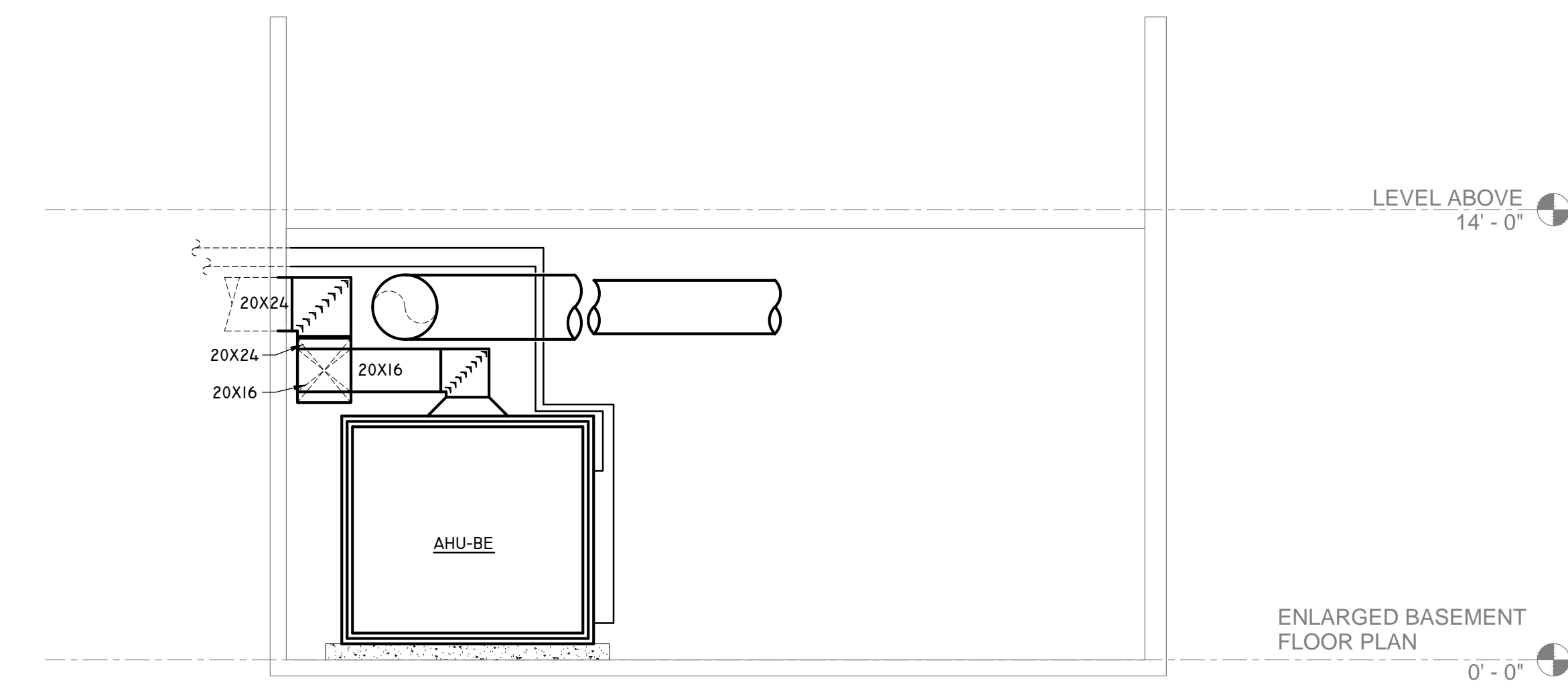
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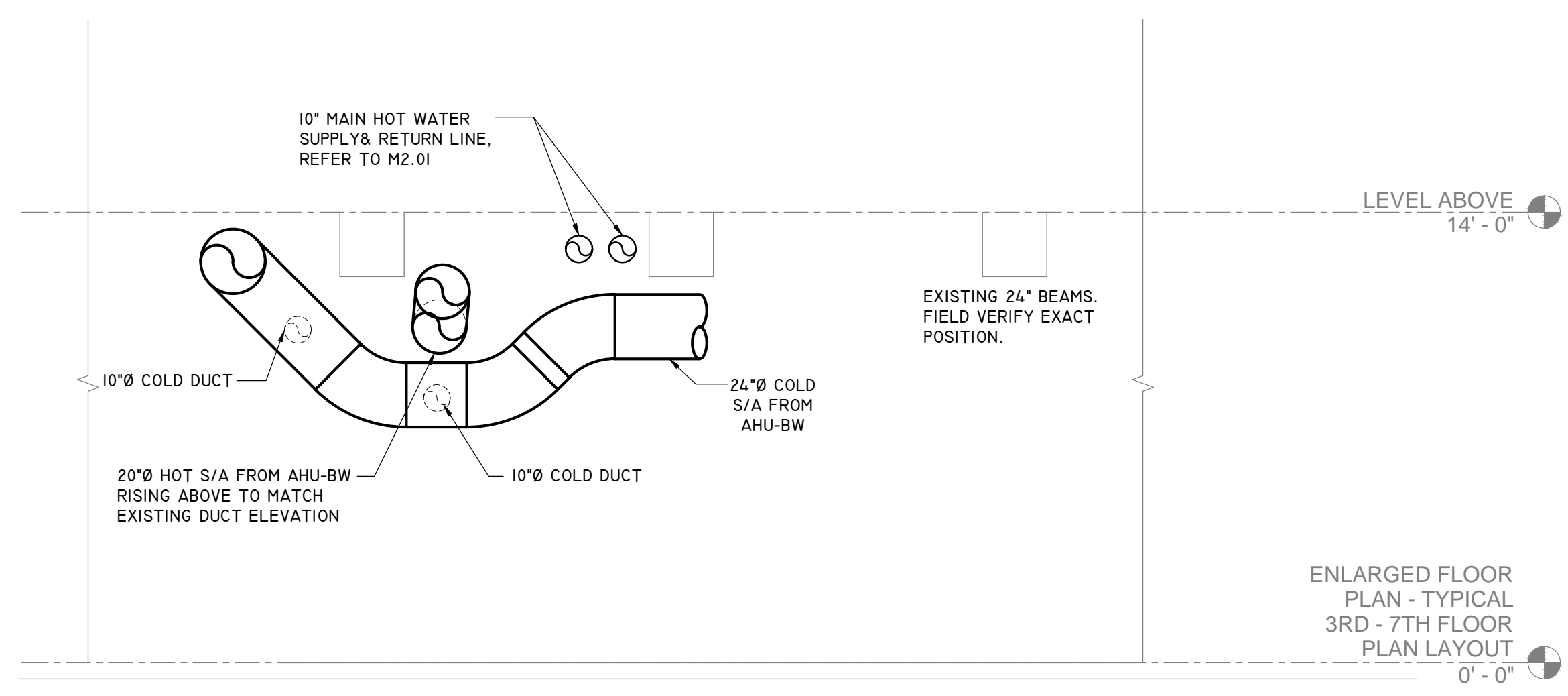
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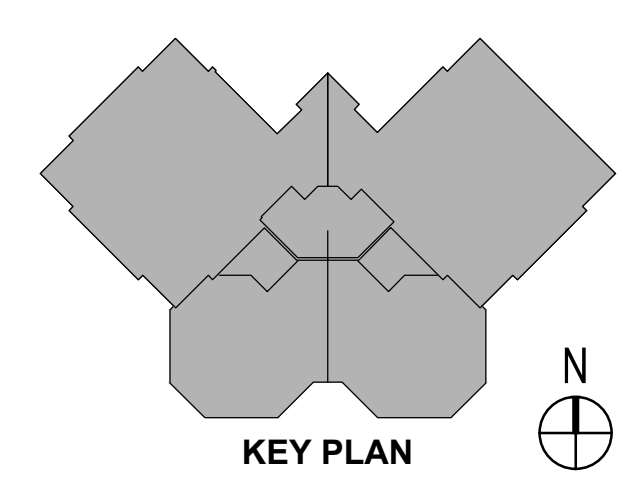
1 SECTION A-A
SCALE: 1/4"=1'-0"



2 SECTION B-B
SCALE: 1/4"=1'-0"



3 SECTION C-C
SCALE: 1/4"=1'-0"



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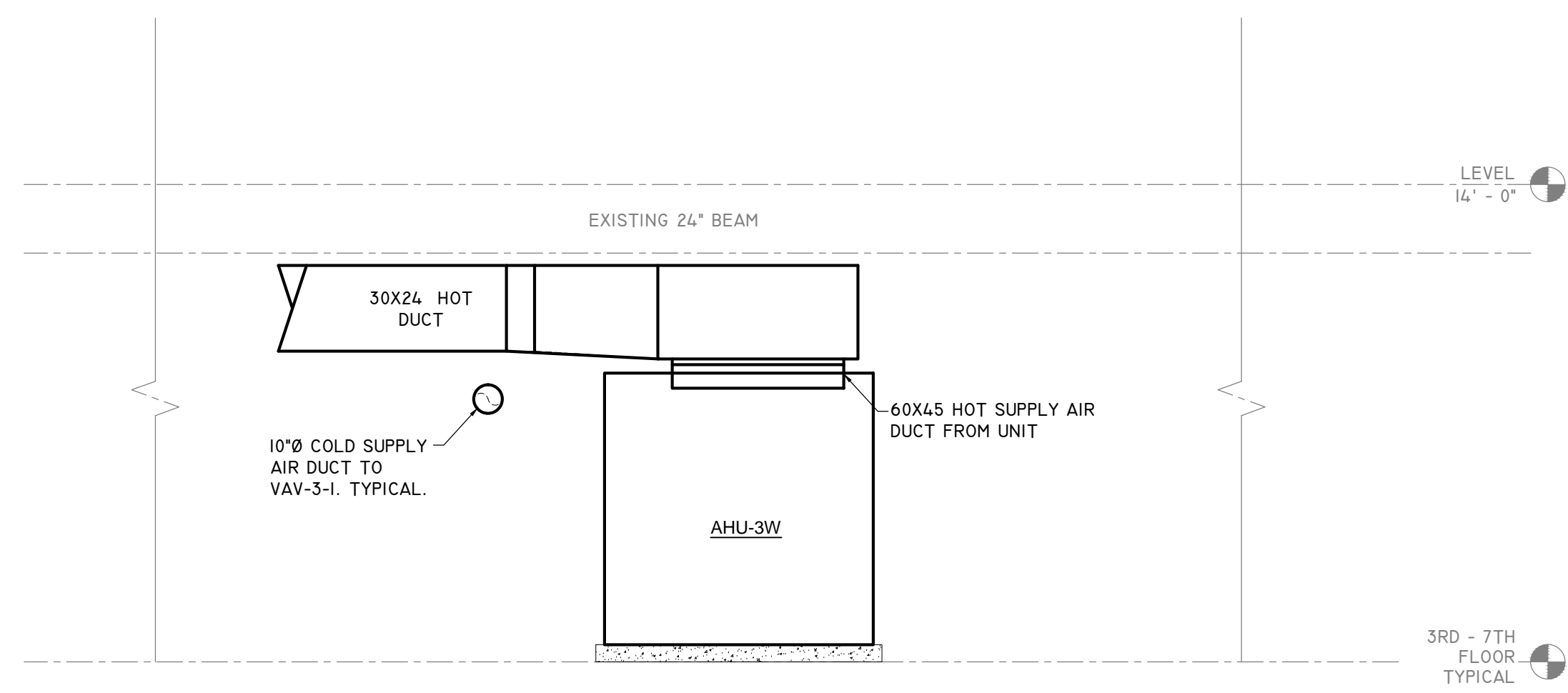
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SECTIONS - BASEMENT MECHANICAL ROOM

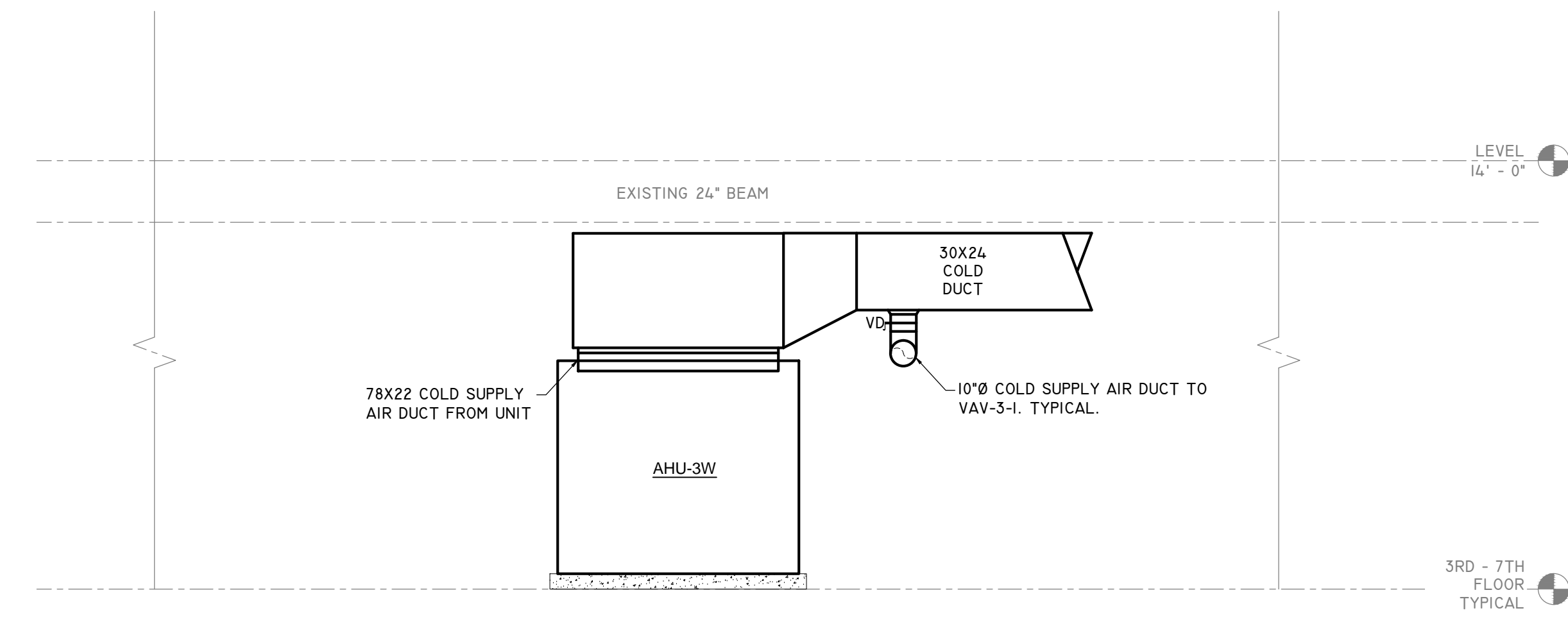
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SECTIONS - BASEMENT MECHANICAL ROOMS

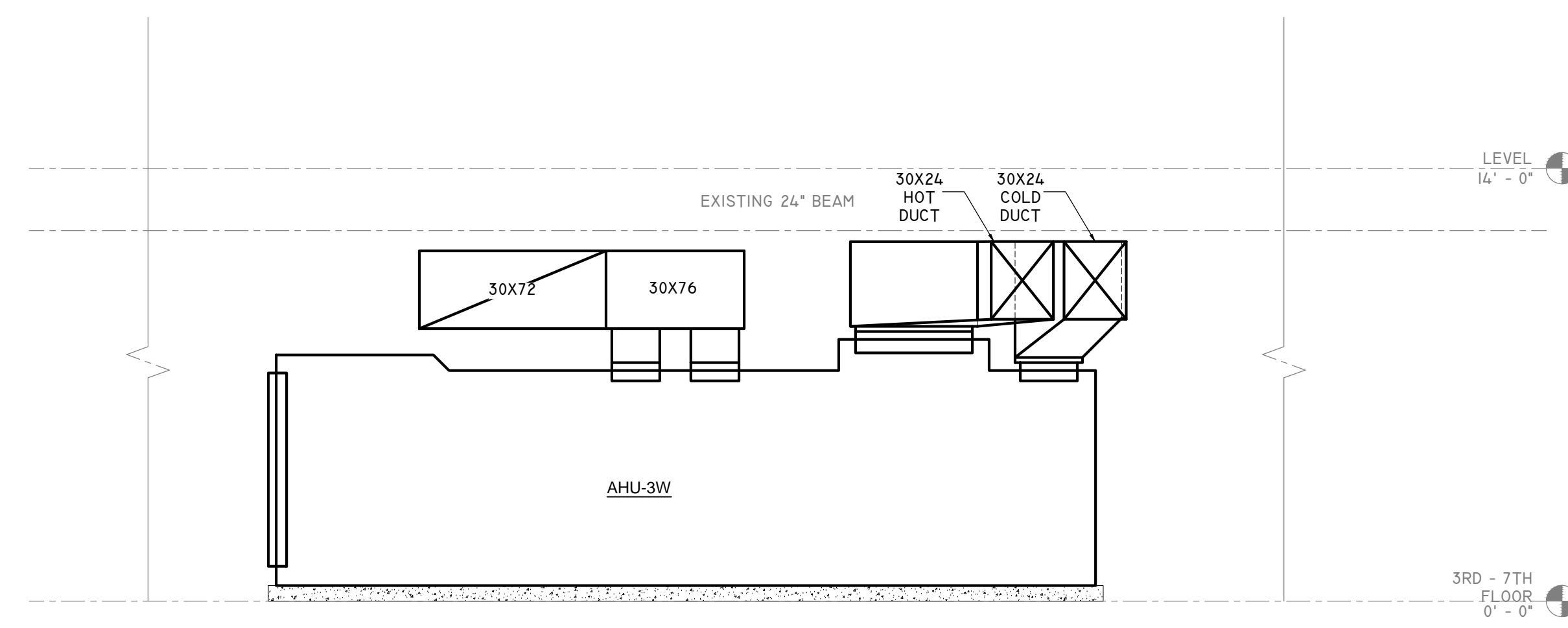
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1 SECTION C-C
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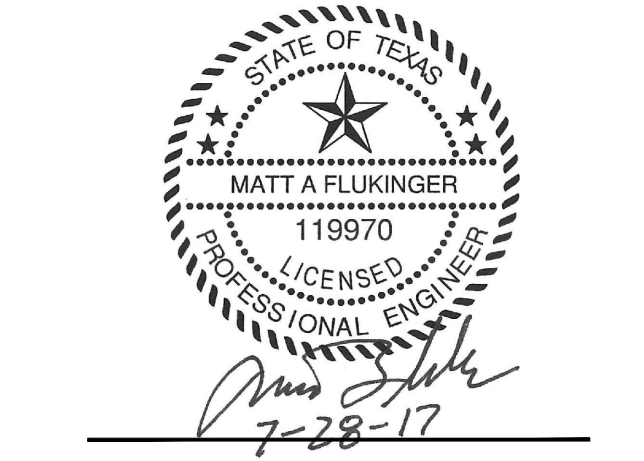
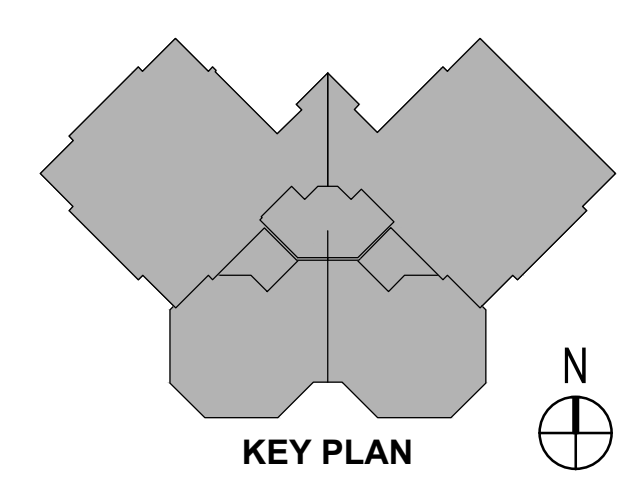


2 SECTION B-B
SCALE: 1/4"=1'-0"



3 SECTION A-A
SCALE: 1/4"=1'-0"

SECTIONS - 3RD THRU 10TH FLOOR MECHANICAL ROOMS



REVISIONS

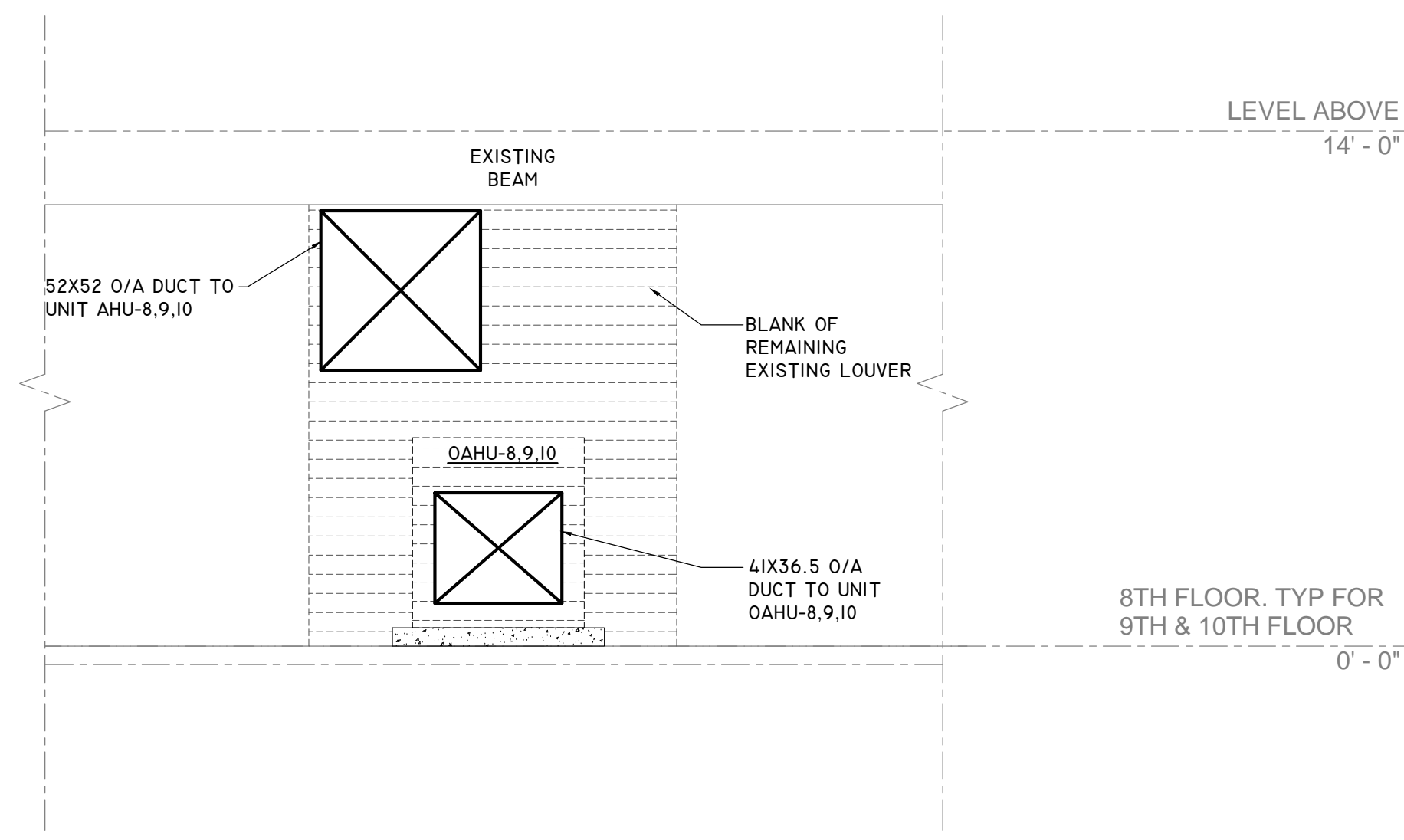
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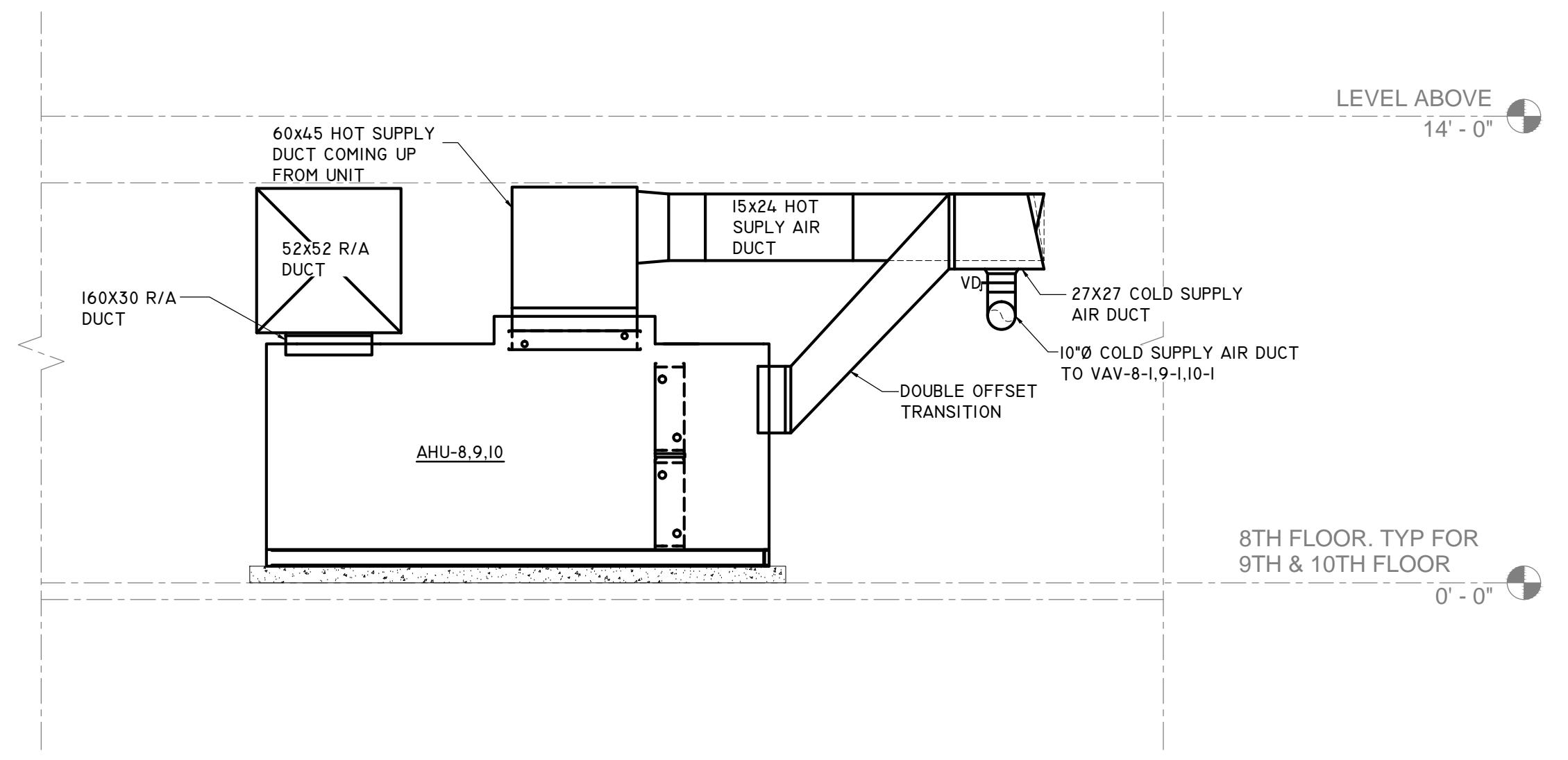
SECTIONS - 3RD THRU
10TH FLOOR
MECHANICAL ROOMS

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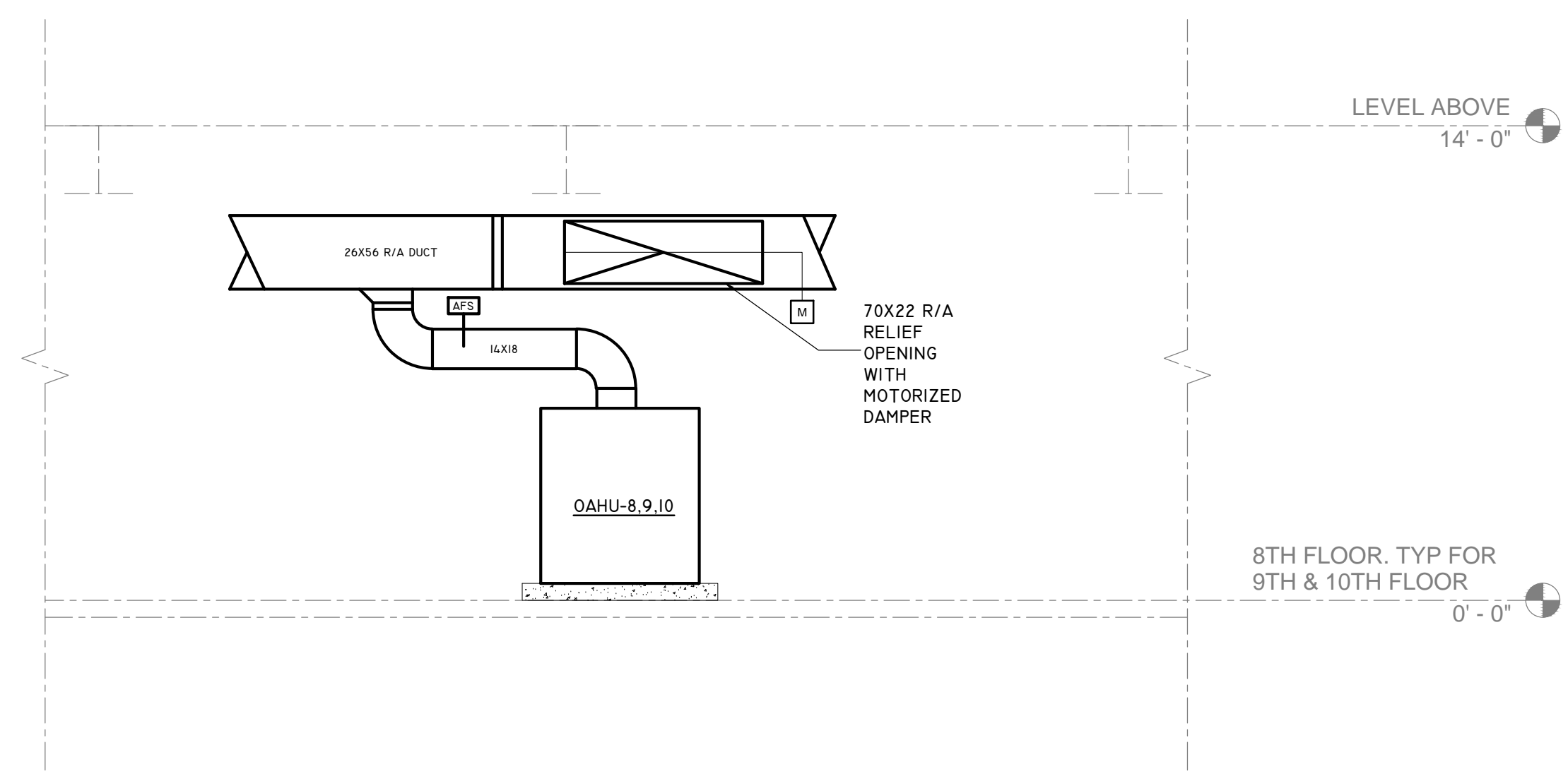
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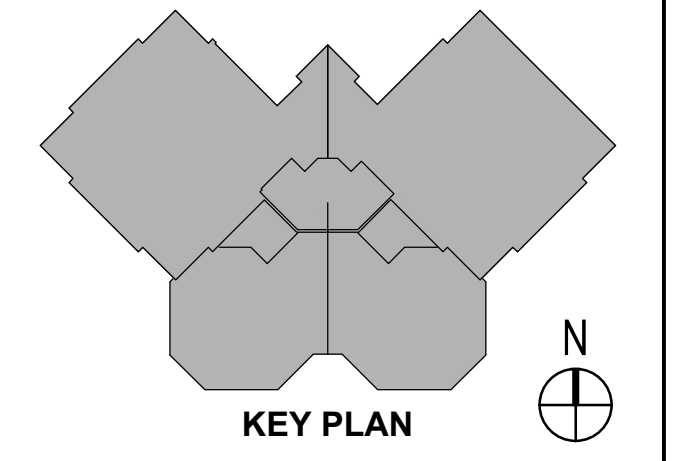
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SCALE: 1/4"=1'-0"



5 SECTION E-E
SCALE: 1/4"=1'-0"

SECTIONS - 8TH THRU 10TH FLOOR MECHANICAL ROOMS

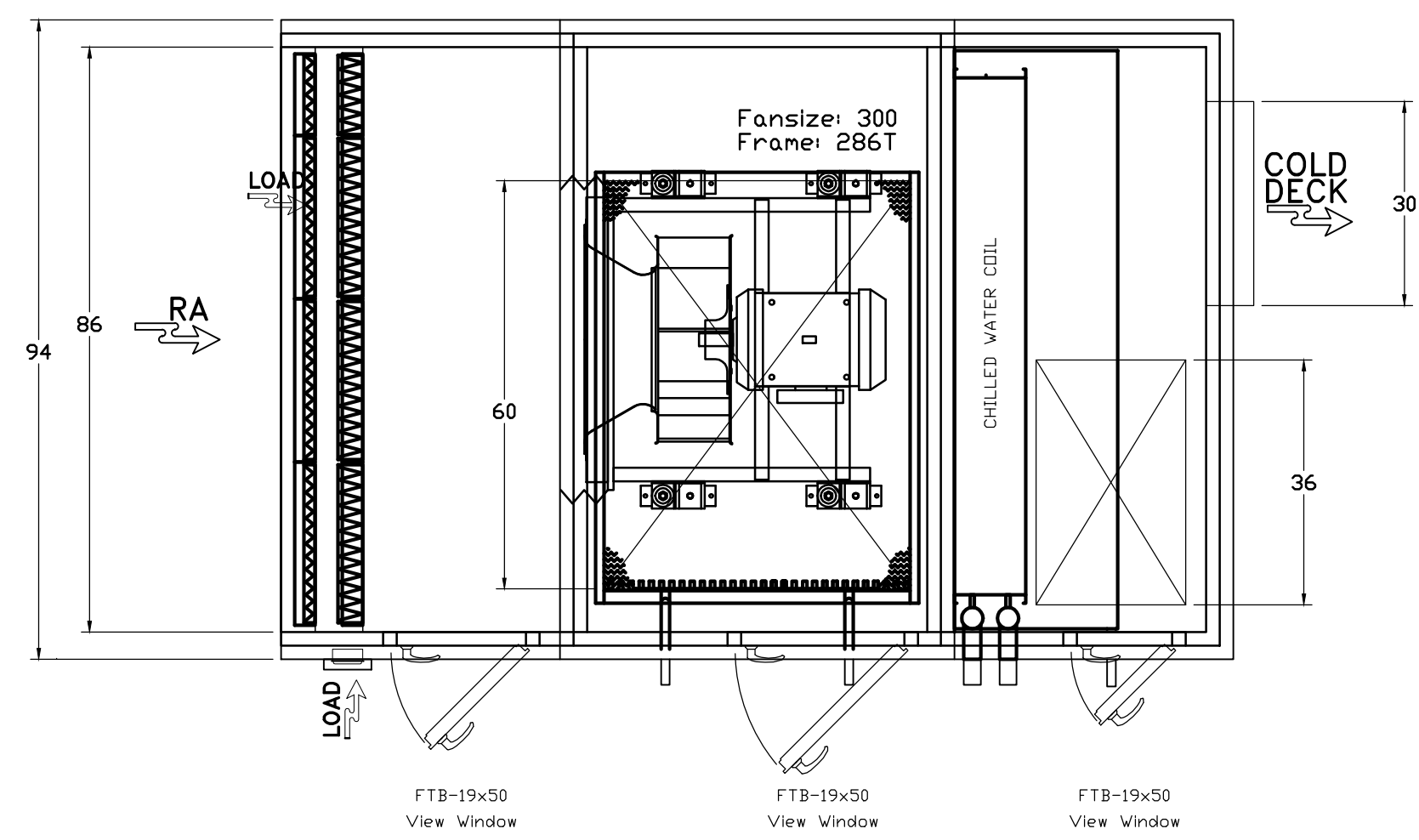


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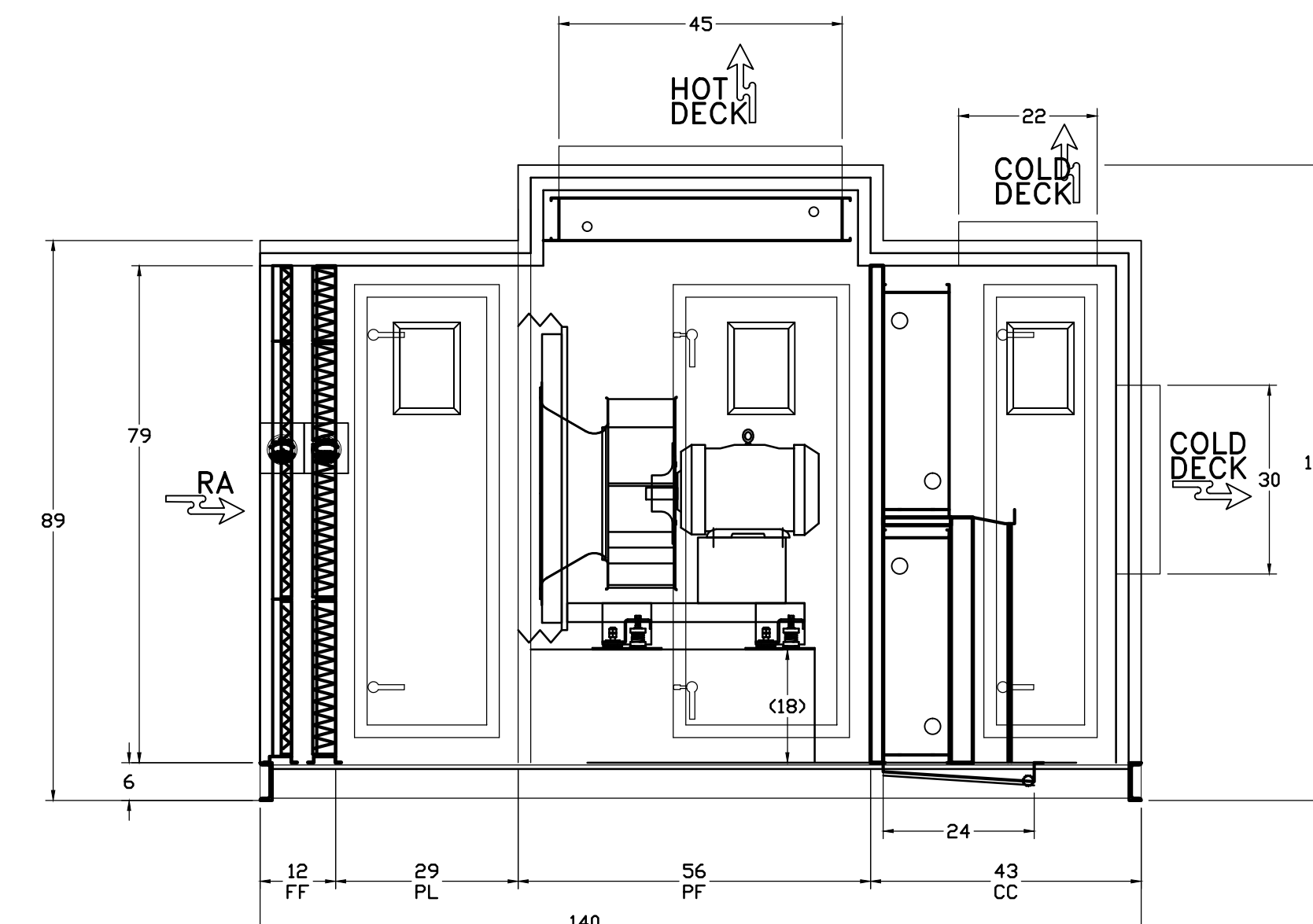
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Date	31 MARCH 2017
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SECTIONS
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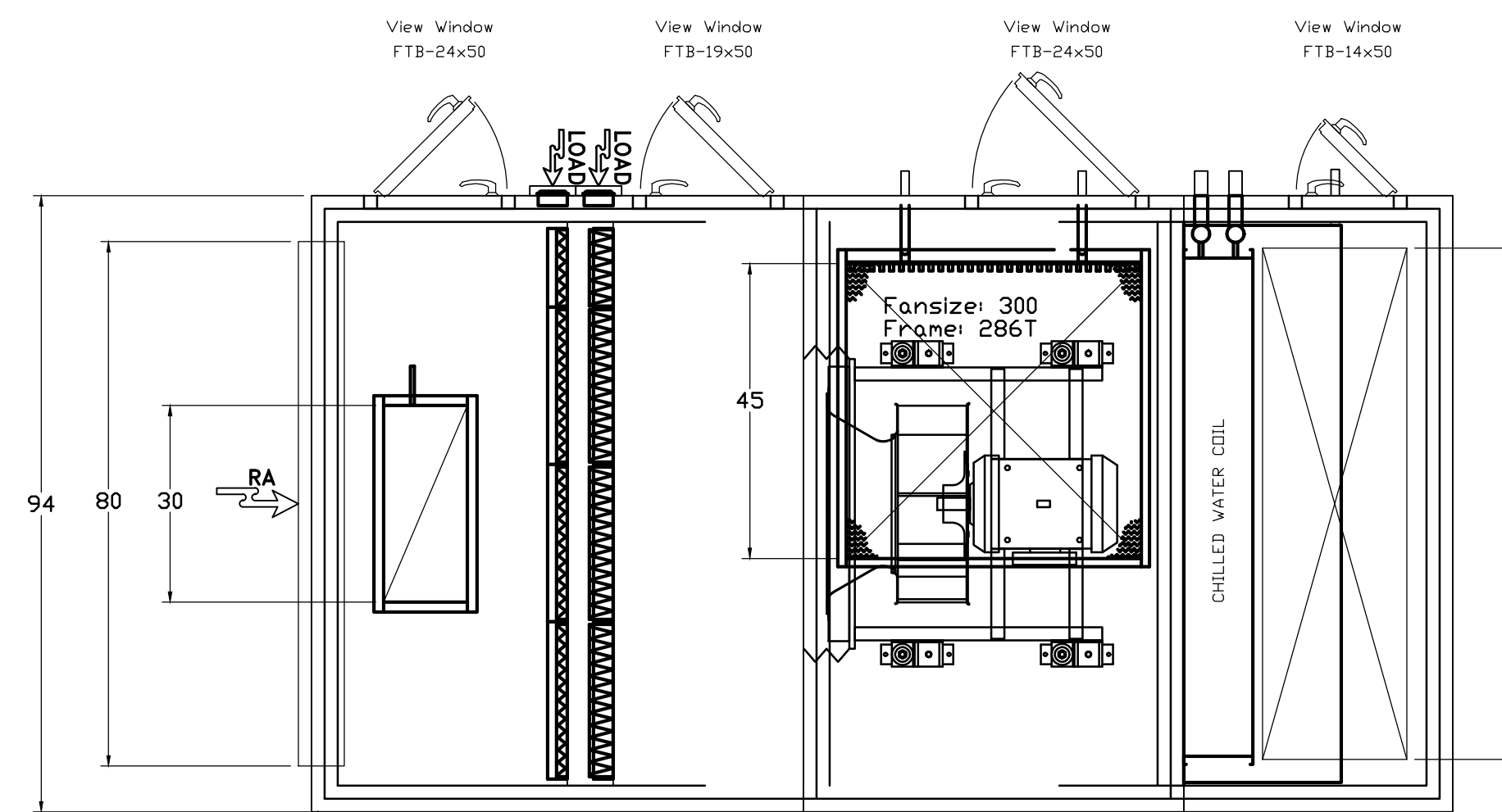
PLAN VIEW



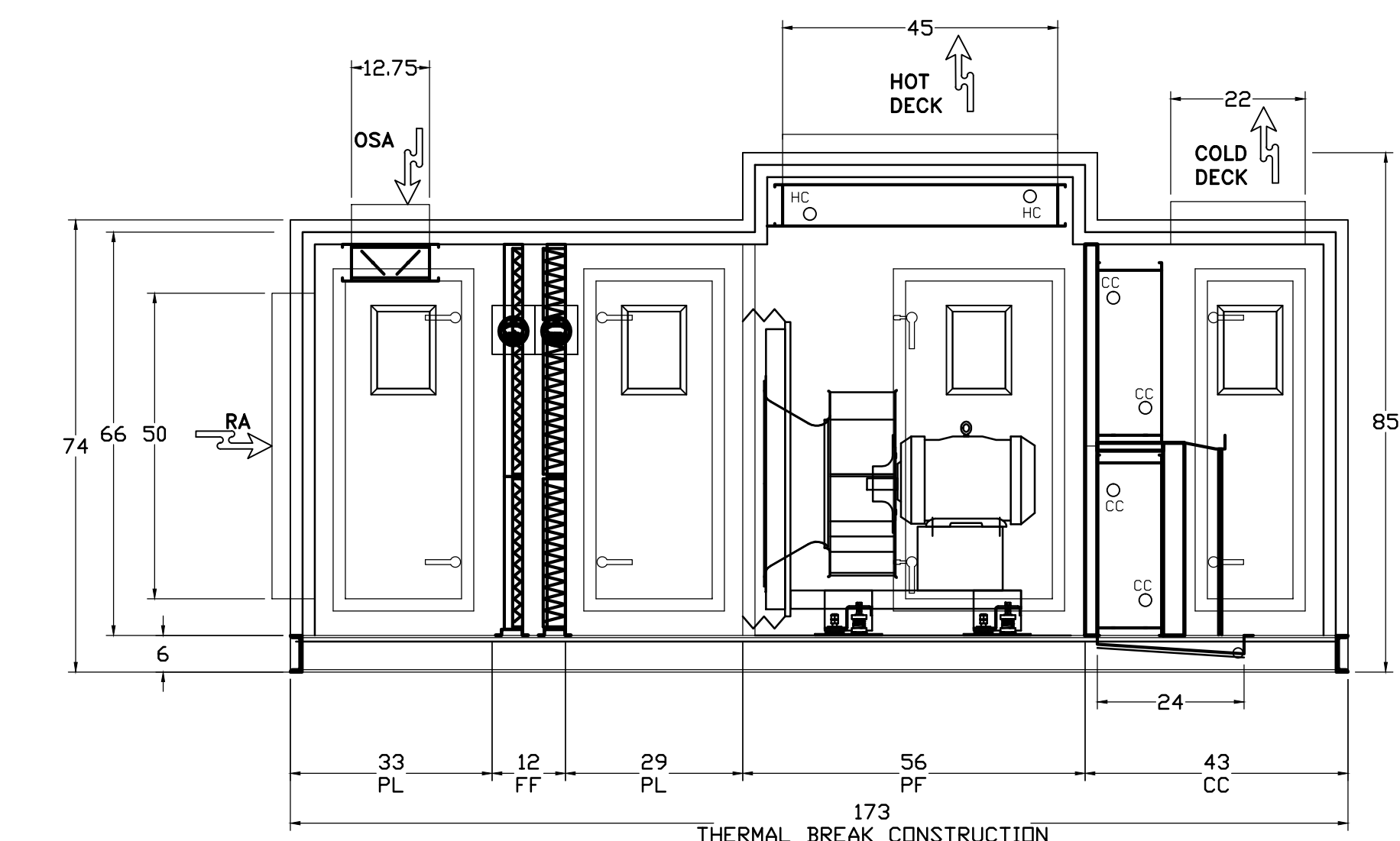
SIDE VIEW

AHU-BW INSTALLATION DETAIL

SCALE: 1/2" = 1'-0" 4



PLAN VIEW



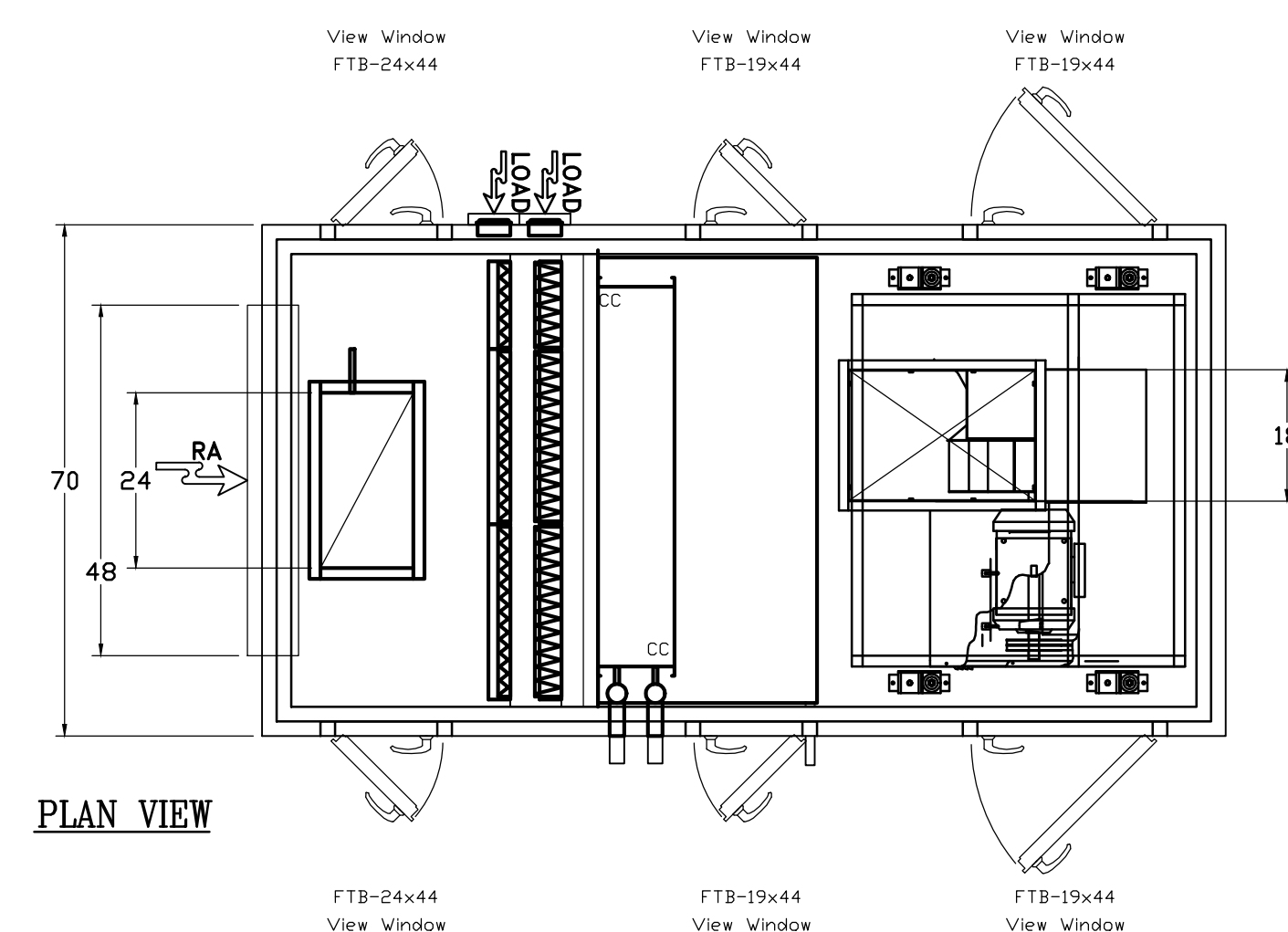
SIDE VIEW

AHU-BE INSTALLATION DETAIL

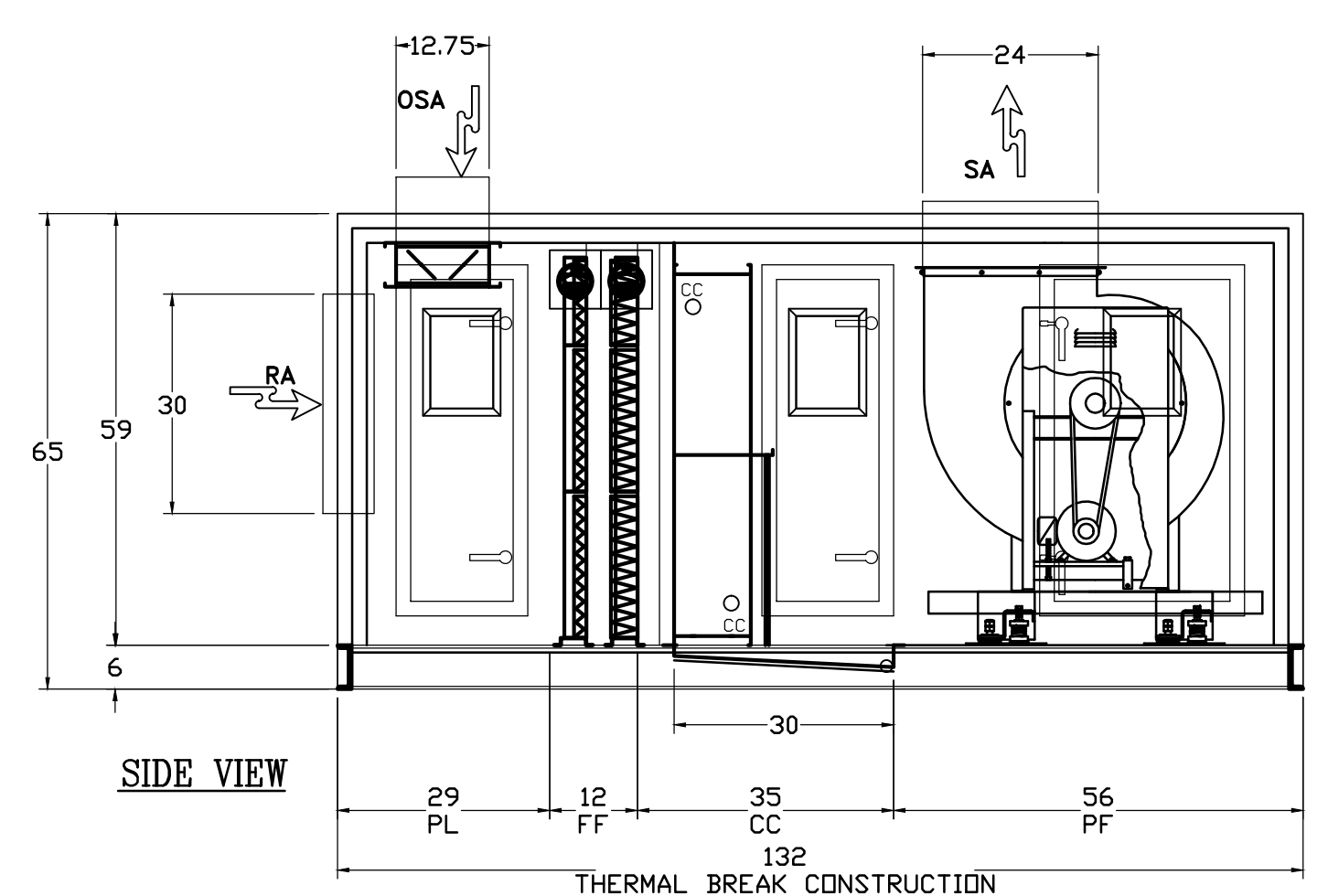
SCALE: 1/2" = 1'-0" 2

LEGENDS	
OSA = OUTSIDE AIR	SA = SUPPLY AIR
RA = RETURN AIR	EA = EXHAUST AIR
NS = NEAR SIDE	FS = FAR SIDE
HS = HIGH SIDE	LS = LOW SIDE
SECTIONS:	
AB = AIR BLENDER	MB = MIXING BOX
CC = COOLING COIL	MS = MOISTURE SEPARATOR
CU = CONDENSING UNIT	MZ = MULTI ZONE
DE = DIRECT EVAPORATIVE	PF = PLENUM FAN
DF = DWDI FAN	PL = PLENUM
DX = DX COIL	PR = PRE-FILTER
EC = ECONOMIZER	SC = STEAM COIL
FF = FINAL FILTER	ST = SOUND TRAP
FU = FURNACE	VF = VEE FILTER
HC = HEATING COIL	
IE = INDIRECT EVAPORATIVE	

- NOTES:
- ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.
 - OPENING DIMENSION TOLERANCES ARE ± 0.50. ALL OTHER CABINET DIMENSION TOLERANCES ARE ± 1.00.
 - LIFTING LUG LOCATIONS ON MECHANICAL DRAWINGS ARE FOR REPRESENTATION ONLY.



PLAN VIEW



SIDE VIEW

SIDE VIEW

AHU-BH INSTALLATION DETAIL

SCALE: 1/2" = 1'-0" 3



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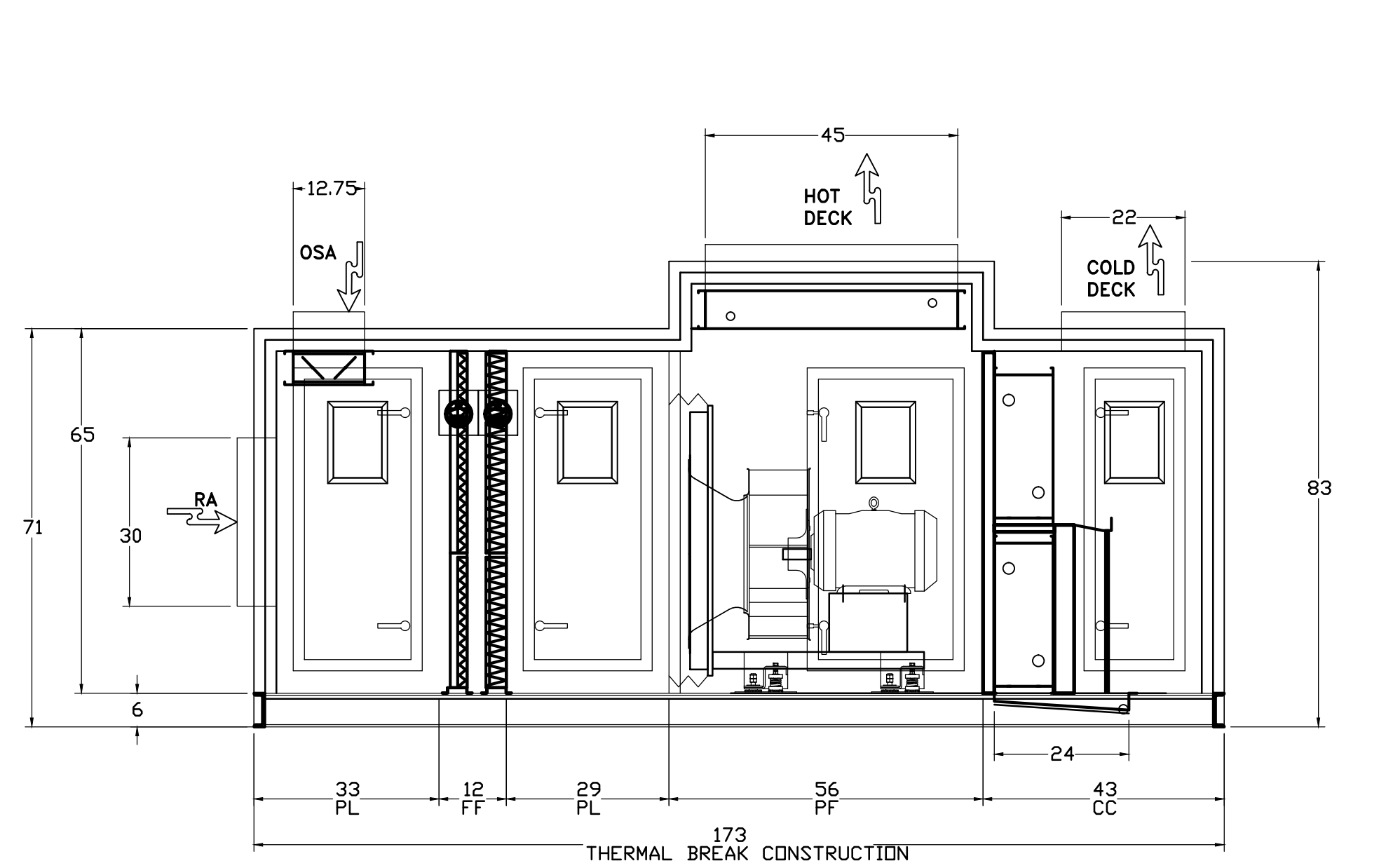
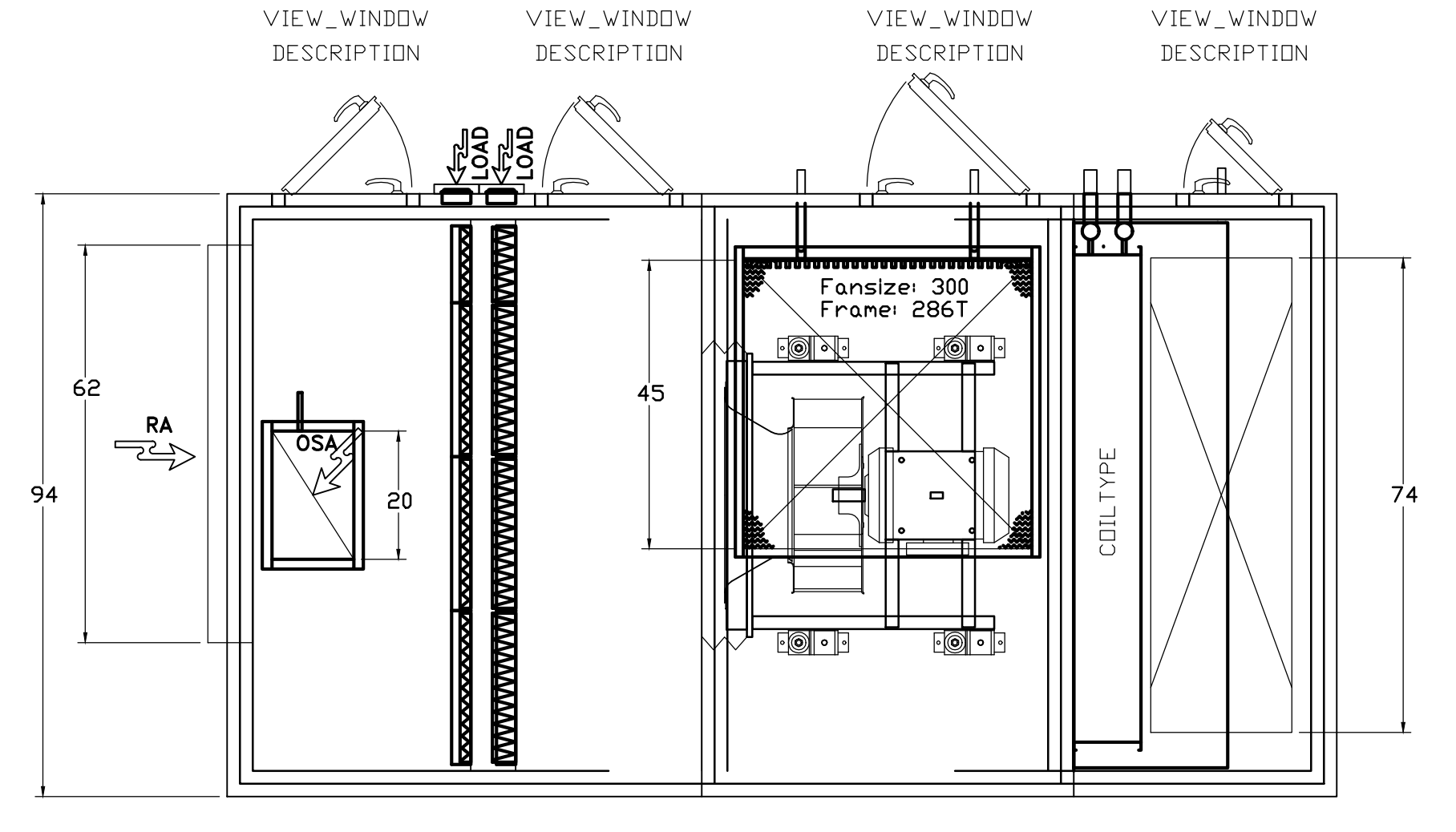
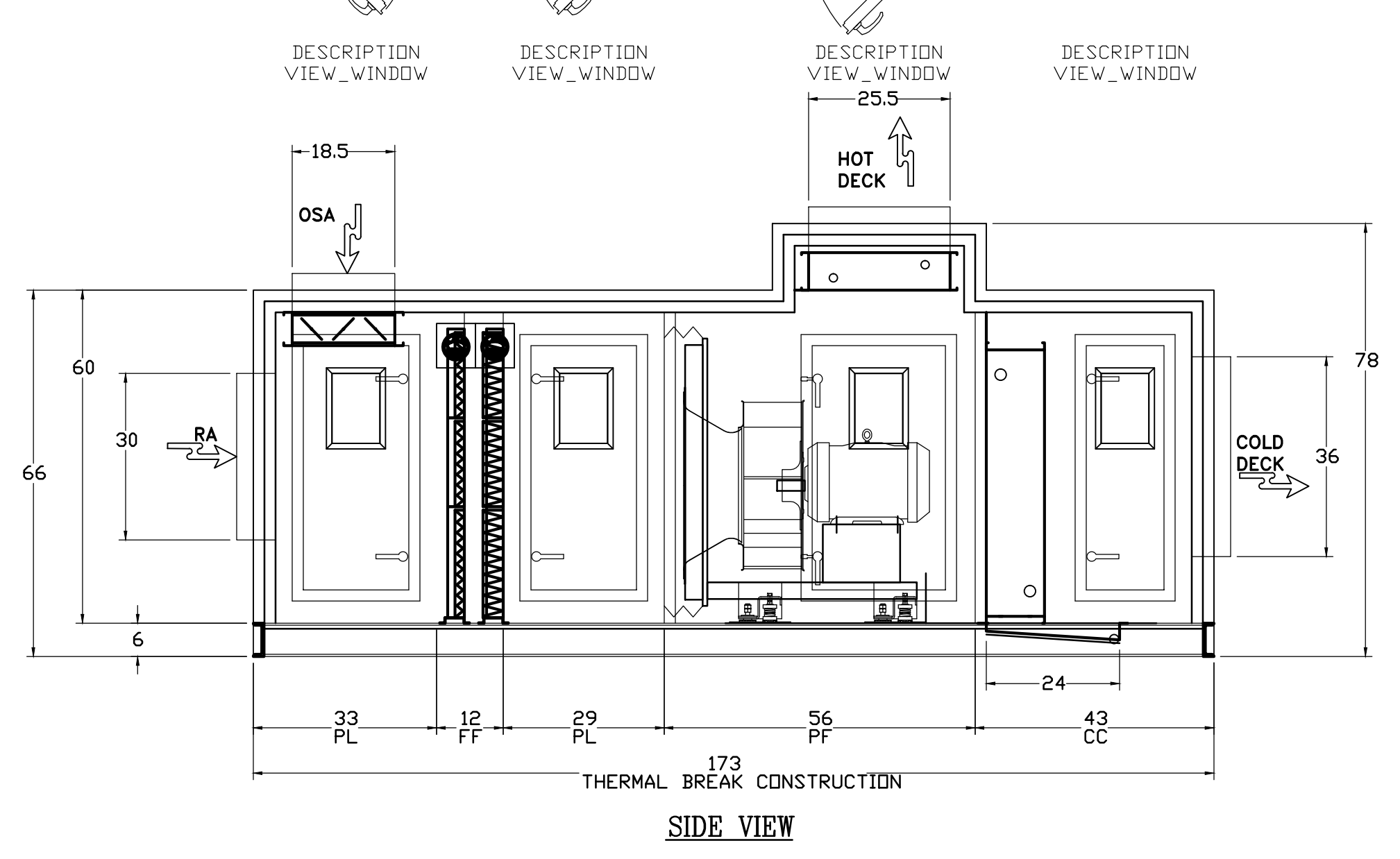
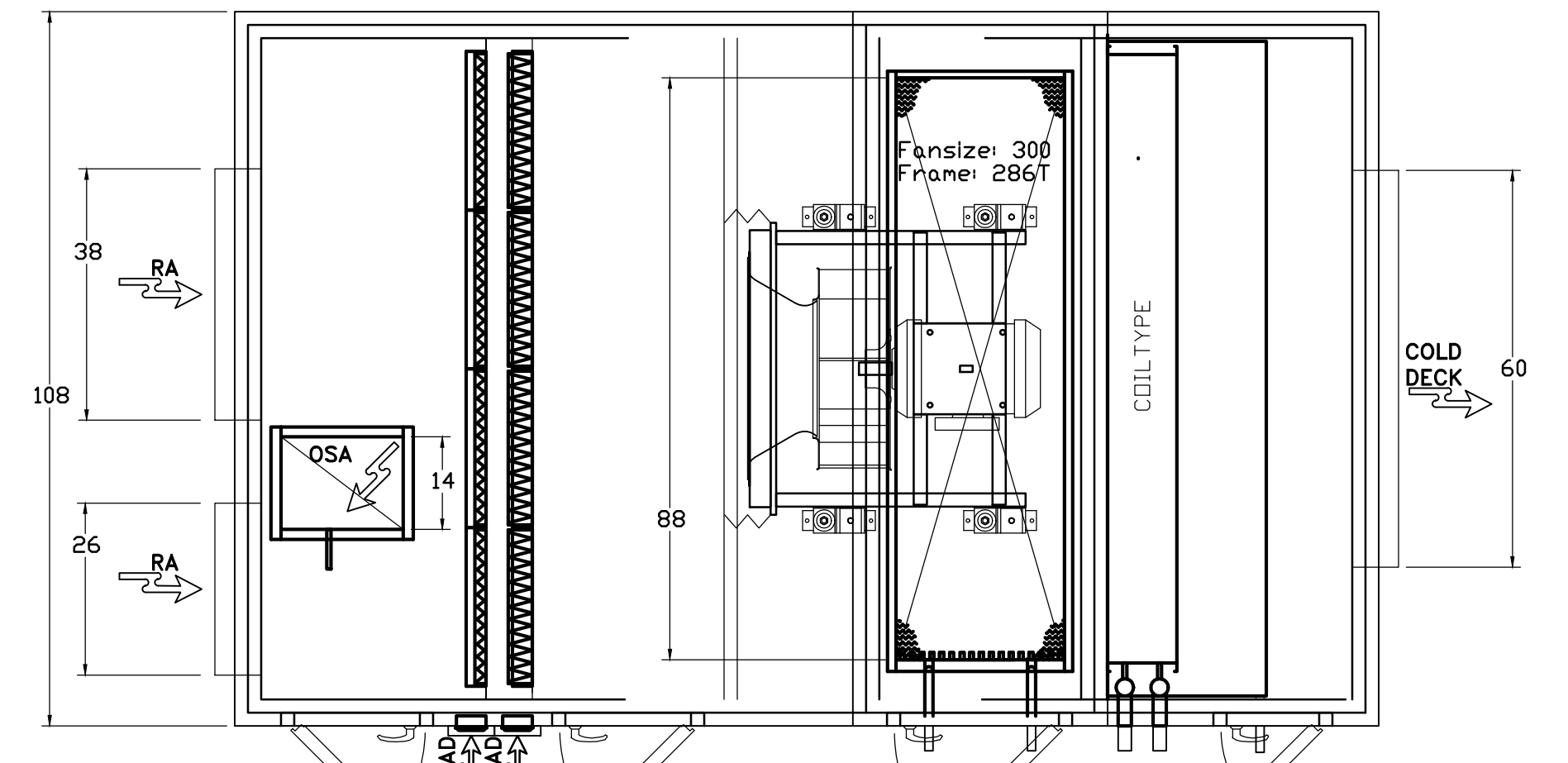
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Date	31 MARCH 2017
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CUSTOM AHU CONFIGURATIONS

Sheet

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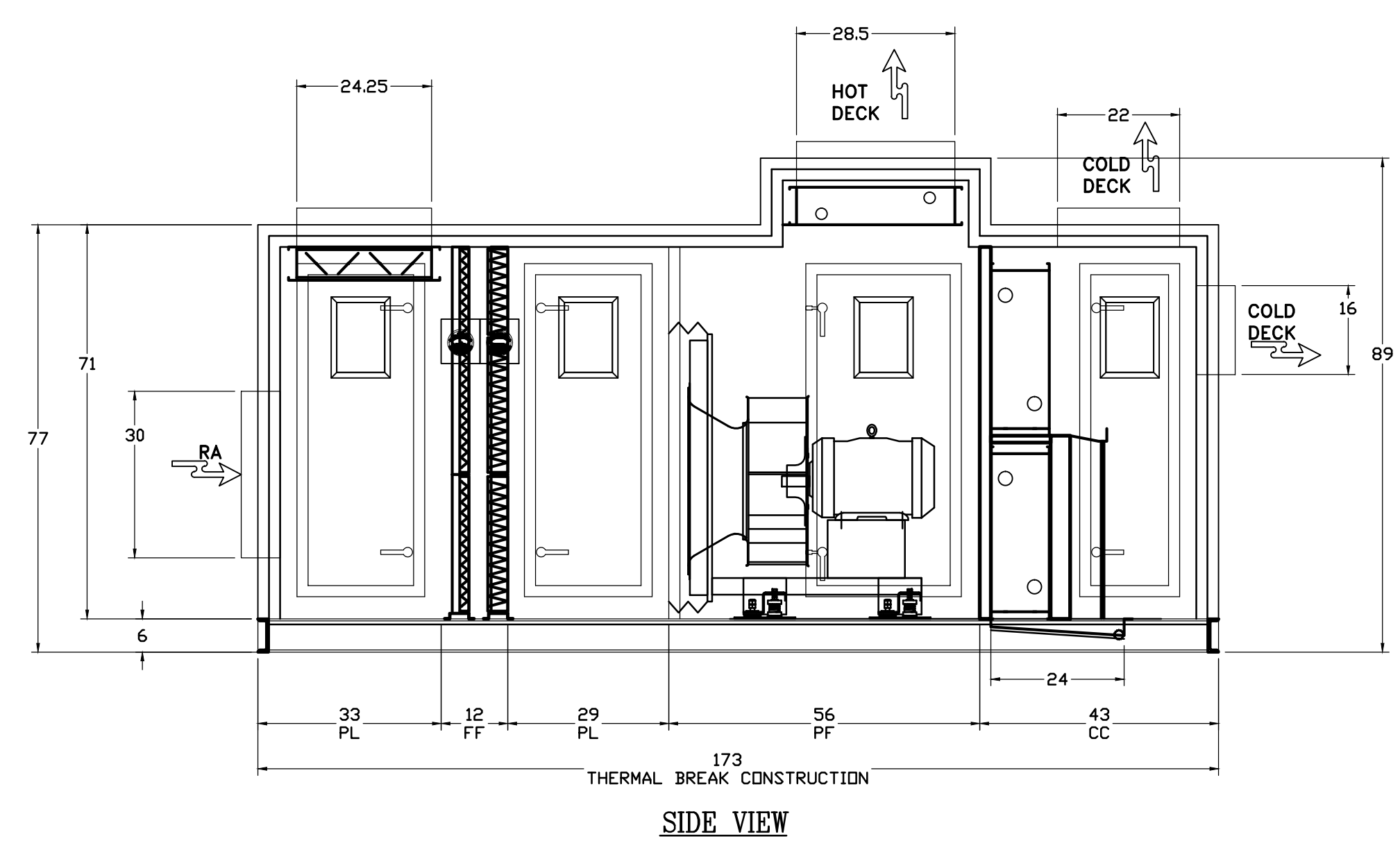
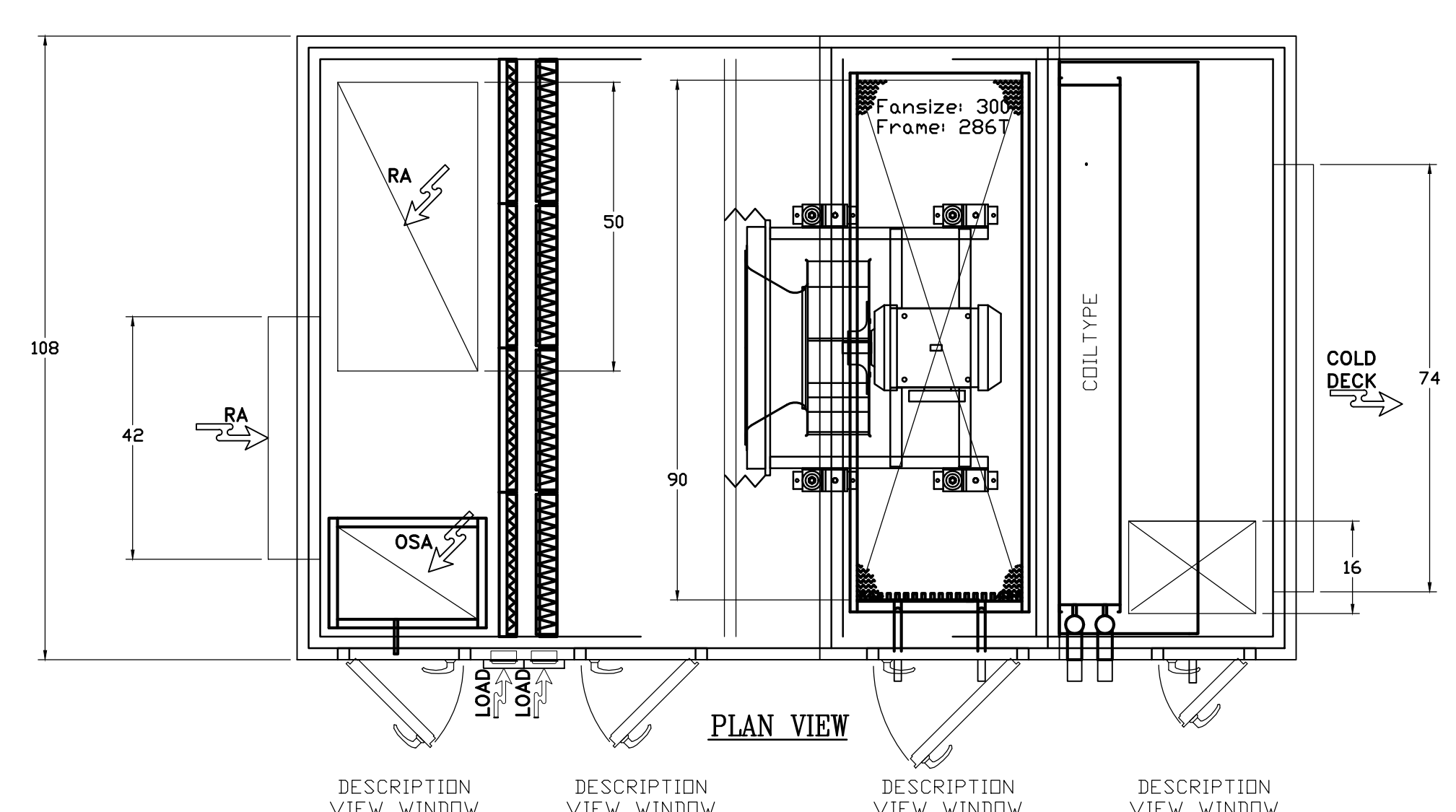
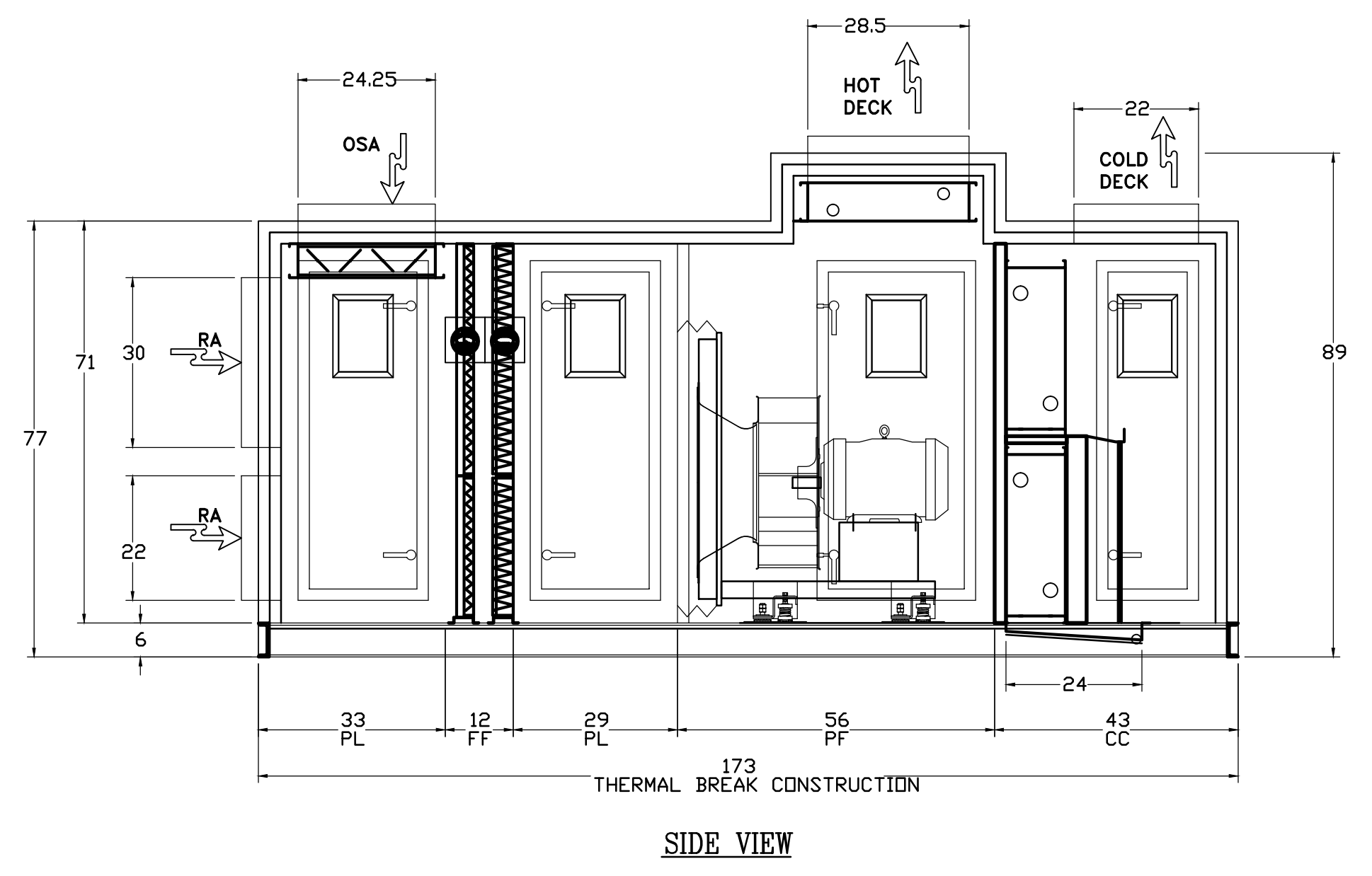
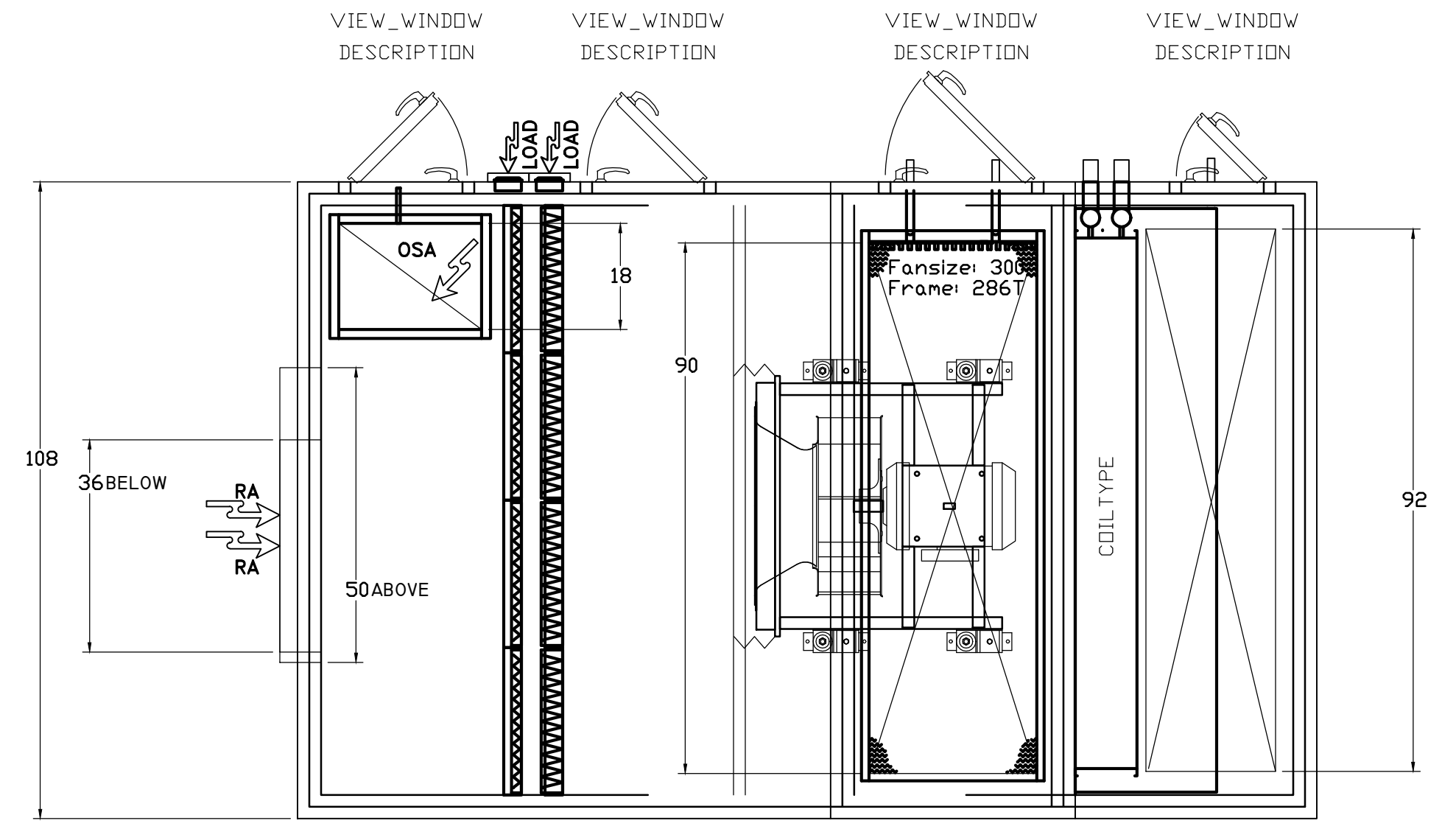


LEGENDS	
OSA = OUTSIDE AIR	SA = SUPPLY AIR
RA = RETURN AIR	EA = EXHAUST AIR
NS = NEAR SIDE	FS = FAR SIDE
HS = HIGH SIDE	LS = LOW SIDE
SECTIONS:	
AB = AIR BLENDER	MB = MIXING BOX
CC = COOLING COIL	MS = MOISTURE SEPARATOR
CU = CONDENSING UNIT	MZ = MULTI ZONE
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DF = DWDI FAN	PL = PLENUM
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FF = FINAL FILTER	ST = SOUND TRAP
FU = FURNACE	VF = VEE FILTER
HC = HEATING COIL	
IE = INDIRECT EVAPORATIVE	

- NOTES:
- ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.
 - OPENING DIMENSION TOLERANCES ARE ± 0.50 . ALL OTHER CABINET DIMENSION TOLERANCES ARE ± 1.00 .
 - LIFTING LUG LOCATIONS ON MECHANICAL DRAWINGS ARE FOR REPRESENTATION ONLY.

AHU-IE INSTALLATION DETAIL SCALE: 1/2" = 1'-0" 4

AHU-IW INSTALLATION DETAIL SCALE: 1/2" = 1'-0" 2



AHU-IE INSTALLATION DETAIL SCALE: 1/2" = 1'-0" 3

AHU-ISW INSTALLATION DETAIL SCALE: 1/2" = 1'-0" 1

1 CUSTOM AHU CONFIGURATIONS SCALE: 1/2"=1'-0"



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CUSTOM AHU CONFIGURATIONS

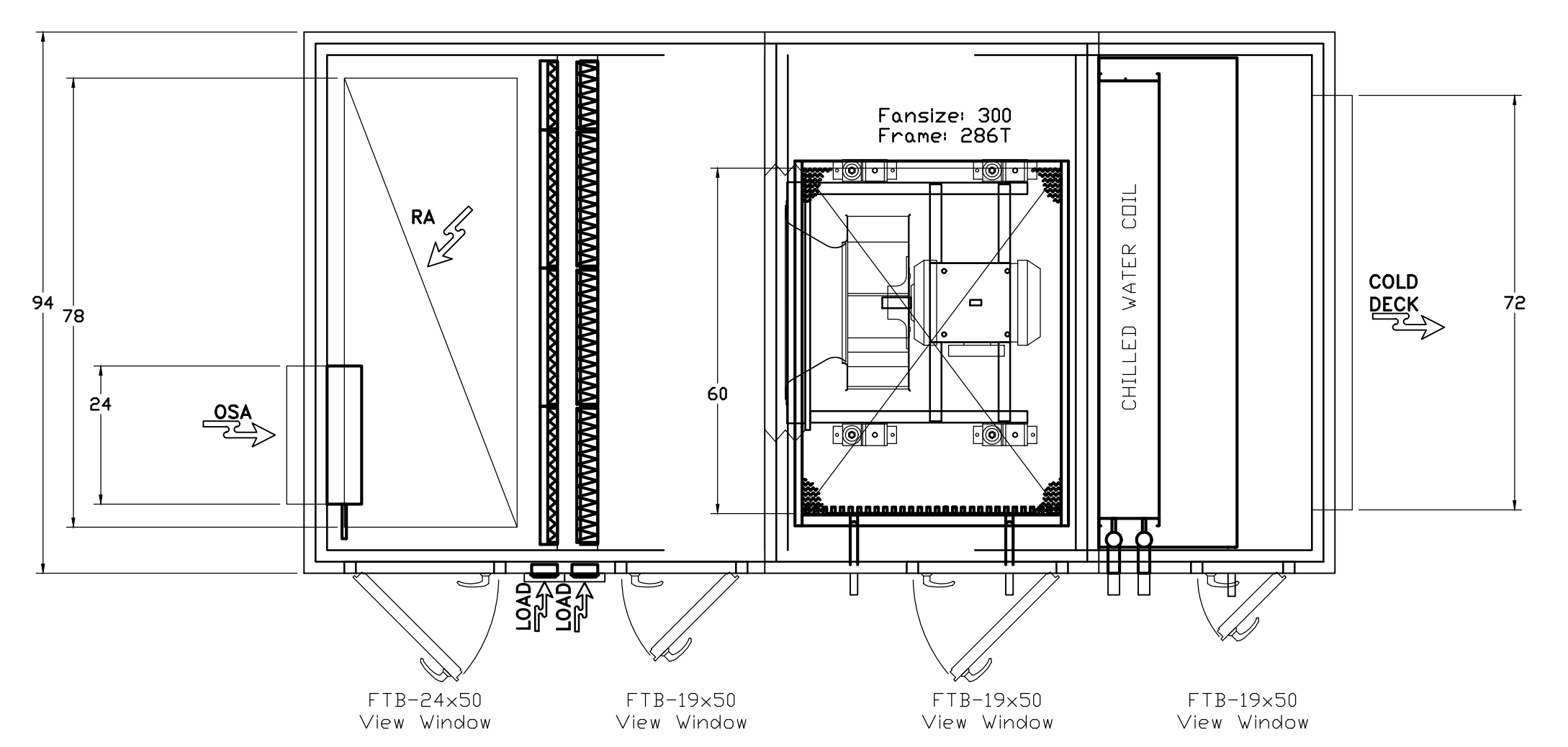
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M506
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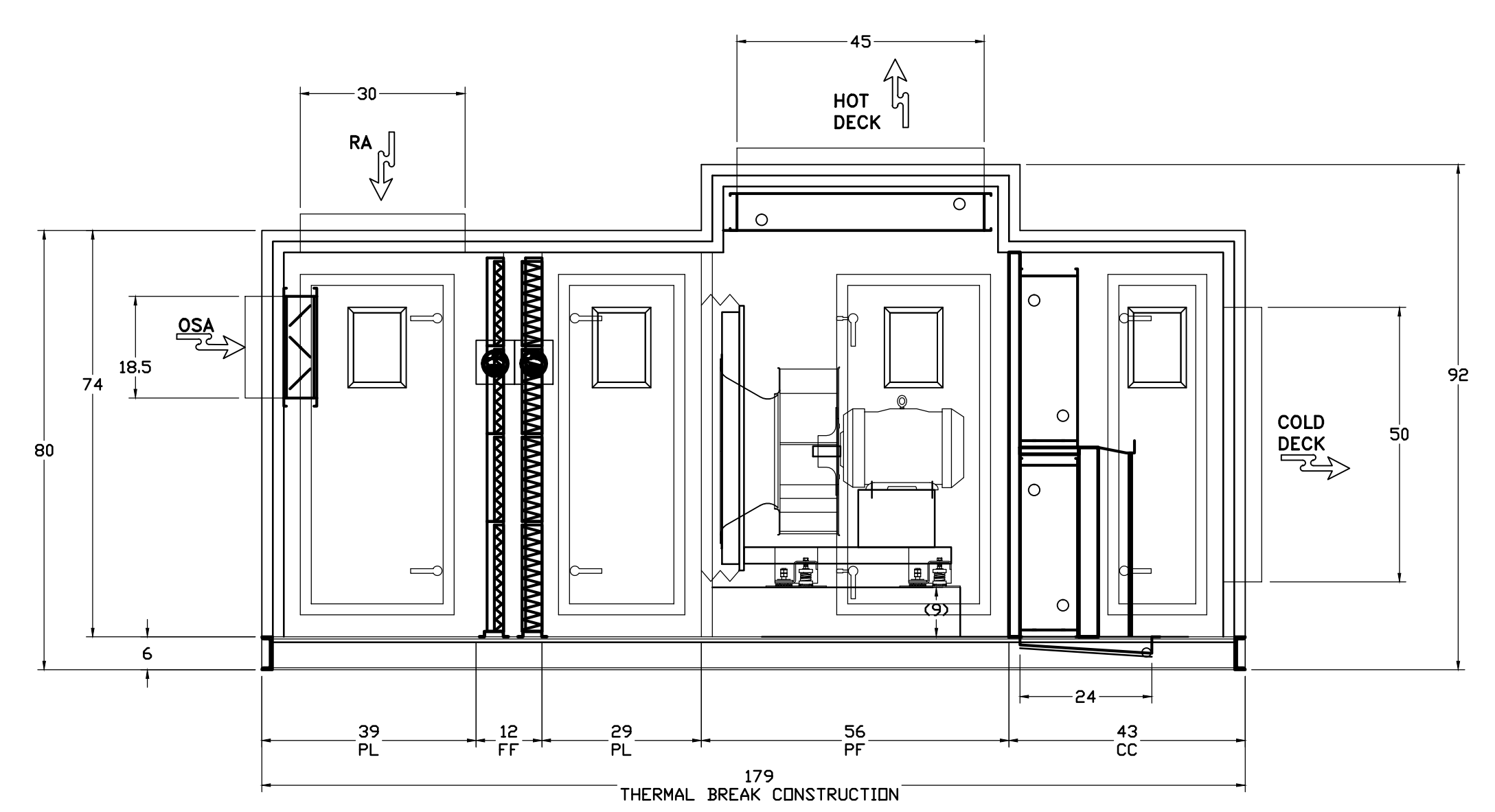
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LEGENDS	
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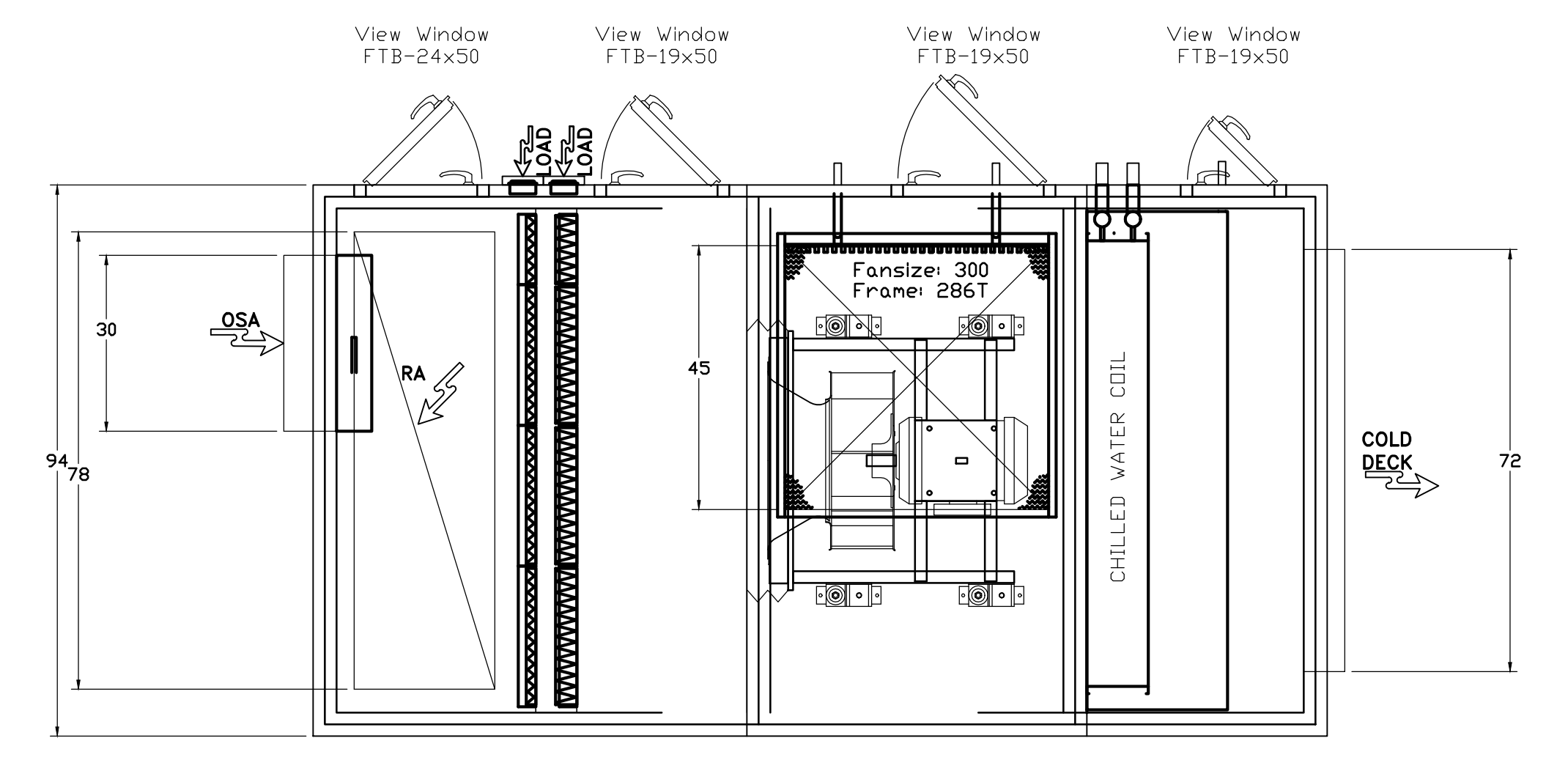
PLAN VIEW



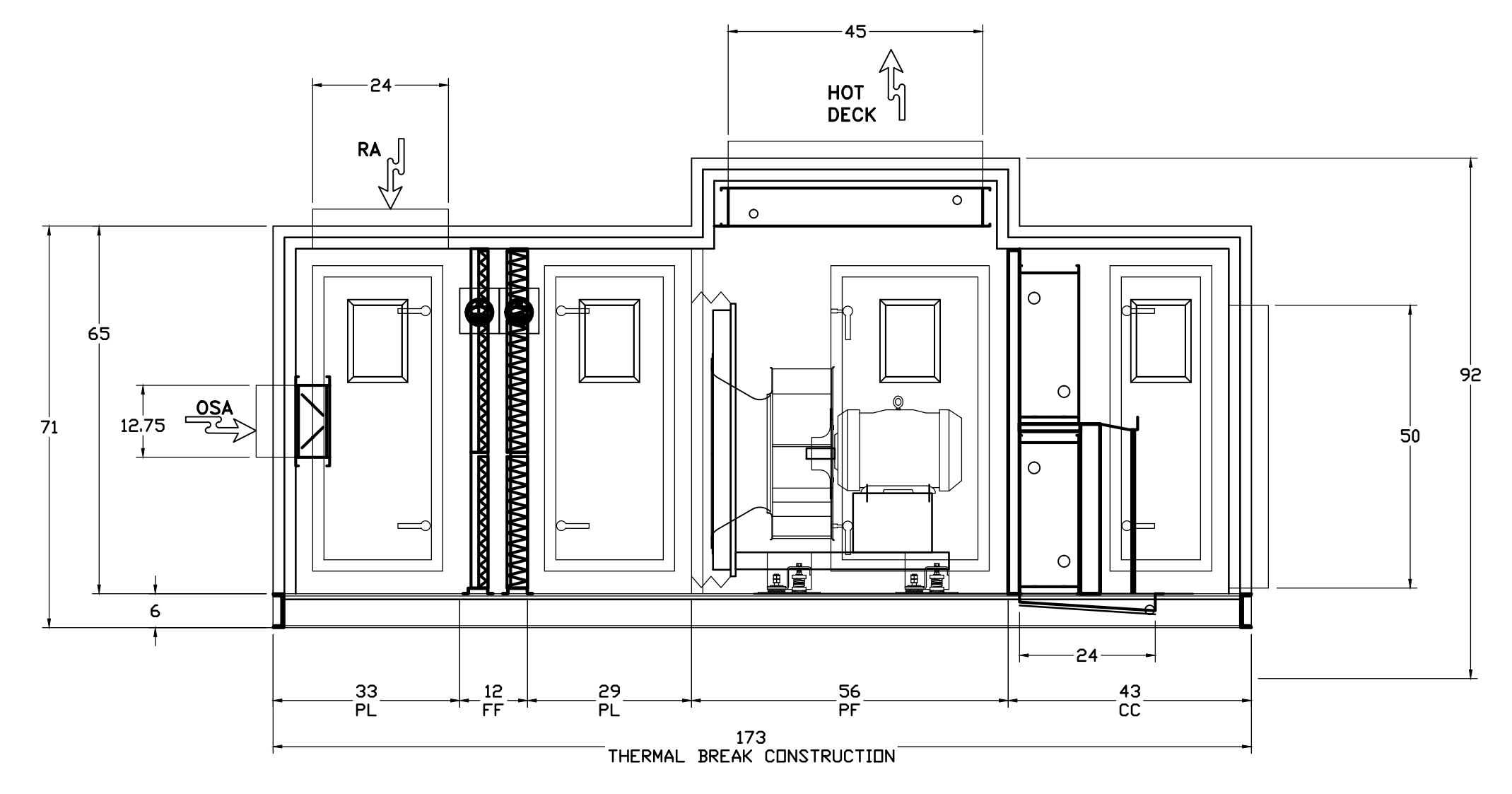
SIDE VIEW

AHU-2E INSTALLATION DETAIL

SCALE: 1/2" = 1'-0" 2



PLAN VIEW



SIDE VIEW

AHU-2W INSTALLATION DETAIL

SCALE: 1/2" = 1'-0" 1

1 CUSTOM AHU CONFIGURATIONS
 SCALE: 1/2"=1'-0"

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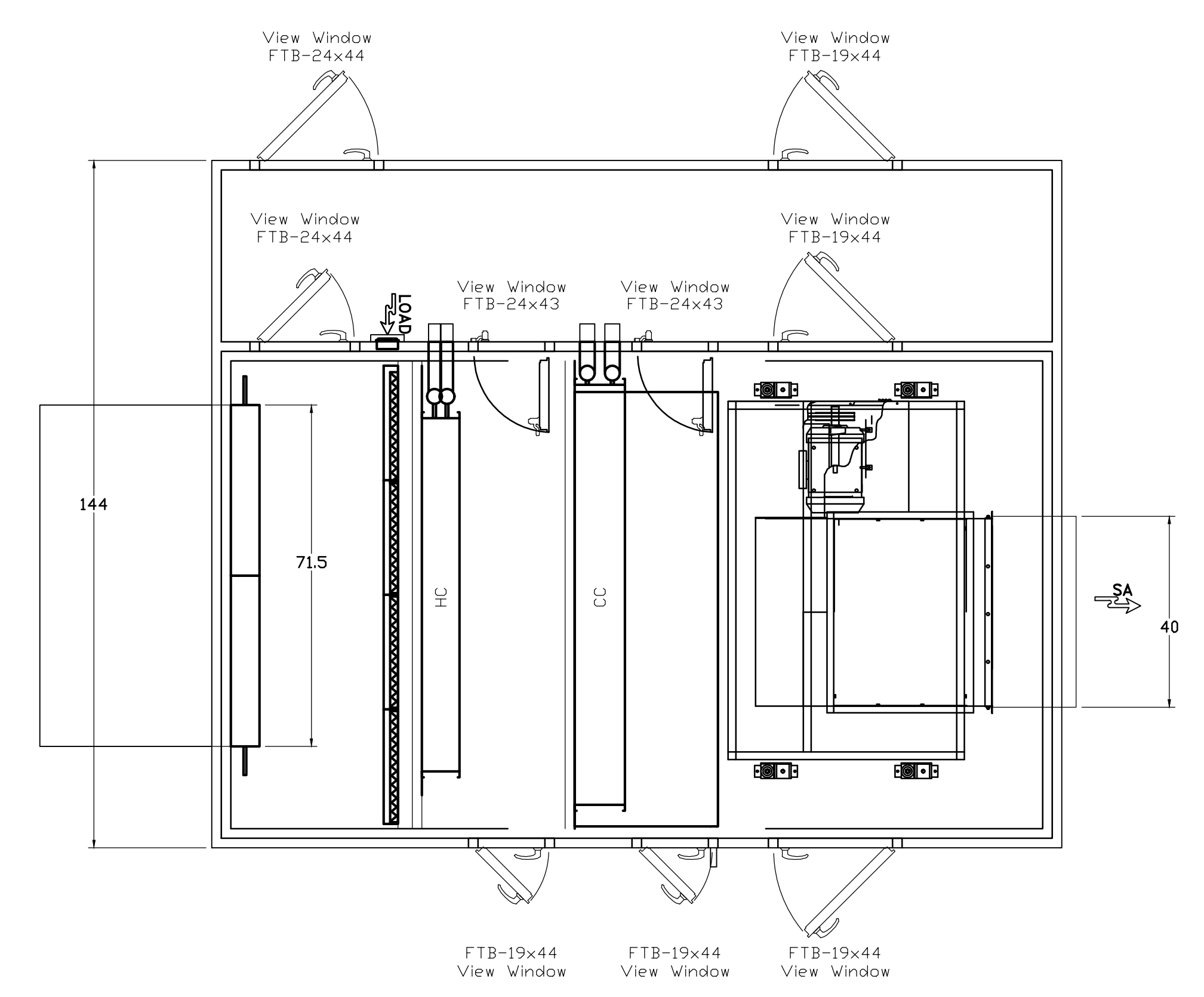
**CUSTOM AHU
 CONFIGURATIONS**

Sheet
M507
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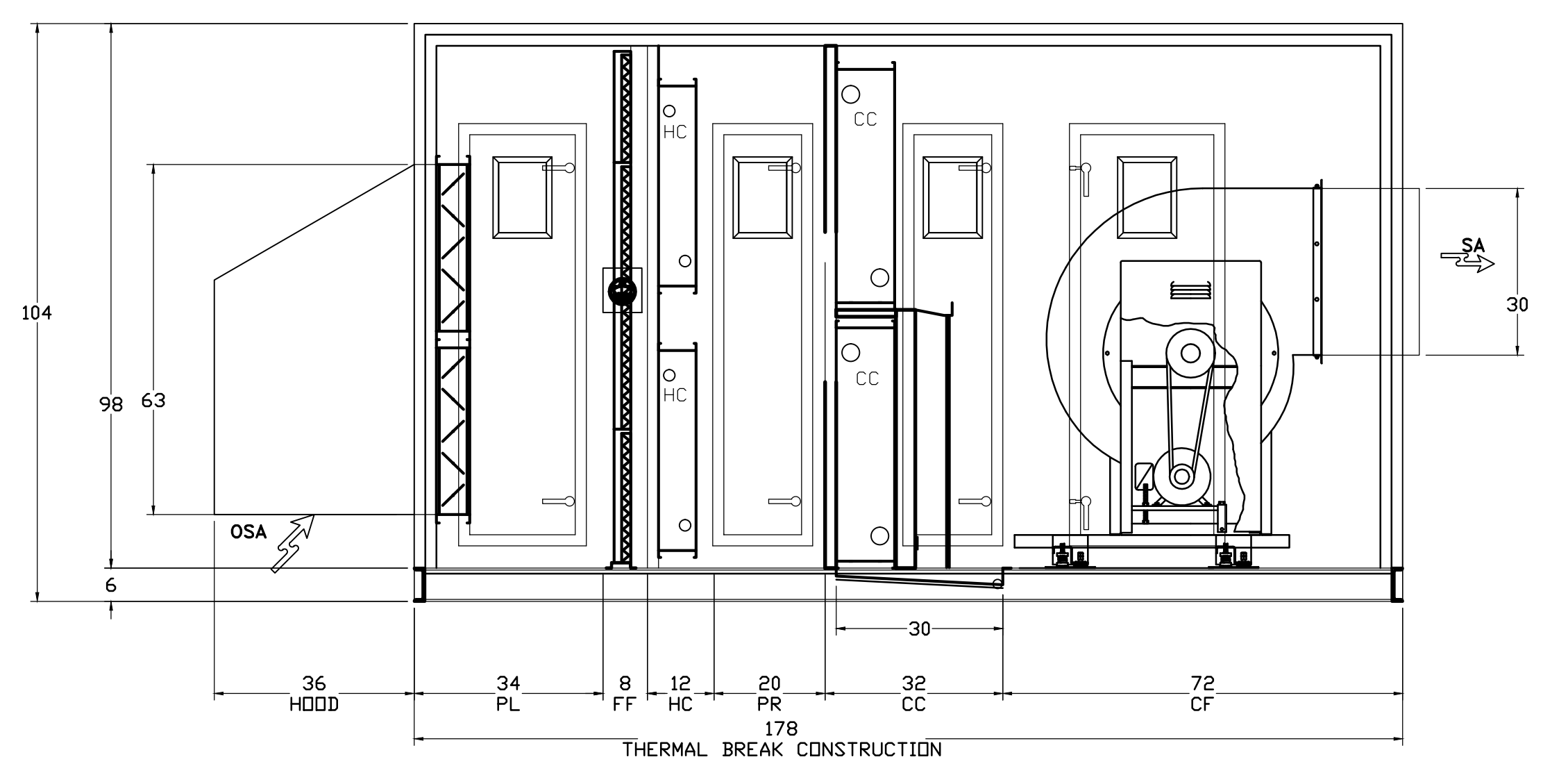
2
1
1/2
0

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DE = DIRECT EVAPORATIVE	PF = PLENUM FAN
DF = DWD FAN	PPF = PRE / FINAL FILTER
DX = DX COIL	PL = PLENUM
EC = ECONOMIZER	PR = PRE-FILTER
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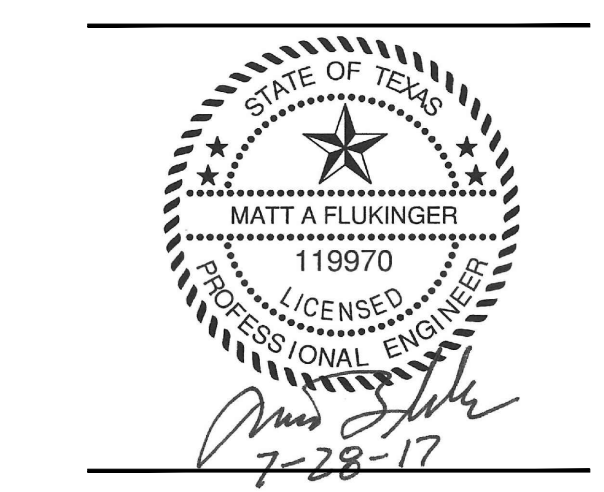


PLAN VIEW



SIDE VIEW

OAHU-I INSTALLATION DETAIL SCALE: 1/2" = 1'-0" 1



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CUSTOM AHU CONFIGURATIONS

Sheet
M508
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2
1 1/2
0



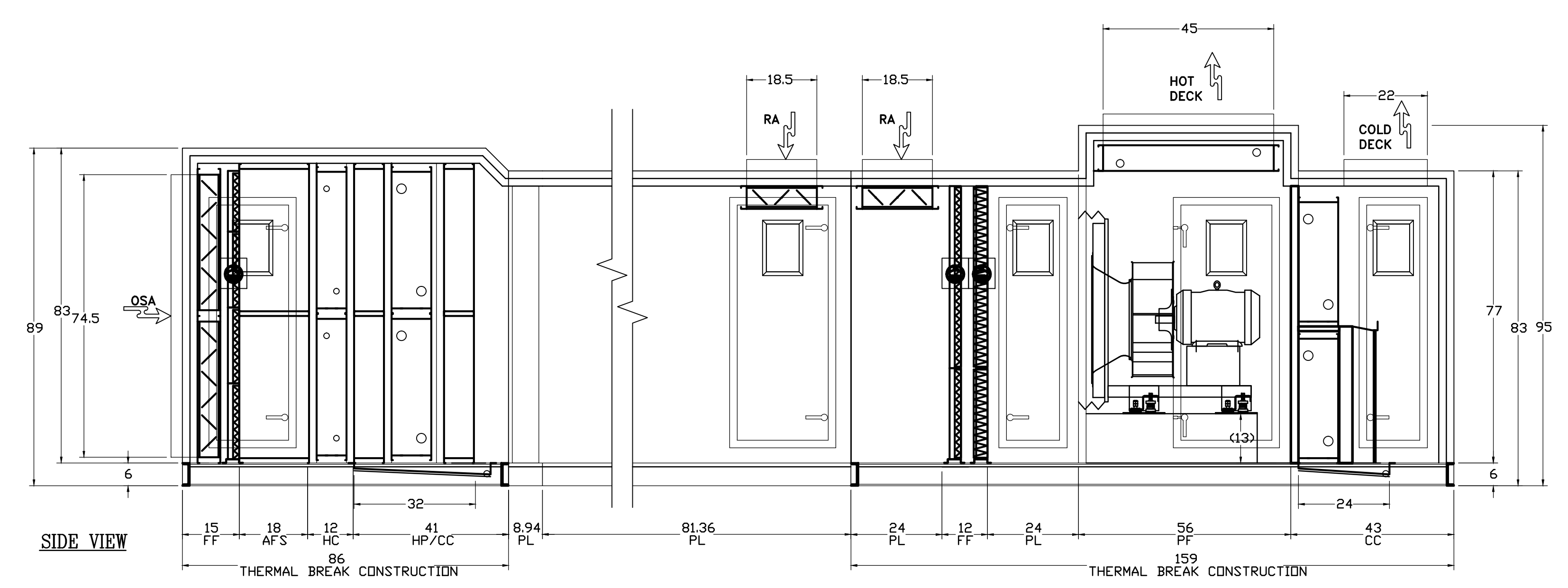
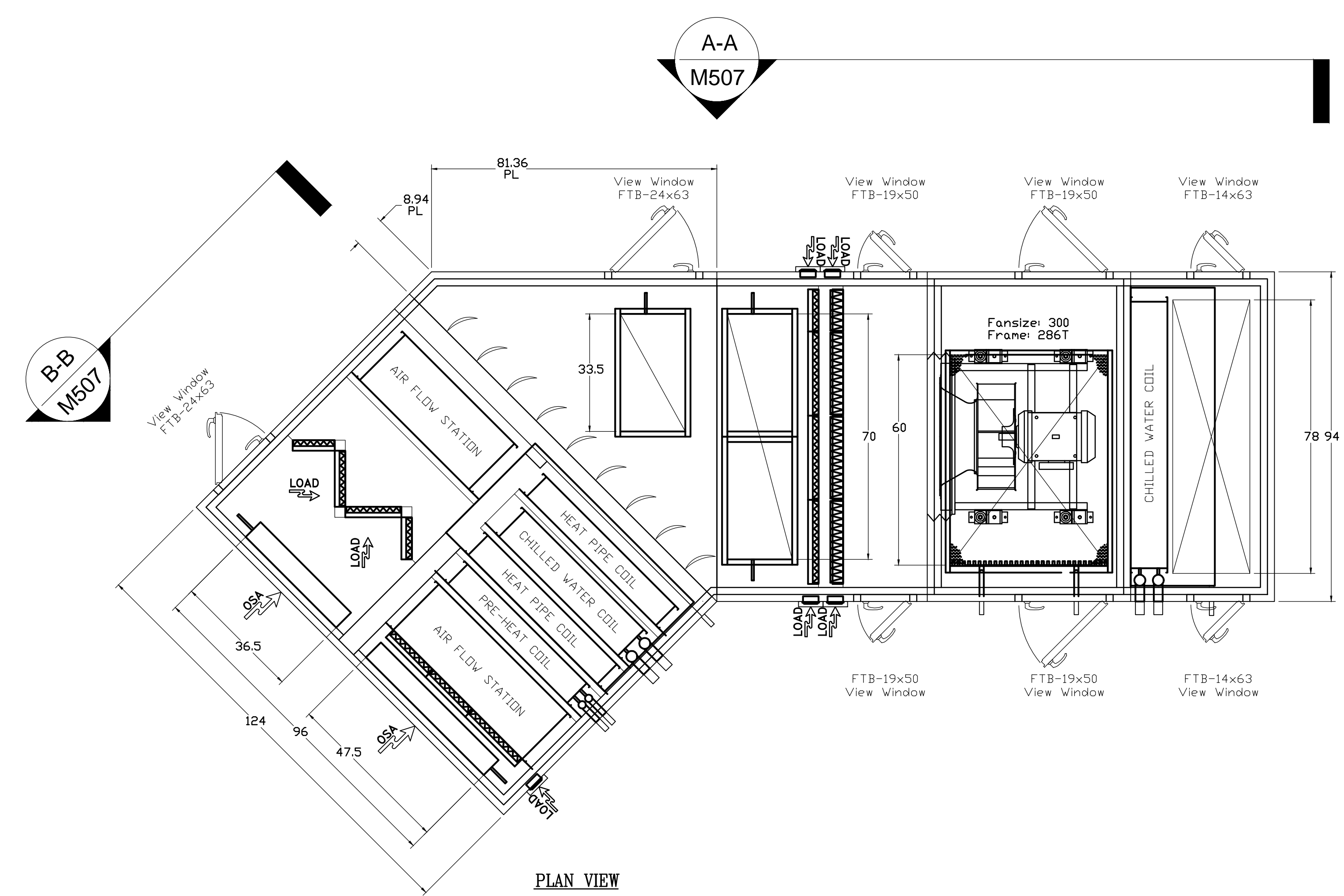
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**CUSTOM AHU
 CONFIGURATIONS**

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SECTION B-B

SECTION A-A

SIDE VIEW

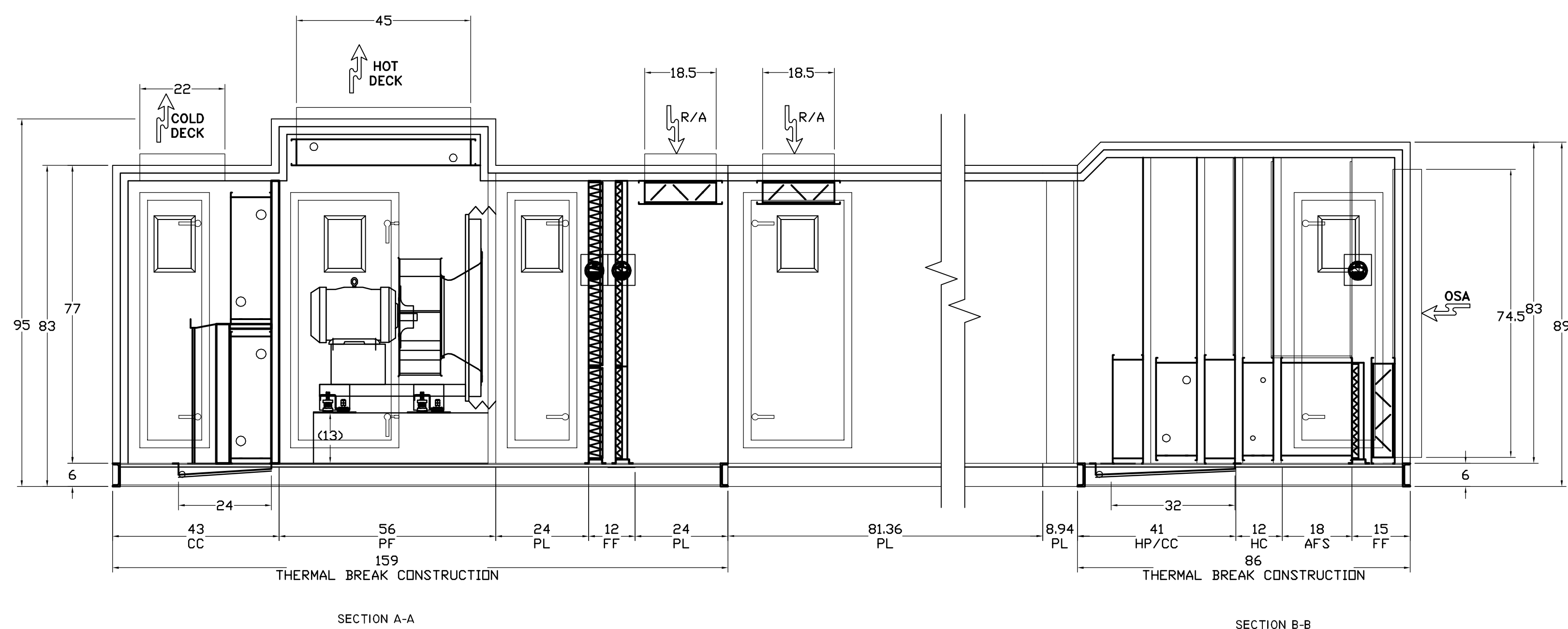
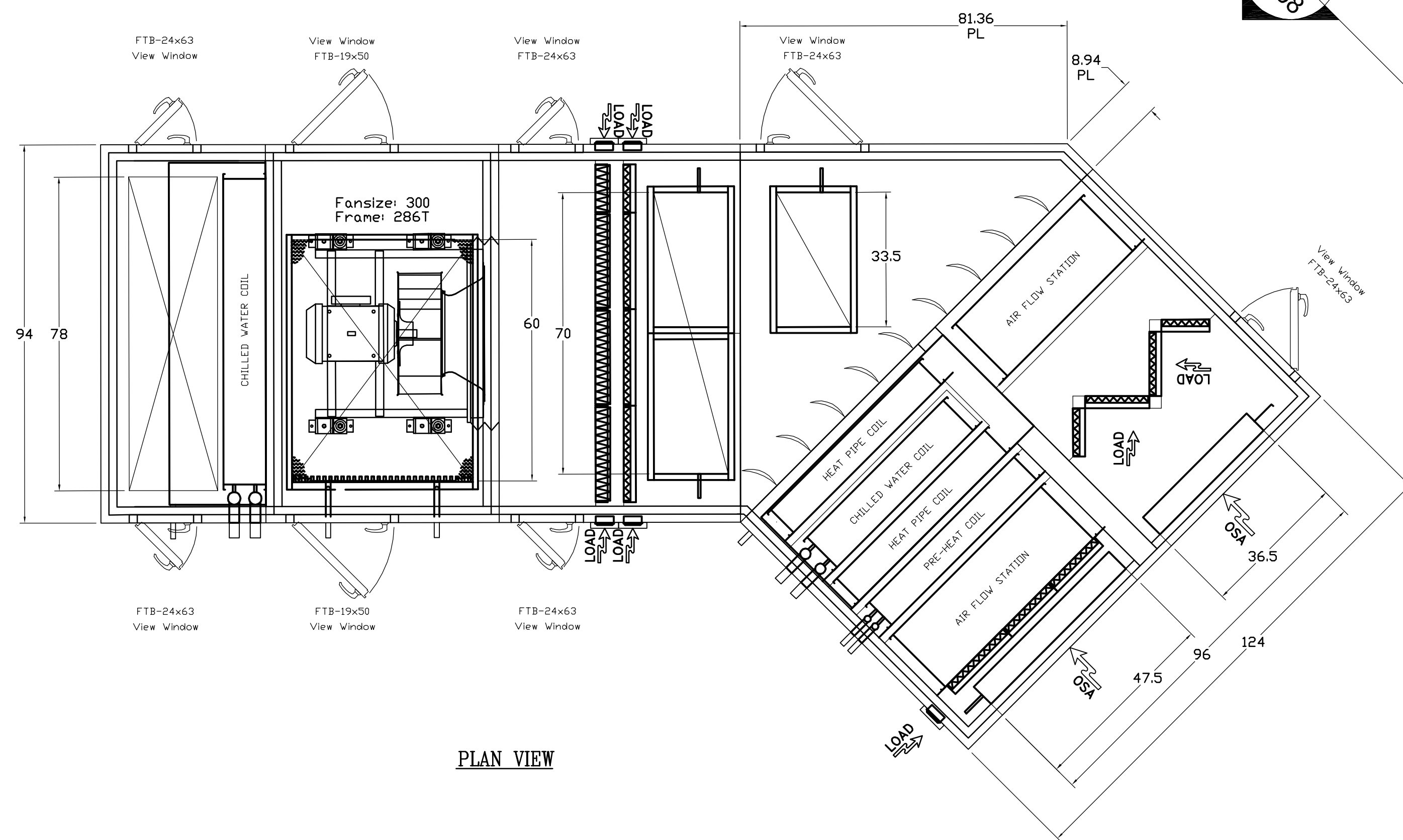
AHU-3W THRU IOW INSTALLATION DETAIL

SCALE: 1/2" = 1'-0" |

0 1/2" = 1'

A-A
M508

B-B
M508



LEGENDS	
OSA = OUTSIDE AIR	SA = SUPPLY AIR
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AHU-3E THRU IOE INSTALLATION DETAIL

SCALE: 1/2" = 1'-0" |

1 CUSTOM AHU CONFIGURATIONS
SCALE: 1/2"=1'-0"



INFRASTRUCTURE ASSOCIATES, INC.
617 RICHMOND AVENUE, SUITE 200
HOUSTON, TEXAS 77057
TYPE REGISTRATION NO. F-4306
(713) 622-0129 PH (713) 622-0557 FAX
WWW.IAHOUSTON.COM



The University of Texas
Health Science Center at Houston

School of Public Health

UT HEALTH
SCIENCE
SCHOOL OF
PUBLIC HEALTH

1200 PRESSLER ST.
HOUSTON, TX 77030



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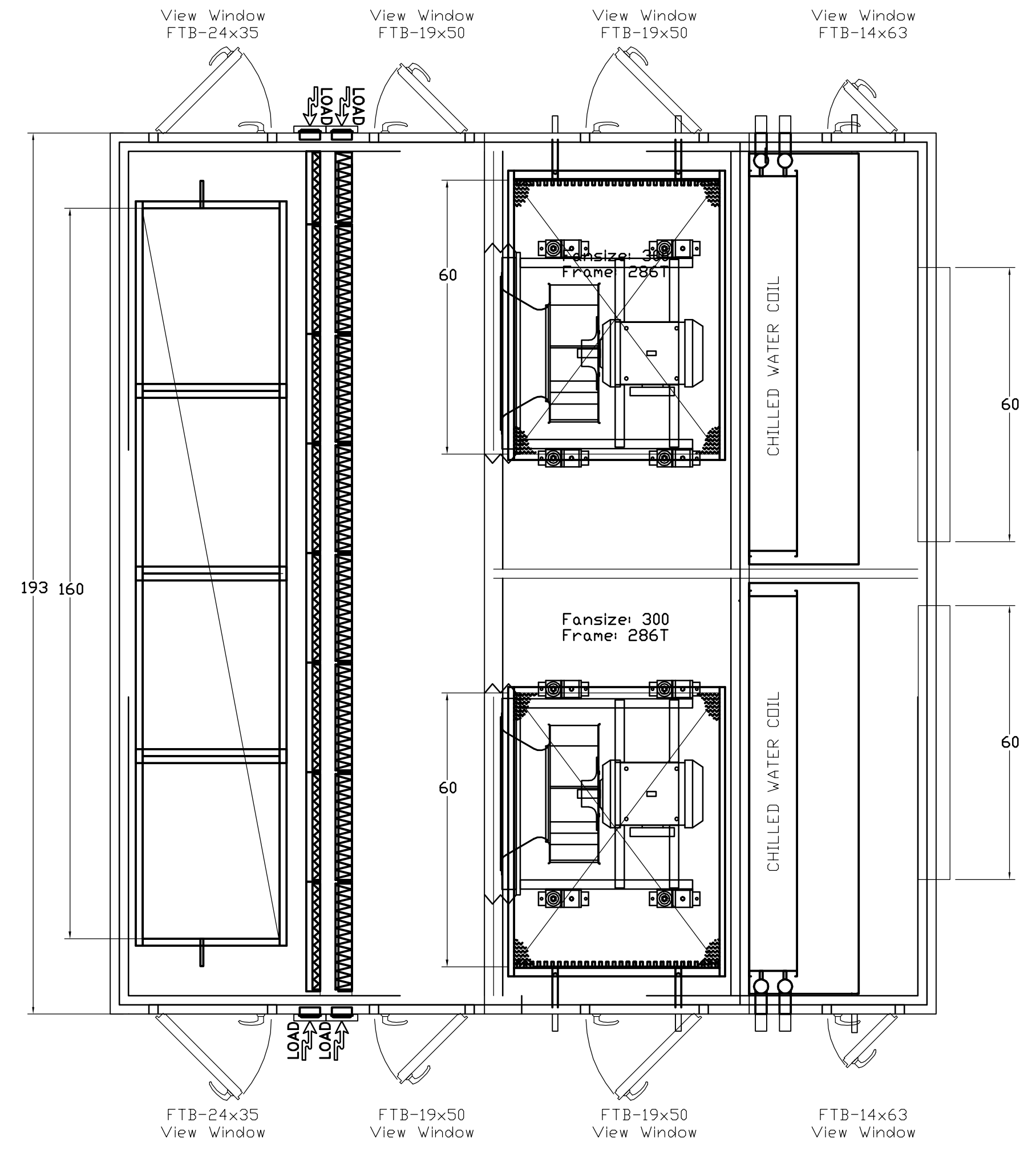
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CUSTOM AHU CONFIGURATIONS

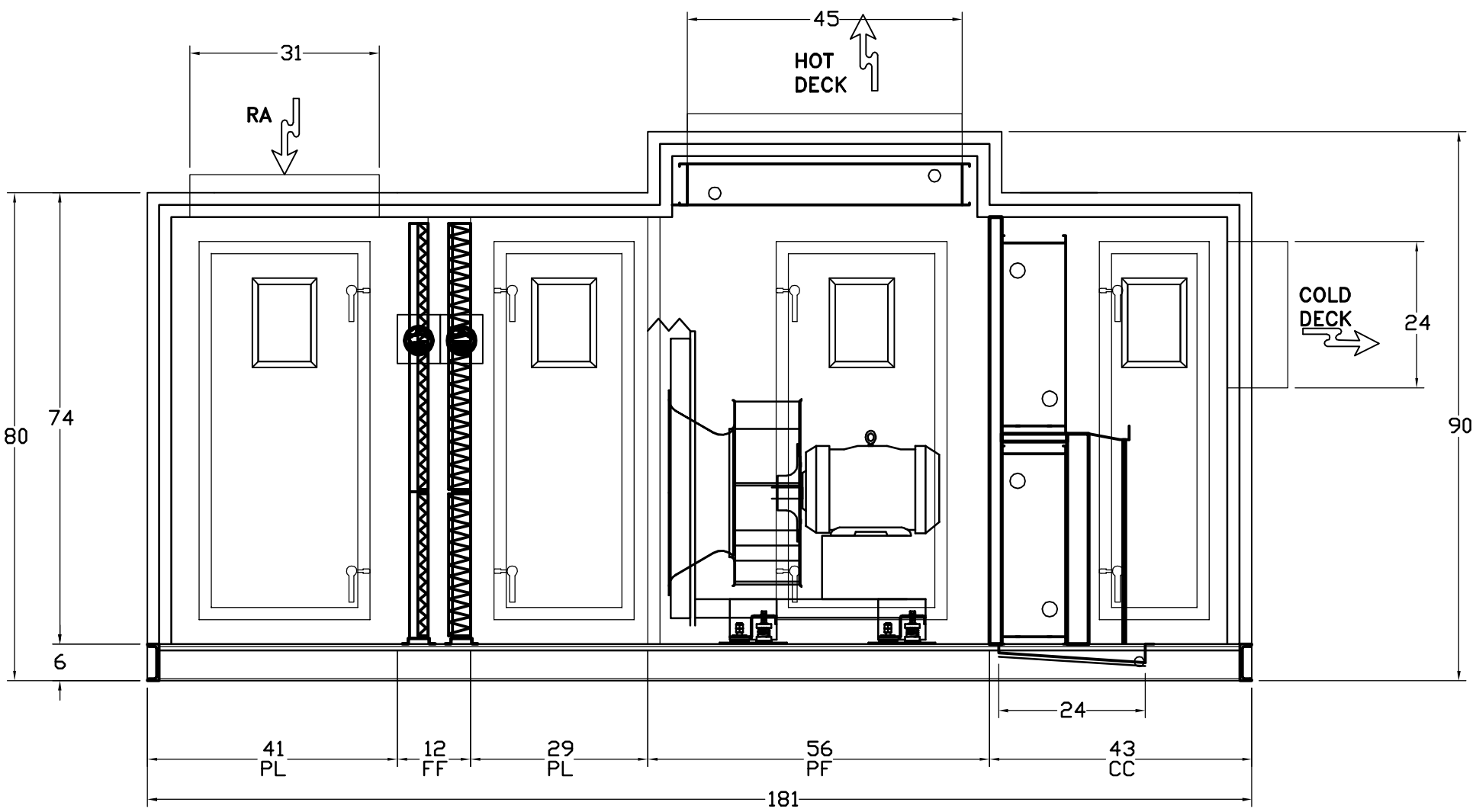
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M510
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0 1/2" = 1'-0"

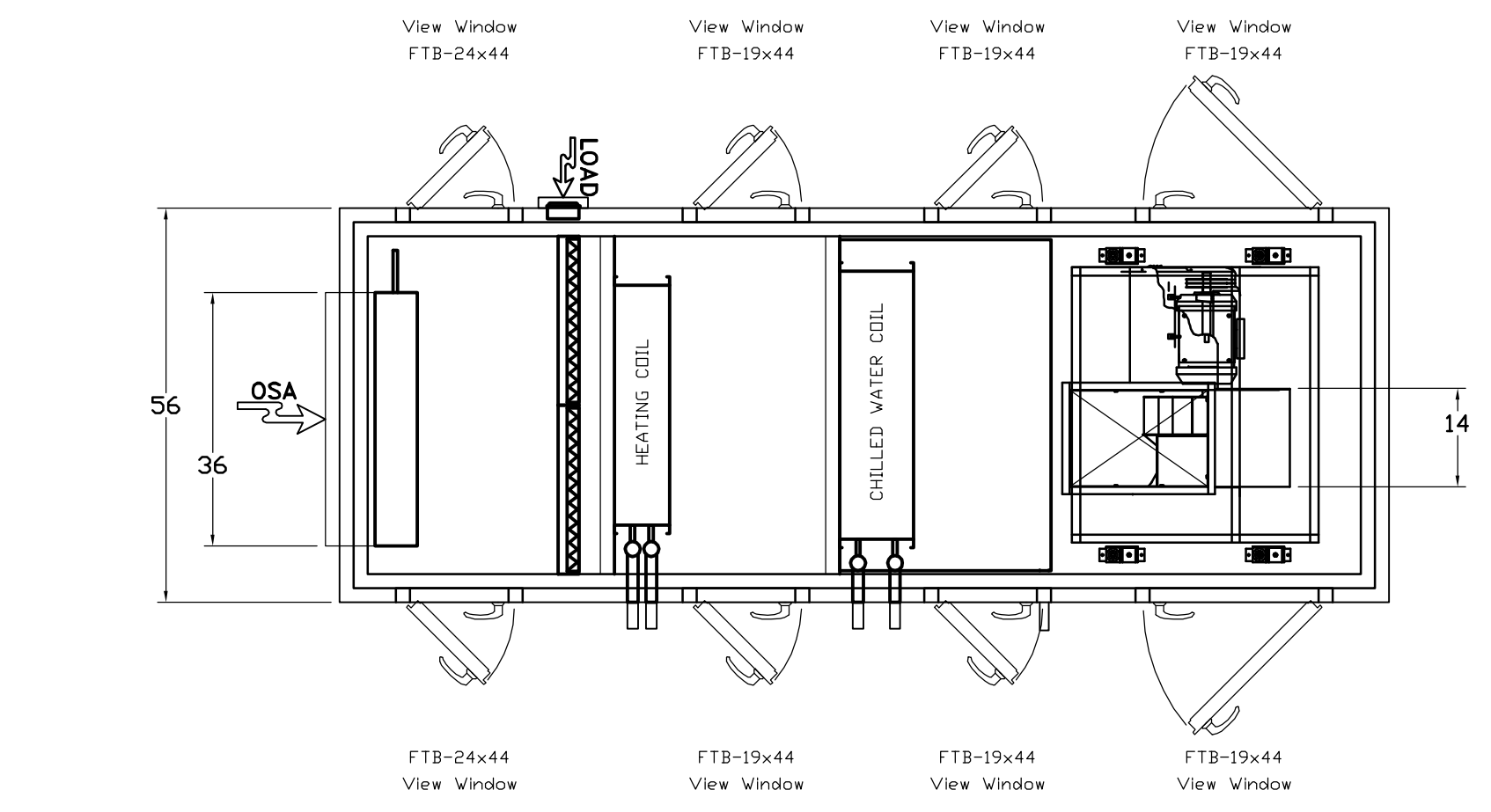


PLAN VIEW

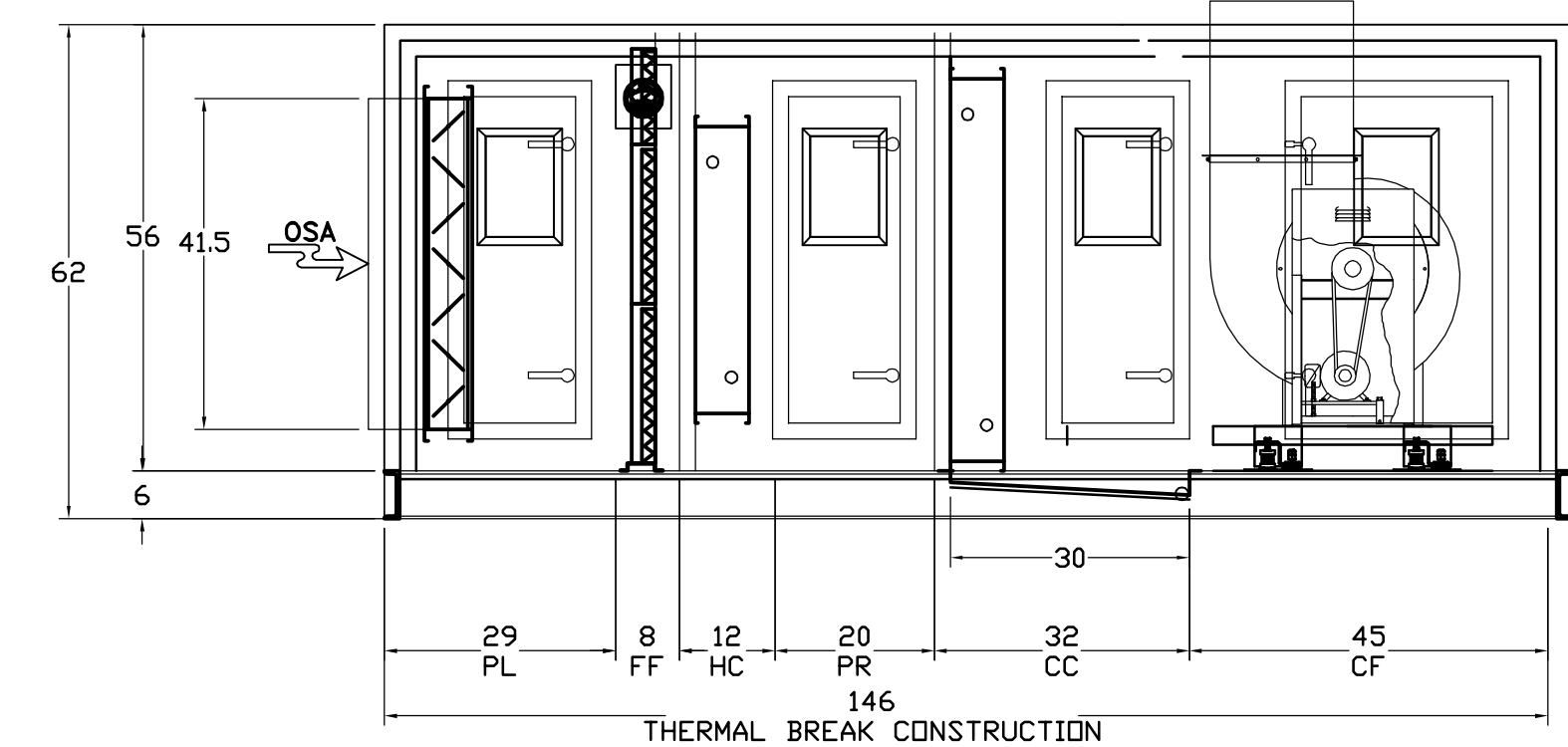


SIDE VIEW

AHU-8 THRU 10 INSTALLATION DETAIL SCALE: 1/2" = 1'-0" 2



PLAN VIEW



SIDE VIEW

OAHU-8 THRU 10 INSTALLATION DETAIL SCALE: 1/2" = 1'-0" 1

LEGENDS	
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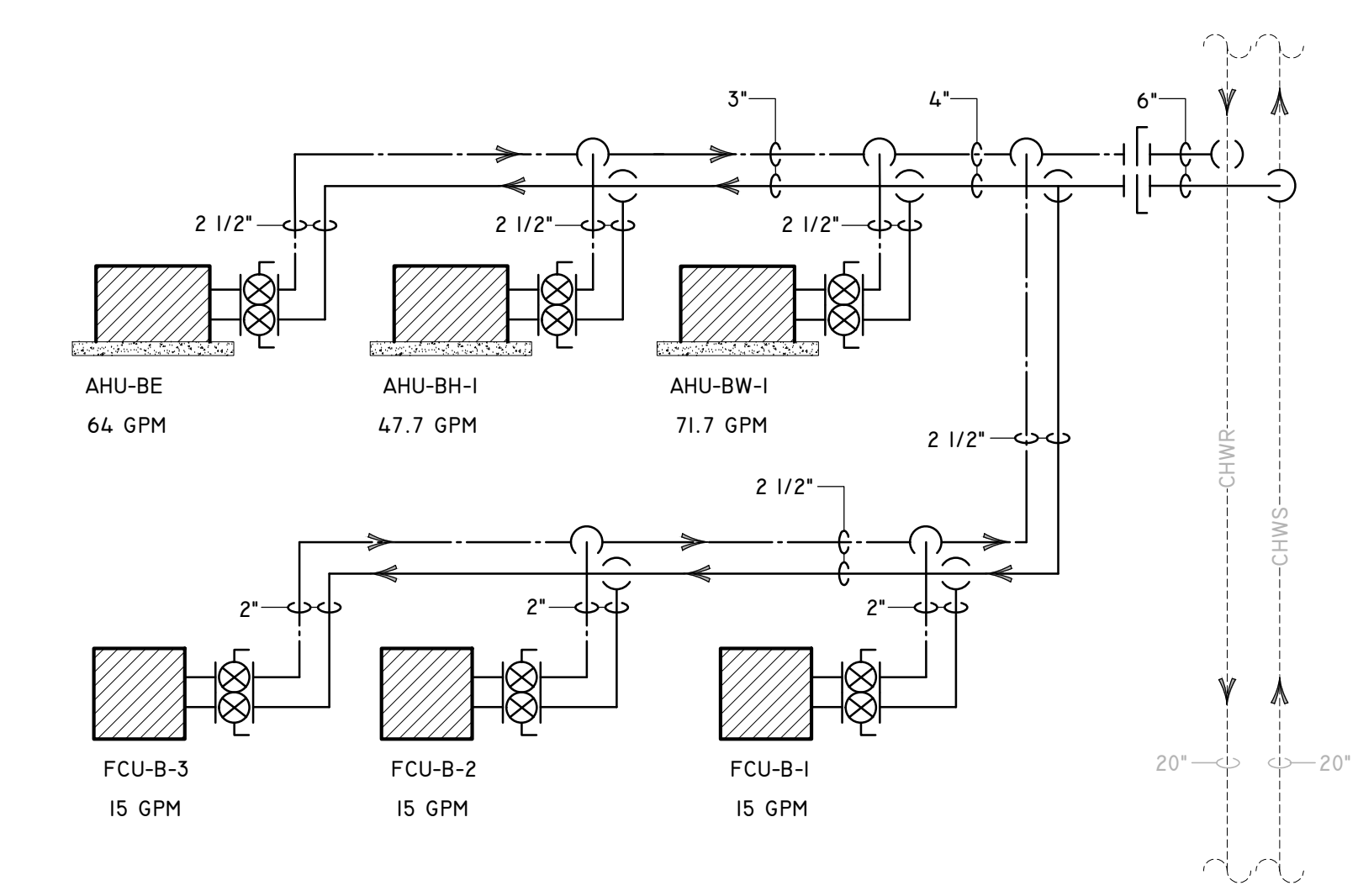
CUSTOM AHU CONFIGURATIONS



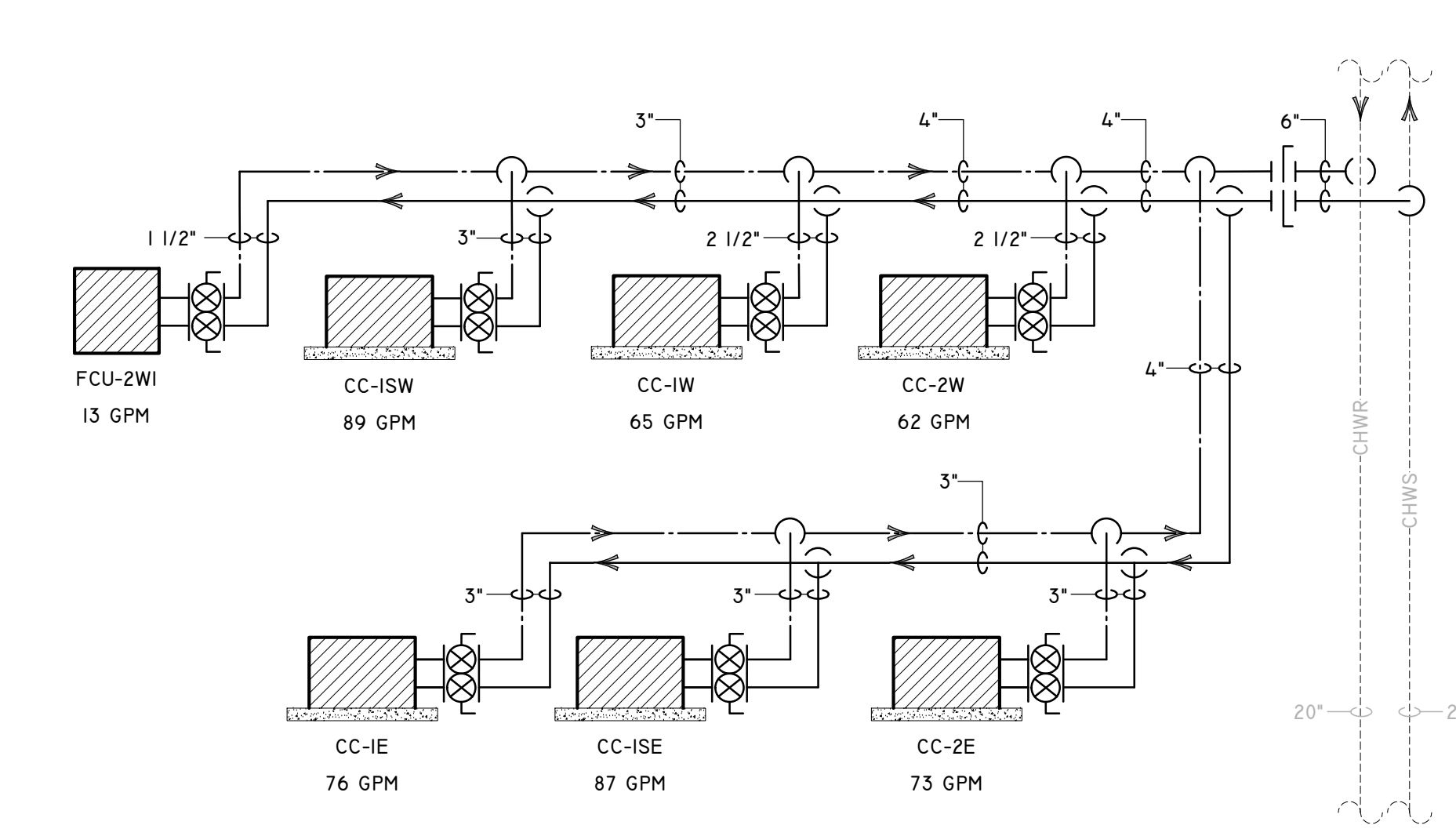
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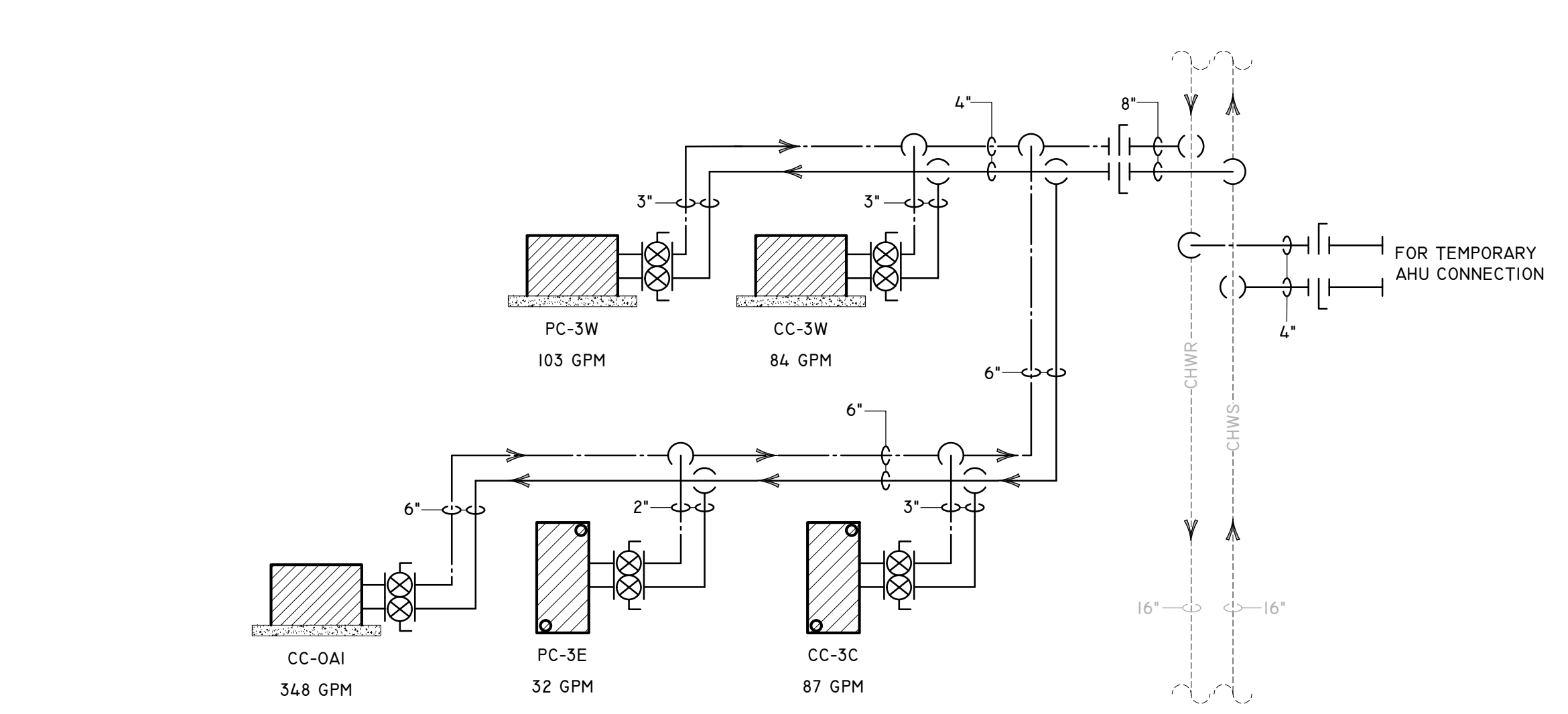
PIPING DIAGRAM -
 CHILLED WATER
 Sheet
M601
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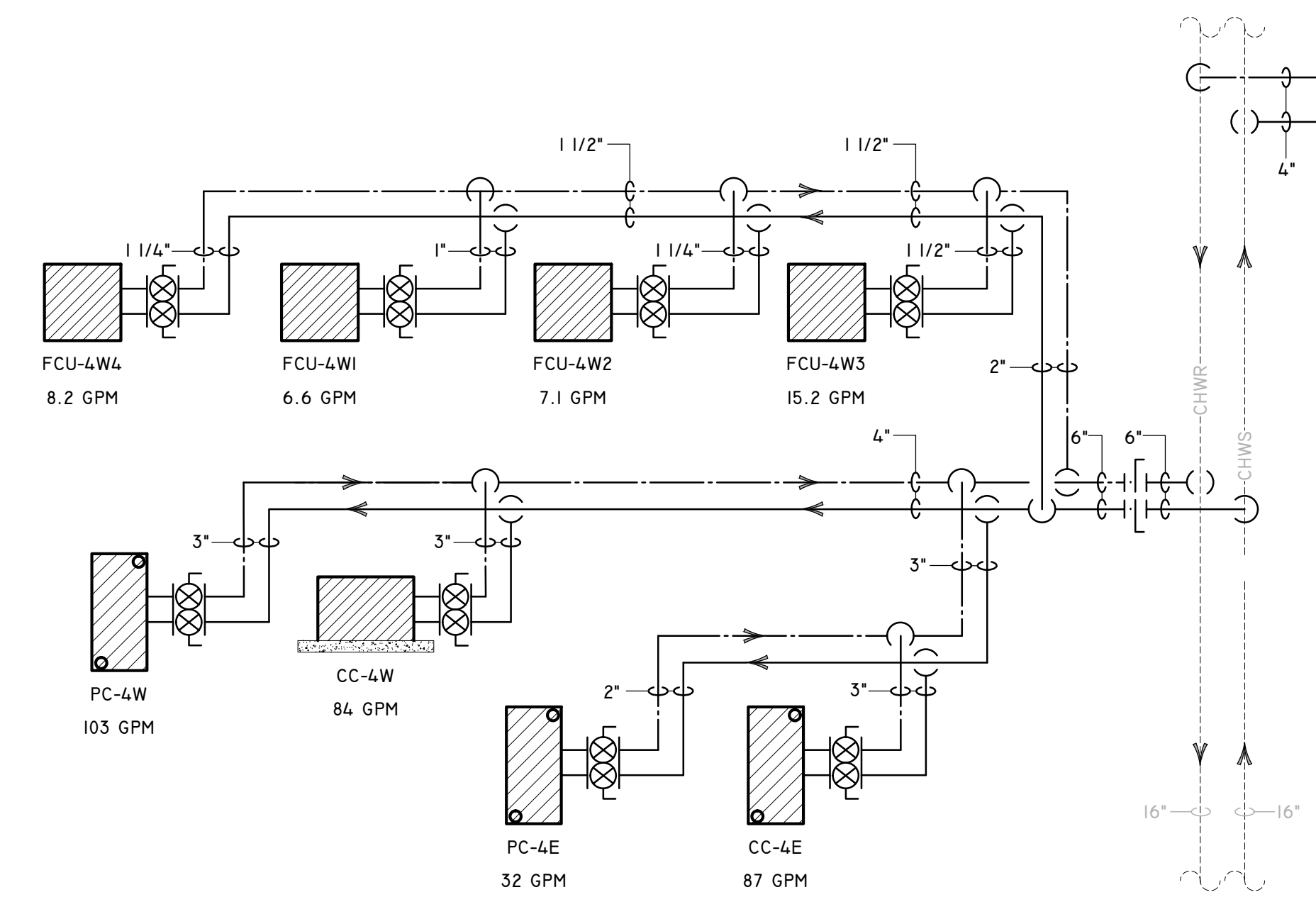
BASEMENT FLOOR



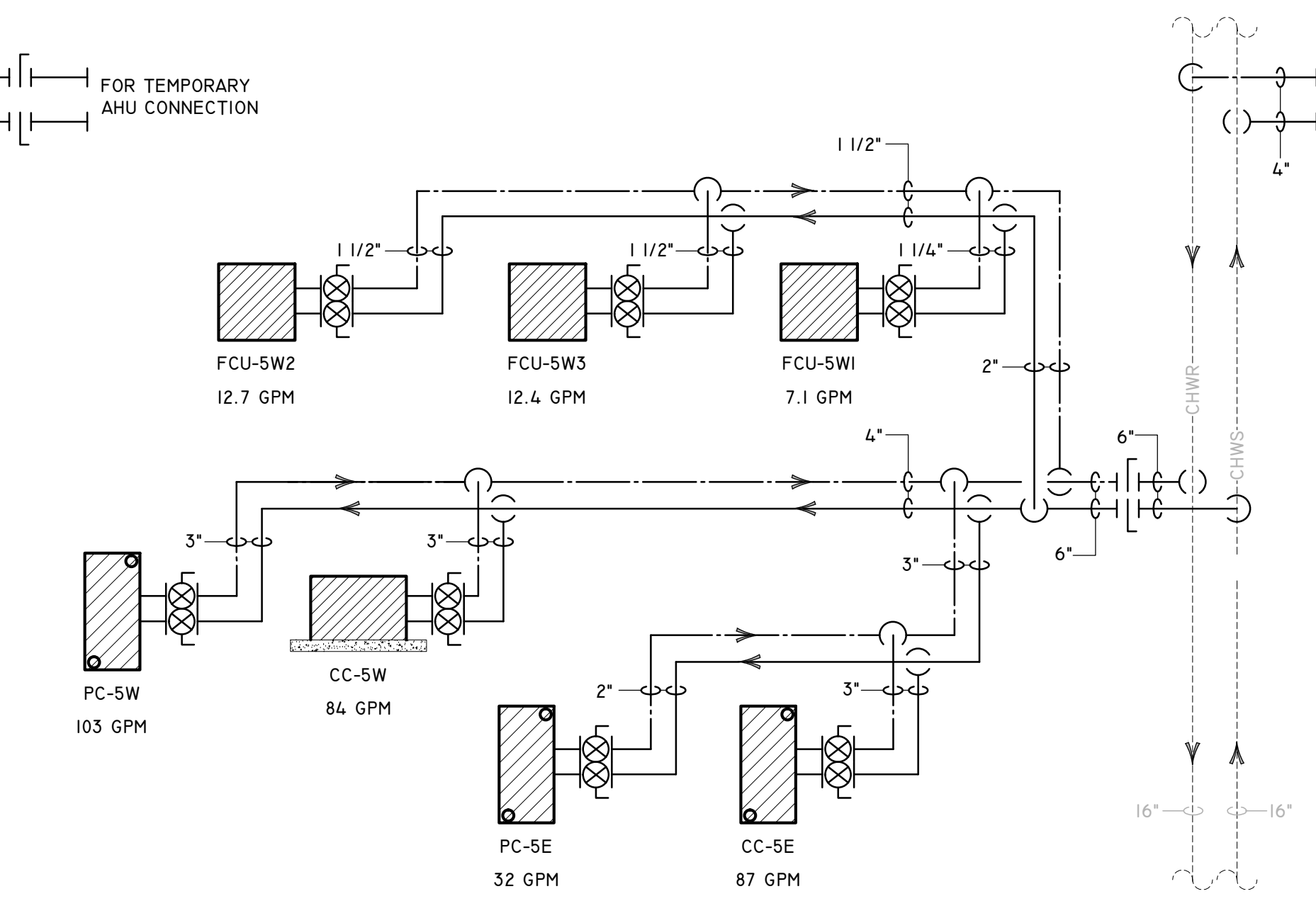
2ND FLOOR



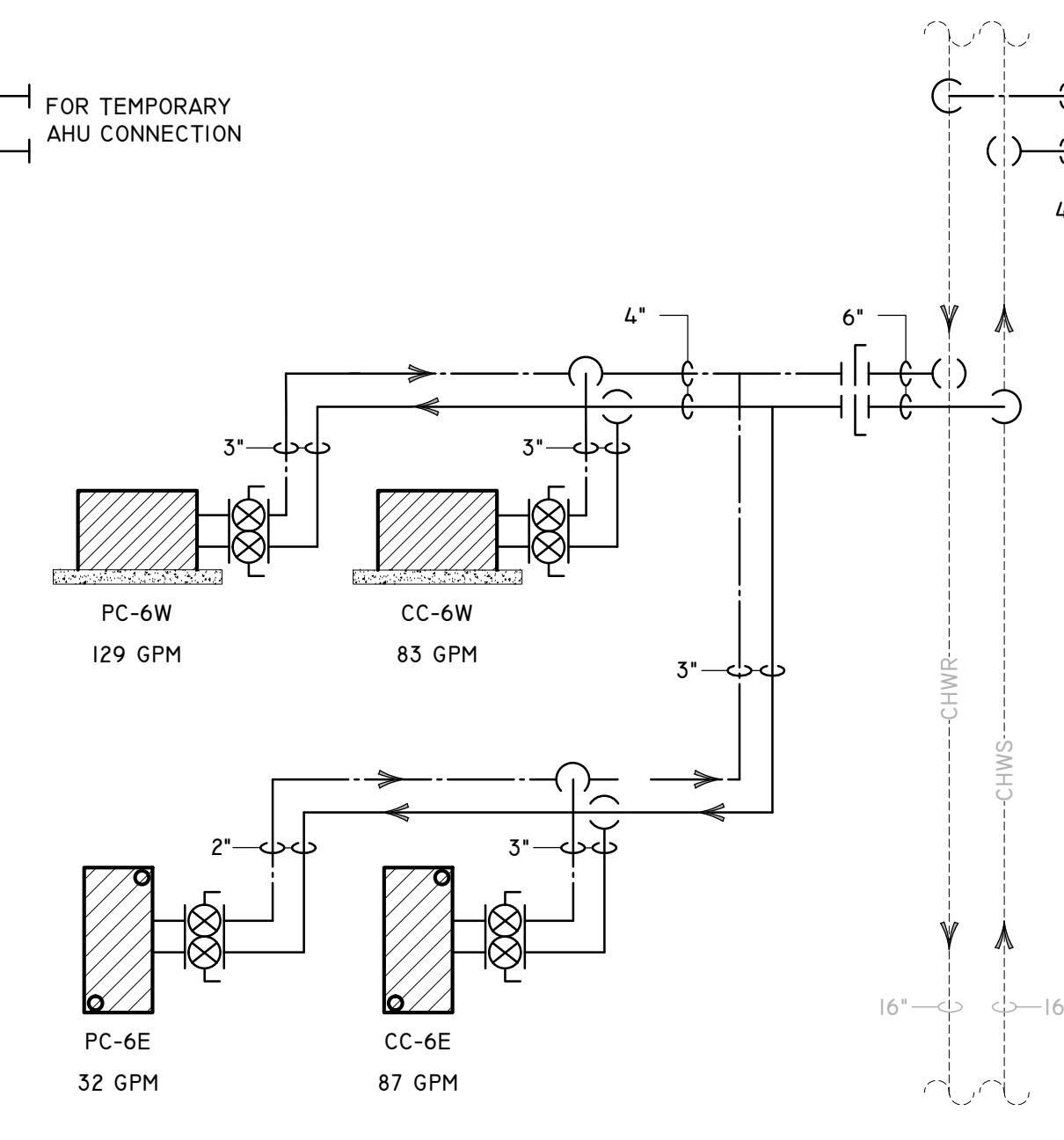
3RD FLOOR



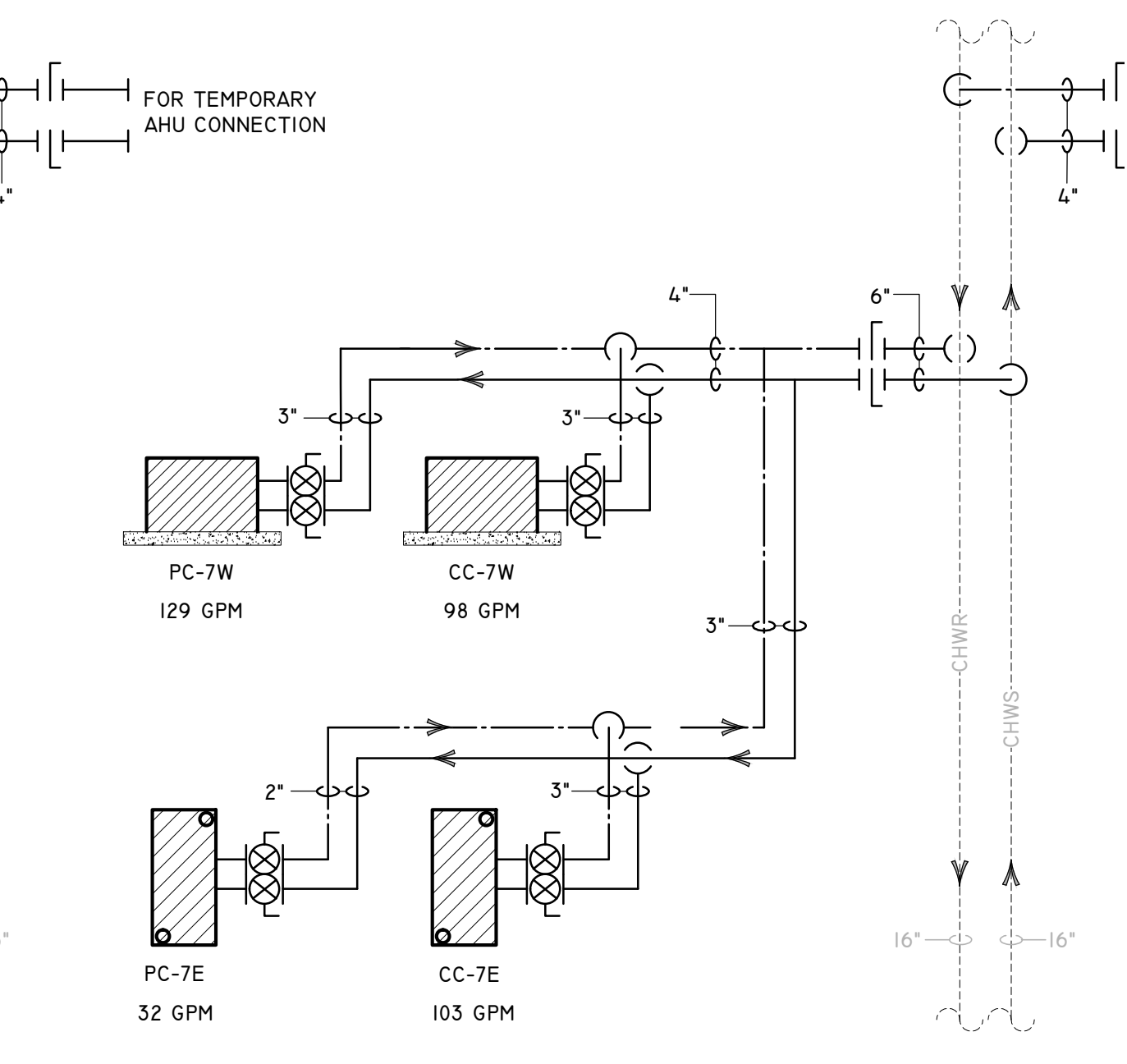
4TH FLOOR



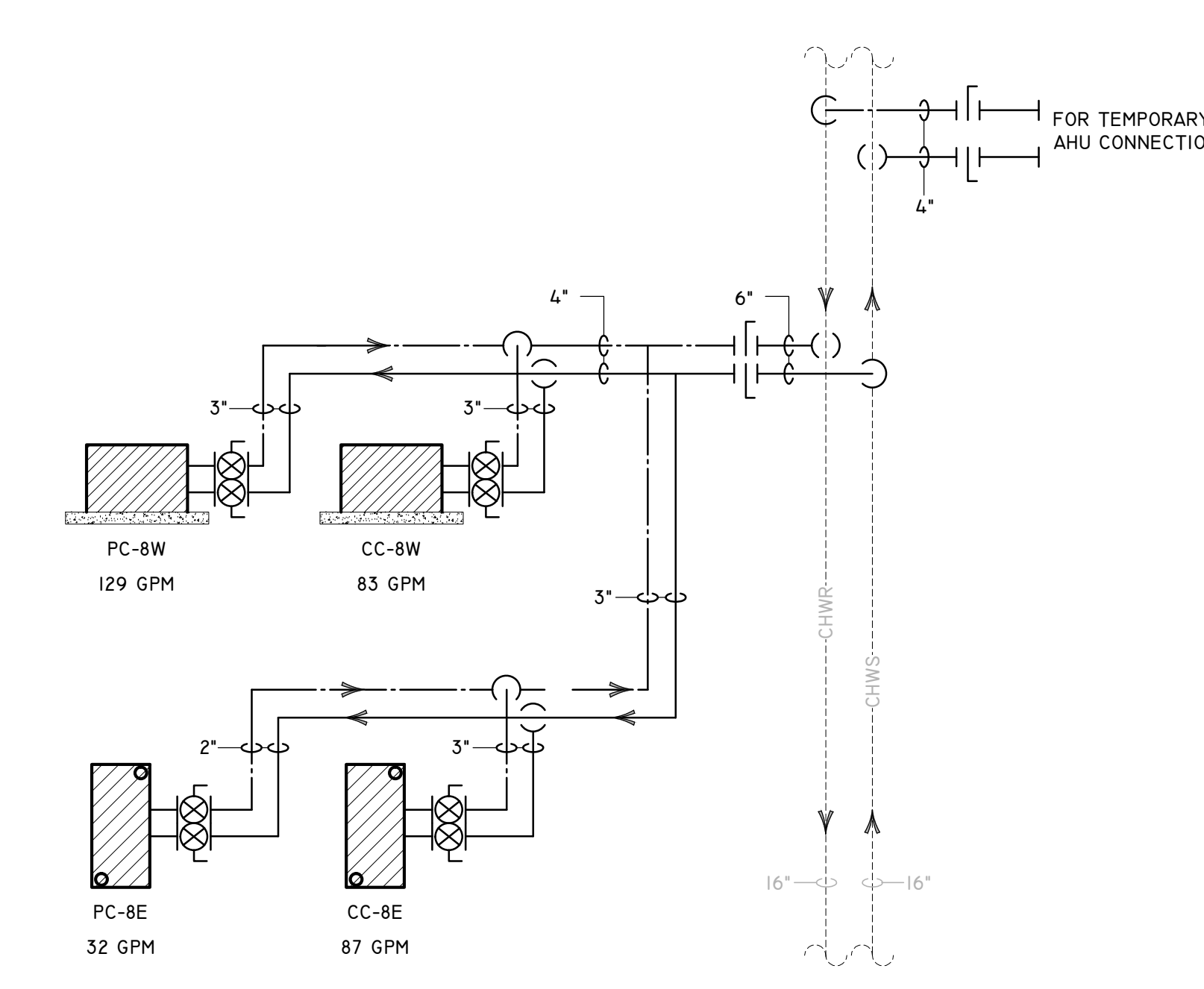
5TH FLOOR



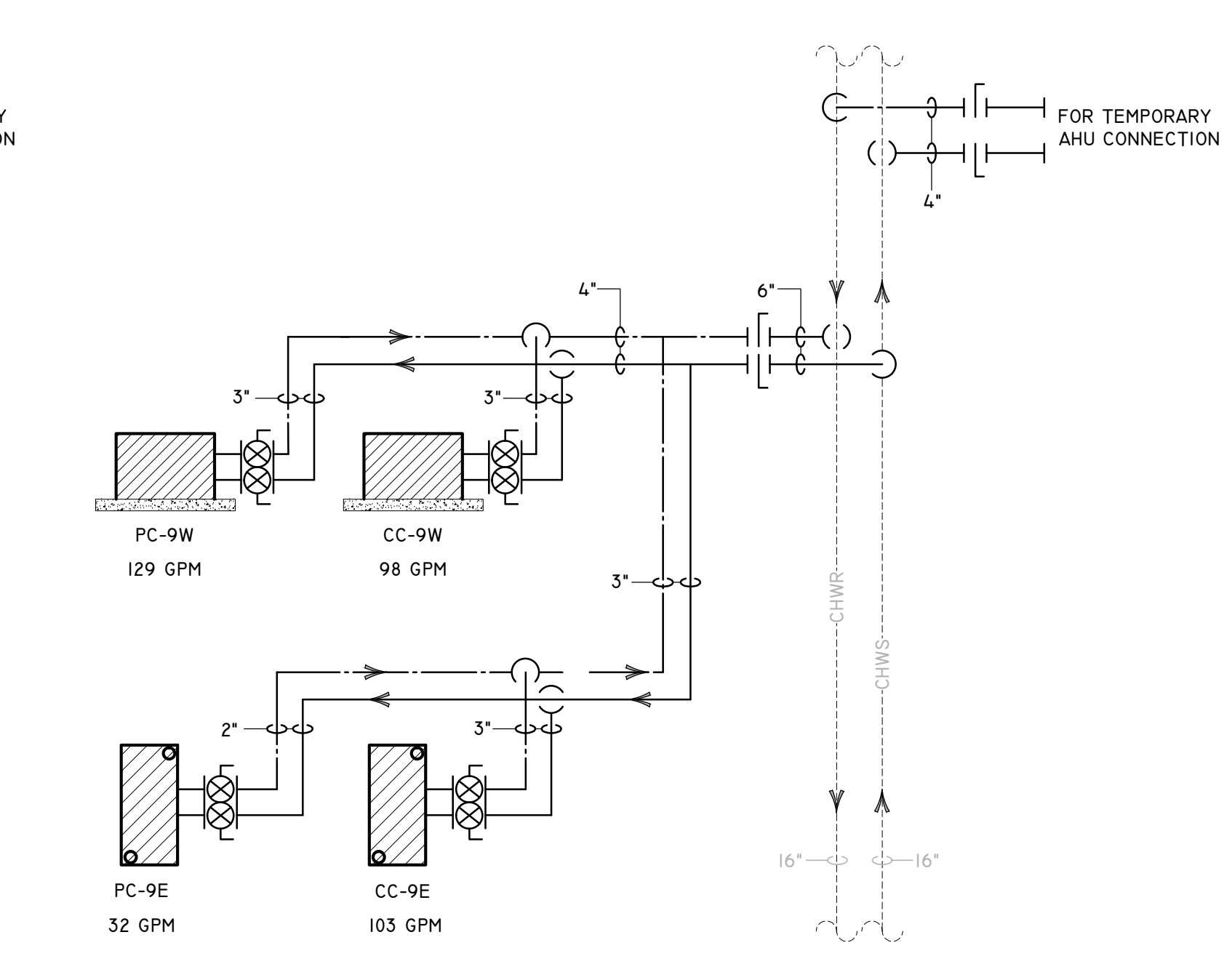
6TH FLOOR



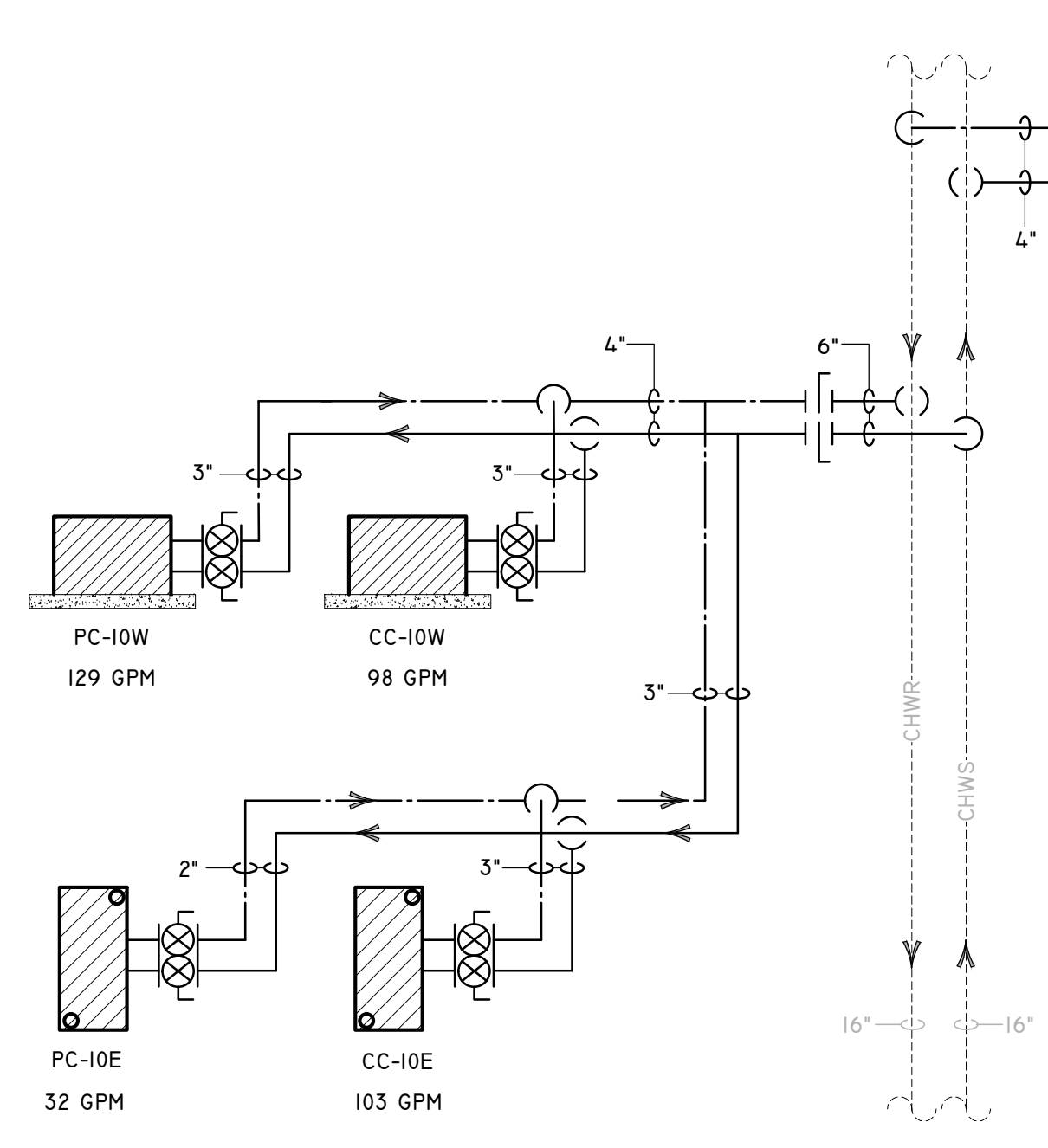
7TH FLOOR



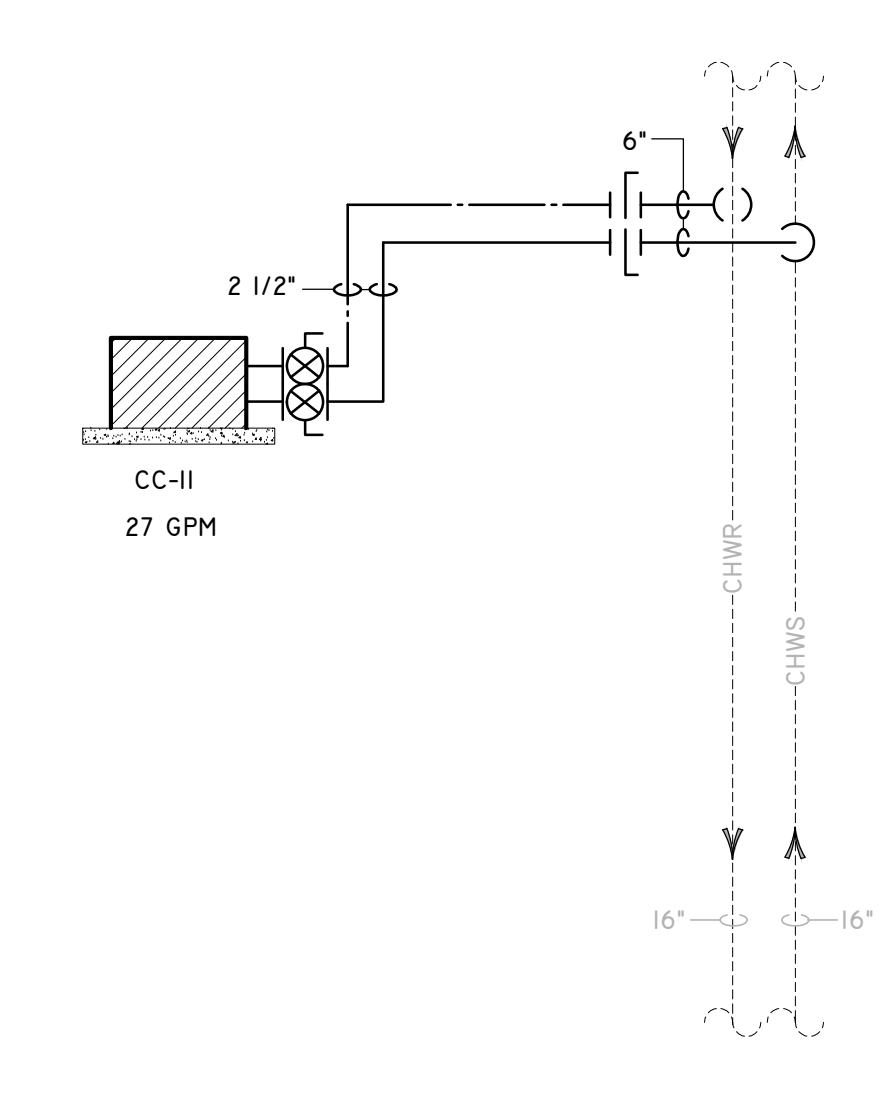
8TH FLOOR



9TH FLOOR



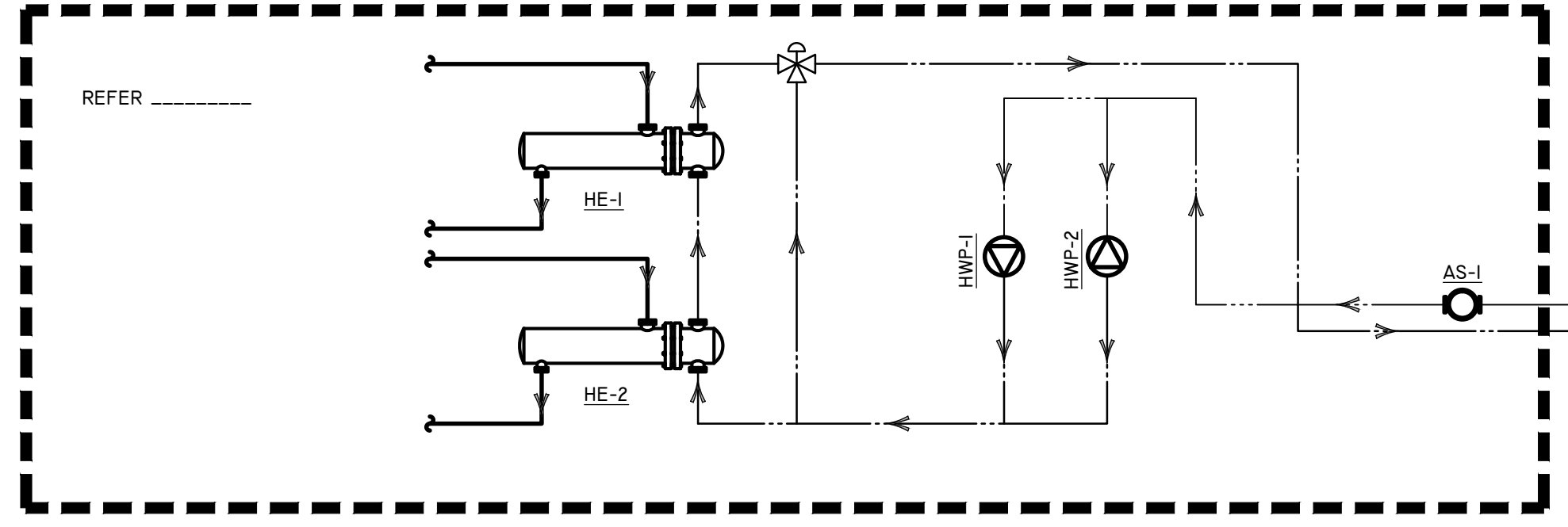
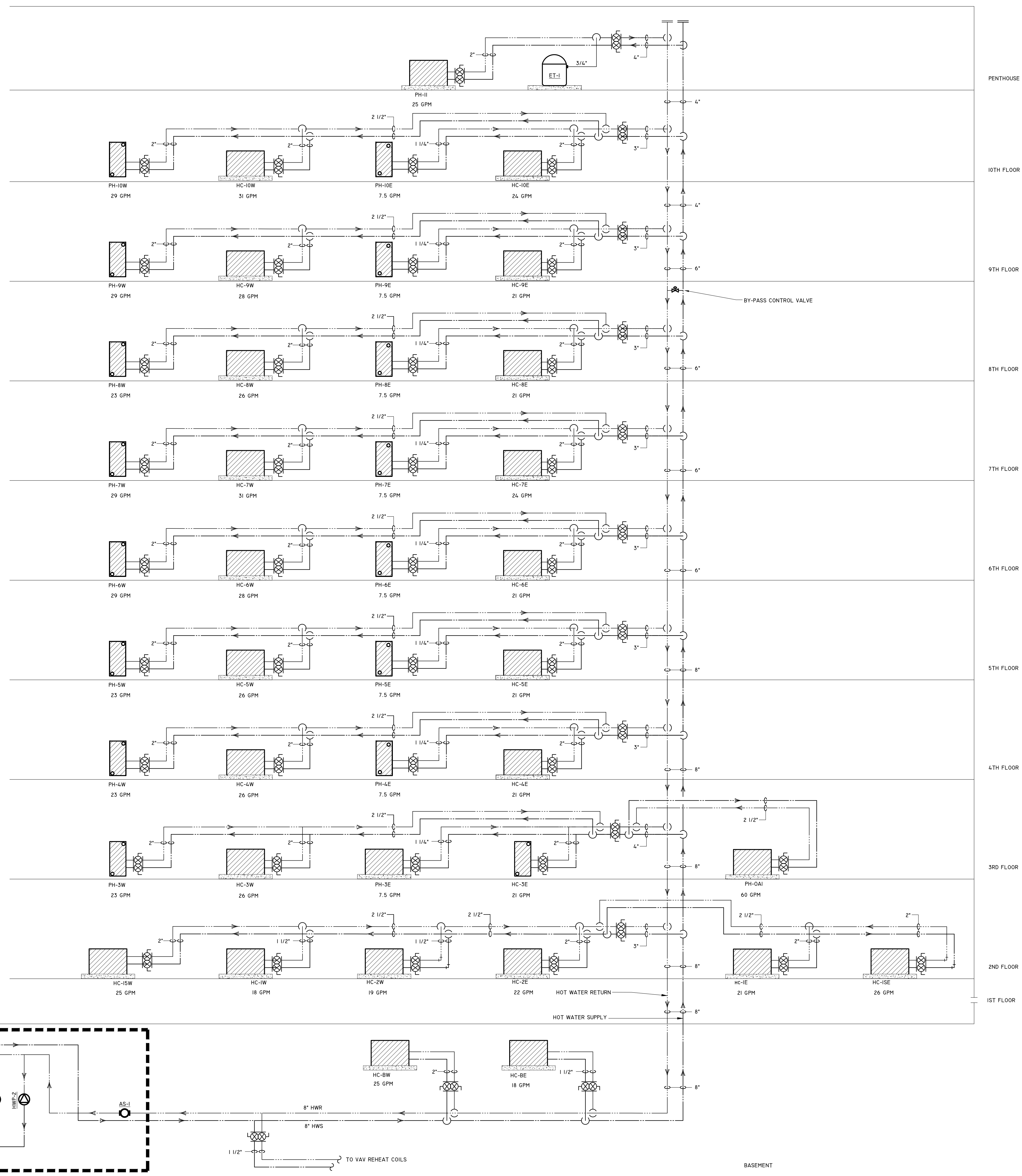
10TH FLOOR



PENTHOUSE

1 CHILLED WATER PIPING DIAGRAM
 SCALE: N.T.S.

2'
1'
1/2'
0'



1 HOT WATER PIPING DIAGRAM
SCALE: N.T.S.

PENTHOUSE
10TH FLOOR
9TH FLOOR
8TH FLOOR
7TH FLOOR
6TH FLOOR
5TH FLOOR
4TH FLOOR
3RD FLOOR
2ND FLOOR
1ST FLOOR
BASEMENT

BY-PASS CONTROL VALVE

HOT WATER RETURN

HOT WATER SUPPLY

BASEMENT



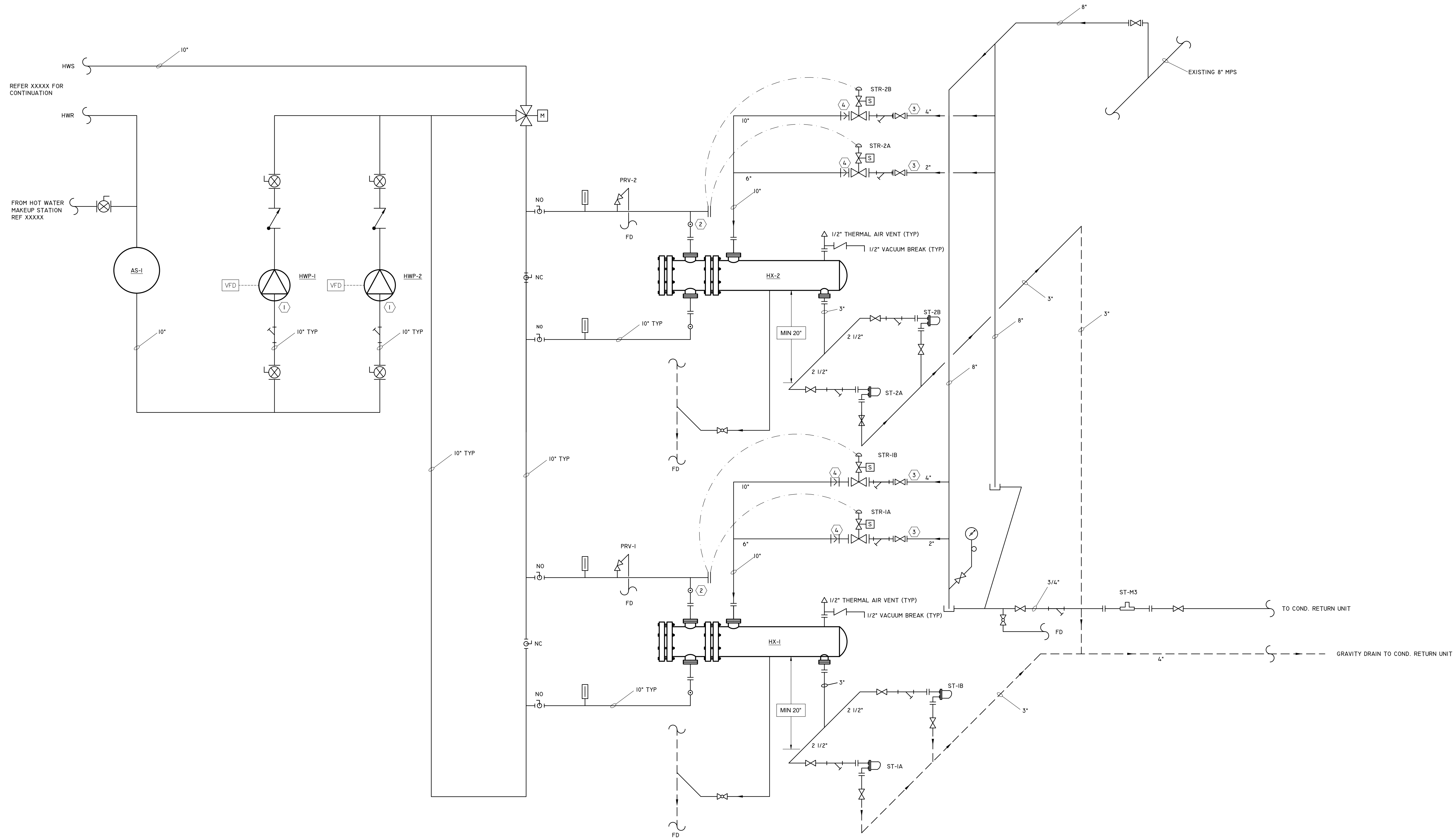
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2
1
1/2
0



- KEY NOTES:
- ① REFER 7/M801 FOR PUMP DETAIL.
 - ② PROVIDE (2) 3/4" T-O-L IN 10" BLIND FLANGE FOR TEMP PILOT SENSING ELEMENTS THERMAL WELLS. COORDINATE THERMAL WELL REQUIREMENTS WITH REGULATOR MRG.
 - ③ MOUNT STRAINERS BASKET LEGS IN THE HORIZONTAL POSITION.
 - ④ PROVIDE NOISE DIFFUSER. REFER TO DETAIL 5/M803.

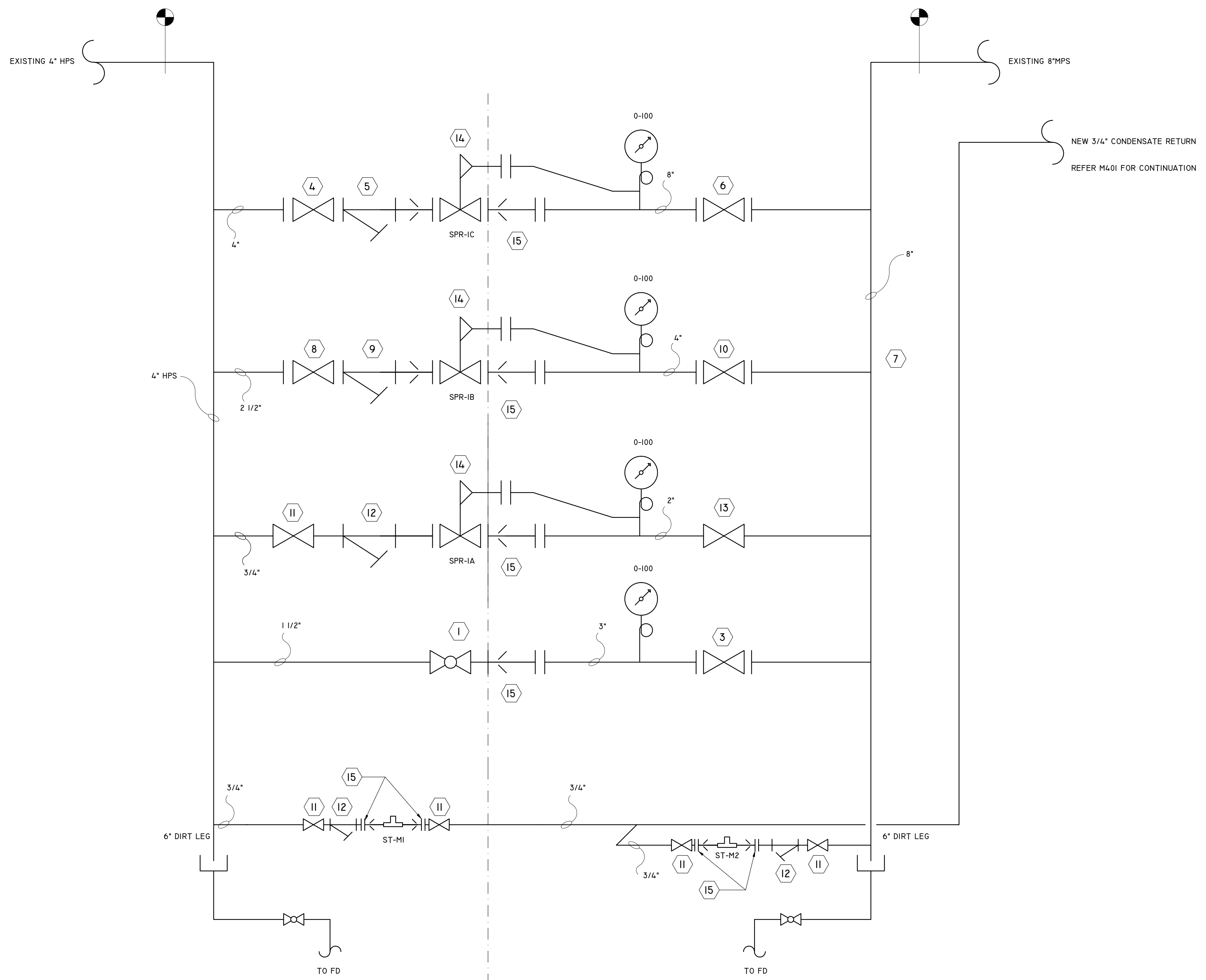
1 HEAT EXCHANGER STEAM TO HOT WATER DIAGRAM
SCALE: N.T.S.



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2
1
1/2
0



- KEYED NOTES:
- 1 PROVIDE 1 1/2" OS&Y GLOBE VALVE.
 - 2 PROVIDE NEW 3"x1/2" THREADED COMPANION FLANGED CONNECTION.
 - 3 PROVIDE 3" FLANGED OS & Y GATE VALVE.
 - 4 PROVIDE 4" FLANGED OS & Y GATE VALVE .
 - 5 PROVIDE 4" STRAINER. INSTALL STRAINER WITH BASKET IN HORIZONTAL POSITION.
 - 6 PROVIDE 8" OS & Y GATE VALVE.
 - 7 NOT USED.
 - 8 PROVIDE 2 1/2" FLANGED OS & Y GATE VALVE .
 - 9 PROVIDE 2 1/2" FLANGED STRAINER. INSTALL STRAINER WITH BASKET IN HORIZONTAL POSITION.
 - 10 PROVIDE 4" FLANGED OS & Y GATE VALVE.
 - 11 PROVIDE 3/4" THREADED OS & Y GATE VALVE.
 - 12 PROVIDE 3/4" THREADED STRAINER.
 - 13 PROVIDE 2" THREADED OS & Y GATE VALVE.
 - 14 PROVIDE PRESSURE REGULATOR VALVE AS SCHEDULED.
 - 15 PROVIDE NOISE DIFFUSER. REFER TO DETAIL 5/M803.

1 STEAM PRESSURE REDUCER DIAGRAM
SCALE: N.T.S.



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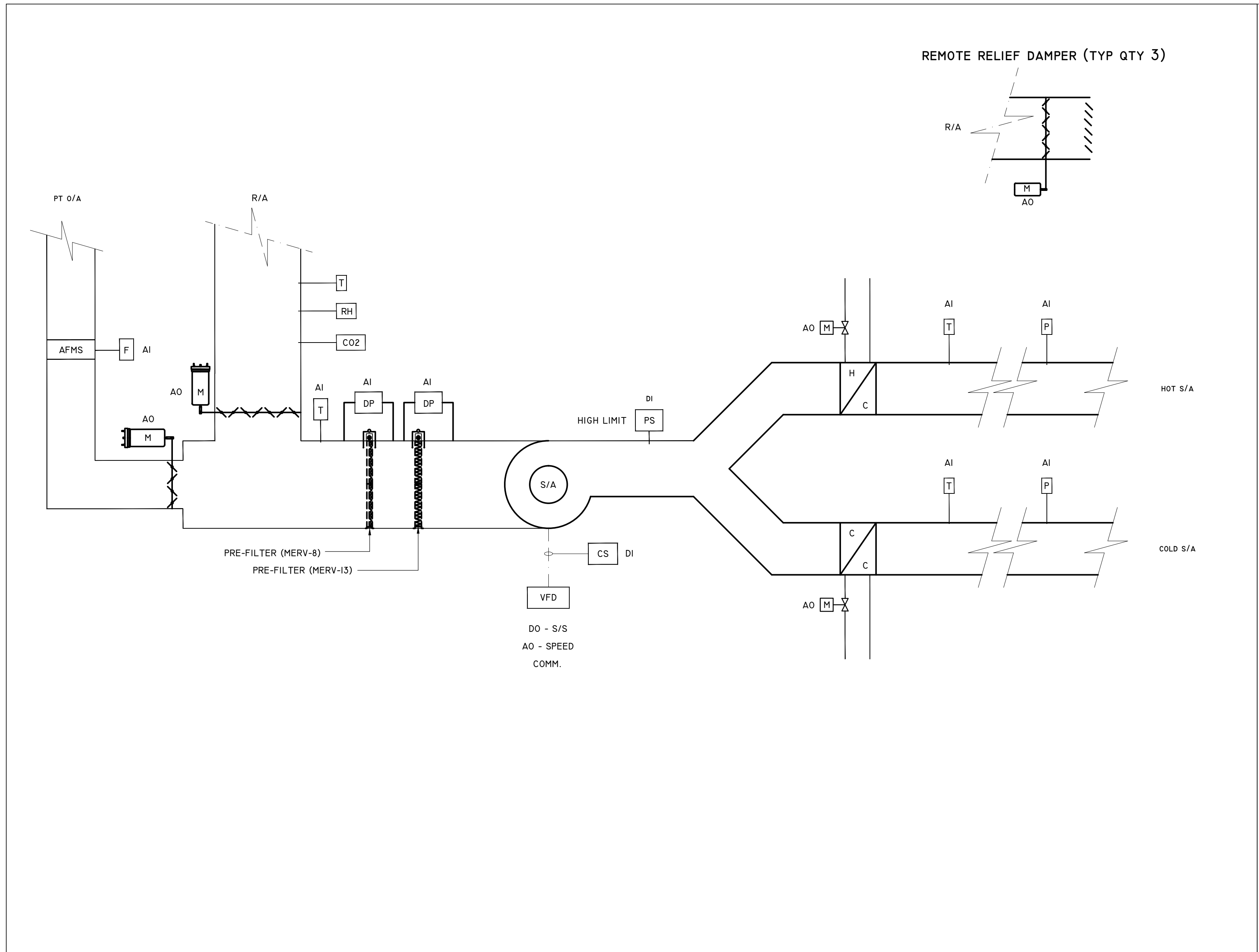
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PIPING DIAGRAM -
STEAM PRESSURE
REDUCER

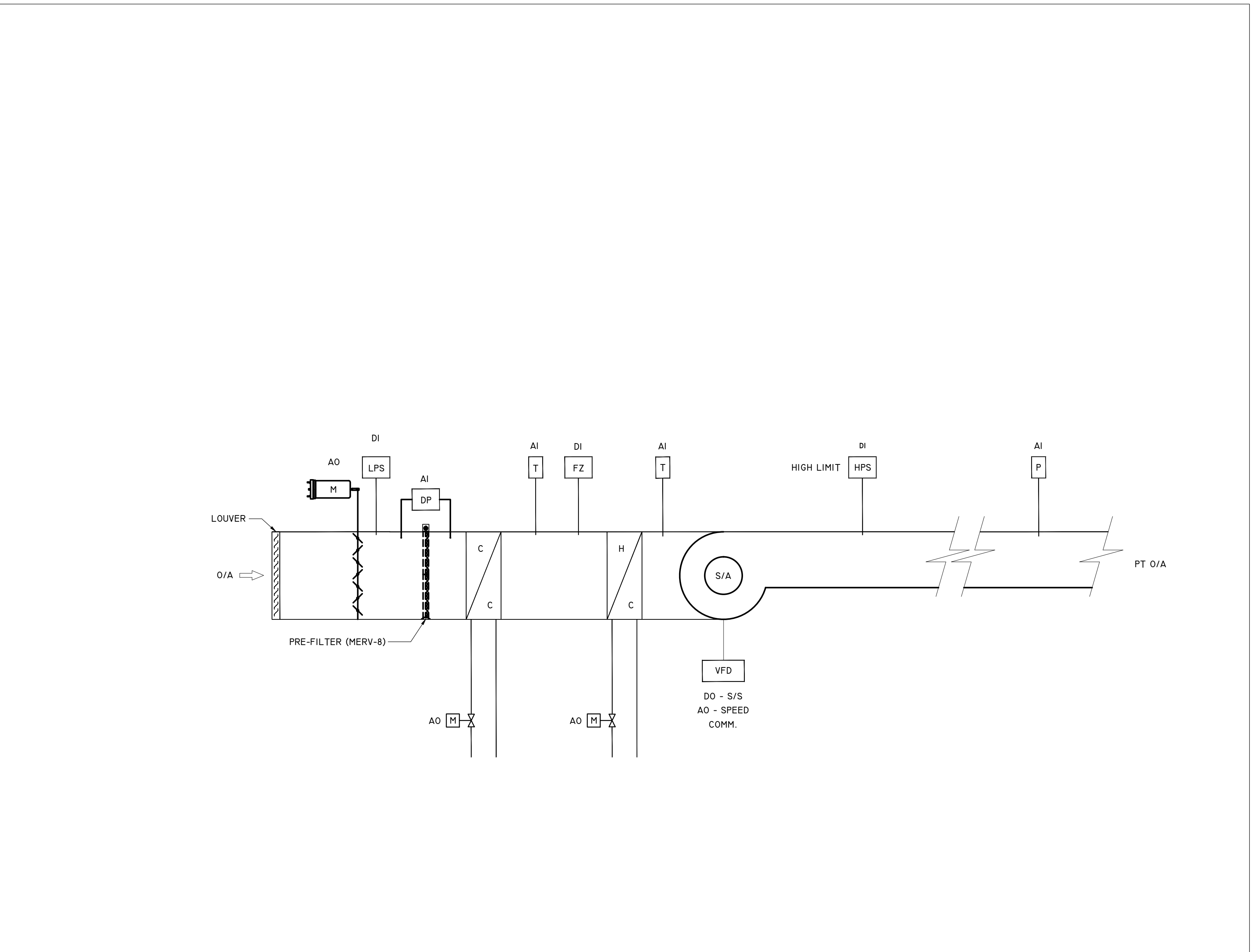
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M604
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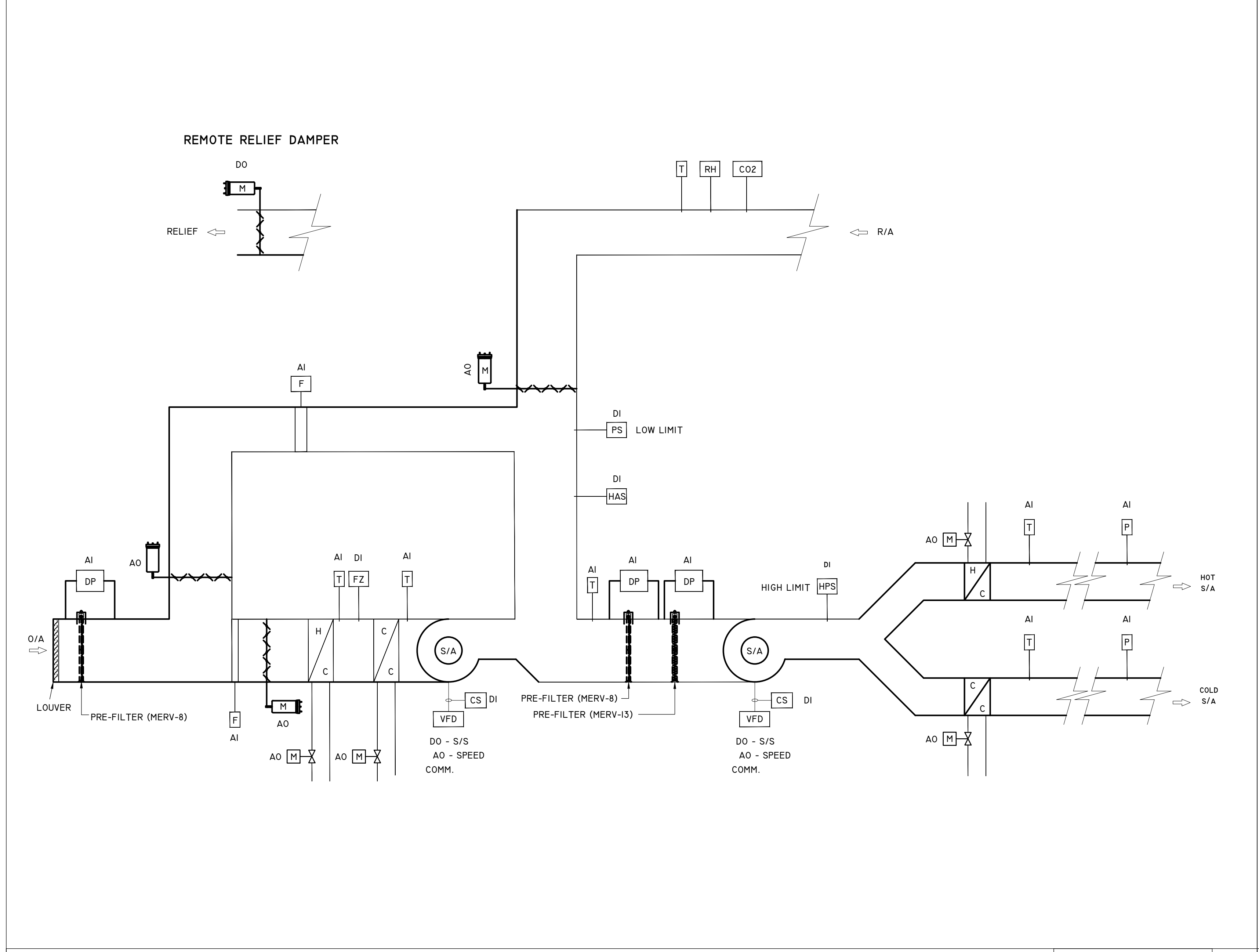
2
1
1/2
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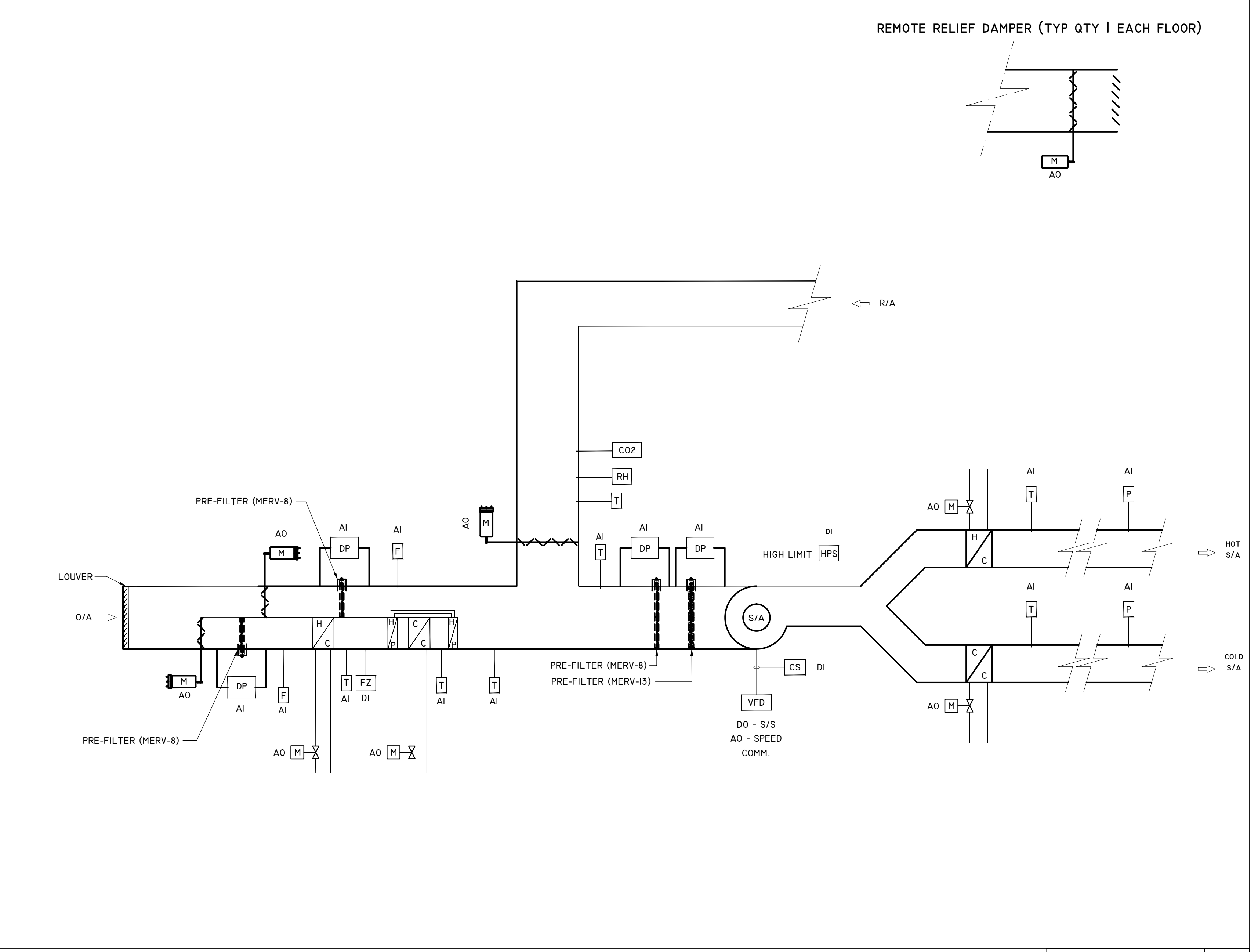
DUAL DUCT AHU CONTROL DIAGRAM - APPLICABLE FOR 2ND FLOOR AHU NOT TO SCALE |



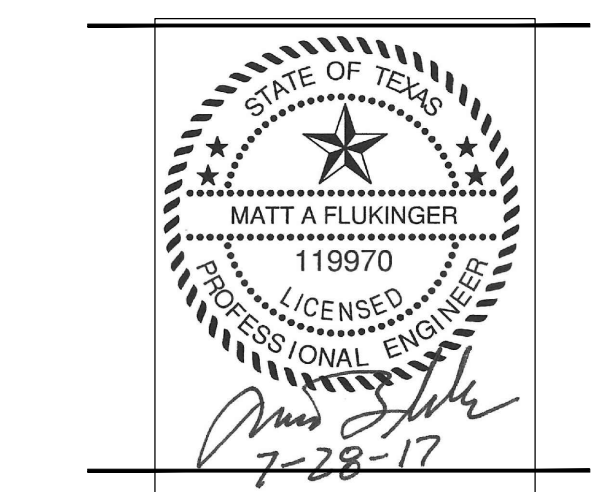
OAHU CONTROL DIAGRAM NOT TO SCALE |



DUAL DUCT AHU CONTROL DIAGRAM - APPLICABLE FOR 8TH TO 10TH FLOOR AHU - ALTERNATE ONLY NOT TO SCALE |



DUAL DUCT AHU CONTROL DIAGRAM - APPLICABLE FOR 3RD TO 7TH FLOOR AHU, 8TH TO 10TH FLOOR (BASE BID) NOT TO SCALE |



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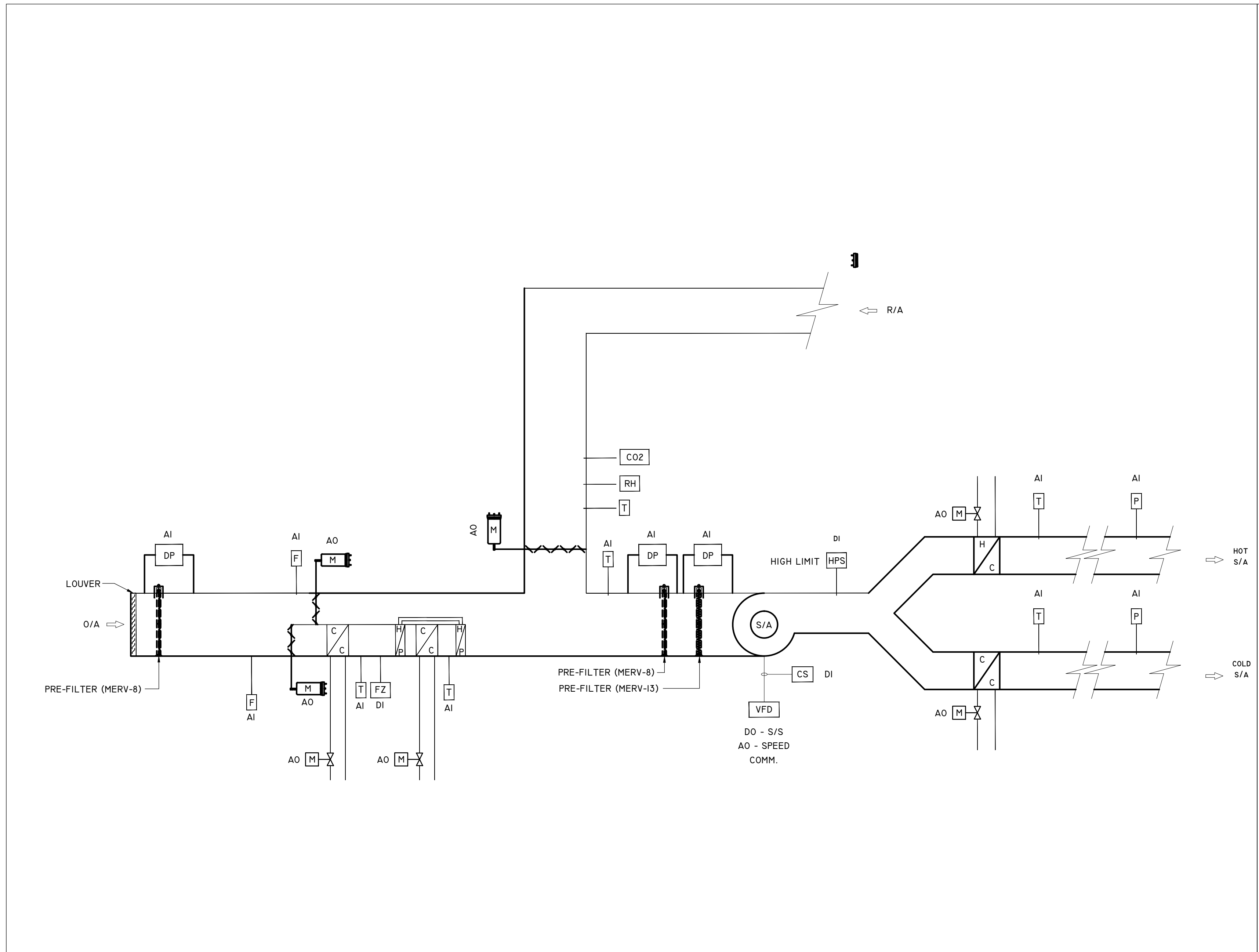
CONTROLS

Sheet

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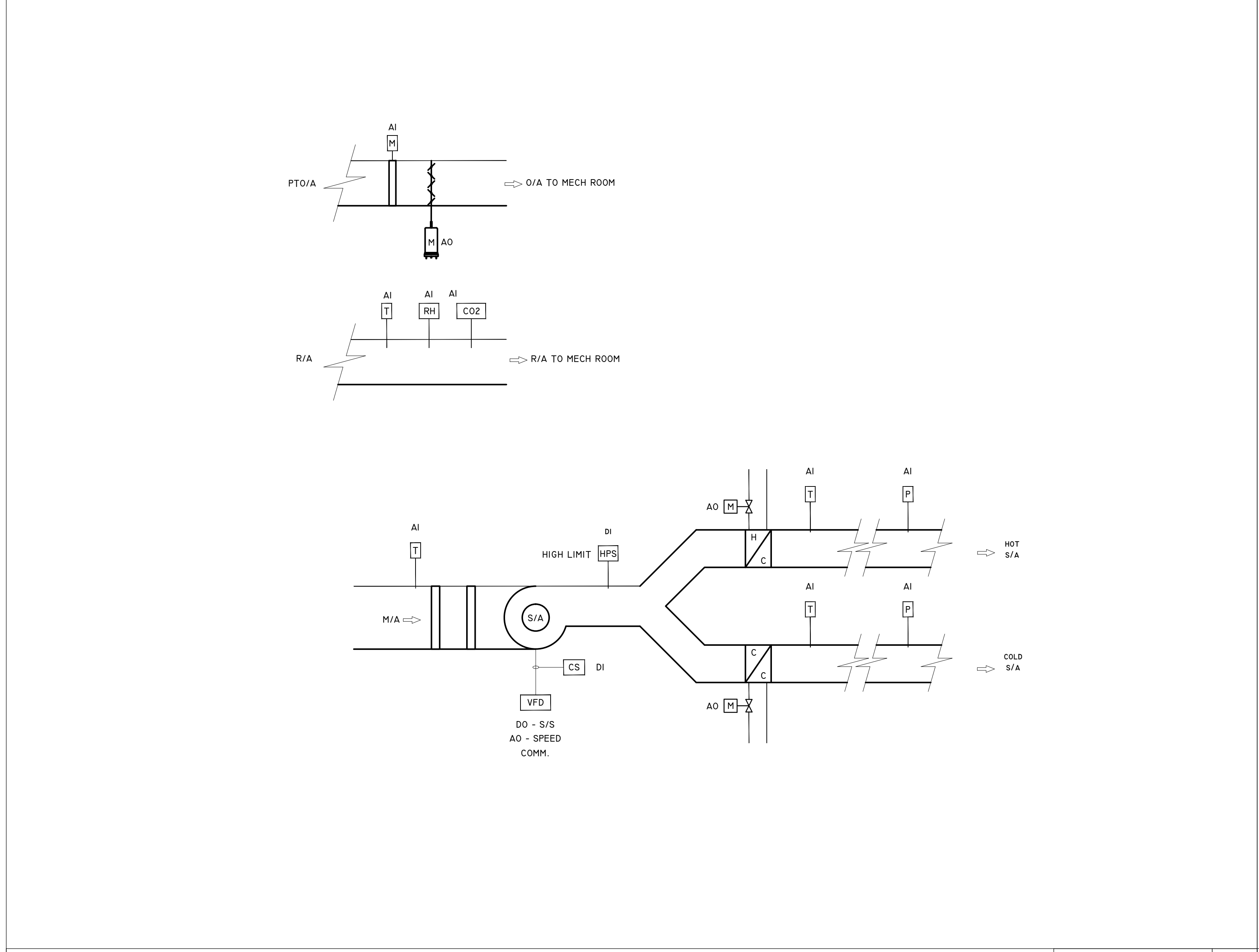
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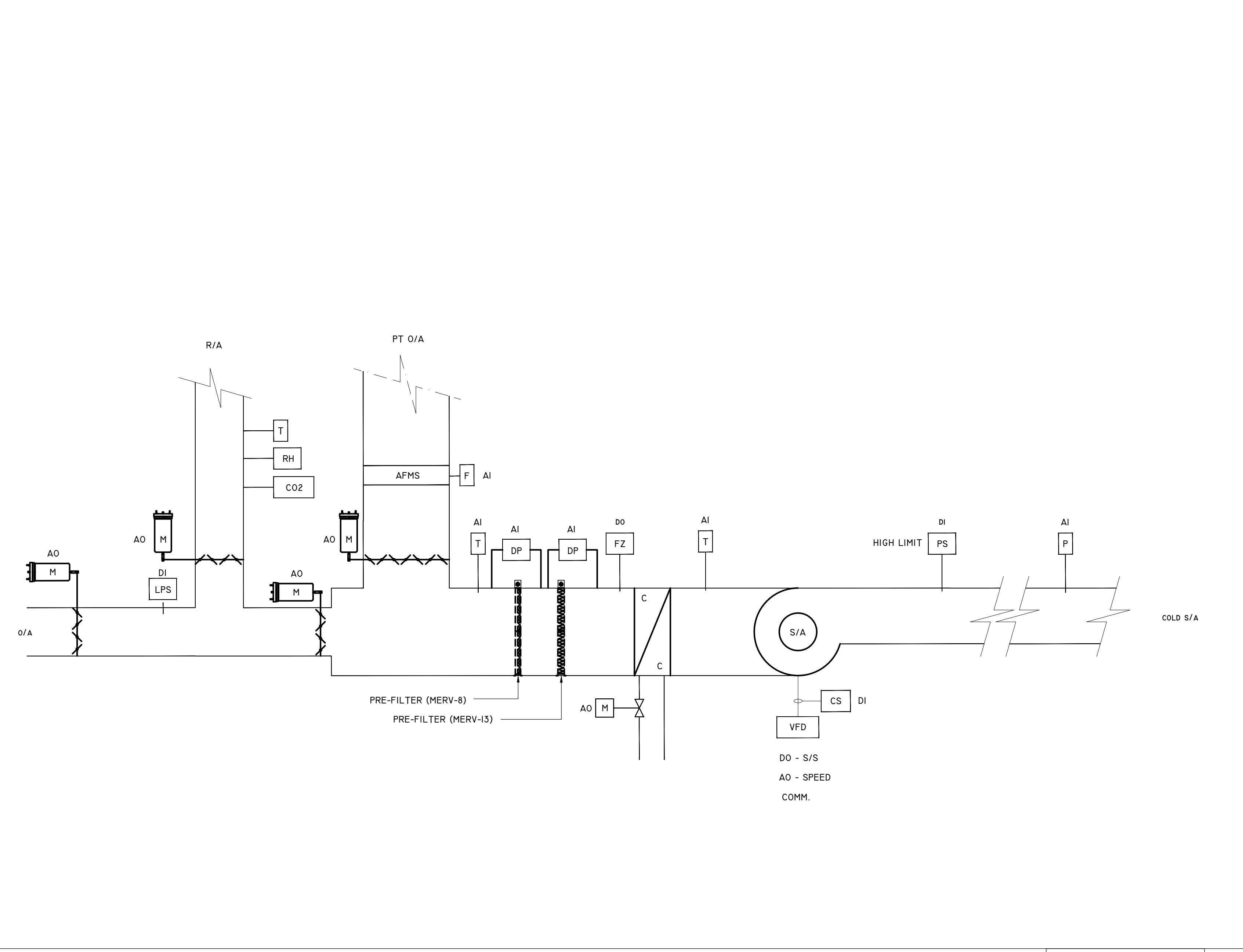
DUAL DUCT AHU CONTROL DIAGRAM - APPLICABLE FOR BASEMENT BE-I AHU NOT TO SCALE |



CONTROL SYMBOLS & LEGENDS NOT TO SCALE |



DUAL DUCT AHU CONTROL DIAGRAM - APPLICABLE FOR BASEMENT BW-I AHU NOT TO SCALE |



DUAL DUCT AHU CONTROL DIAGRAM - APPLICABLE FOR BASEMENT BH-I AHU NOT TO SCALE |



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05/31/2017	ISSUED FOR BID
07/28/2017	ADDENDUM 1

Sheet Information	
Date	31 MARCH 2017
Job Number	-
Drawn	KN, KT, CJT
Checked	IT, SK
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Title	

CONTROLS
 Sheet
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REVISIONS

05/31/2017	ISSUED FOR BID
07/28/2017	ADDENDUM 1

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SEQUENCE OF OPERATION.

ENGAGE HYDRONIC HEATING SYSTEM AUTOMATICALLY UPON CALL FOR DEMAND, USER DEFINED SCHEDULE, OR MANUAL OVER-RIDE.

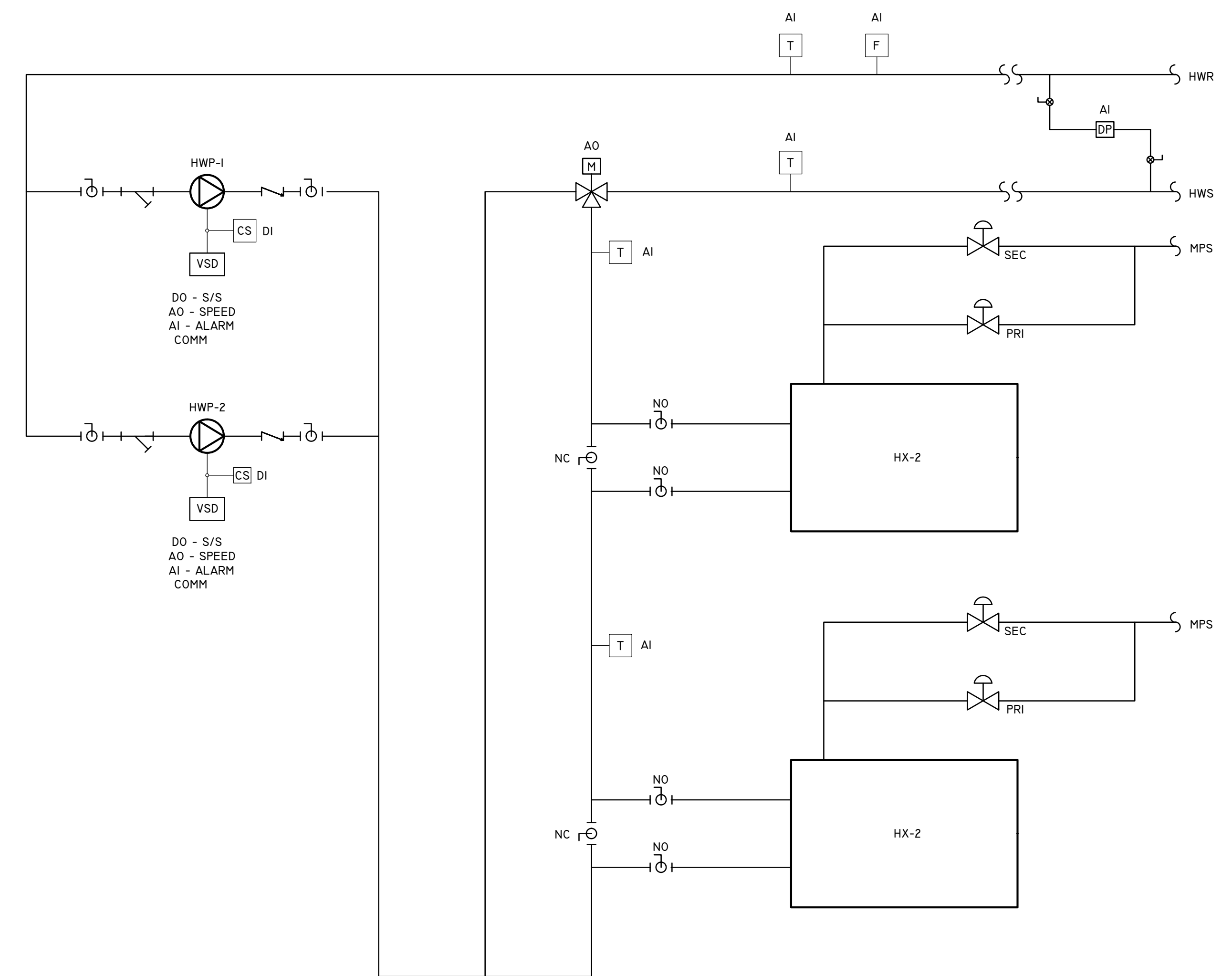
UPON SYSTEM ENGAGEMENT, ENGAGE PRIMARY HW PUMP AND VISE VERSA. MODULATE PUMP SPEED TO MAINTAIN DIFFERENTIAL HW PRESSURE ABOUT 15 PSIG SET POINT (ADJ). A DECREASE IN DIFFERENTIAL PRESSURE ACTS TO INCREASE PUMP SPEED AND VISE VERSA. DISENGAGE PRIMARY HW PUMP, ENGAGE SECONDARY HW PUMP, AND INITIATE ALARM UPON PERSISTENT STATUS FAILURE OF PRIMARY PUMP. ROTATE PRIMARY AND SECONDARY HWP DESIGNATIONS AUTOMATICALLY TO EQUALIZE ACCUMULATED RUN HOURS.

UPON HW SYSTEM ENGAGEMENT, ENGAGE HX-1 PRIMARY AND SECONDARY STEAM VALVE SOLENOIDS AS HW MIXING VALVE OPENS TO 5% (ADJ) FLOW THROUGH HEAT EXCHANGERS AND VISE VERSA. ENGAGE HX-2 PRIMARY AND SECONDARY STEAM VALVE SOLENOIDS AS HX-1 LEAVING WATER TEMP DROPS PERSISTENTLY BELOW 173F (ADJ). DISENGAGE HX-2 PRIMARY AND SECONDARY STEAM VALVE SOLENOIDS AS HX-1 LEAVING WATER TEMP RISES PERSISTENTLY ABOVE 178 F (ADJ).

MODULATE HW MIXING VALVE TO MAINTAIN HWS TEMP ABOUT HWS SETPOINT. A DECREASE IN HWS TEMP ACTS TO INCREASE FLOW THROUGH HEAT EXCHANGERS AND DECREASE BYPASS FLOW. AN INCREASE IN HWS TEMP ACTS TO DECREASE FLOW THROUGH HEAT EXCHANGERS AND INCREASE BYPASS FLOW. RESET HWS SETPOINT FROM 120F TO 180F AS O/A TEMP DECREASES FROM 60F TO 30F (ALL POINTS USER ADJ).

MONITOR AND DISPLAY ALL FIELD DEVICE INPUT AND OUTPUT VARIABLES. INITIATE ALARMS UPON ANY OF THE FOLLOWING CONDITIONS:

- HIGH HW SYSTEM DIFFERENTIAL PRESSURE
- LOW HW SYSTEM DIFFERENTIAL PRESSURE
- HIGH HX-1 LEAVING WATER TEMP
- LOW HX-1 LEAVING WATER TEMP
- HIGH HX-2 LEAVING WATER TEMP
- LOW HX-2 LEAVING WATER TEMP
- HIGH HWS TEMP
- LOW HWS TEMP
- HWP-1 STATUS FAILURE
- HWP-1 VSD ALARM
- HWP-2 STATUS FAILURE
- HWP-2 VSD ALARM

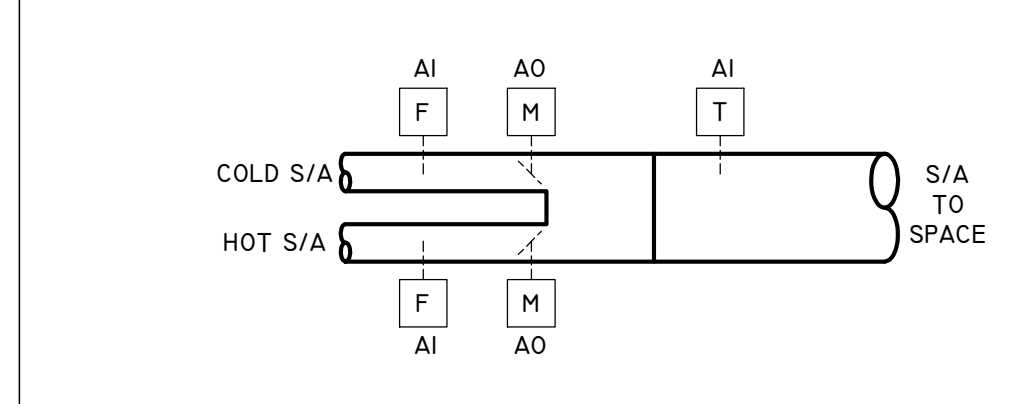
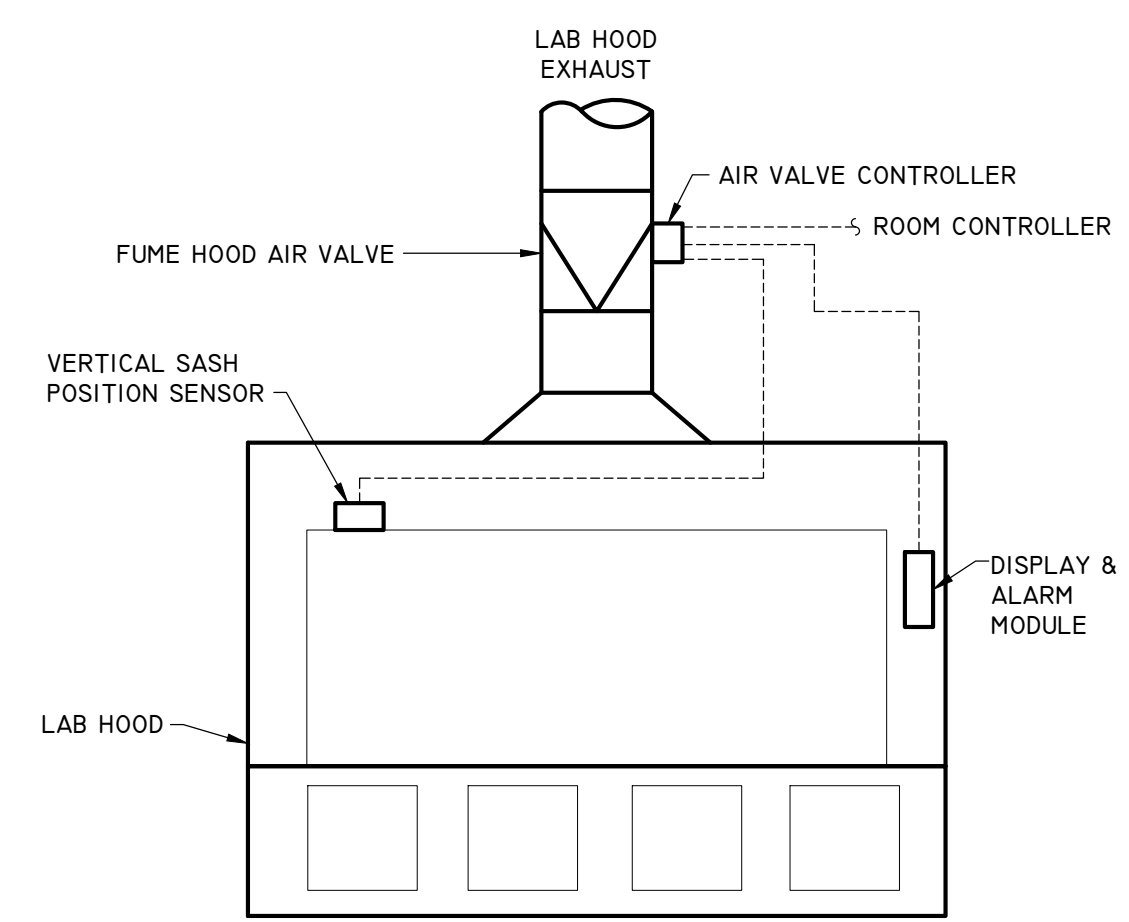


HOT WATER SYSTEM CONTROL DIAGRAM

NOT TO SCALE 3

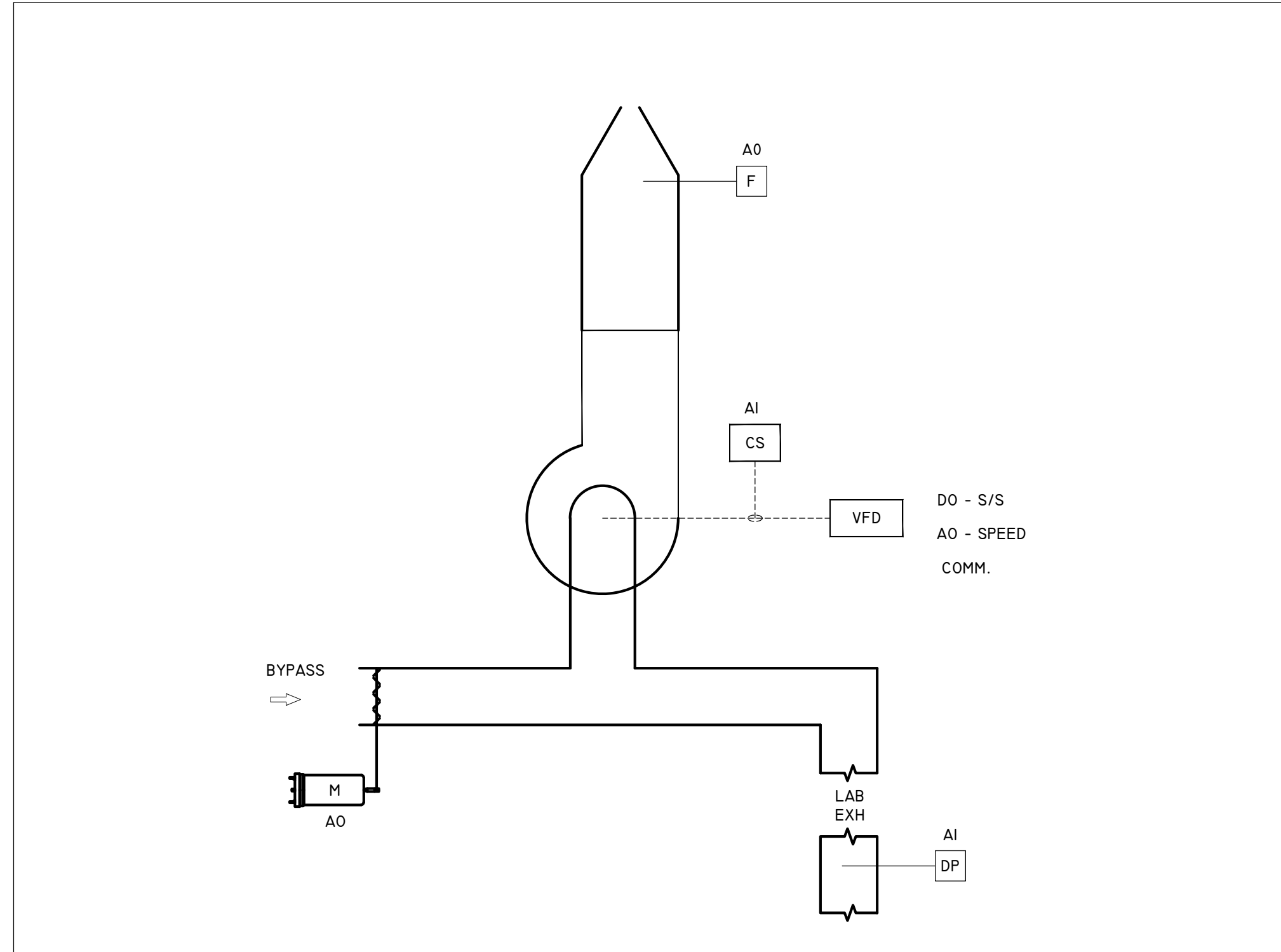
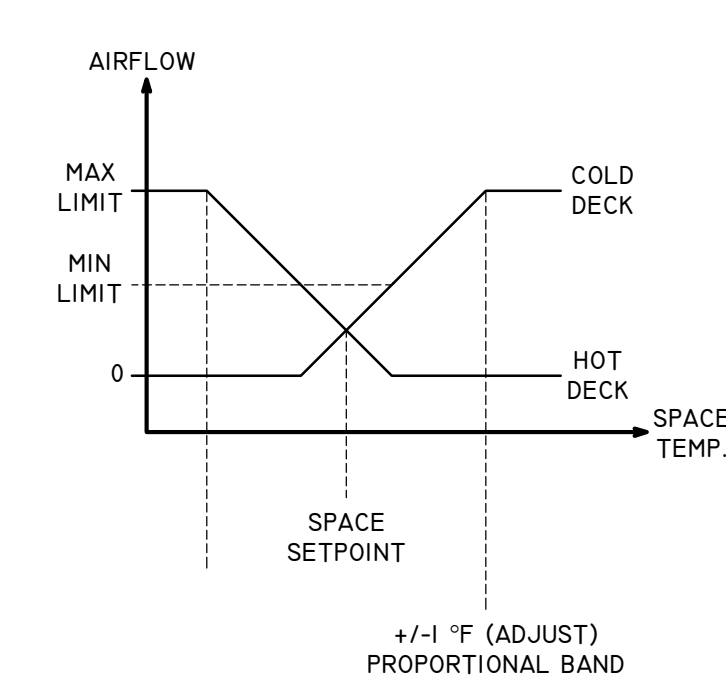
TYPICAL FUME HOOD CONTROL SYSTEM

MODULATE FUME HOOD EAV AIRFLOW TO MAINTAIN INSTANTANEOUS SASH OPENING AIR VELOCITY (AS INDICATED BY VERTICAL/HORIZONTAL SASH POSITION SENSOR ABOUT SET POINT. AN INCREASE IN SASH VELOCITY ACTS TO DECREASE AIR FLOW AND VISE VERSA. MODULATE EAV DAMPER POSITION TO MAINTAIN EAV AIRFLOW TARGET. AN INCREASE IN EAV AIRFLOW ACTS TO CLOSE EAV DAMPER AND VISE VERSA. DISPLAY SASH VELOCITY LOCALLY AND ALARM LOCALLY ON LOW OR HIGH SASH VELOCITY CONDITION. ALARM TO BAS ON PERSISTENT LOW AIR VELOCITY CONDITION.



NOTE:

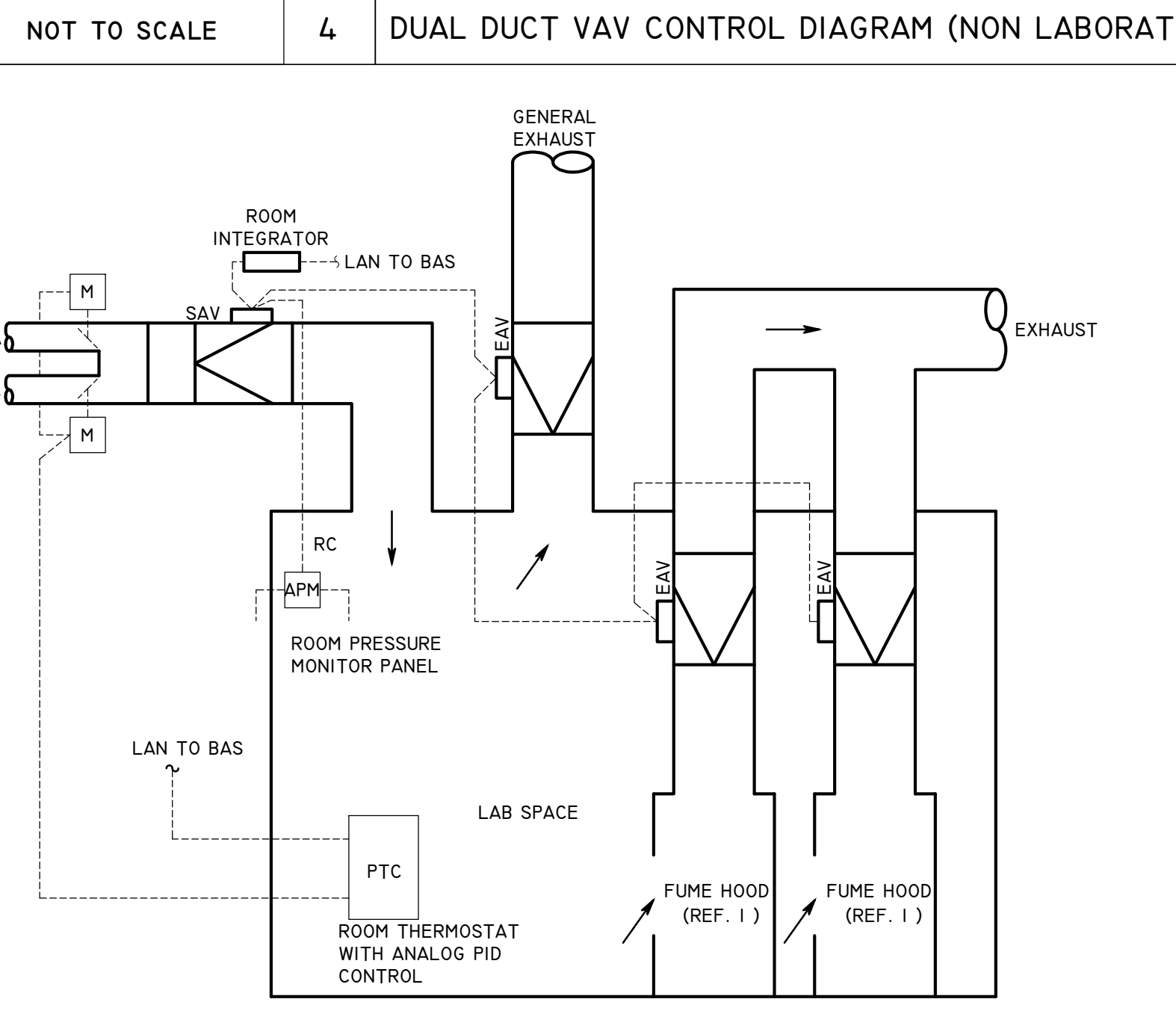
1. PROVIDE NEW DAMPER MOTOR ACTUATORS AT HOT & COLD DAMPERS, NEW FLOW SENSORS, NEW TEMP SENSORS, AND TERMINAL UNIT CONTROLLER FOR RETROFIT TERMINAL UNITS.
2. PROGRAM MINIMUM AIR FLOW LIMIT AT 30% OF MAX (20 CFM/PERSON) LIMIT UNLESS NOTED OTHERWISE.
3. PROGRAM MAXIMUM LIMIT PER TERMINAL UNIT SCHEDULE.
4. REF. PLANS FOR T STATE LOCATION.



EF-7-1 & 7-2 CONTROL DIAGRAM

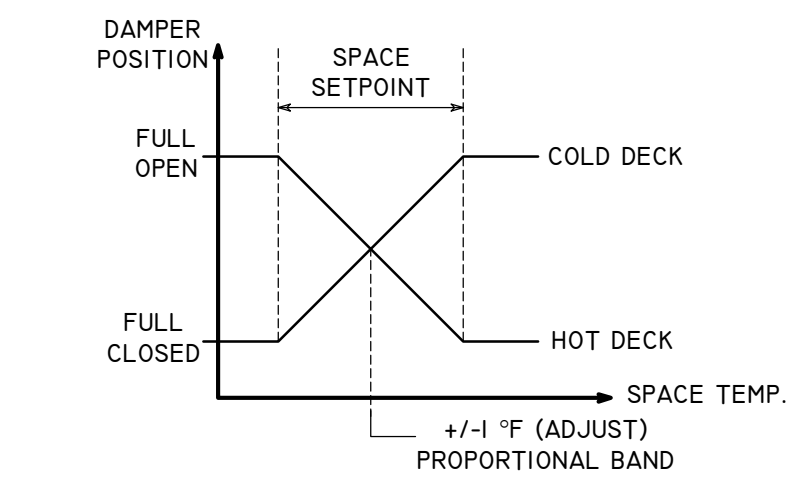
NOT TO SCALE 6

TYPICAL LABORATORY CONTROL SEQUENCES WITH FUME HOOD(S)



TYPICAL LABORATORY CONTROL SEQUENCES WITHOUT FUME HOODS

MODULATE ROOM EXHAUST EAV AIRFLOW TO EQUAL THE INSTANTANEOUS SUM OF S/A SAV AIRFLOW, PLUS A FIXED OFFSET OF 200 CFM PER DOWNWAY LEADING INTO THE LAB. MONITOR DIFFERENTIAL PRESSURE BETWEEN THE LAB AND SURROUNDING ACCESS CORRIDOR. ALARM ON PERSISTENT LOW CONDITION. MONITOR ALL SAV AND EAV'S AND ALARM TO BAS ON FAULT CONDITION.



MODULATE HOOD EXHAUST AIR VALVES PER 4/M703.

MODULATE GENERAL EXHAUST AIR VALVES SUCH THAT HOOD EXHAUST AIRFLOW PLUS GENERAL EXHAUST AIRFLOW EQUALS CONSTANT TOTAL ROOM EXHAUST VALUE. A DECREASE IN HOOD AIRFLOW ACTS TO INCREASE GENERAL EXHAUST AIRFLOW AND VISE VERSA. MODULATE GENERAL EXHAUST EAV DAMPER TO MAINTAIN GENERAL EXHAUST AIRFLOW. AN INCREASE IN GENERAL EXHAUST AIRFLOW ACTS TO CLOSE THE GENERAL EXHAUST EAV DAMPER AND VISE VERSA. REFERENCE AIRFLOW DIAGRAMS FOR OCCUPIED AND UNOCCUPIED TOTAL ROOM EXHAUST VALUES. ALARM ON PERSISTENT HIGH OR LOW TOTAL ROOM EXHAUST AIRFLOW.

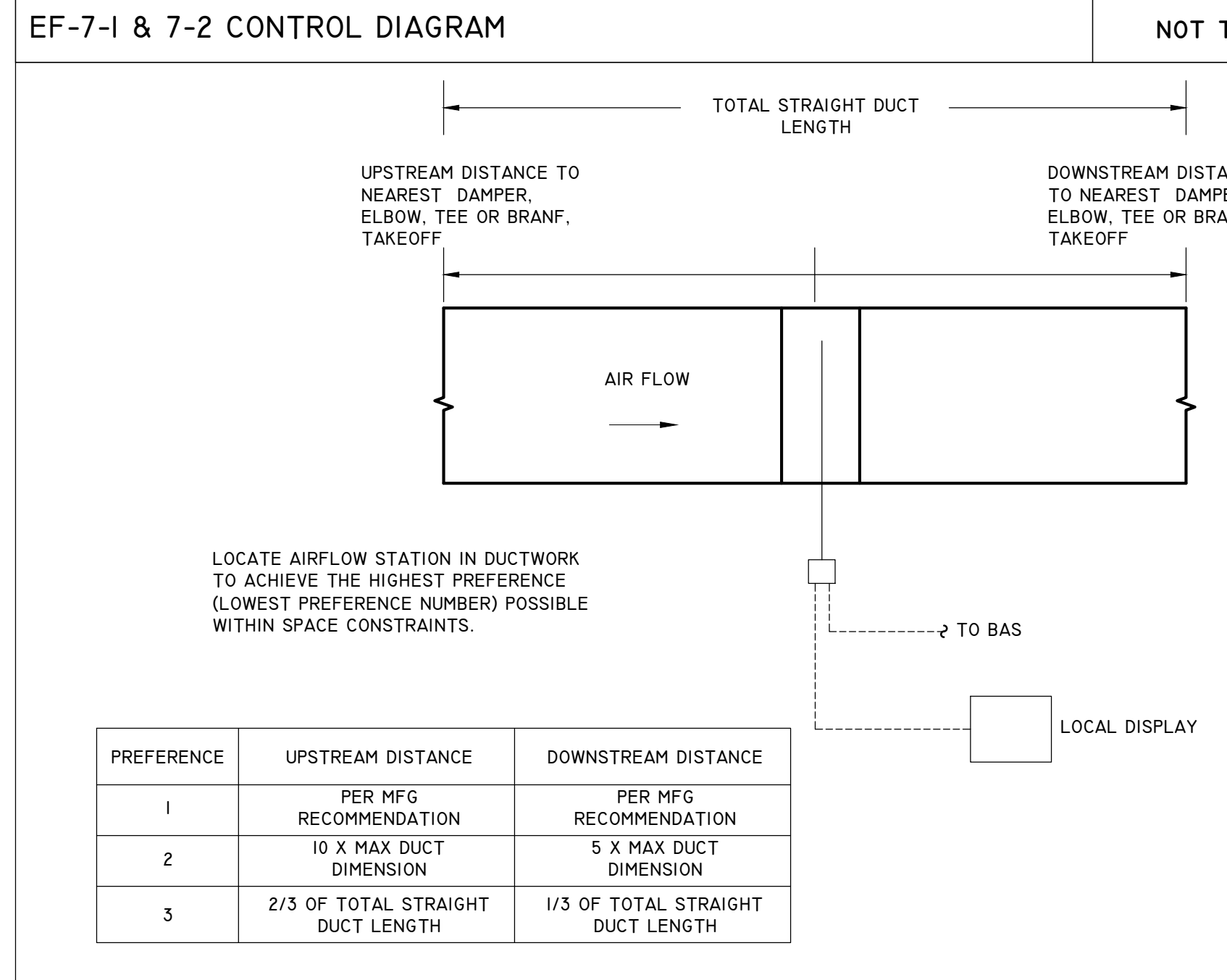
MODULATE SUPPLY AIR VALVE SUCH THAT SUPPLY AIRFLOW EQUALS THE SUM OF HOOD EXHAUST AIRFLOWS PLUS THE GENERAL EXHAUST AIRFLOW MINUS A FIXED OFFSET. PROGRAM THE INITIAL DEFAULT VALUE OF THE FIXED OFFSET EQUAL TO THE NUMBER OF DOORS INTO THE LAB MULTIPLIED BY 200 CFM EACH. MODULATE THE SUPPLY AIR VALVE DAMPER TO MAINTAIN SUPPLY AIR FLOW. AN INCREASE IN AIRFLOW ACTS TO CLOSE THE DAMPER AND VISE VERSA.

MONITOR AND DISPLAY ROOM DIFFERENTIAL PRESSURE WITH RESPECT TO ADJACENT CORRIDOR. ALARM LOCALLY ON PERSISTENT HIGH OR LOW DIFFERENTIAL PRESSURE. DISPLAY DIAGNOSTIC AIRFLOW DATA AT MONITORING PANEL.

MODULATE TERMINAL UNIT AIR DAMPERS TO MAINTAIN SPACE TEMPERATURE ABOUT ADJUSTABLE SETPOINT. AN INCREASE IN SPACE TEMPERATURE ACTS TO OPEN THE COLD SUPPLY AIR DAMPER AND VISE VERSA. MODULATE HOT SUPPLY AIR DAMPER SIMULTANEOUSLY INVERSELY PROPORTIONAL TO COLD SUPPLY AIR DAMPER WITHOUT OFFSET. DISPLAY LOCAL SPACE TEMPERATURE AND SETPOINT AT ROOM THERMOSTAT. ALARM ON PERSISTENT HIGH OR LOW TEMPERATURE.

INTERFACE LOCAL LABORATORY AIRFLOW, PRESSURE, AND TEMPERATURE CONTROLS TO FACILITY LOCAL AREA NETWORK. INTEGRATE MONITORING AND DIAGNOSTIC DATA INTO BUILDING AUTOMATION GRAPHICAL USER INTERFACE.

FOR SAV-BI ONLY: MODULATE REHEAT COIL TO MAINTAIN SPACE TEMP ABOUT SET POINT. A DECREASE IN SPACE TEMP ACTS TO INCREASE HOT WATER FLOW AND VISE VERSA.



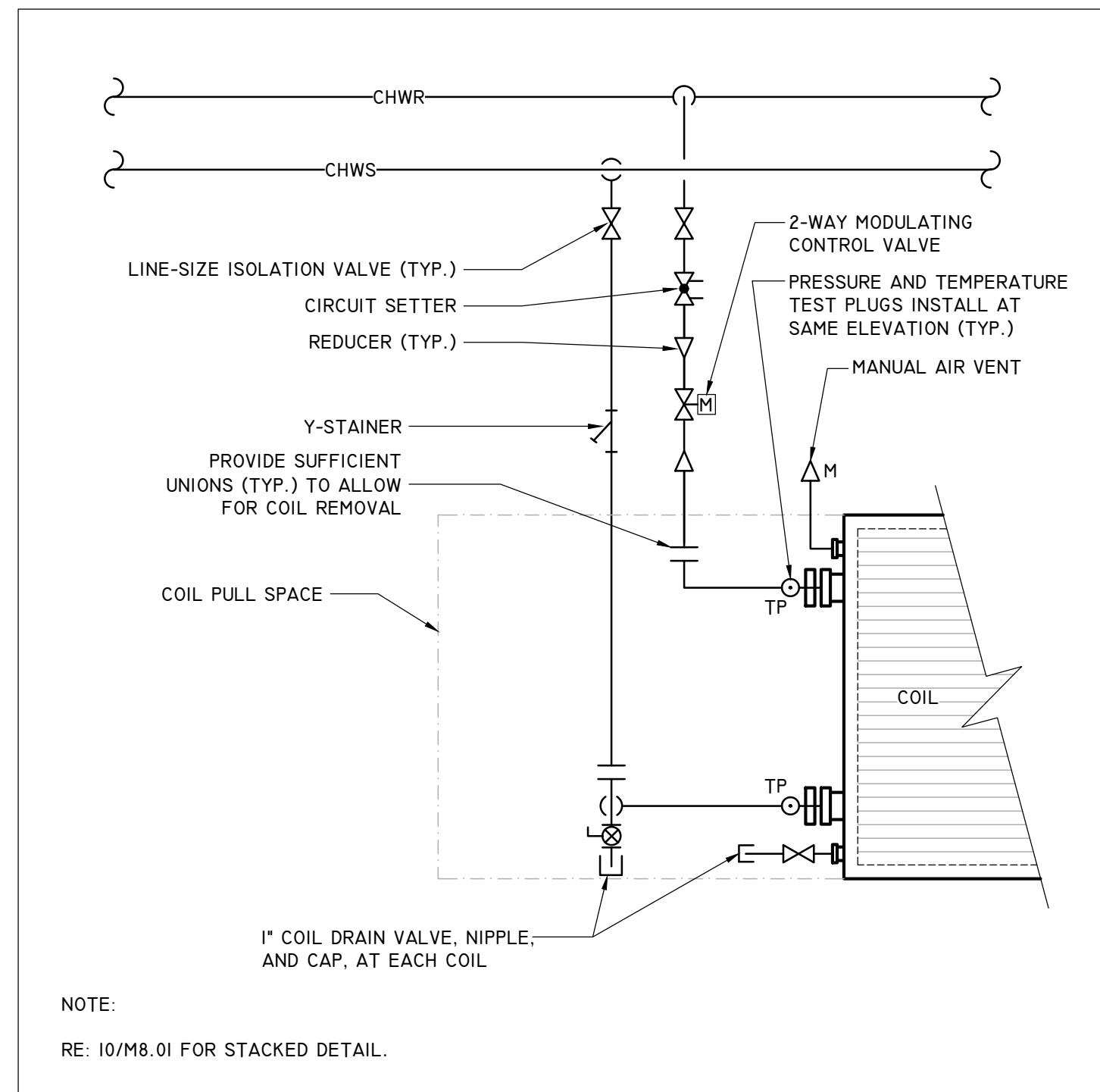
AIR FLOW STATION INSTALLATION

NOT TO SCALE 5

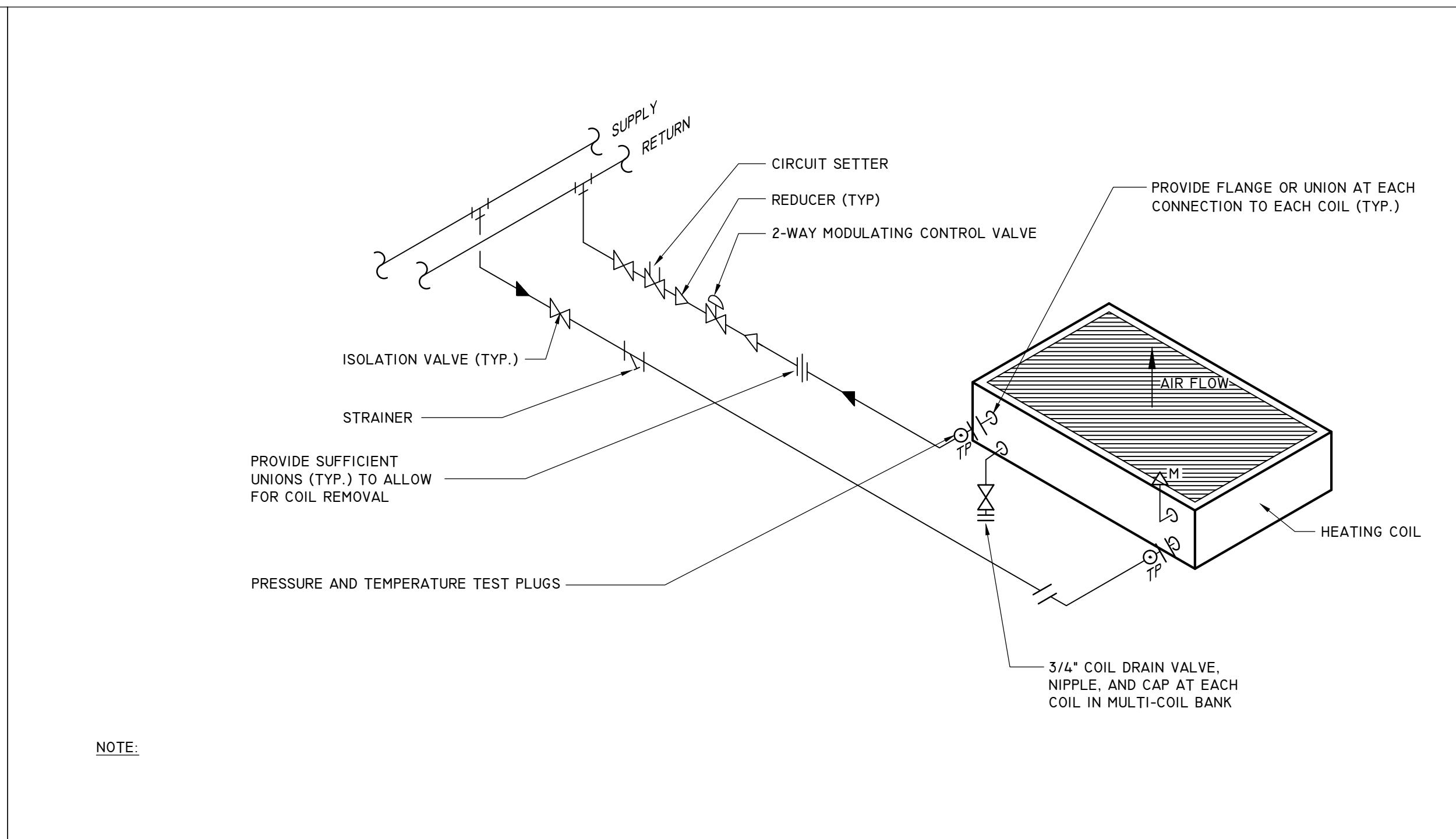
TYPICAL LABORATORY CONTROL WITH FUME HOODS

NOT TO SCALE 1

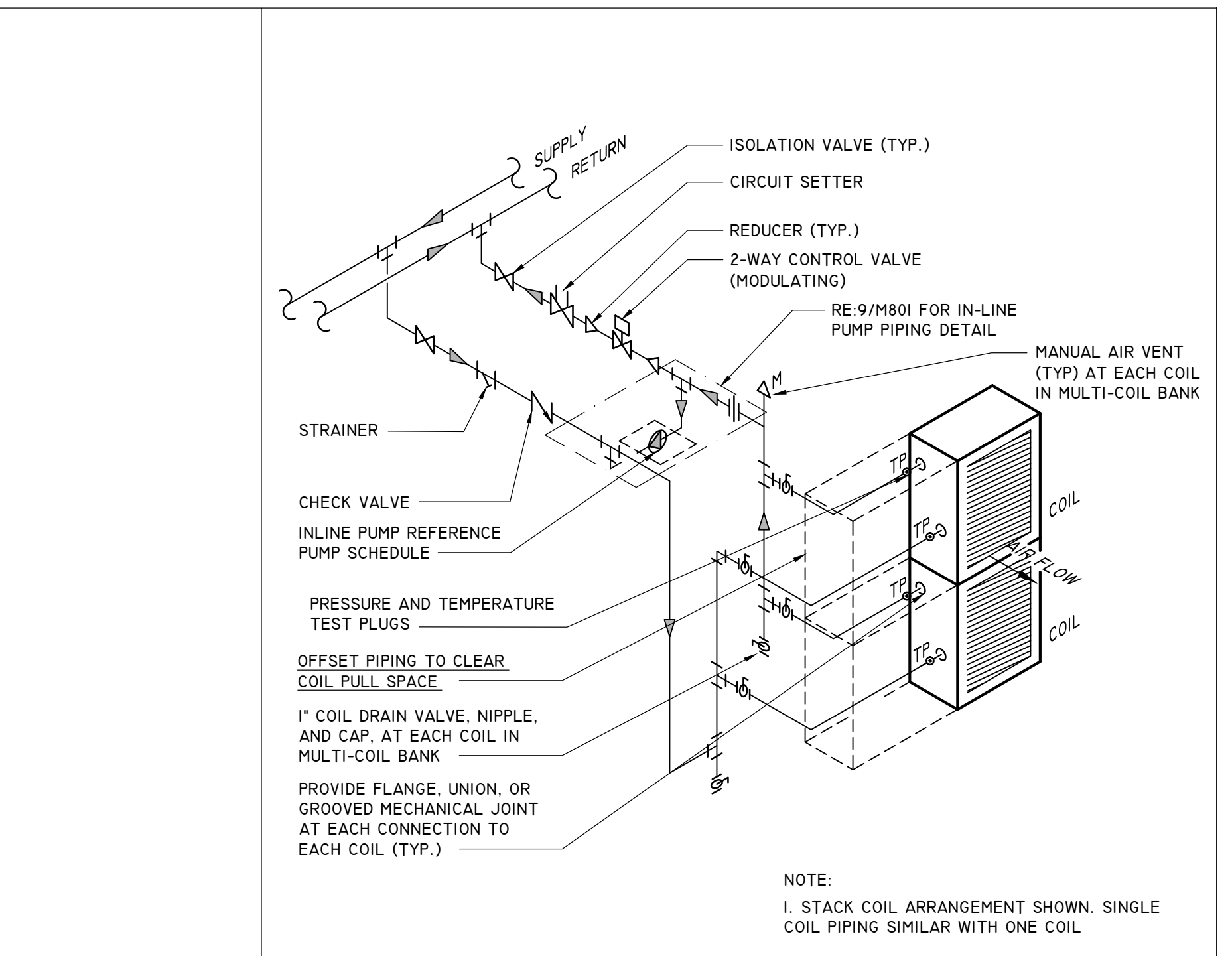
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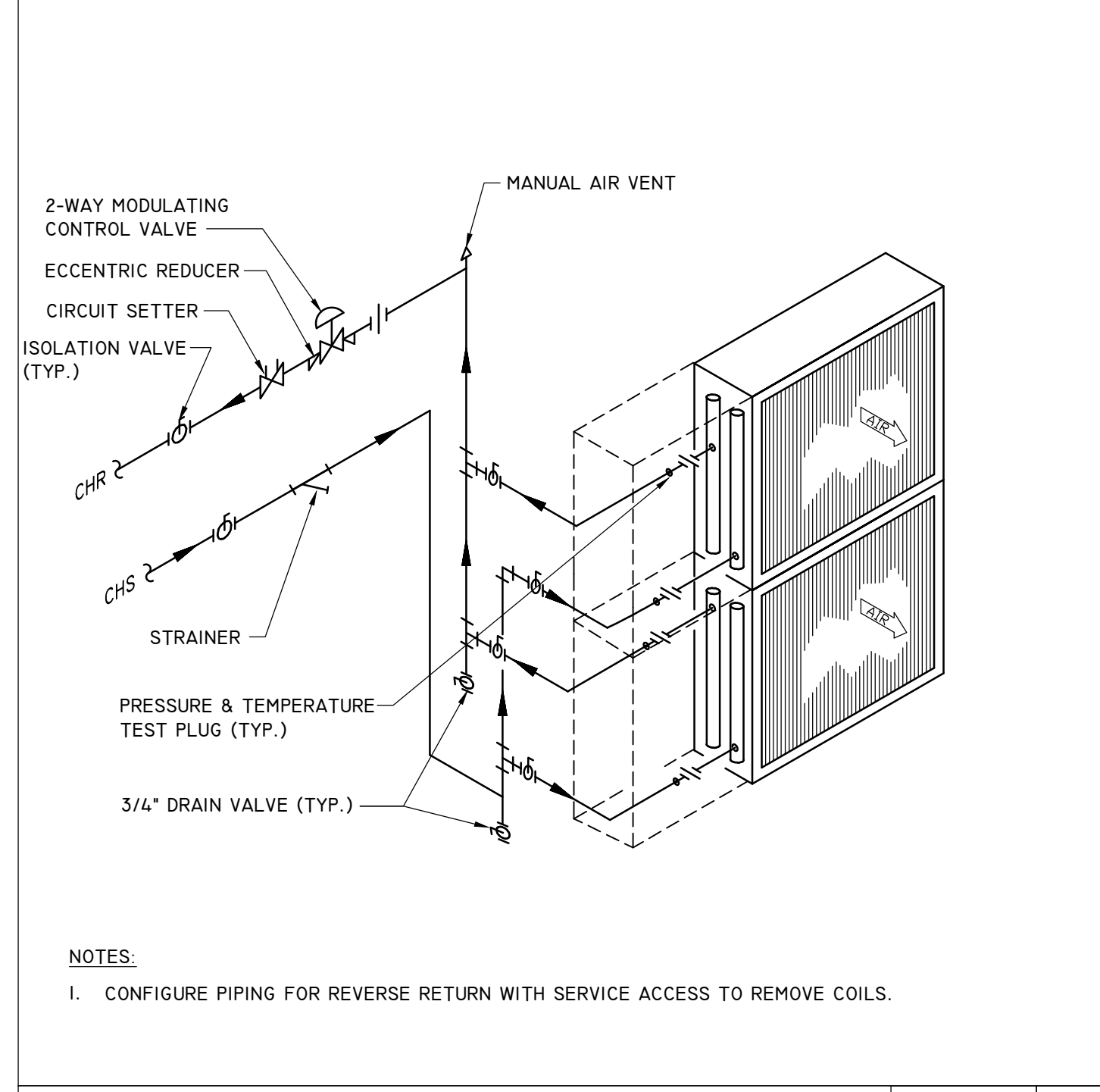
COOLING COIL PIPING DETAIL NOT TO SCALE II



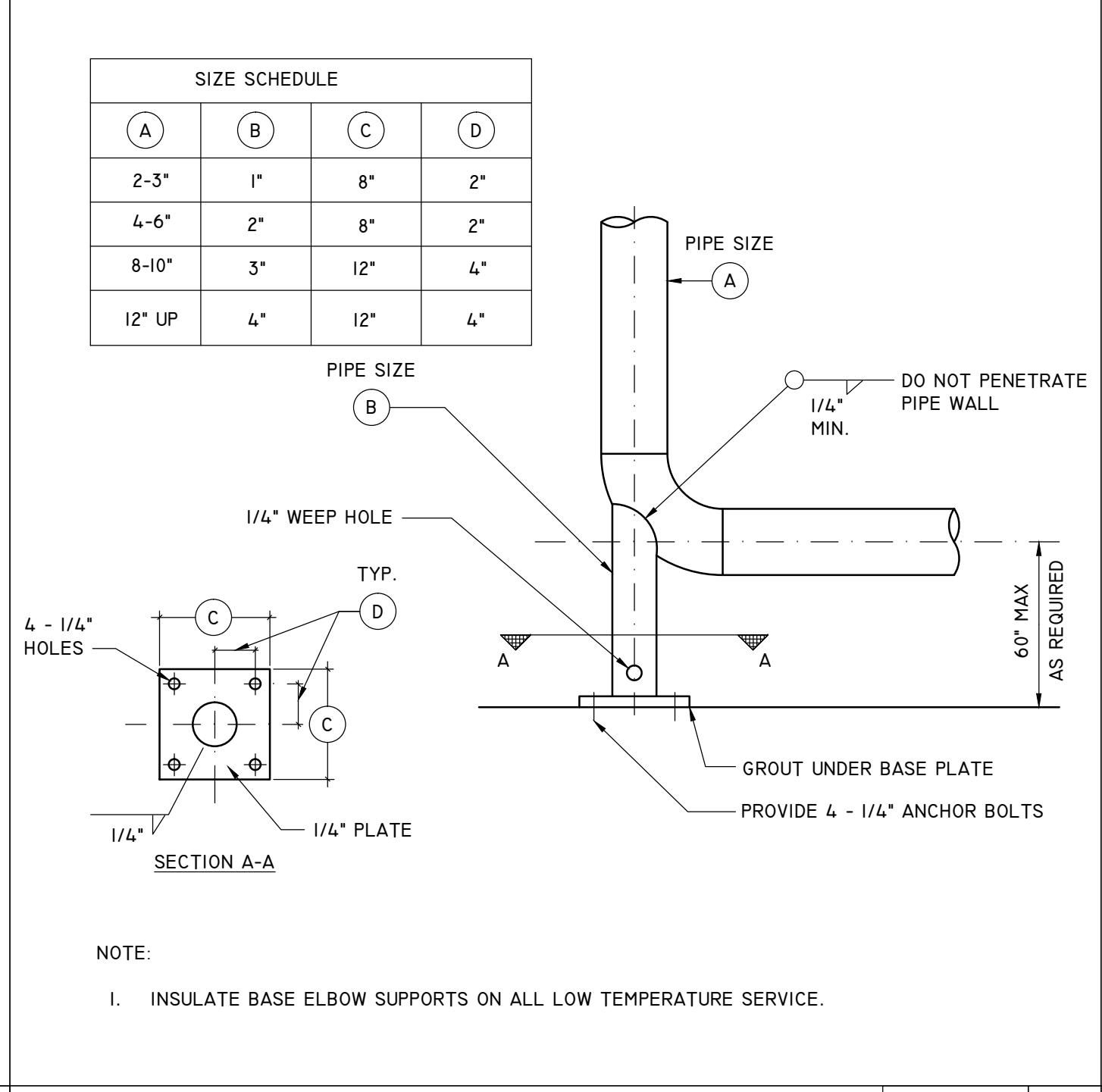
VERTICAL DISCHARGE HEATING COIL PIPING DETAIL NOT TO SCALE 6



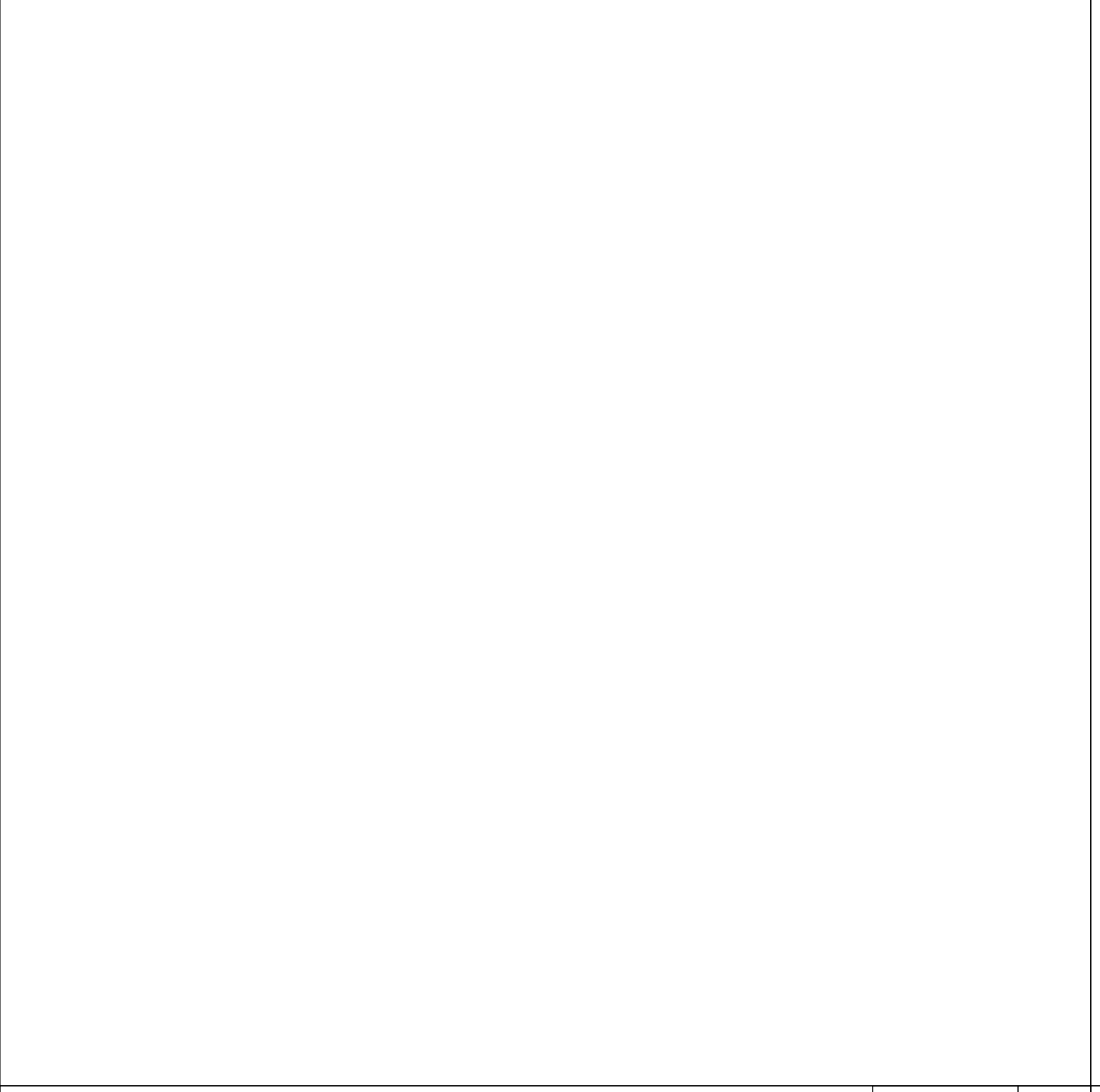
PREHEAT COIL WITH FREEZE PROTECTION PUMP NTS 3



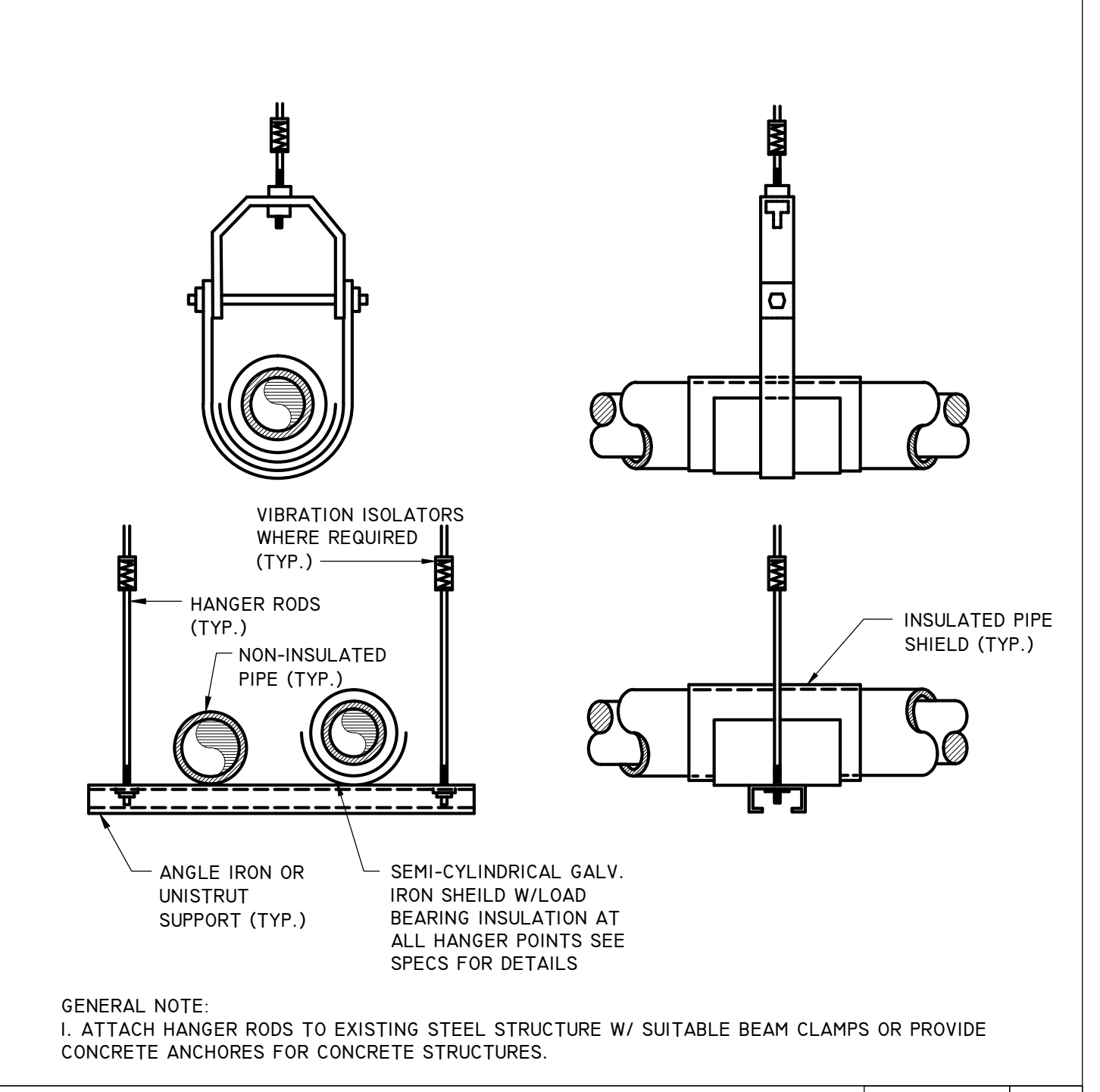
STACKED COIL PIPING DETAILS NOT TO SCALE 10



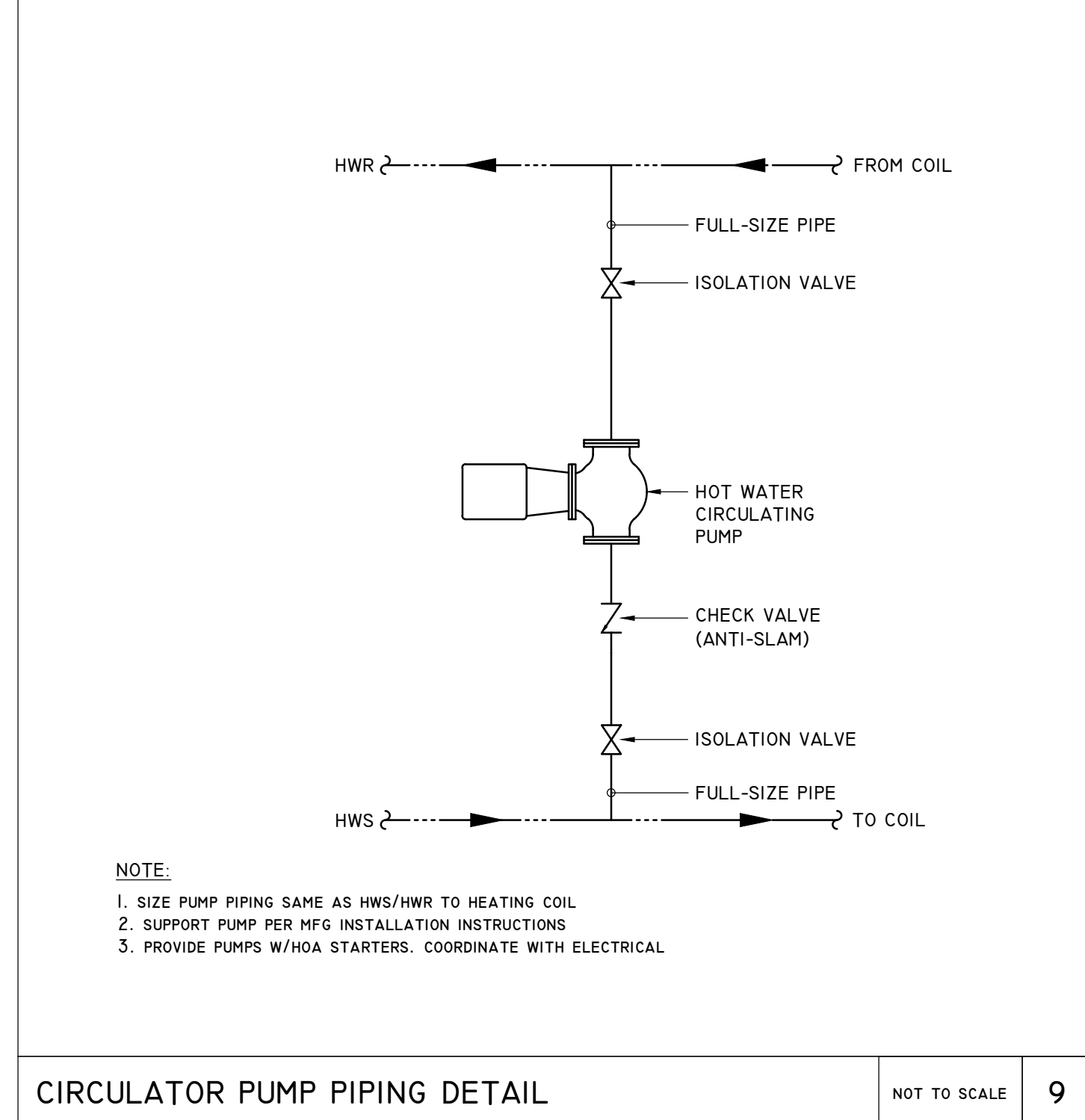
BASE ELBOW SUPPORT DETAIL NOT TO SCALE 8



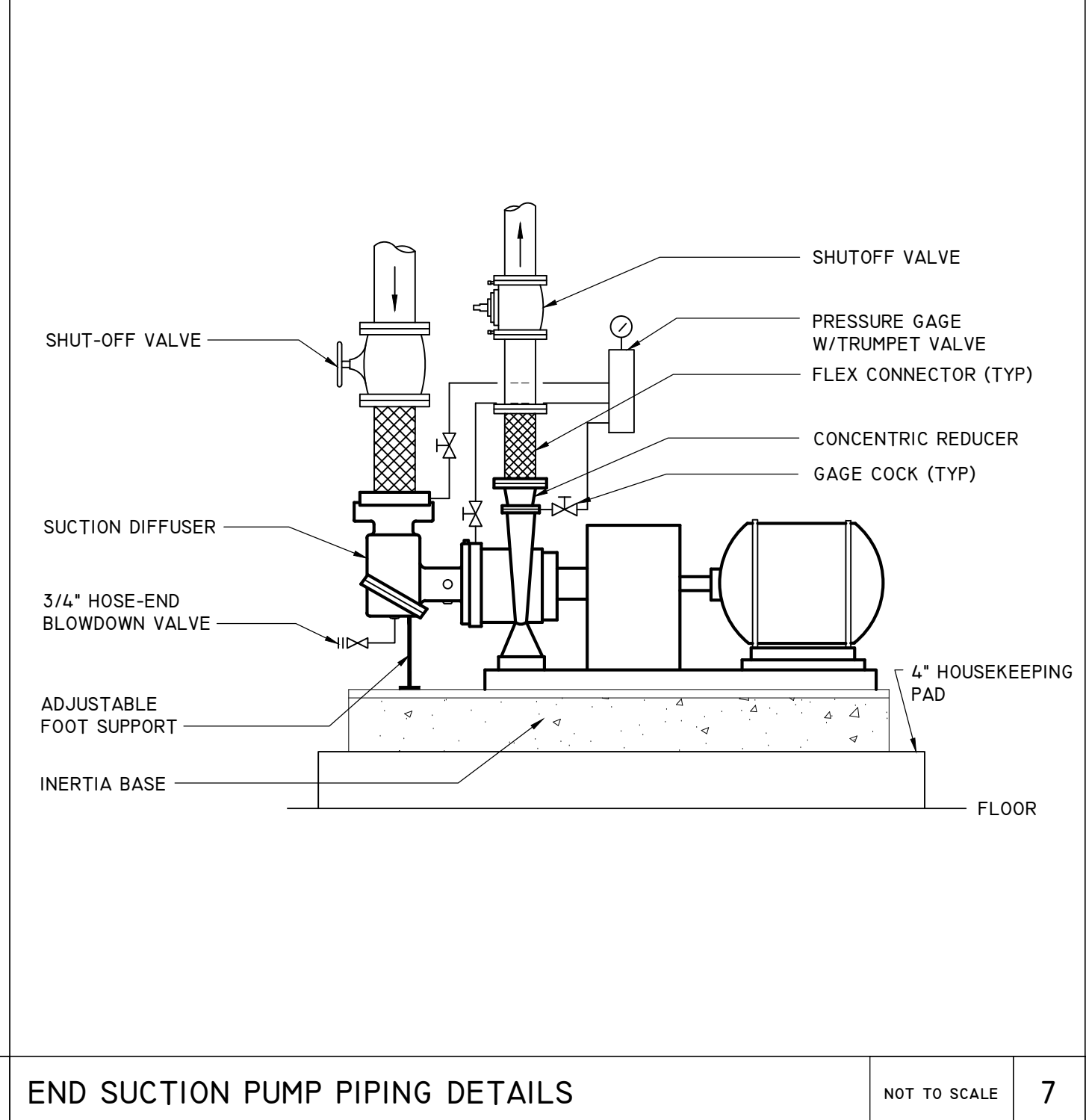
NOT USED NOT TO SCALE 5



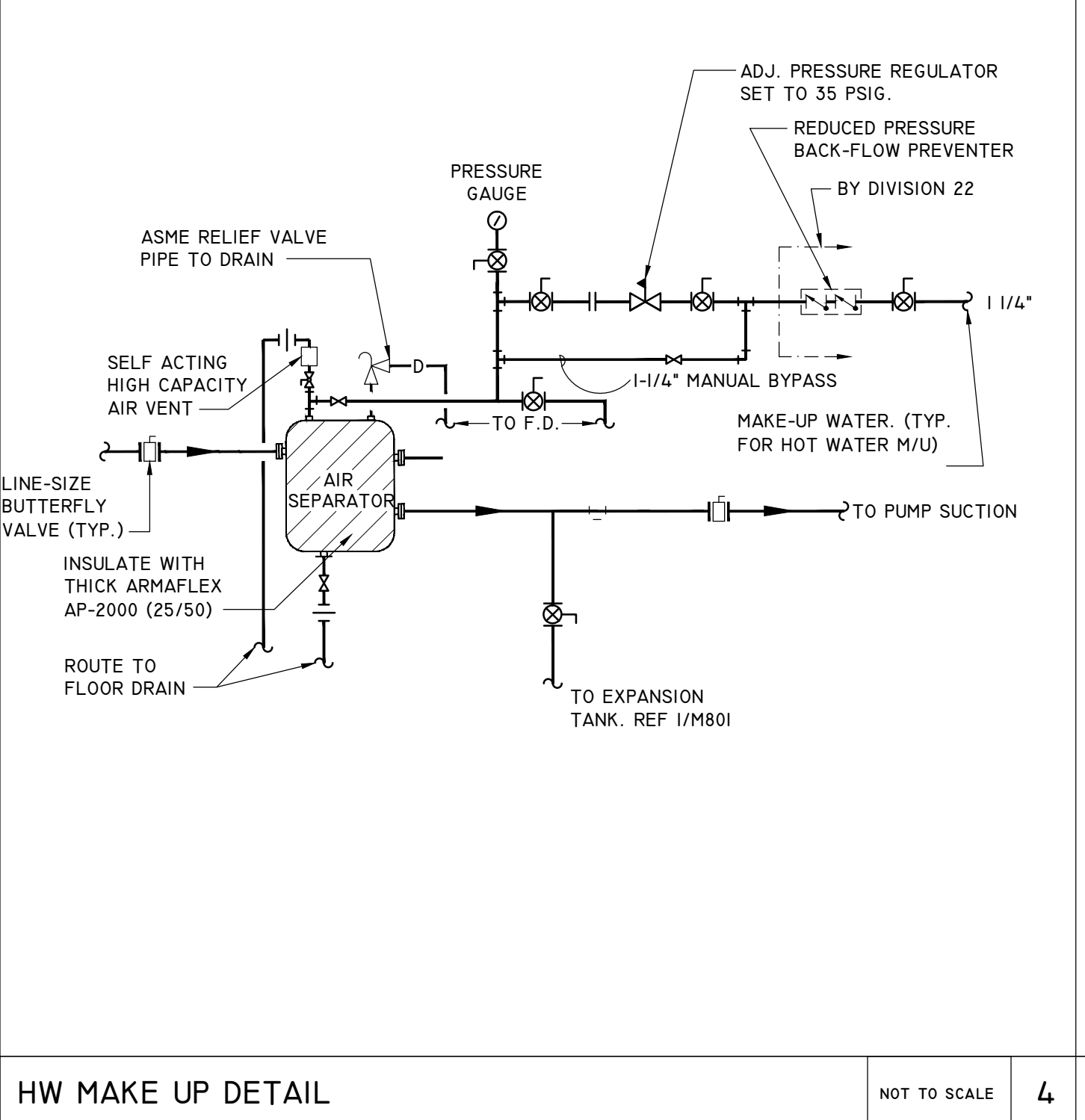
PIPE HANGER DETAIL NOT TO SCALE 2



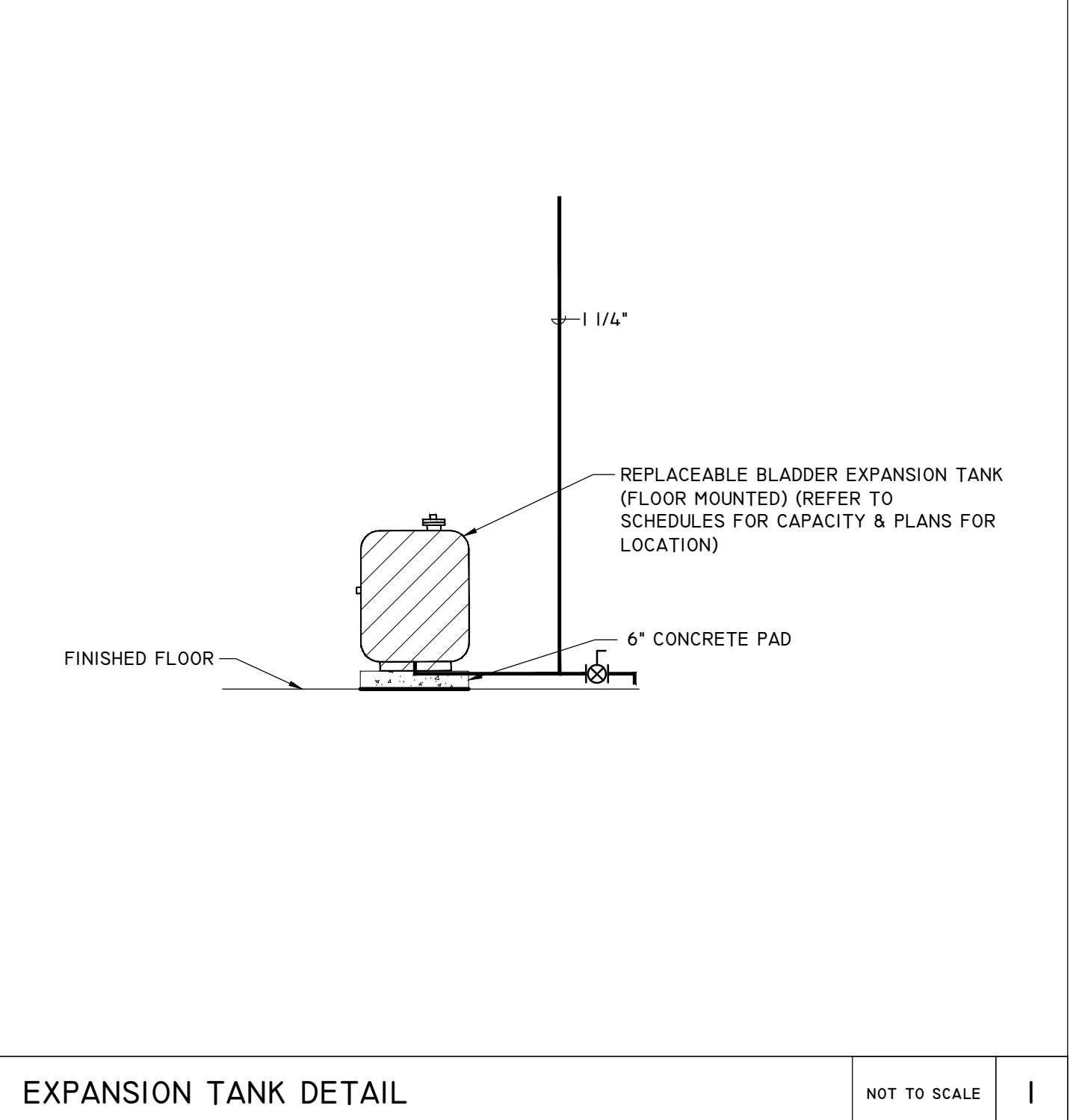
CIRCULATOR PUMP PIPING DETAIL NOT TO SCALE 9



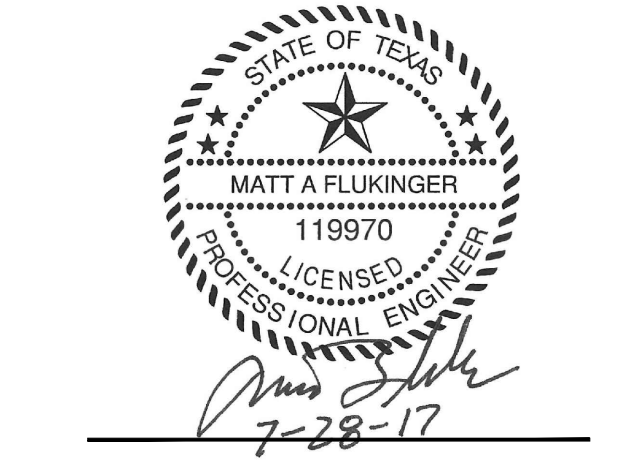
END SUCTION PUMP PIPING DETAILS NOT TO SCALE 7



HW MAKE UP DETAIL NOT TO SCALE 4



EXPANSION TANK DETAIL NOT TO SCALE I



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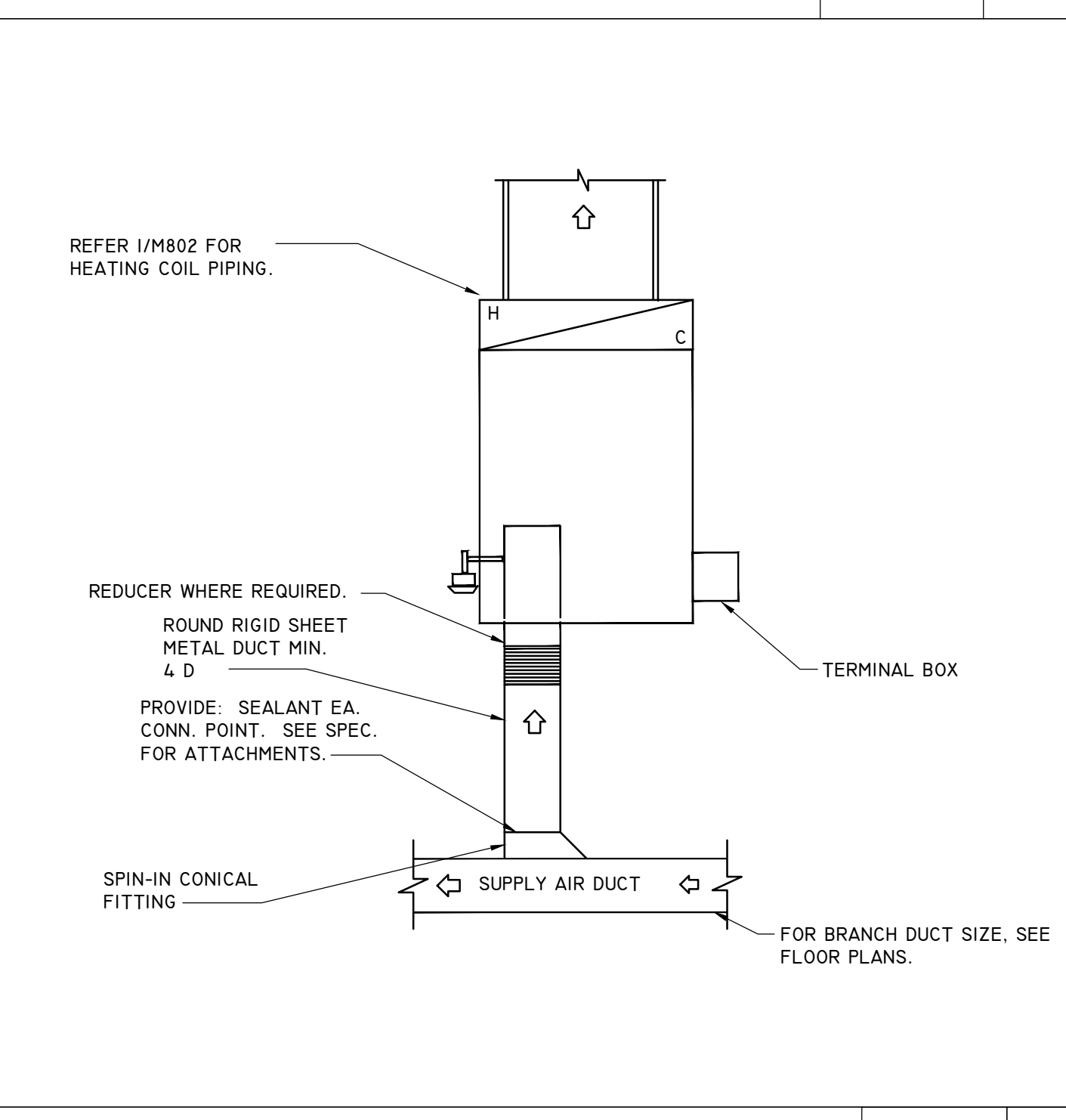
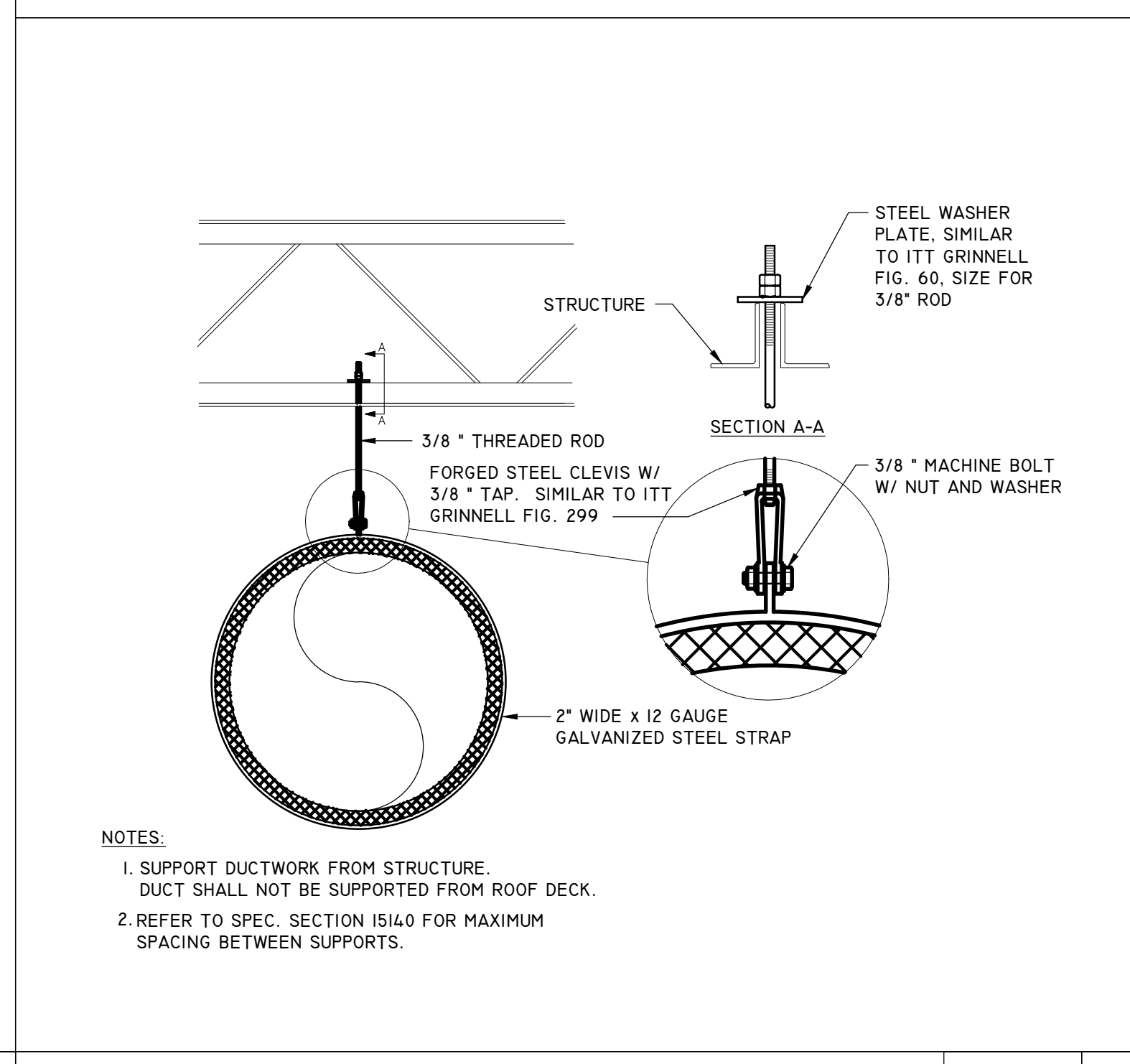
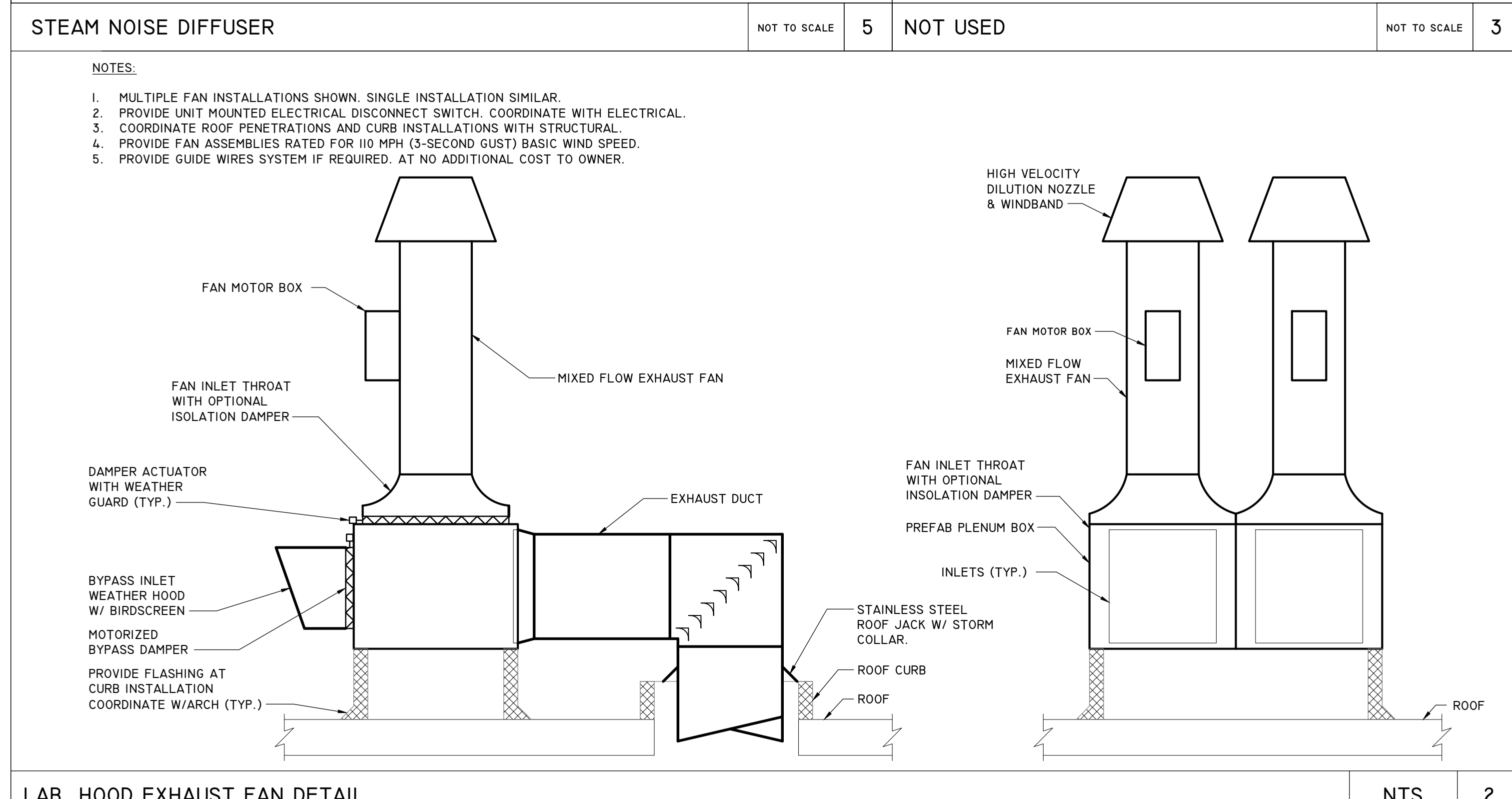
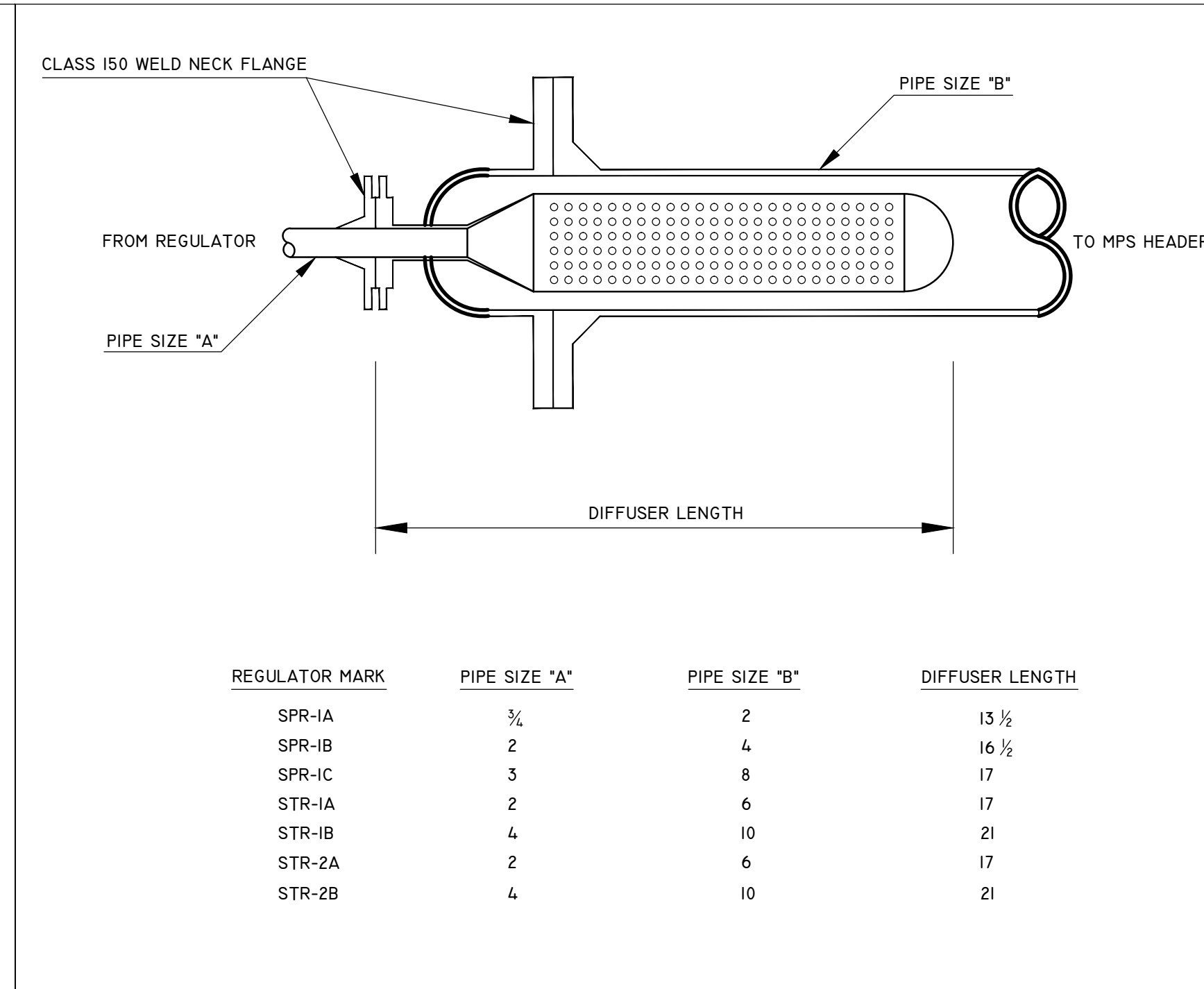
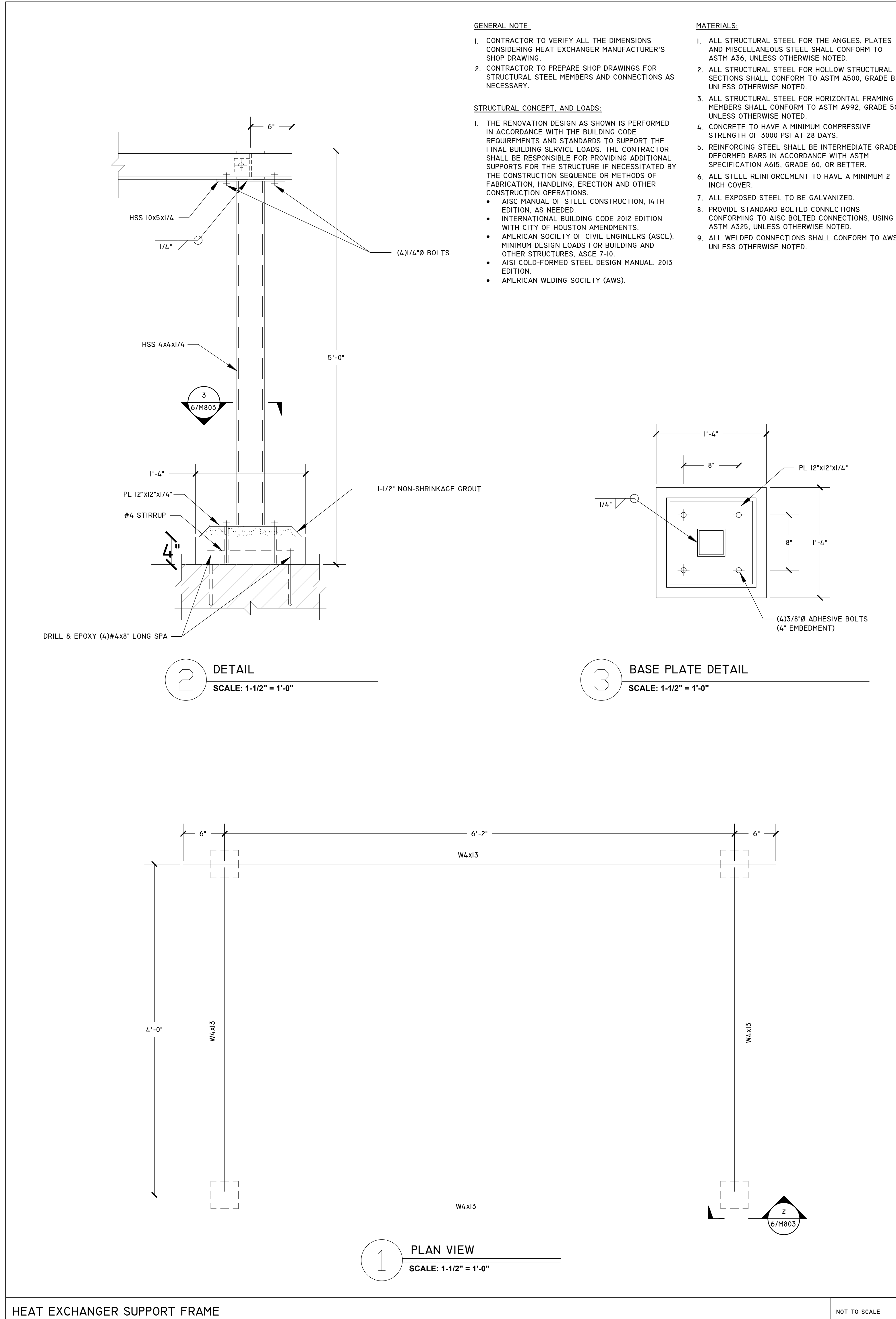
DETAILS

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<p style="text-align: center;">NOTE: SEE FLOOR PLANS FOR DIMENSIONS</p>	<p style="text-align: center;">NOTES: 1. PROVIDE MOTORIZED DAMPER FOR UNITS WITH 300-CFM AND BACK-DRAFT DAMPER FOR ALL OTHERS. DAMPER TO CLOSE WHEN UNIT IS NOT IN OPERATION. 2. DAMPERS LEAKAGE SHALL NOT EXCEED 0.3 CFM/SF.</p>	<p style="text-align: center;">NOTES: 1. REINFORCE METAL DECK WITH TIGHT FITTING WOOD BLOCKING 2. ANGLE IRON FRAME 3. IF THE SUPPORTED EQUIPMENT HAS BUILT-IN COUNTER FLASHING, THEN COUNTER FLASHING SHOWN ABOVE IS NOT REQUIRED</p> <p style="text-align: center;">NOTE: ENSURE ROOF CURB IS PROPERLY SECURED TO DECK ACCORDING TO MIAMI-DADE REQUIREMENTS.</p>	<p style="text-align: center;">NOTES: PROVIDE VOLUME DAMPER WHERE SHOWN ON PLANS DO NOT COVER WITH INSULATION. HANDLE MUST BE VISIBLE</p> <p style="text-align: center;">NOTES: 90° ELBOW SHOWN PROVIDE ROUND ELBOW WHEN SHOWN ON PLANS SINGLE THICKNESS TURNING VANES PROVIDE VOLUME DAMPER WITH LOCKING NUT</p>																								
DUCTWORK FITTINGS DETAIL	POWER ROOF VENTILATOR DETAIL	ROOF CURB DETAIL	BRANCH DUCT DETAIL																								
NOT TO SCALE	NOT TO SCALE	NOT TO SCALE	NOT TO SCALE																								
12	9	6	3																								
<p style="text-align: center;">DIM. DRAW-THRU UNIT BLOW-THRU UNIT "A" FAN T.S.P. + 1" FAN T.S.P. -1" "B" FAN T.S.P. + 2" 2"</p> <p style="text-align: center;">KEYED NOTES: 1. SIZE DRAIN PIPING AT LEAST ONE PIPE SIZE LARGER THAN DRAIN FAN CONNECTION. PROVIDE UNION AT UNIT CONNECTION. 2. UPSTREAM CLEANOUT WITH REMOVABLE CAP OR PLUG. EXTEND ABOVE TOP RIM OF DRAIN PAN. 3. DOWNSTREAM PLUGGED CLEANOUT AT HEAD END OF DRAIN. 4. OPEN VENT - DO NOT CAP. 5. ROUTE DISCHARGE TO INDIRECT DRAIN. PITCH DOWN AT 1/8" PER FOOT. PROVIDE CLEANOUTS AT CHANGES OF DIRECTION.</p>	<p style="text-align: center;">NOTE: THE FLANGED BELLMOUTH FITTING MUST BE PROVIDED, WHERE HEIGHT OF DUCT SHOWN ON PLANS CAN ACCOMMODATE THE FITTING. ONLY WHERE THE DUCT HEIGHT DOES NOT ALLOW THE INSTALLATION OF BELLMOUTH FITTING, PROVIDE STRAIGHT FITTING. FLEX DUCT MAY BE LOCATED IN RISER OR HORIZONTAL RUN.</p>	<p style="text-align: center;">NOTES: 1. USE THIS DETAIL FOR EXTERNALLY INSULATED DUCTWORK. 2. EXTEND ROUND SHEETMETAL DUCTWORK AND ASSOCIATED DUCT INSULATION FROM MAIN DUCT, SO FLEXIBLE DUCT LENGTH DOES NOT EXCEED 6 FEET.</p>																									
TYPICAL CONDENSATE DRAIN DETAIL	CEILING DIFFUSER CONNECTION DETAIL	SPIN FITTING DETAIL	DUCT TRANSITION DETAIL																								
NOT TO SCALE	NOT TO SCALE	NOT TO SCALE	NOT TO SCALE																								
11	8	5	2																								
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3">RECTANGULAR DUCT</th> <th colspan="3">ROUND DUCT</th> </tr> <tr> <th>MAX OF DUCT PERIMETER/IN.</th> <th>STRAP</th> <th>MAX LOAD EACH HANGAR/LBS.</th> <th>DIAMETER / INCHES</th> <th>STRAP</th> <th>MAX LOAD EACH HANGAR/LBS.</th> </tr> </thead> <tbody> <tr> <td>P12 + 72</td> <td>1x20 GA</td> <td>20</td> <td>UP TO 20"</td> <td>1x20 GA</td> <td>20</td> </tr> <tr> <td>P12 + 72</td> <td>1x18 GA</td> <td>30</td> <td>21" TO 36"</td> <td>1x18 GA</td> <td>30</td> </tr> </tbody> </table> <p style="text-align: center;">NOTE: 1. NO TRANSVERSE OR LONGITUDINAL BRACING REQUIRED IF DUCT IS SUSPENDED 12 INCHES FROM STRUCTURE. 2. FOR TRANSVERSE AND LONGITUDINAL BRACING FOLLOW "SMACNA". 3. BRACING NOT REQUIRED FOR RECTANGULAR DUCTS WITH CROSS SECTIONAL AREA OF LESS THAN 28 INCHES IN DIAMETER.</p>	RECTANGULAR DUCT			ROUND DUCT			MAX OF DUCT PERIMETER/IN.	STRAP	MAX LOAD EACH HANGAR/LBS.	DIAMETER / INCHES	STRAP	MAX LOAD EACH HANGAR/LBS.	P12 + 72	1x20 GA	20	UP TO 20"	1x20 GA	20	P12 + 72	1x18 GA	30	21" TO 36"	1x18 GA	30	
RECTANGULAR DUCT			ROUND DUCT																								
MAX OF DUCT PERIMETER/IN.	STRAP	MAX LOAD EACH HANGAR/LBS.	DIAMETER / INCHES	STRAP	MAX LOAD EACH HANGAR/LBS.																						
P12 + 72	1x20 GA	20	UP TO 20"	1x20 GA	20																						
P12 + 72	1x18 GA	30	21" TO 36"	1x18 GA	30																						
GOOSENECK DETAIL	DUCT THROUGH ROOF DETAIL	DUCT TYPE NOTES	TERMINAL UNIT PIPING DETAIL																								
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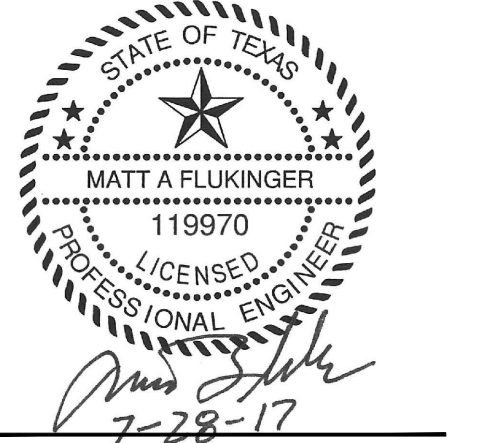
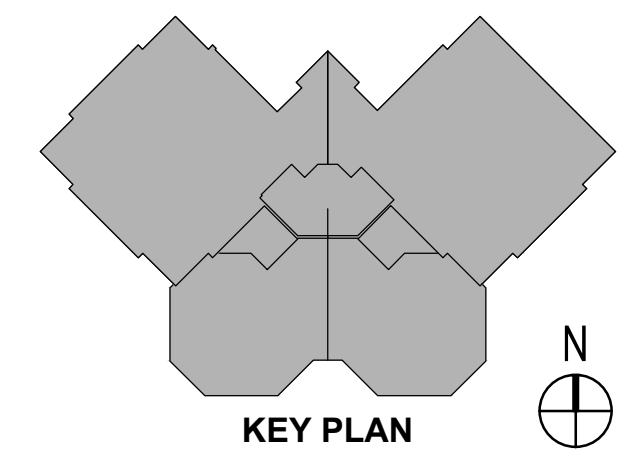
HEAT EXCHANGER SUPPORT FRAME NOT TO SCALE 6 ROUND DUCT SUPPORT FROM STRUCTURE DETAIL NOT TO SCALE 4 SINGLE DUCT VAV UNIT DETAIL NOT TO SCALE 1

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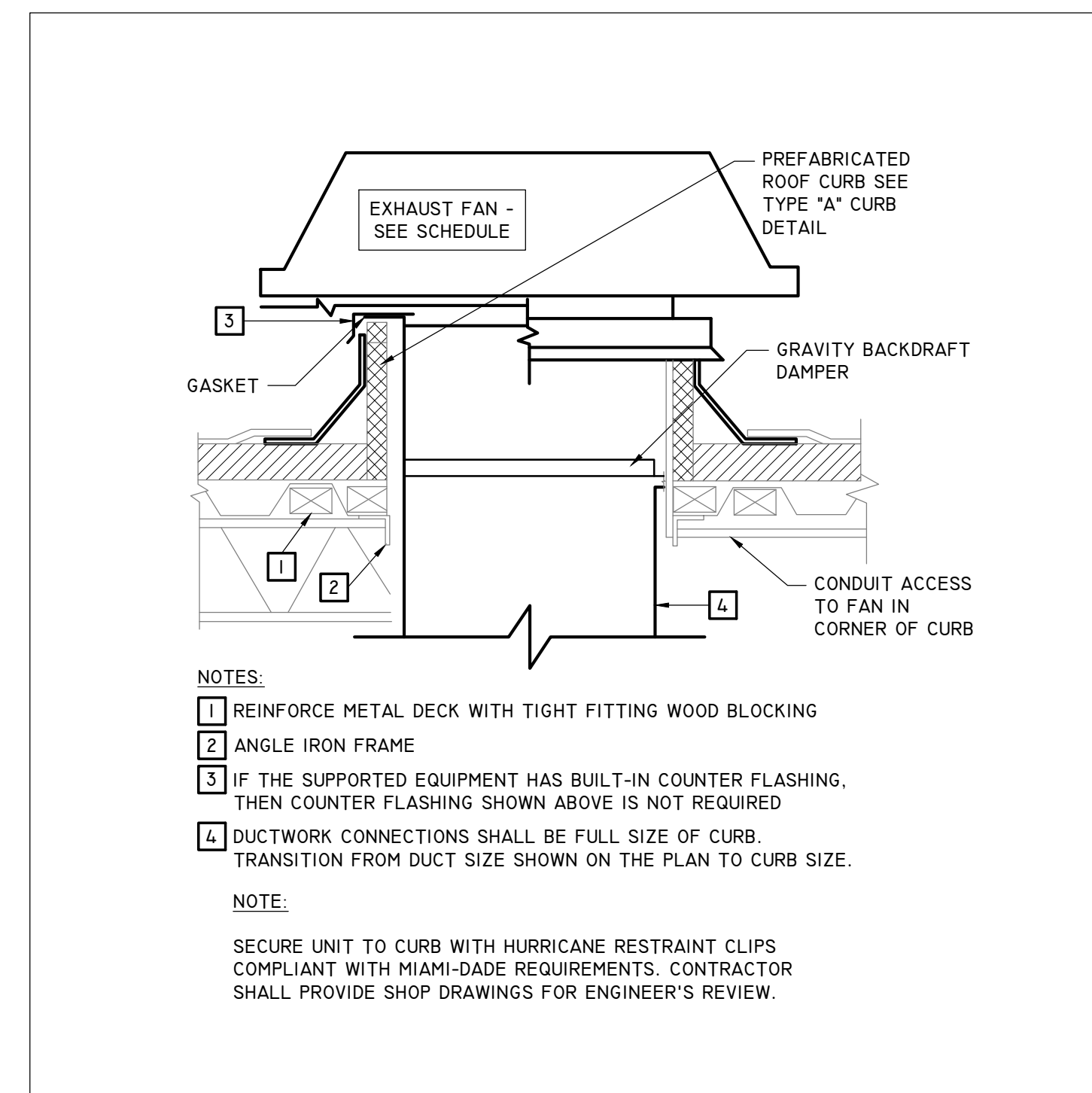
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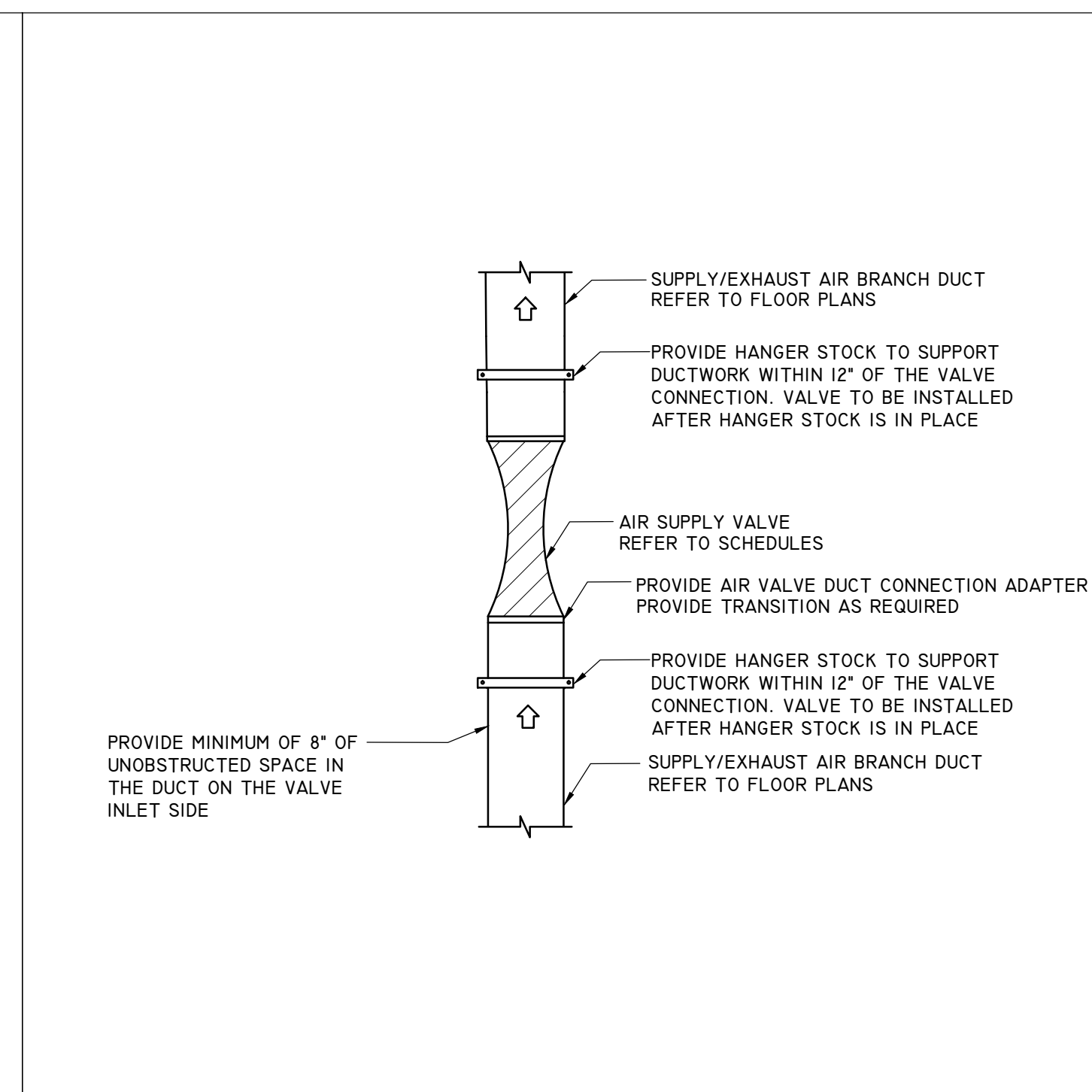
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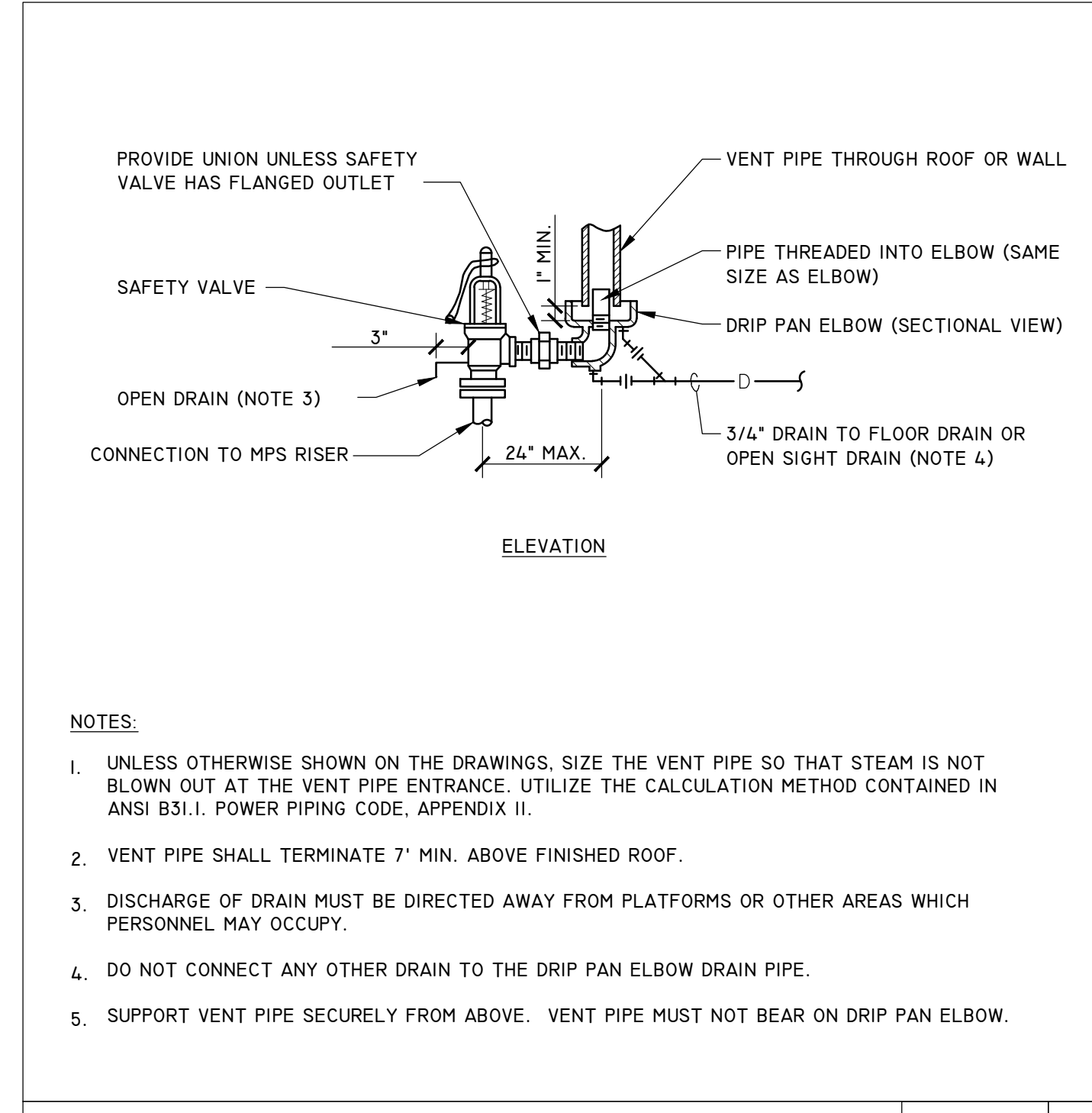
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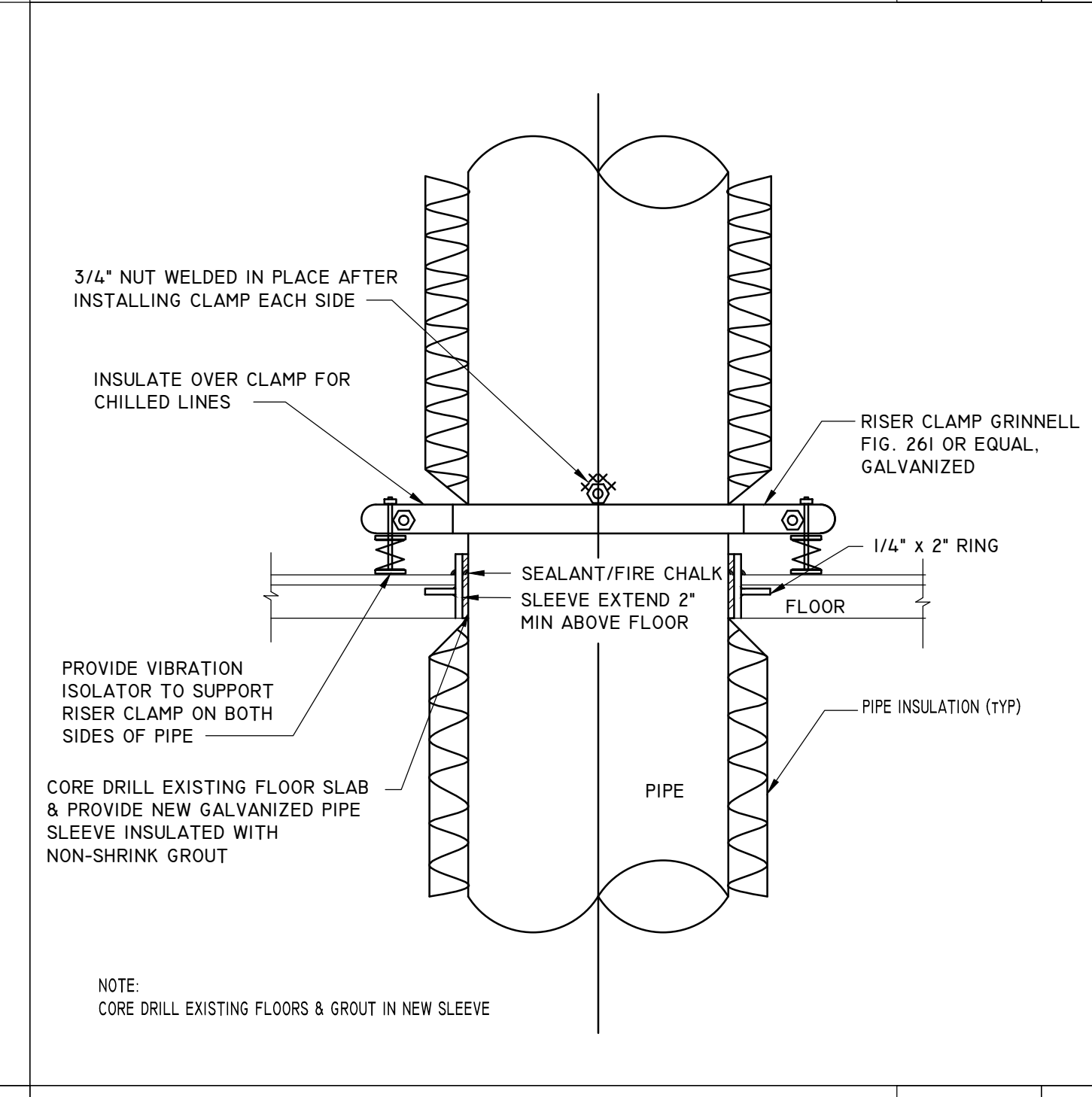
ROOF MOUNTED EXHAUST FAN DETAIL NOT TO SCALE 6



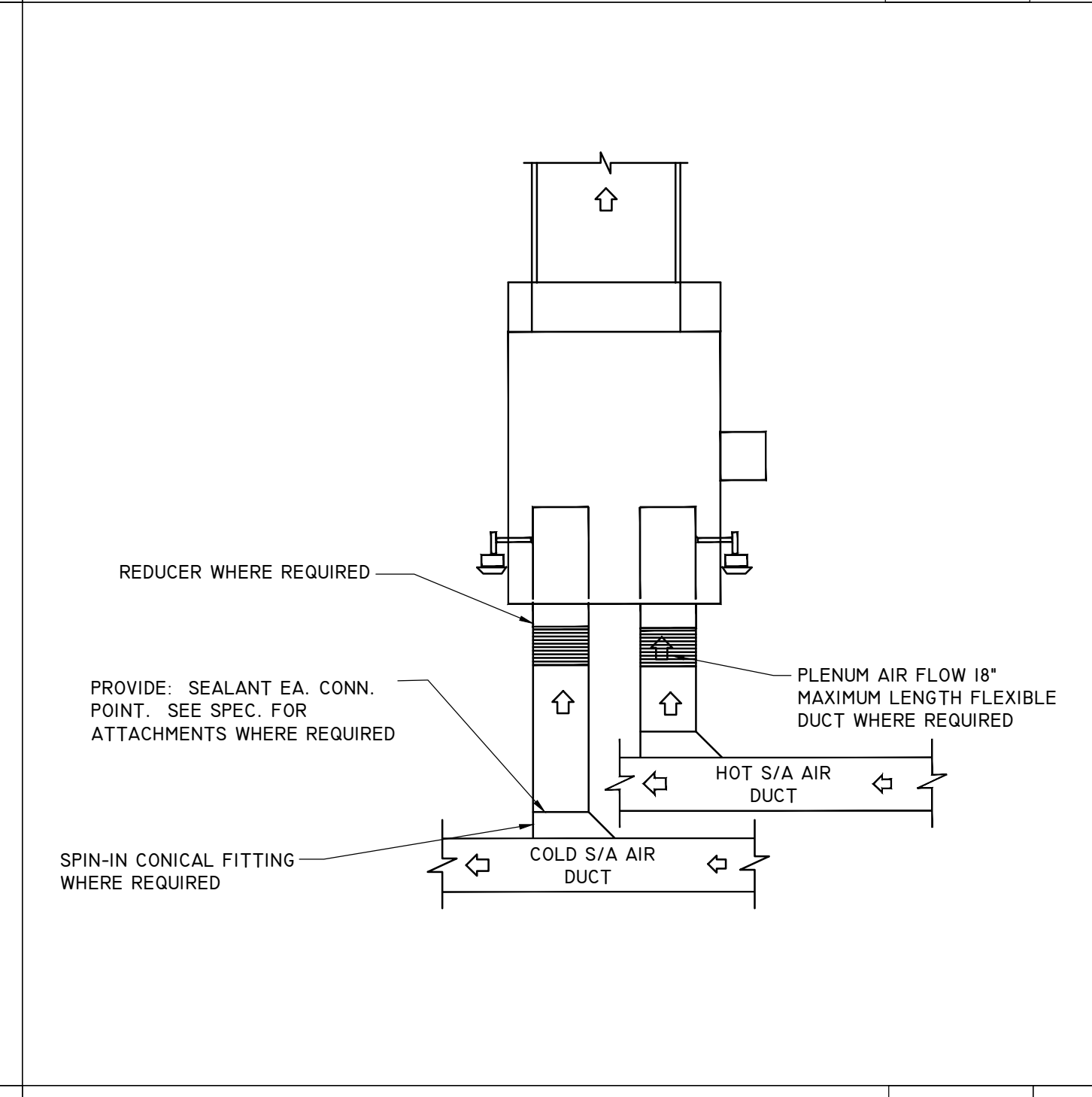
AIR VALVE INSTALLATION DETAIL NOT TO SCALE 3



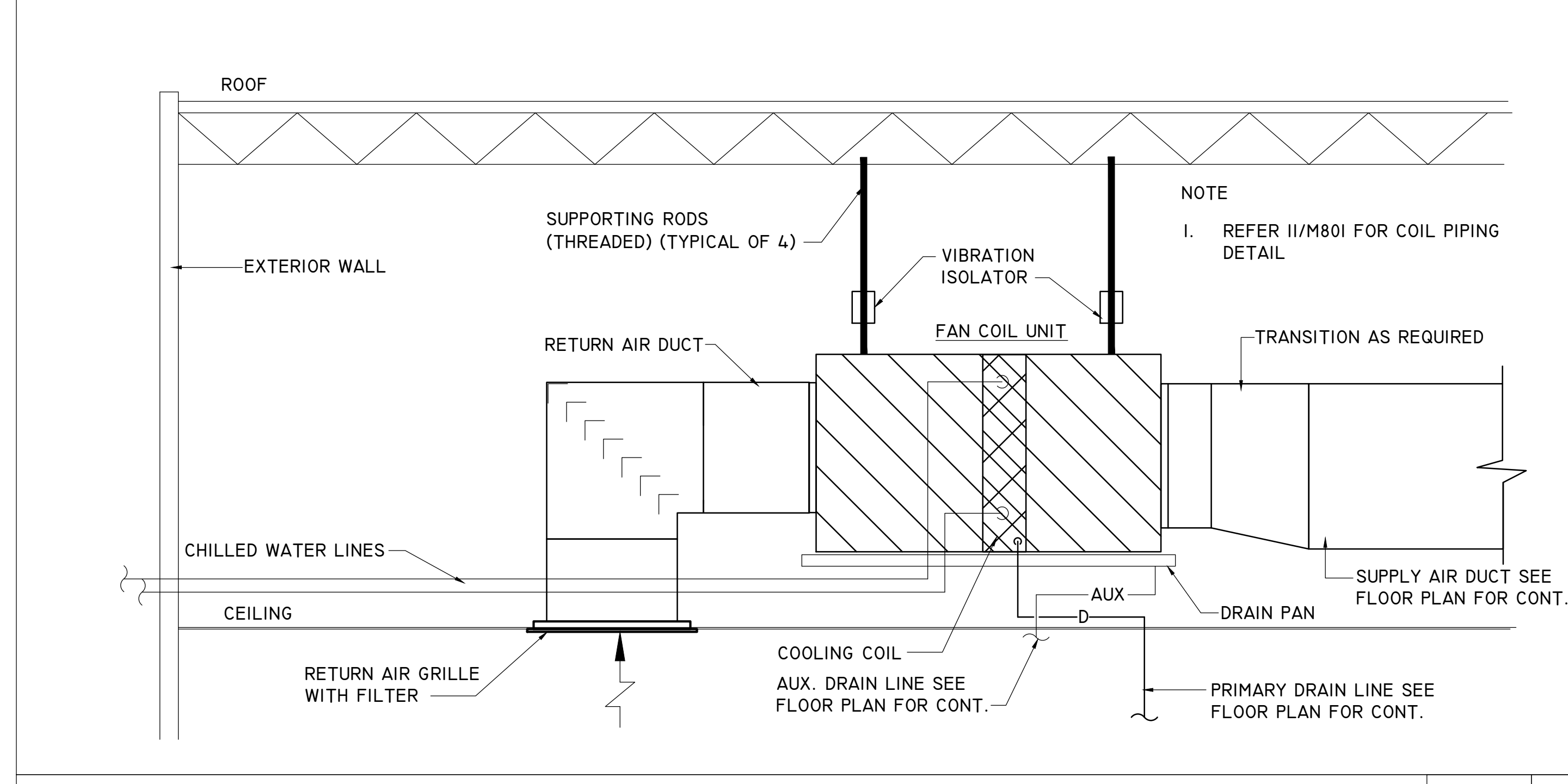
STEAM SAFETY VALVE DETAIL NOT TO SCALE 7



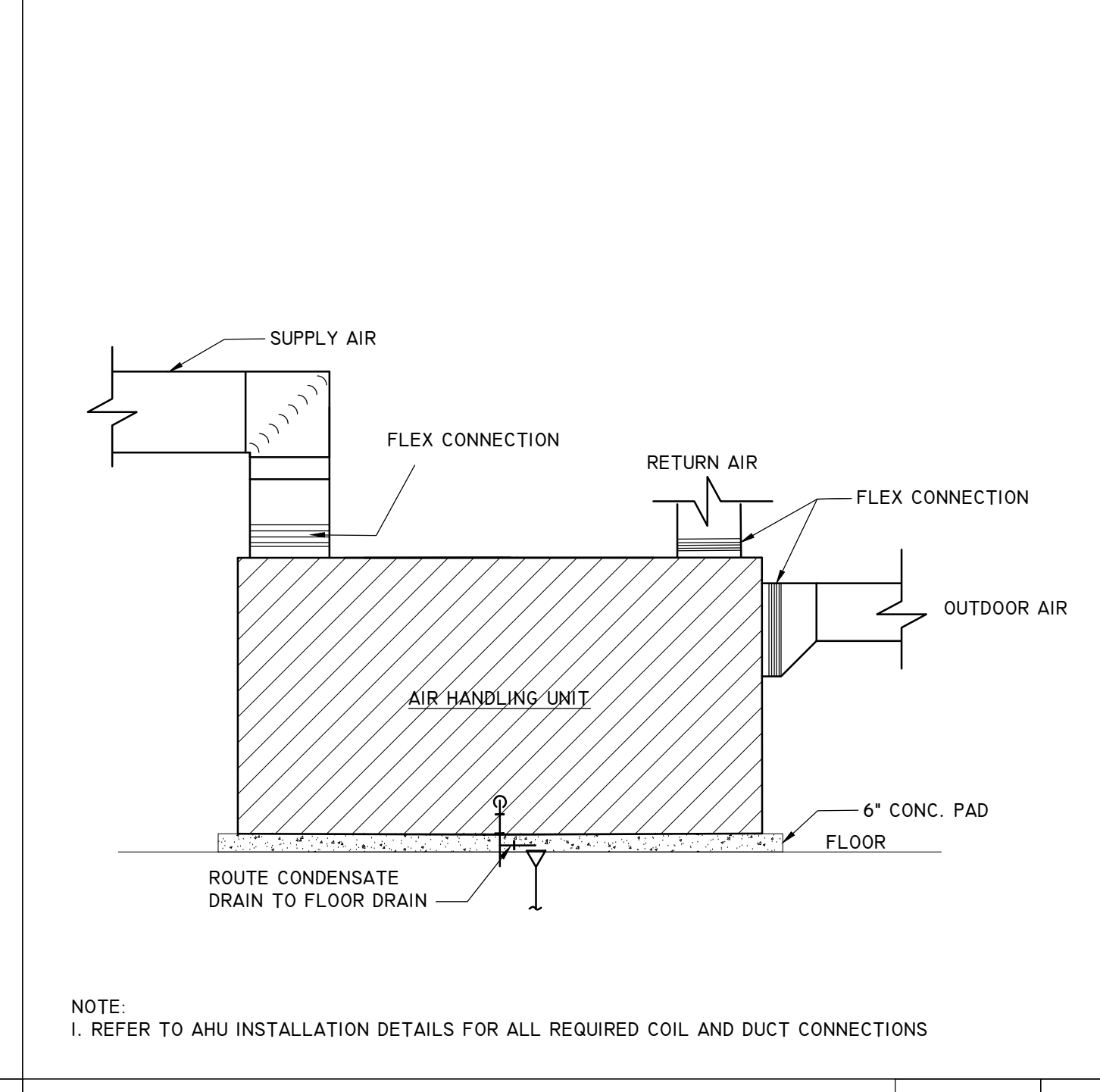
HOT WATER RISER CLAMP PIPE SUPPORT DETAIL NOT TO SCALE 5



DUAL DUCT TERMINAL UNIT DETAIL NOT TO SCALE 2



TYPICAL HORIZONTAL FAN COIL UNIT DETAIL NOT TO SCALE 4



TYPICAL AIR HANDLING UNIT DETAIL NOT TO SCALE 1

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GENERAL NOTES

BOOK SPECIFICATION SUPERCEDE ANY NOTES BELOW

- THESE DRAWINGS ARE SCHEMATIC IN NATURE AND ARE NOT INTENDED TO SHOW ALL OFFSETS. INSTALL PIPING AS CLOSE AS POSSIBLE TO LOCATIONS SHOWN. WHERE INTERFERENCE'S WITH COMPONENTS OF OTHER TRADE'S WORK (STRUCTURAL FOUNDATIONS OR OTHER BUILDING ELEMENTS) REQUIRE ROUTINGS AND LOCATIONS THAT VARY FROM THOSE SHOWN, THE CONTRACTOR SHALL OBTAIN PROJECT ENGINEER'S APPROVAL PRIOR TO INSTALLATION. NO ADDITIONAL COST SHALL BE GRANTED FOR THESE CHANGES.
- BEFORE BEGINNING EXCAVATIONS OR DEMOLITION OF ANY NATURE WHATSOEVER, CONTRACTOR SHALL LOCATE ALL SERVICES AND UTILITIES OCCURRING WITHIN THE BOUNDS OF THE PROJECT. THE CONTRACTOR SHALL THEN PROCEED WITH CAUTION IN HIS WORK SO THAT NO UTILITY OR LINE SERVING AREAS THAT ARE TO REMAIN BE DAMAGED WITH A RESULTANT LOSS OF SERVICE. VERIFY THE SOURCE AND SERVICE OF EACH AND EVERY LINE ENCOUNTERED AND RECORD SERVICE, SIZE AND LOCATION ON RECORD DRAWINGS.
- ROUGH-IN PLUMBING PIPING USING DIMENSIONS SHOWN ON ARCHITECTURAL DRAWINGS. LOCATION OF ALL PIPING SHALL ALLOW INSTALLATION OF FIXTURES WITHOUT THE NEED TO FURR-OUT WALLS.
- PROVIDE CLEANOUTS IN EXCESS OF THOSE SHOWN WHICH ARE REQUIRED BY THE PLUMBING CODE.
- INDIVIDUAL FIXTURE SUPPLY AND DRAIN SERVICES ARE NOT SHOWN DUE TO DRAWING SPACE LIMITATIONS. THIS CONTRACTOR SHALL PROVIDE ALL SERVICES FOR A COMPLETE FIRST CLASS INSTALLATION.
- FURNISH AND INSTALL ALL NECESSARY VALVES, TRAPS, GAUGES, STRAINERS, UNIONS, ETC. FOR EACH PIECE OF EQUIPMENT HAVING PLUMBING CONNECTIONS TO FACILITATE PROPER FUNCTIONING AND SERVICING.
- SEAL ALL PENETRATIONS THROUGH RATED WALLS, FLOORS AND CEILINGS WITH A UL LISTED ASSEMBLY TO PROVIDE A RATING EQUAL TO OR GREATER THAN THE RATING OF THE WALL, FLOOR OR CEILING.
- EACH CONTRACTOR SHALL VISIT THE SITE AND ASCERTAIN FOR HIMSELF THE CONDITIONS TO BE MET THERE IN IMPLEMENTING HIS WORK AND MAKE DUE PROVISIONS FOR THE SAME. IT IS ASSUMED THAT THE CONTRACTOR HAS VISITED THE PREMISES AND THAT HIS COST ESTIMATE COVERS ALL NECESSARY LABOR AND MATERIALS TO PROPERLY ACCOMPLISH HIS WORK. FAILURE ON THE PART OF THE CONTRACTOR TO COMPLY WITH THIS REQUIREMENT SHALL NOT BE CONSIDERED JUSTIFICATION FOR OMISSIONS OR FAULTY WORK OR FOR THE PAYMENT OF ADDITIONAL COMPENSATION.
- FIELD VERIFY EXISTING AND FUTURE GRADES WITHIN AREAS WHERE WORK IS BEING DONE.
- VERIFY EXACT LOCATION OF EQUIPMENT PRIOR TO INSTALLATION OF FLOOR DRAINS. RELOCATION DUE TO MISPLACEMENT SHALL BE AT CONTRACTORS EXPENSE.
- PROVIDE ACCESS PANELS FOR ALL BALL VALVES, WATER HAMMER ARRESTORS AND ETC THAT REQUIRE MAINTENANCE ACCESS.

STEAM FIRED WATER HEATER

PLAN MARK	MFR.	MODEL	TYPE	SERVICE	STEAM				COLD IN	HOT WTR	RECOVERY GPM	
					PSIG	TEMP.	PPH	MIN. ASME CLASS				
WH-1	THERMAPLO	TH750H-1448-DWEN	SEMI-INST	DOMESTIC HEATING WTR	60	400	4,200	250	5.0	4.0	14.0	85
WH-2	THERMAPLO	TH750H-1448-DWEN	SEMI-INST	DOMESTIC HEATING WTR	60	400	4,200	250	5.0	4.0	14.0	85

NOTES:
 1. HEATER SHALL BE SEMI-INST TYPE WITH STAINLESS STEEL SHELL.
 2. PROVIDE UNITS COMPLETE WITH FACTORY AUTOMATED TEMPERATURE CONTROL SYSTEM AND SINGLE POINT ELECTRICAL CONNECTIONS.
 3. UNIT SHALL BE SKIDMOUNTED

HOT WATER CIRCULATING PUMP SCHEDULE

MARK	MFR.	MODEL NO.	TYPE	G.P.M.	HEAD	H.P.	VOLTAGE	MOTOR R.P.M.	LOCATION
HWCP-1	BELL & GOSSETT	-	IN LINE BRONZE	4.0	60	1-1/2	480/3760	1725	MECH. ROOM

NOTES:
 1. HOT WATER CIRCULATION PUMP SHALL BE PROVIDED WITH TIMER TO DE-ENERGIZE THE PUMP UNDER DURING UNOCCUPIED PERIODS PER LATEST IEC.

SUMP PUMP SCHEDULE

MARK	MANUFACTURER	QTY	HP	HEAD	VOLTS	PHASE	HZ	GPM	LOCATION
P-1	BELL & GOSSETT	2	3	30	480	3	60	125	EJECTOR / PUMP
P-2	BELL & GOSSETT	2	5	32	480	3	60	200	SUMP PUM
P-3	BELL & GOSSETT	2	1	34	480	3	60	60	EJECTOR / PUMP

NOTES:
 1. PROVIDE NEW RAIL SYSTEM FOR EACH PIT FOR EASY REMOVAL OF PUMPS.
 2. PROVIDE NEW FLOAT SWITCH SYSTEMS HIGH, LOW, ON OFF.
 3. PROVIDE NEW CONTROLS AND TIE SYSTEM CONTROLS TO BAS SYSTEM.

GRADE OF HORIZONTAL DRAINAGE PIPING

- HORIZONTAL DRAINAGE PIPING SHALL RUN IN PRACTICAL ALIGNMENT AND UNIFORM SLOPE OF NOT LESS THAN ONE-FOURTH (1/4) OF AN INCH PER FOOT OR TWO PERCENT (2) TOWARD POINT OF DISPOSAL PROVIDED THAT, WHERE IT IS IMPRACTICAL DUE TO THE DEPTH OF THE STREET SEWER OR TO THE STRUCTURAL FEATURES OR TO THE ARRANGEMENT OF ANY BUILDING OR STRUCTURE TO OBTAIN A SLOPE OF ONE-FOURTH (1/4) OF AN INCH PER FOOT OR TWO PERCENT, ANY SUCH PIPE OR PIPING FOUR (4) INCHES OR LARGER IN DIAMETER MAY HAVE A SLOPE OF NOT LESS THAN ONE EIGHTH (1/8) OF AN INCH OR ONE (1) PERCENT, WHEN FIRST APPROVED BY THE ADMINISTRATIVE AUTHORITY.

PIPING MATERIALS

- SANITARY WASTE: (ABOVE SLAB ONLY)
PIPE: CAST IRON ASTM A 74, HUBLESS, SERVICE WEIGHT. ALL 90'S MUST HAVE CLEANOUTS.
JOINTS: NO HUB, ASTM C 564 NEOPRENE GASKETS AND STANDARD. ALL CLAMPS SHALL BE WIDE BODY HUSKY CLAMPS. CLAMP ASSEMBLIES SHALL CONFORM TO FM 1680 WHERE REQUIRED BY THE ADMINISTRATIVE AUTHORITY.
FITTINGS: CAST IRON, ASTM A 888 DRAINAGE PATTERN.
- VENT STACKS:
FOR PIPING 1-1/2" AND SMALLER: PROVIDE DWV COPPER OR SCHEDULE 40 GALVANIZED PIPE AND FITTINGS. FOR PIPING 2" AND LARGER, USE CAST IRON SOIL PIPE AND FITTINGS. SAME AS ABOVE SLAB PIPING INDICATED ABOVE. PIPE MUST CONFORM TO ASTM A-74.
- DOMESTIC WATER:
TYPE "L" COPPER TUBING WITH WROUGHT COPPER FITTINGS AND 95/5 (TIN/ANTIMONY) SOLDER JOINTS.

PLUMBING FIXTURE SCHEDULE

MARK	DESCRIPTION	SIZE OF CONNECTION				REMARKS
		TRAP	SS	SV	CW	
EW-1	EYE WASH	-	-	-	1/2"	EW893 WATERSAVER, EYEWASH, DECK MOUNTED 90° SWIVEL, ALL-STAINLESS STEEL, RIGHT HAND MOUNTING. APPLICATION: ALL-STAINLESS STEEL EYEWASH FOR MOUNTING ON COUNTER NEXT TO SINK. SPRAY HEADS SWIVEL 90 DEGREES FROM STORAGE TO OPERATIONAL POSITION. UNIT IS CONSTRUCTED ENTIRELY IN STAINLESS STEEL. IDEAL FOR USE IN HIGHLY CORROSIVE ENVIRONMENTS, CLEANROOMS AND PHARMACEUTICAL APPLICATIONS. SPRAY HEAD ASSEMBLY: TWO (2) GS-PLUSJ SPRAY HEADS. EACH HEAD HAS A FLIP TOP DUST COVER, INTERNAL FLOW CONTROL AND FILTER TO REMOVE IMPURITIES FROM THE WATER FLOW. VALVE: 1/2" IPS STAINLESS STEEL STAY-OPEN BALL VALVE. VALVE HAS STAINLESS STEEL BALL AND TFE SEALS. MOUNTING UNIT MAY BE MOUNTED ON RIGHT SIDE (EW893) OR LEFT SIDE (EW893LH) OF SINK, FURNISHED WITH LOCKOUT AND WASHER FOR SECURING UNIT TO COUNTERTOP. CONSTRUCTION: TYPE 316 STAINLESS STEEL. SUPPLY: 1/2" NPT MALE INLET. SIGN ANSI-COMPLIANT IDENTIFICATION SIGN. QUALITY ASSURANCE: UNIT IS COMPLETELY ASSEMBLED AND WATER TESTED PRIOR TO SHIPMENT. PROVIDE TMV AP3600 THERMOSTATIC MIXING VALVE PRECISELY BLENDS HOT AND COLD WATER TO DELIVER TEMPO WATER AS REQUIRED BY ANSI Z358.1-2014. REFER TO TEMPERING UNITS SECTION FOR COMPLETE TECHNICAL AND PRODUCT SELECTION INFORMATION. PROVIDE TEMPERATURE GAUGE ON OUTLET.
EW-1	EYE WASH / SHOWER (SAFETY FIXTURE)	-	2"	2"	1 1/4"	S19-310AC BRADLEY, COMBINATION DRENCH SHOWER AND EYE/FACE WASH UNIT, 10 3/4" DIAMETER CORROSION-RESISTANT STAINLESS STEEL EYEWASH BOWL, TWIN PERFORATED-DISK EYE/FACE WASH HEADS WITH PROTECTIVE SPRAYHEAD COVERS, OPERATED BY A LARGE, HIGHLY VISIBLE PUSH HANDLE AND A FOOT TREADLE. SAFE, STEADY WATER FLOW UNDER VARYING WATER SUPPLY CONDITIONS FROM 30-90 PSI IS ASSURED BY INTEGRAL FLOW CONTROL IN THE SPRAYHEAD ASSEMBLY. CHROME-PLATED BRASS 1" NPT STAY-OPEN BALL SHOWER VALVE, OPERATED BY A STAINLESS PULL ROD WITH TRIANGULAR HANDLE.
TMV-1	EMERGENCY WATER MIXING VALVE	-	-	-	1 1/2"	TM-5125-STSTL-EXP LEONARD, DURA-TROL® SOLID BIMETAL THERMOSTAT DIRECTLY LINKED TO VALVE PORTING TO CONTROL THE INTAKE OF HOT AND COLD WATER AND COMPENSATE FOR SUPPLY TEMPERATURE AND PRESSURE FLUCTUATIONS. DURA-TROL® IS HIGHLY RESPONSIVE AND CANNOT BE DAMAGED BY EXTREMES IN TEMPERATURE. PRIMARY MIXING VALVE CAN BE SET TO THE CORRECT TEMPERATURE FOR THE APPLICATION. LOCKING TEMPERATURE REGULATOR TO PREVENT ACCIDENTAL MOVEMENT SET FOR 85°F. RECOMMENDED HOT INLET TEMPERATURE HOFF. PRIMARY VALVE WILL CLOSE DOWN ON FAILURE OF COLD WATER SUPPLY. PRIMARY VALVE WITH SPECIAL BUILT IN COLD WATER BYPASS CAPABLE OF 4.0 GPM (5.1 L/MIN) @ 30 PSI (2.1 BAR) UPON FAILURE OF HOT WATER SUPPLY. ADJUSTABLE HIGH TEMPERATURE LIMIT STOP SET FOR 90°F (32°C). FULL 1 1/4" TOP INLETS AND 1 1/2" TOP OUTLET. INTEGRAL WALL SUPPORT. DIAL THERMOMETER (0 TO 140°F, -10 TO 60°C). ROUGH BRONZE FINISH EXPOSED STAINLESS STEEL CABINET WITH HINGED DOOR AND CYLINDER LOCK. UNION ANGLE CHECKSTOPS ON INLETS. COMPLIANCE: (1) (1) ANSI Z 358.1 2004. OUTLET TEMPERATURE SHALL BE 85°F. CAUTION: ALL THERMOSTATIC WATER MIXING VALVES HAVE LIMITATIONS. THEY WILL NOT PROVIDE THE DESIRED ACCURACY OUTSIDE OF THEIR FLOW CAPACITY RANGE. CONSULT THE FLOW CAPACITY CHART AND DO NOT OVERSIZE. MINIMUM FLOW MUST BE NO LESS THAN AS INDICATED.
WHA-1	WATER HAMMER ARRESTOR	-	-	-	-	5000 J.R. SMITH "HYDROTROL" ALL STAINLESS STEEL SHOCK ABSORBERS SHALL BE INSTALLED AT ALL SOLENOID, REMOTE OPERATED OR QUICK CLOSING VALVES AND AT EACH PLUMBING FIXTURE OR BATTERY OF PLUMBING FIXTURES. INSTALL ON BOTH HOT AND COLD WATER BRANCH LINES IN AN UPRIGHT POSITION AS CLOSE AS POSSIBLE TO THE VALVE OR VALVES BEING SERVED. SIZES AND LOCATIONS AS INDICATED ON DRAWINGS.
RPZ-1	DOUBLE CHECK VALVE ASSEMBLIES	-	-	-	AS SHOWN	LF009 WATTS, LEAD FREE* REDUCED PRESSURE ZONE ASSEMBLIES PREVENT THE REVERSE FLOW OF POLLUTED WATER FROM ENTERING INTO THE POTABLE WATER SUPPLY DUE TO BACKSIPHONAGE AND OR BACKPRESSURE. IT CONSISTS OF LEAD FREE* BRONZE BODY CONSTRUCTION (1/4 TO 2 IN.) OR LEAD FREE* FDA APPROVED EPOXY COATED CAST IRON (2 1/2 TO 3 IN.). TWO IN-LINE INDEPENDENT CHECK VALVES, REPLACEABLE CHECK SEATS WITH AN INTERMEDIATE RELIEF VALVE, AND BALL VALVE TEST COCKS. SERIES LF009 IS IDEAL FOR PROTECTION OF HEALTH HAZARD CROSS-CONNECTIONS OR FOR CONTAMINATION AT THE SERVICE LINE ENTRANCE. CHECK WITH LOCAL WATER AUTHORITIES FOR INSTALLATION REQUIREMENTS. MAXIMUM WORKING PRESSURE: 175PSI (12.06 BAR).

PLUMBING LEGEND

DISREGARD LEGEND ITEMS NOT INDICATED ON DRAWINGS

	NEW PLUMBING FIXTURE
	SANITARY WASTE
	CONDENSATE DRAIN LINE
	VENT
	DOMESTIC COLD WATER PIPING
	DOMESTIC HOT WATER PIPING
	DOMESTIC HOT WATER RETURN PIPING
	NATURAL GAS
	FLOOR CLEAN OUT
	EXTERIOR CLEANOUT
	WALL CLEANOUT
	FLOOR DRAIN
	FLOOR SINK
	RISER IDENTIFICATION
	ELBOW UP
	ELBOW DOWN
	BALL VALVE
	BALANCING VALVE
	GAS VALVE
	GATE VALVE
	GLOBE VALVE
	CHECK VALVE
	CAP AND SEAL
	VENT THROUGH ROOF
	EXISTING



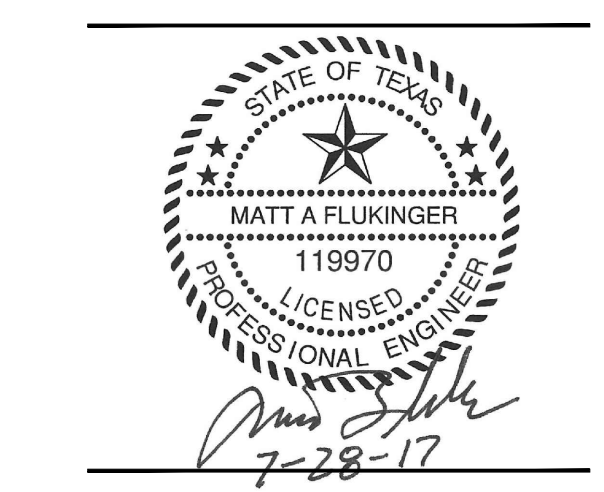
INFRASTRUCTURE ASSOCIATES, INC.
 617 RICHMOND AVENUE, SUITE 200
 HOUSTON, TEXAS 77057
 TDP# REGISTRATION NO. F-45506
 (713) 622-0120 PH (713) 622-0557 FAX
 WWW.IAHOUSTON.COM



The University of Texas
 Health Science Center at Houston
 School of Public Health

UT HEALTH
 SCIENCE
 SCHOOL OF
 PUBLIC HEALTH

1200 PRESSLER ST.
 HOUSTON, TX 77030



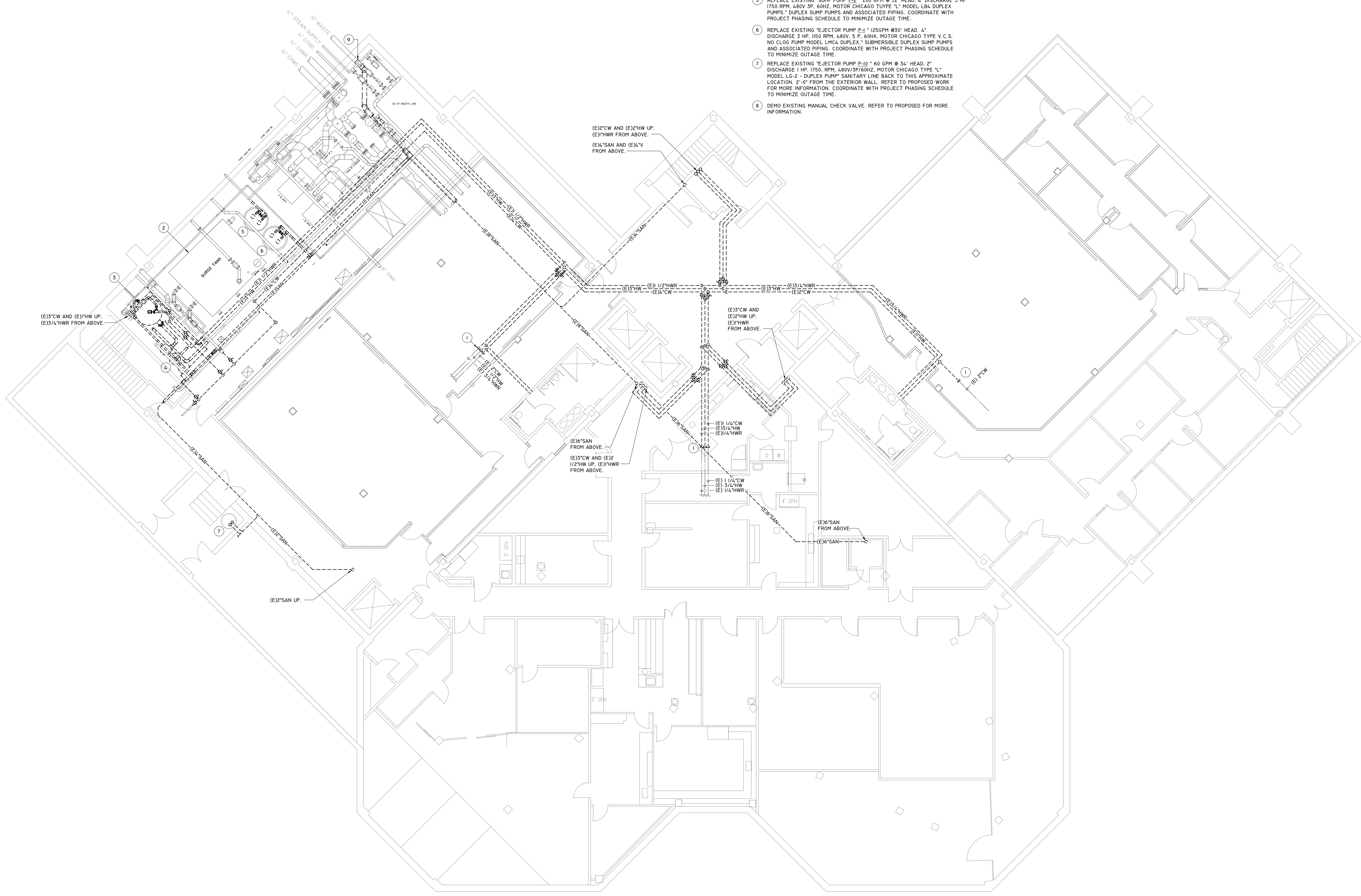
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05/31/2017	ISSUED FOR BID
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Sheet Information	
Date	31 MARCH 2017
Job Number	-
Drawn	KN, KT, CJT
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SCHEDULES, NOTES
 AND LEGEND

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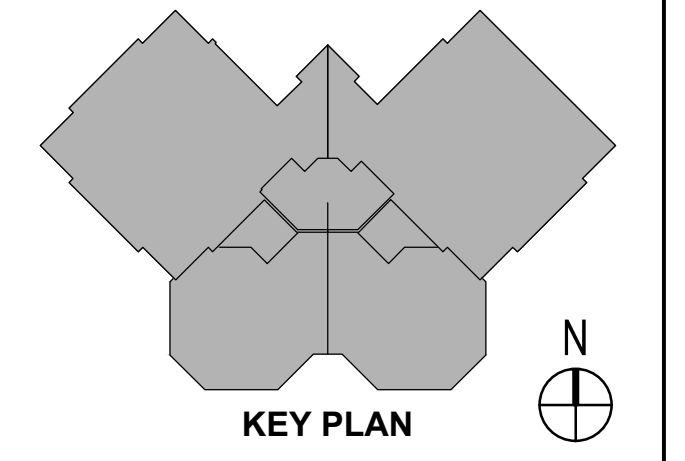


- KEYED NOTE:**
- 1 ALL EXISTING PIPING SHALL REMAIN UNTIL THE END OF THE 'ADA RESTROOM PROJECT BY OTHER'. THE CONTRACTOR SHALL DEMO THE EXISTING PIPING UP TO THIS POINT AT THE END OF THE 'ADA RESTROOM PROJECT'. CONTRACTOR SHALL COORDINATE WITH OWNER PHASING SCHEDULE. REFER TO PROPOSED WORK FOR MORE INFORMATION.
 - 2 REMOVE ALL RUST FROM EXISTING BREAK TANK. PROVIDE 1 COAT OF PRIMER AND 2 COATS OF MARINE GRADE PAINT COLOR TO MATCH EXISTING.
 - 3 DEMO EXISTING DOMESTIC HOT WATER SYSTEM, PIPING AND ASSOCIATED APPARATUS. HOT WATER RE-CIRCULATING SYSTEM SHALL BE REPLACED WITH SAME SIZE AS EXISTING REFER TO PROPOSED DRAWINGS FOR NEW LOCATION. CONTRACTOR SHALL COORDINATE WITH OWNER PHASING SCHEDULE TO DETERMINE MINIMAL DOWN TIME IN THE HOT WATER SYSTEM.
 - 4 REPLACE EXISTING WATER SOFTENER SYSTEM, WITH EQUAL CAPACITY SYSTEM.
 - 5 REPLACE EXISTING "SUMP PUMP P-2" * 200 GPM @ 32' HEAD, 4" DISCHARGE 3 HP 1750 RPM, 480V 3P, 60HZ, MOTOR CHICAGO TYPE "L" MODEL LB4 DUPLEX PUMPS * DUPLEX SUMP PUMPS AND ASSOCIATED PIPING, COORDINATE WITH PROJECT PHASING SCHEDULE TO MINIMIZE OUTAGE TIME.
 - 6 REPLACE EXISTING "EJECTOR PUMP P-1" * 125 GPM @ 30' HEAD, 4" DISCHARGE 3 HP, 1150 RPM, 480V, 5 P, 60HZ, MOTOR CHICAGO TYPE V.C.S. NO CLOG PUMP MODEL LMCA DUPLEX * SUBMERSIBLE DUPLEX SUMP PUMPS AND ASSOCIATED PIPING, COORDINATE WITH PROJECT PHASING SCHEDULE TO MINIMIZE OUTAGE TIME.
 - 7 REPLACE EXISTING "EJECTOR PUMP P-10" * 60 GPM @ 34' HEAD, 2" DISCHARGE 1 HP, 1750, RPM, 480V/3P/60HZ, MOTOR CHICAGO TYPE "L" MODEL LG-2 * DUPLEX PUMP * SANITARY LINE BACK TO THIS APPROXIMATE LOCATION, 2'-0" FROM THE EXTERIOR WALL. REFER TO PROPOSED WORK FOR MORE INFORMATION. COORDINATE WITH PROJECT PHASING SCHEDULE TO MINIMIZE OUTAGE TIME.
 - 8 DEMO EXISTING MANUAL CHECK VALVE. REFER TO PROPOSED FOR MORE INFORMATION.

- GENERAL NOTE:**
1. THE EXISTING WATER HEATER SHALL BE DEMOED WATER HEATER PROPOSED WH-1 IS INSTALLED. ONCE THE PROPOSED WATER HEATER SYSTEM IS IN OPERATION CONTRACTOR SHALL DEMO THE EXISTING WATER HEATER INCLUDED ALL ASSOCIATED PIPING AND APPARATUS.
 2. EXISTING COLD WATER, HOT WATER, HOT WATER RETURN HWR, SANITARY AND VENT PIPING SHALL REMAIN EXISTING AND IN OPERATION UNTIL THE END OF THE 'ADA PROJECT' THEN PIPING SHALL BE DEMOED UNDER THIS PACKAGE.

Infrastructure Associates
 INFRASTRUCTURE ASSOCIATES, INC.
 617 RICHMOND AVENUE, SUITE 200
 HOUSTON, TEXAS 77057
 TYPE REGISTRATION NO. F-45506
 (713) 622-0120 PH (713) 622-0557 FAX
 WWW.IAHOUSTON.COM

UTHealth
 The University of Texas
 Health Science Center at Houston
 School of Public Health
**UT HEALTH
 SCIENCE
 SCHOOL OF
 PUBLIC HEALTH**
 1200 PRESSLER ST.
 HOUSTON, TX 77030



STATE OF TEXAS
 MATT A. FLUKINGER
 LICENSED PROFESSIONAL ENGINEER
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Date	31 MARCH 2017
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BASEMENT FLOOR PLAN - PLUMBING

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1 BASEMENT FLOOR PLAN - PLUMBING EXISTING PIPING
 SCALE: 1/8" = 1'-0"

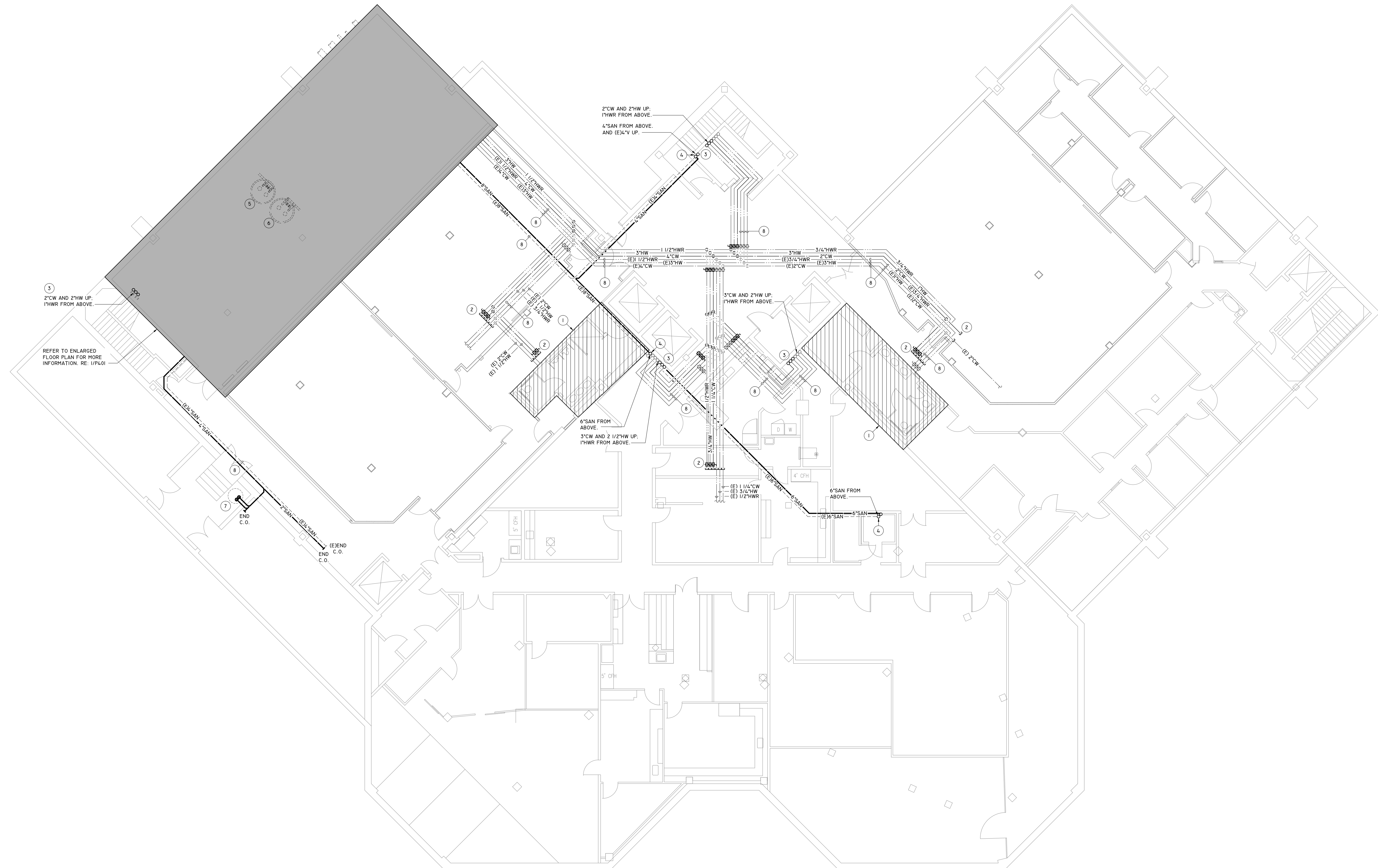
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KEYED NOTE:

- 1 THE BUILD OUT FOR THIS RESTROOM SHALL BE RENOVATED IN THE 'ADA PROJECT BY OTHER'.
- 2 ALL EXISTING CW, HW, HWR, SAN, AND VENT TO REMAIN IN SERVICE UNTIL THE END OF THE 'ADA PROJECT'. ROUTE PROPOSED CW, HW, HWR, SAN AND VENT LINES PARALLEL TO THE EXISTING PIPING WITH THE SAME SIZE PIPING. ROUTE MAIN WATER LINES AND RISERS AND PROVIDE NEW PENETRATIONS THRU EACH FLOOR. SEAL ALL PENETRATIONS WITH FIRE RATED SEALANT. PROVIDE A TAP WITH A SHUT OFF VALVE, CAP AND SEAL, ON EACH LEVEL FOR EACH RISER. THE 'ADA RESTROOM RENOVATION PROJECT (BY OTHER)' SHALL CONNECT TO THE PROPOSED RISERS. UNDER THIS PROJECT THE CONTRACTOR SHALL DEMO ALL OLD HORIZONTAL AND VERTICAL RUNS THAT ARE NO LONGER IN USE. CONTRACTOR SHALL REPAIR WALLS, FLOORS, SLABS, CEILINGS TO MATCH EXISTING UNLESS OTHERWISE NOTED ON THE ARCHITECTURAL DRAWINGS.
- 3 INSTALL NEW CW, HW, AND HWR RISERS NEXT TO THE EXISTING PIPE RISER WITH LINE SIZE BALL VALVES, CAP AND SEAL FOR THE NEXT PROJECT. ALL VALVES SHALL BE NIBCO 'HYDRAPURE' BALL VALVE ONLY. CERTIFIED 'LEAD FREE'.
- 4 INSTALL PROPOSED SANITARY, VENT LINES AND RISERS NEXT TO THE EXISTING PIPING CAP AND SEAL 4" SAN AND 4" V LINES AT EACH FLOOR THEN CAP AND SEAL FOR THE ADA RESTROOM RENOVATION PROJECT.
- 5 REPLACE EXISTING 'SUMP PUMP P-2' * 200 GPM @ 32' HEAD, 4" DISCHARGE 3 HP 1750 RPM, 480V 3P, 60HZ, MOTOR CHICAGO TUYPE 'L' MODEL LB4 DUPLX PUMPS * DUPLX SUMP PUMPS AND ASSOCIATED PIPING. COORDINATE WITH PROJECT PHASING SCHEDULE TO MINIMIZE OUTAGE TIME.
- 6 REPLACE EXISTING 'EJECTOR PUMP P-1' * 125GPM @30' HEAD, 4" DISCHARGE 5 HP, 1150 RPM, 480V, 3 P, 60HZ, MOTOR CHICAGO TYPE V.C.S. NO CLOG PUMP MODEL LMC4 DUPLX.* SUBMERSIBLE DUPLX SUMP PUMPS AND ASSOCIATED PIPING. COORDINATE WITH PROJECT PHASING SCHEDULE TO MINIMIZE OUTAGE TIME.
- 7 REPLACE EXISTING 'EJECTOR PUMP P-10' * 60 GPM @ 34' HEAD, 2" DISCHARGE 1 HP, 1750, RPM, 480V/3P/60HZ, MOTOR CHICAGO TYPE 'L' MODEL LG-2 - DUPLX PUMP SANITARY LINE BACK TO THIS APPROXIMATE LOCATION: 2'-0" FROM THE EXTERIOR WALL. REFER TO PROPOSED WORK FOR MORE INFORMATION. COORDINATE WITH PROJECT PHASING SCHEDULE TO MINIMIZE OUTAGE TIME.
- 8 EXISTING PLUMBING LINES TO REMAIN UNTIL THE END OF THE ADA RESTROOM RENOVATION PROJECT BY OTHER. UNDER THIS BASE BID CONTRACTOR SHALL DEMO AND REMOVE ALL UNUSED LINES. CONTRACTOR SHALL REPAIR WALLS, FLOORS, SLABS, CEILINGS TO MATCH EXISTING UNLESS OTHERWISE NOTED ON THE ARCHITECTURAL DRAWINGS.

GENERAL NOTE:

1. ALL EXISTING HAND HELD EYE WASH STATIONS IN CORRIDORS SHALL BE REPLACED WITH EWI THROUGH THE ENTIRE BUILDING. ALL EYE/FACE DRENCH SHOWERS SHALL BE REPLACED WITH ESH-1 IF THEY ARE NOT IN PRISTINE CONDITION. ALL EMERGENCY SHOWERS SHALL BE PROVIDED WITH TEMPERED WATER WITH LOCAL MIXING VALVES @ 85°F.
2. CONTRACTOR IS RESPONSIBLE FOR RECONNECTING ANY EXISTING LINES THAT ARE NOT SHOWN ON THESE PLANS AFTER THE ADA RESTROOM RENOVATION. CONTRACTOR SHALL COORDINATE WITH OWNER PHASING TO AVOID DOWN TIME.
3. ALL COLD WATER PIPING AND PIPING SHALL BE INSULATED WITH 1" FIBERGLASS INSULATION, ALL HOT AND HOT WATER RETURN PIPING SHALL BE INSULATED AS FOLLOVED (1 1/4" AND BELOW 1" FIBERGLASS INSULATION SHALL BE USED) AND (1 1/2" AND ABOVE 2" FIBERGLASS INSULATION SHALL BE USED)



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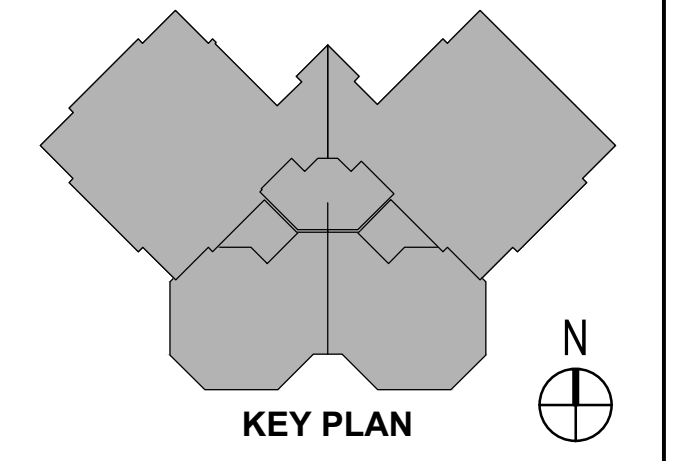
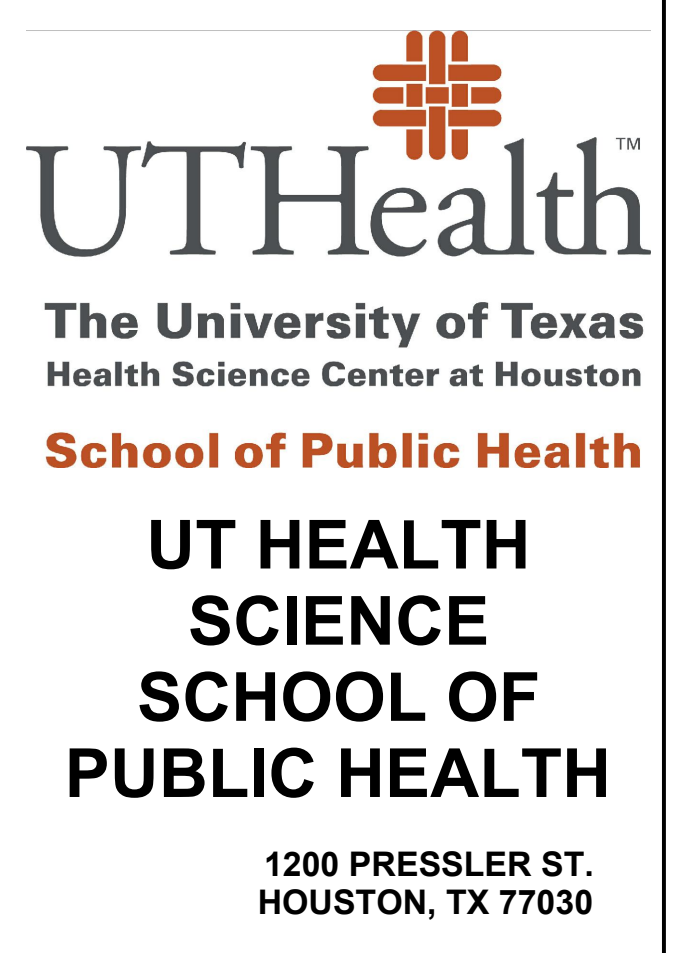
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1 BASEMENT FLOOR PLAN - PLUMBING - PROPOSED NEW PIPING
SCALE: 1/8" = 1'-0"



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05/31/2017	ISSUED FOR BID
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BASEMENT FLOOR PLAN - PLUMBING

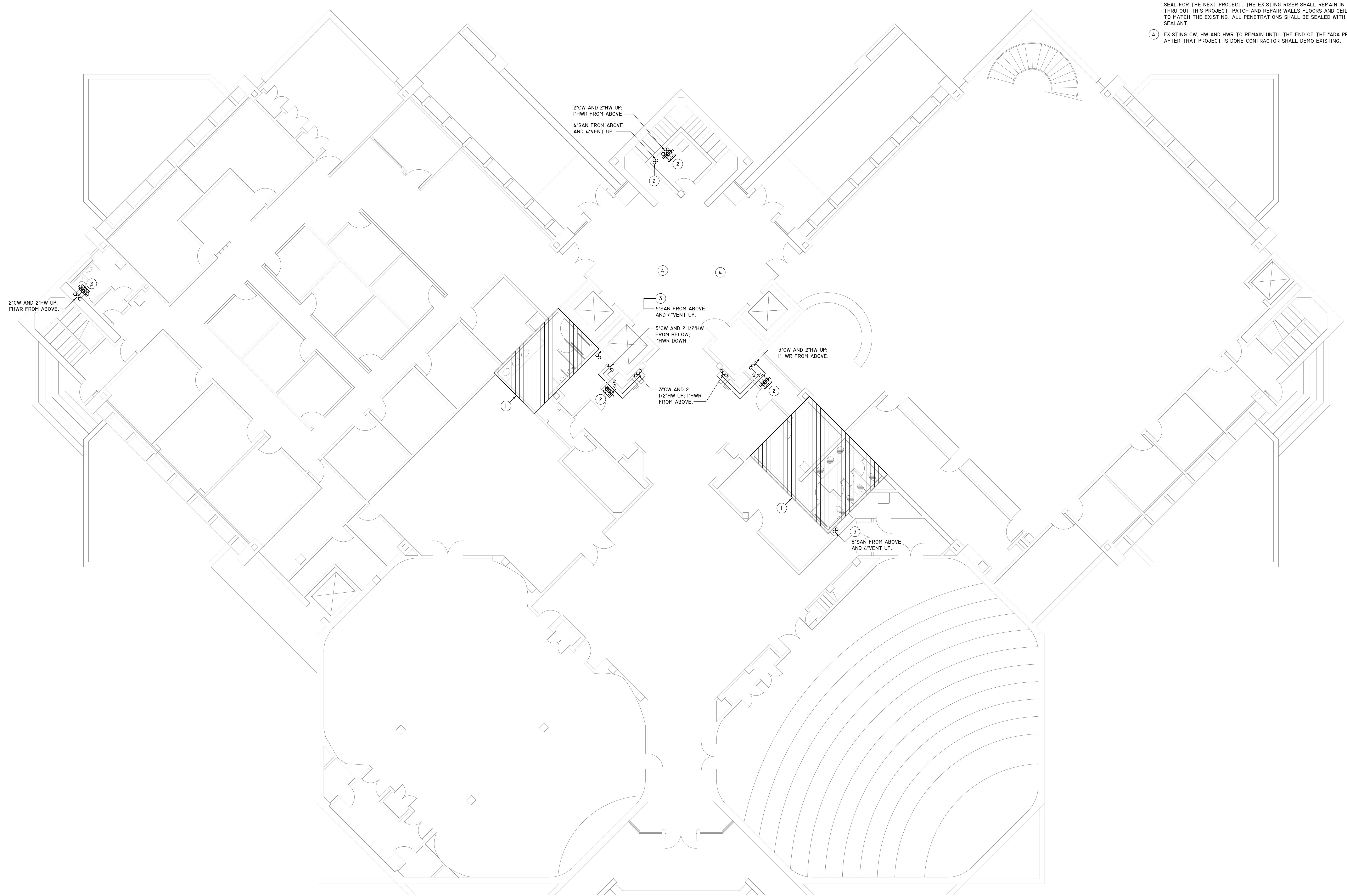
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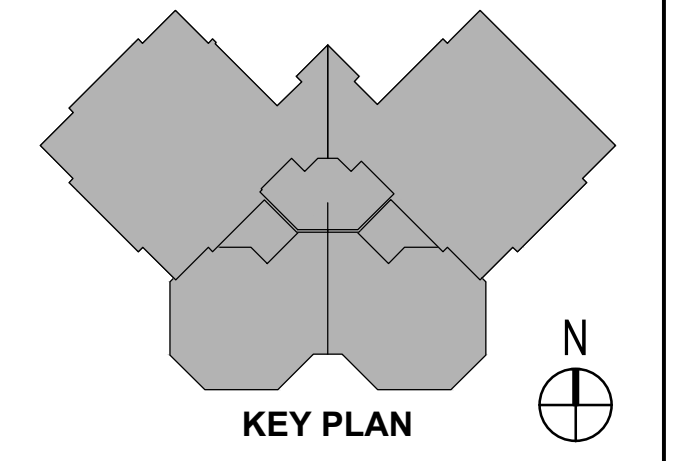
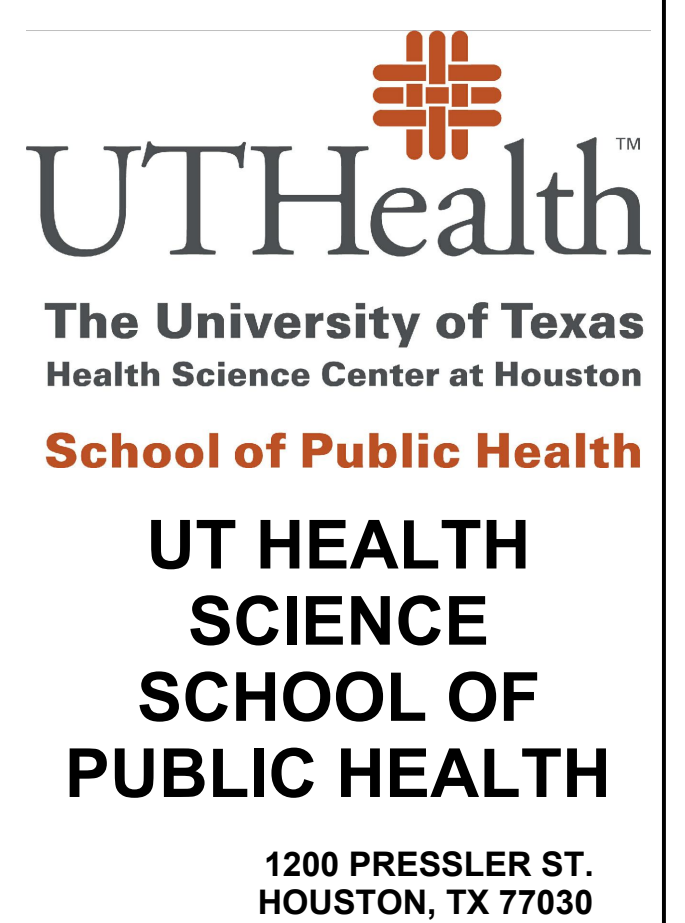
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GENERAL NOTE:
 1. EXISTING PLUMBING FIXTURE TO REMAIN, UNLESS OTHERWISE NOTED BY ARCHITECT.
 2. ALL EXISTING CW, HW, HWR, SAN, AND VENT TO REMAIN IN SERVICE UNTIL THE END OF THE 'ADA RESTROOM PROJECT BY OTHER'. ROUTE PROPOSED CW, HW, HWR, SAN AND VENT LINES PARALLEL TO THE EXISTING PIPING WITH THE SAME SIZE PIPING. ROUTE MAIN WATER LINES AND RISERS AND PROVIDE NEW PENETRATIONS THRU EACH FLOOR. SEAL ALL PENETRATIONS WITH FIRE RATED SEALANT. PROVIDE A TAP WITH A SHUT OFF VALVE. CAP AND SEAL ON EACH LEVEL FOR EACH RISER. THE 'ADA PROJECT' SHALL CONNECT TO THE PROPOSED RISERS. UNDER THIS PROJECT THE CONTRACTOR SHALL DEMO ALL OLD HORIZONTAL AND VERTICAL RUNS THAT ARE NO LONGER IN USE. CONTRACTOR SHALL REPAIR WALLS, FLOORS, SLABS, CEILING TO MATCH EXISTING UNLESS OTHERWISE NOTED ON THE ARCHITECTURAL DRAWINGS.

KEYED NOTE:
 ① REFER TO OTHER PROJECT FOR WORK IN THIS AREA.
 ② INSTALL NEW RISERS NEXT TO THE EXISTING RISERS WITH SAME SIZE LINES AS THE EXISTING. PROVIDE A TAP OFF CAP AND SEAL FOR THE NEXT PROJECT PROVIDE LINE SIZE BALL VALVES FOR EACH PIPE. THE EXISTING RISER SHALL REMAIN IN USE THRU OUT THIS PROJECT. PATCH AND REPAIR WALLS FLOORS AND CEILING TO MATCH THE EXISTING. ALL PENETRATIONS SHALL BE SEALED WITH FIRE SEALANT.
 ③ INSTALL PROPOSED SANITARY AND VENT PIPING RISERS NEXT TO THE EXISTING RISERS WITH SAME SIZE LINES AS THE EXISTING. PROVIDE A TAP OFF CAP AND SEAL FOR THE NEXT PROJECT. THE EXISTING RISER SHALL REMAIN IN USE THRU OUT THIS PROJECT. PATCH AND REPAIR WALLS FLOORS AND CEILING TO MATCH THE EXISTING. ALL PENETRATIONS SHALL BE SEALED WITH FIRE SEALANT.
 ④ EXISTING CW, HW AND HWR TO REMAIN UNTIL THE END OF THE 'ADA PROJECT' AFTER THAT PROJECT IS DONE CONTRACTOR SHALL DEMO EXISTING.



1 FIRST FLOOR PLAN - PLUMBING
 SCALE: 1/8" = 1'-0"



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Title	

FIRST FLOOR PLAN - PLUMBING

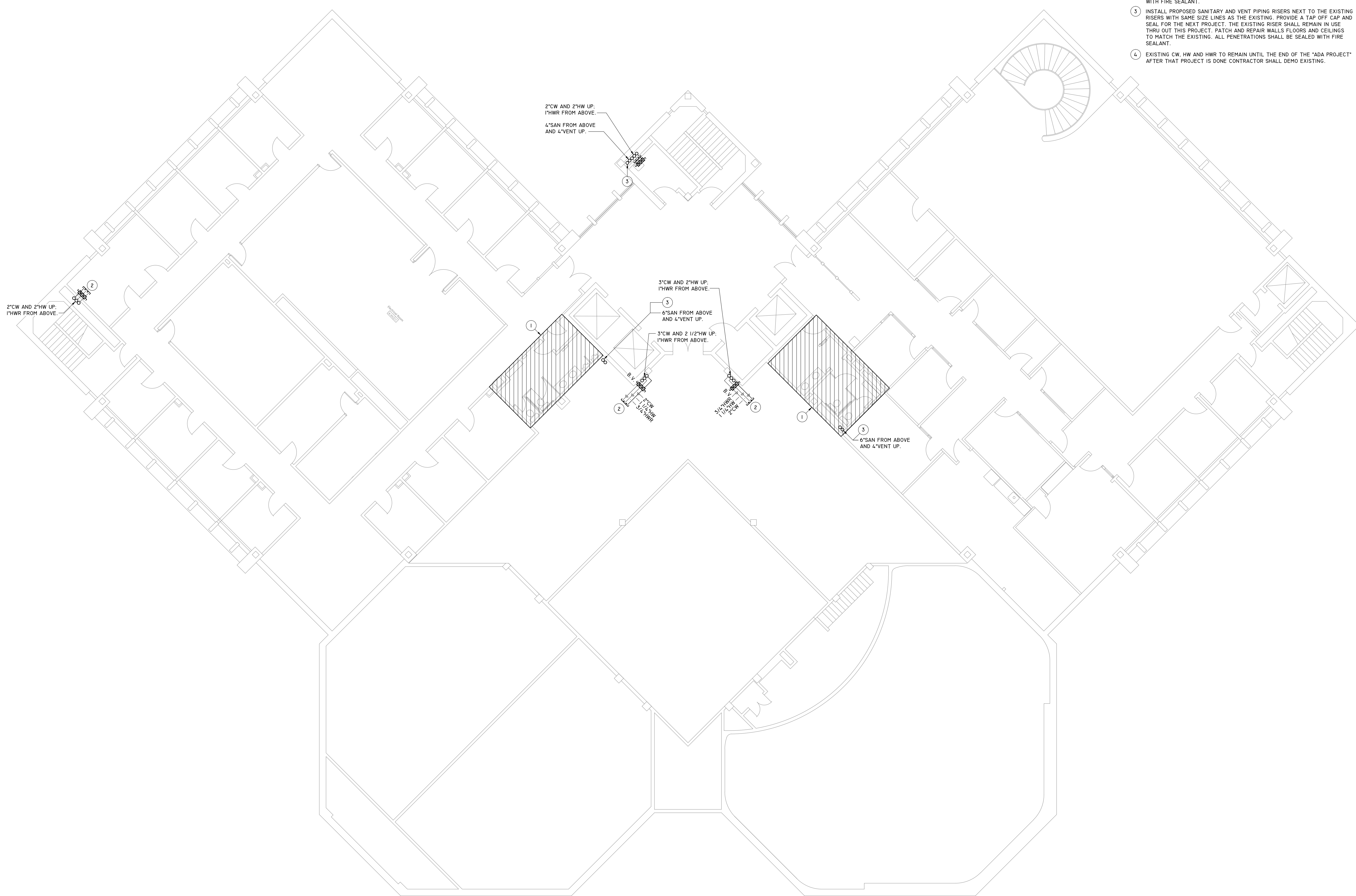
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- GENERAL NOTE:**
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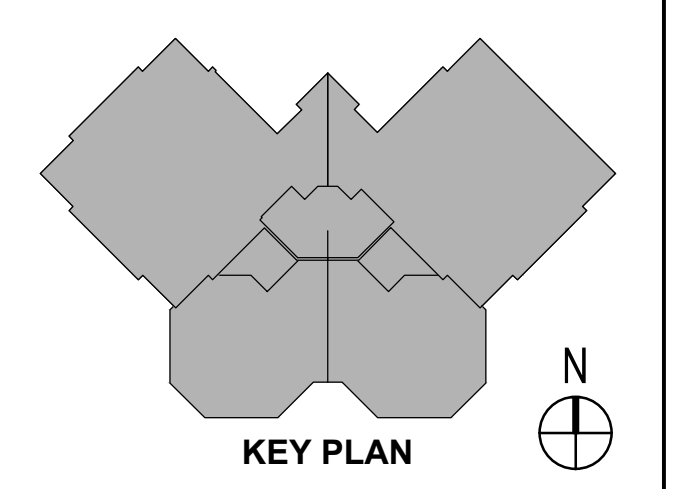
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1 SECOND FLOOR PLAN - PLUMBING
SCALE: 1/8" = 1'-0"

Infrastructure Associates
INFRASTRUCTURE ASSOCIATES, INC.
617 RICHMOND AVENUE, SUITE 200
HOUSTON, TEXAS 77057
TYPE REGISTRATION NO. F-4506
(713) 622-0120 PH (713) 622-0557 FAX
WWW.IAHOUSTON.COM

UTHealth
The University of Texas
Health Science Center at Houston
School of Public Health
**UT HEALTH
SCIENCE
SCHOOL OF
PUBLIC HEALTH**
1200 PRESSLER ST.
HOUSTON, TX 77030



STATE OF TEXAS
MATT A. FLUKINGER
118970
LICENSED PROFESSIONAL ENGINEER
Matt A. Flukinger
7-28-17

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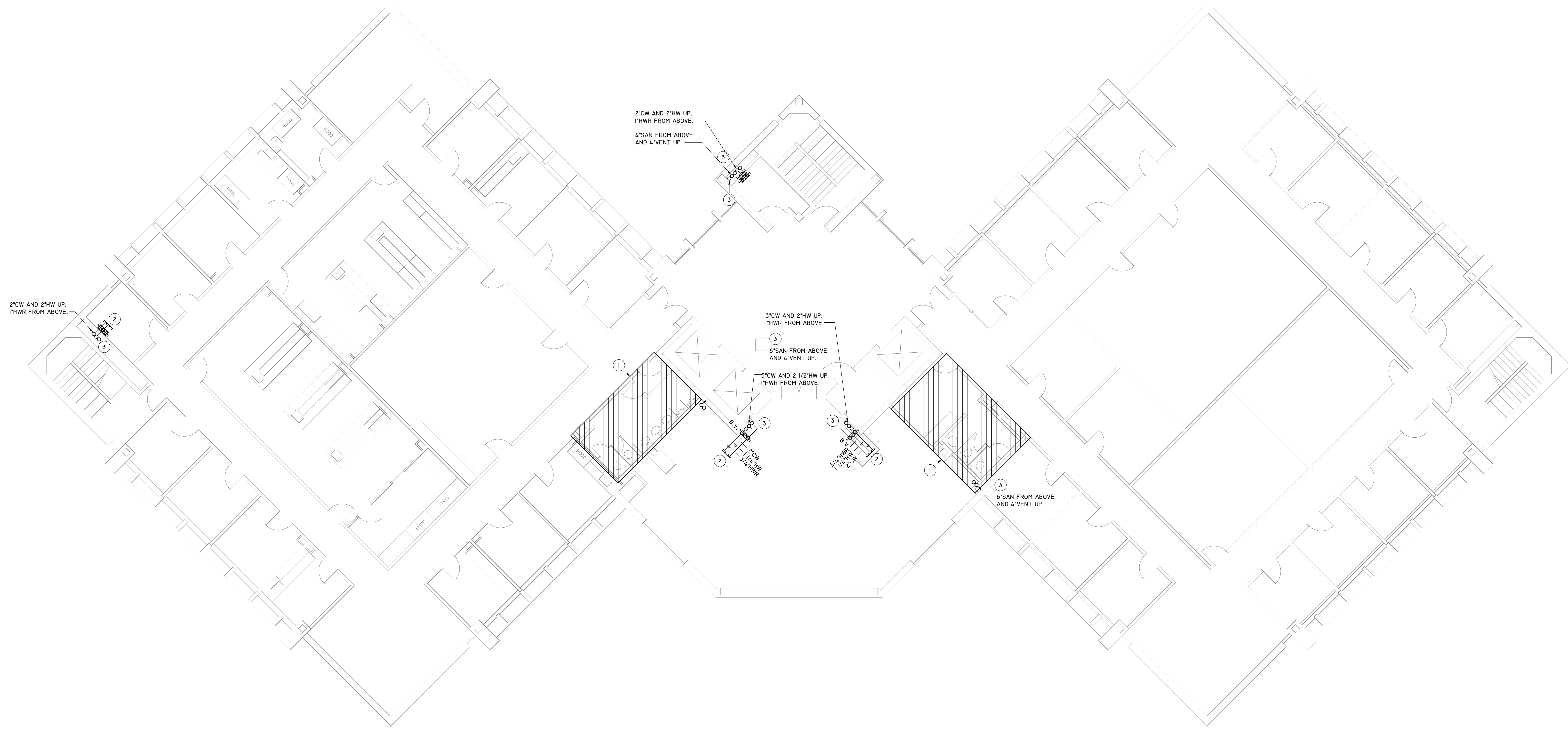
Date	31 MARCH 2017
Job Number	-
Drawn	KN, KT, CJT
Checked	IT, SK
Approved	MAF, SK
Title	

SECOND FLOOR PLAN - PLUMBING
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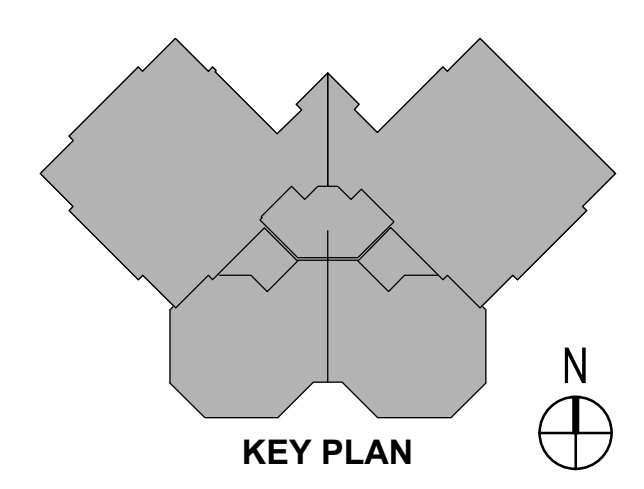
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1 THIRD FLOOR PLAN - PLUMBING
SCALE: 1/8" = 1'-0"



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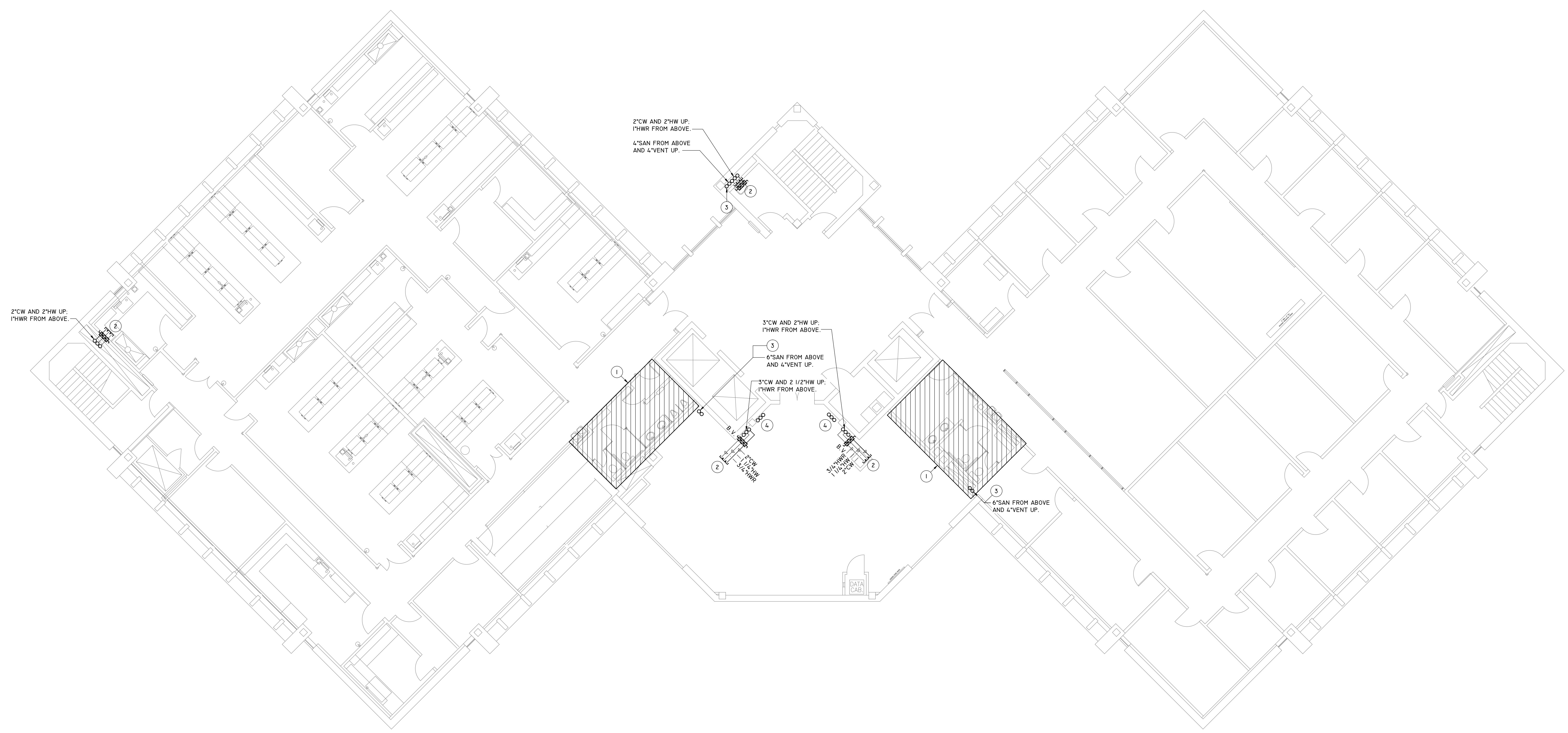
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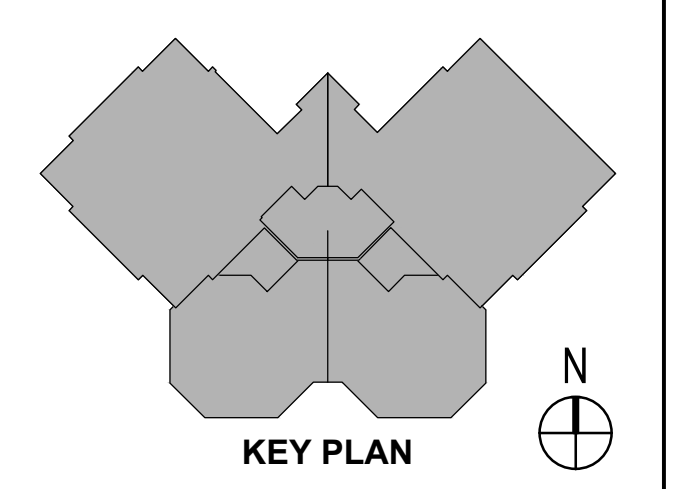
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1 FOURTH FLOOR PLAN - PLUMBING
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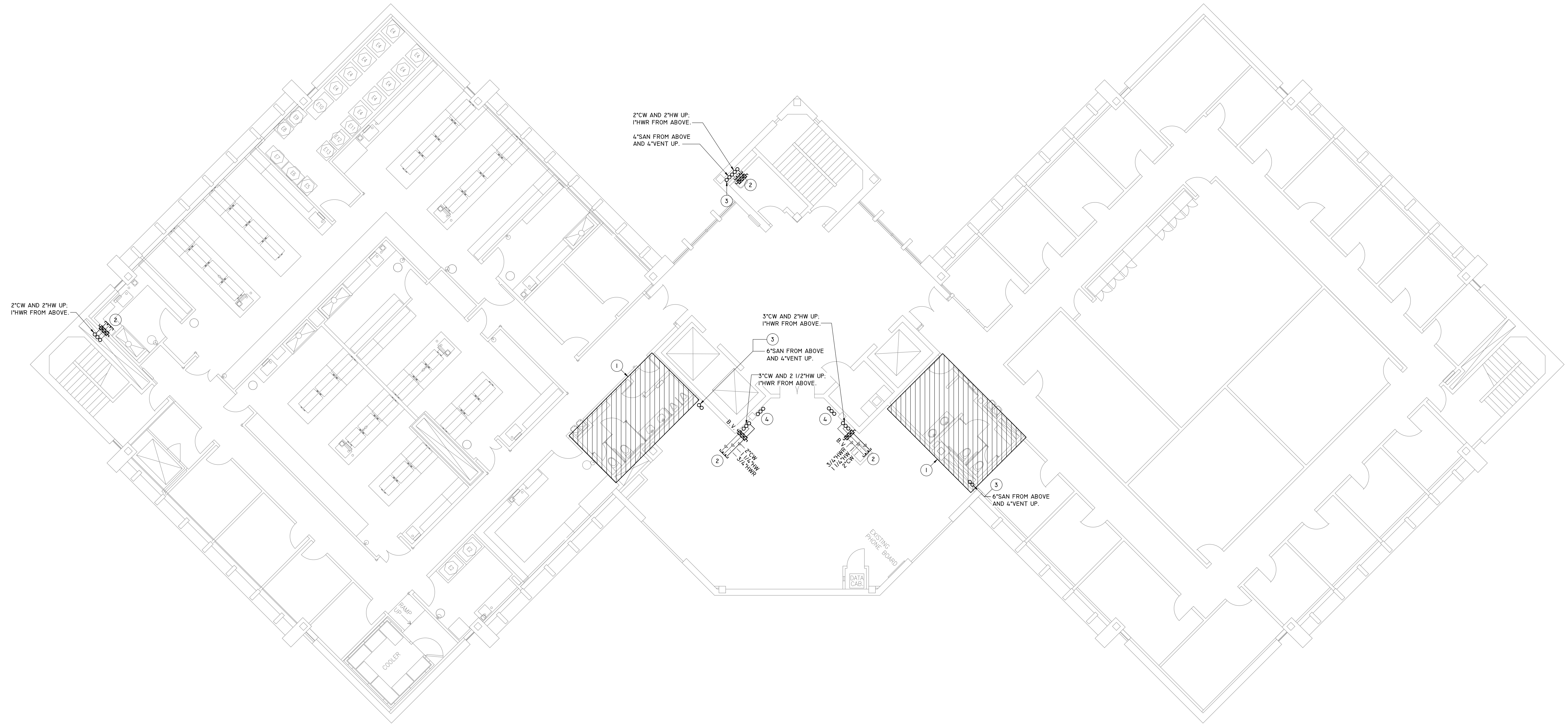
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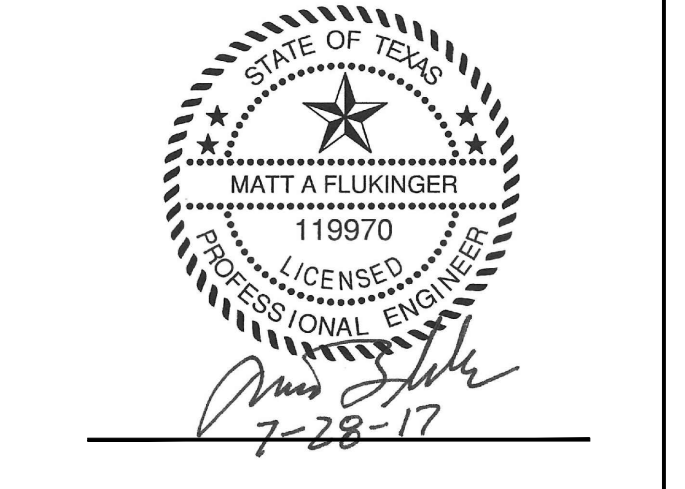
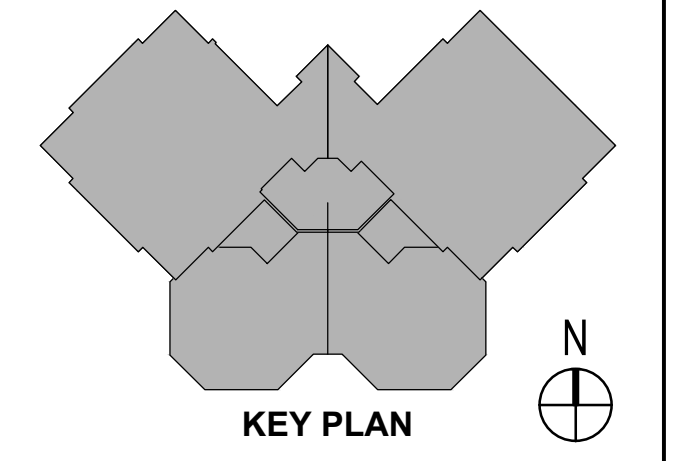
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1 FIFTH FLOOR PLAN - PLUMBING
SCALE: 1/8" = 1'-0"



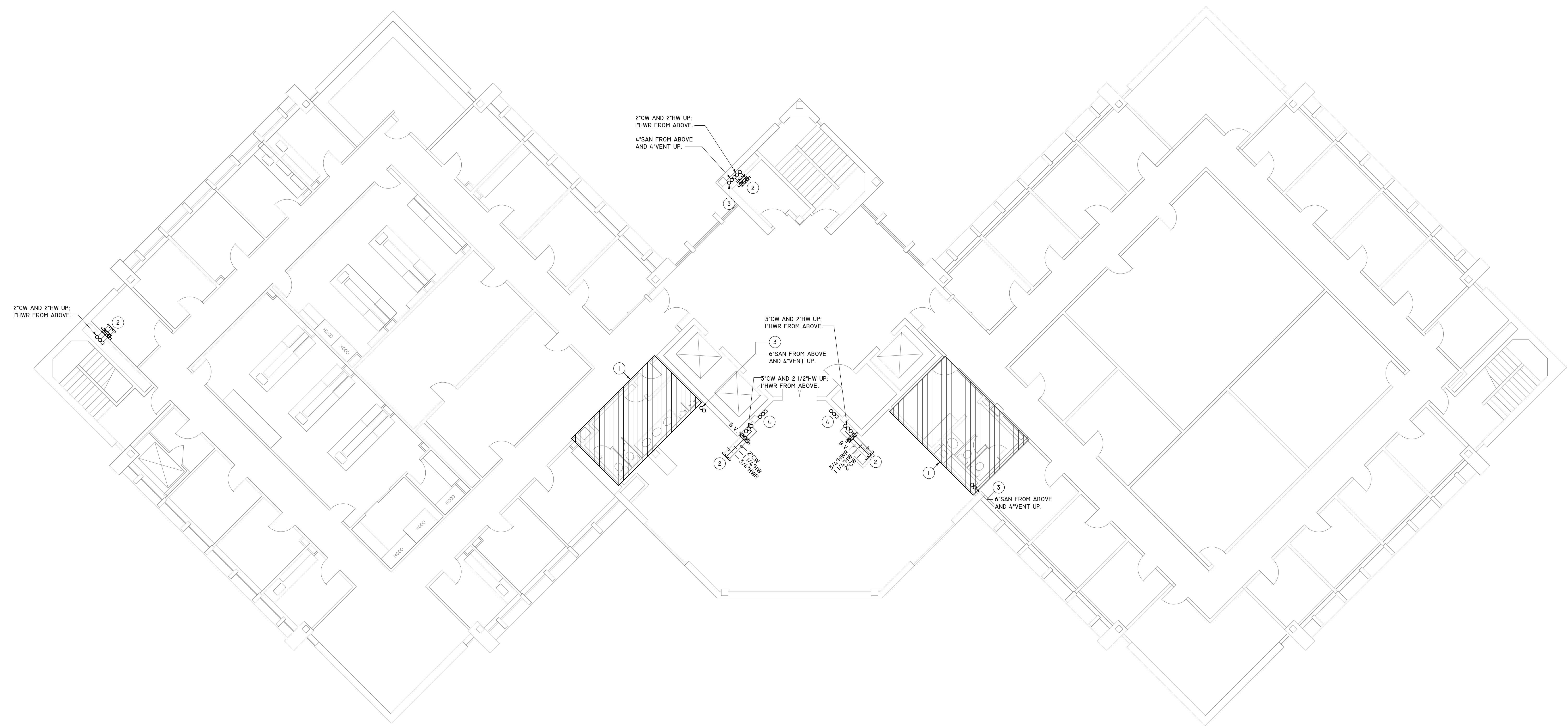
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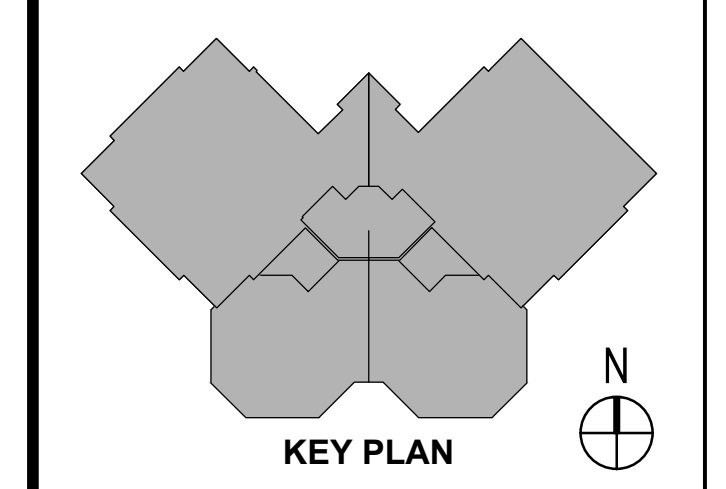
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1 SIXTH FLOOR PLAN - PLUMBING
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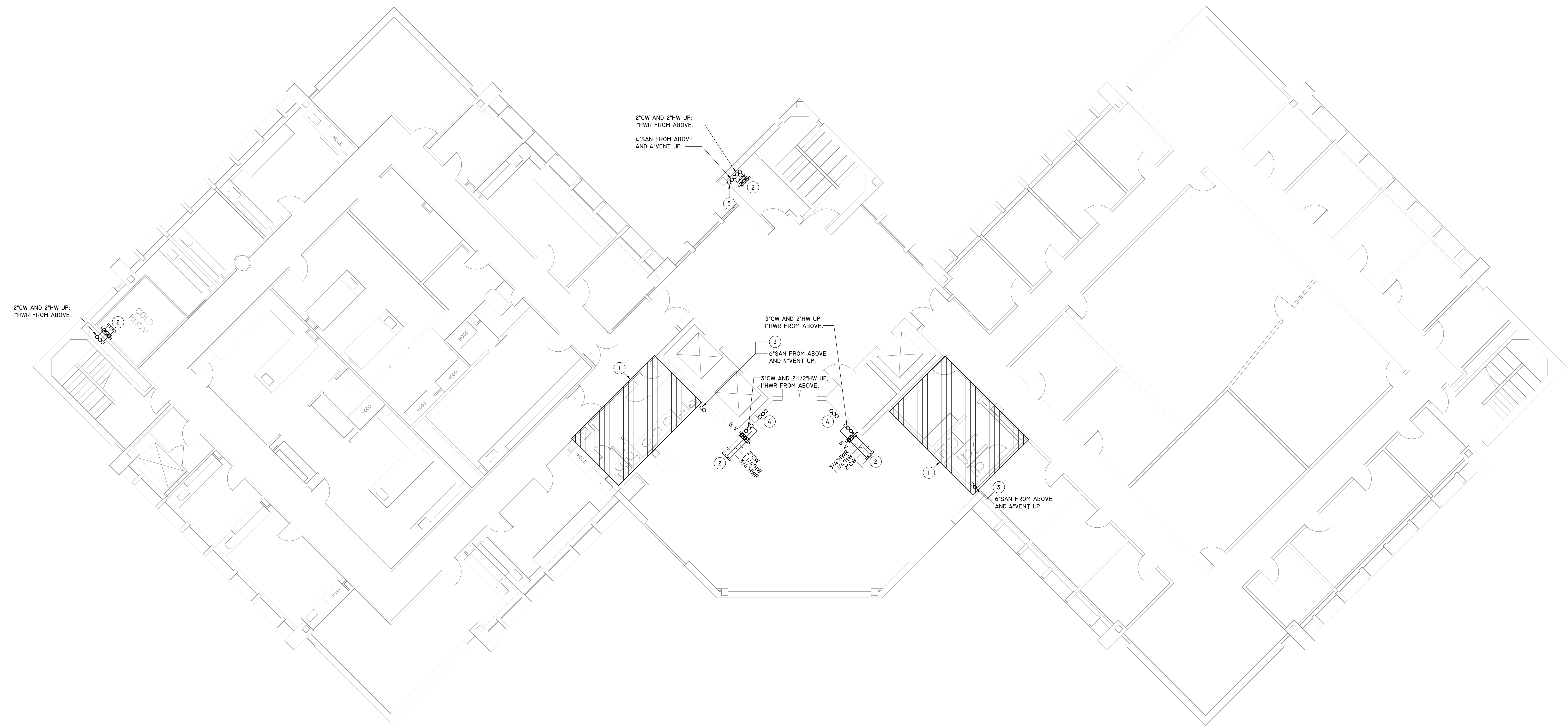
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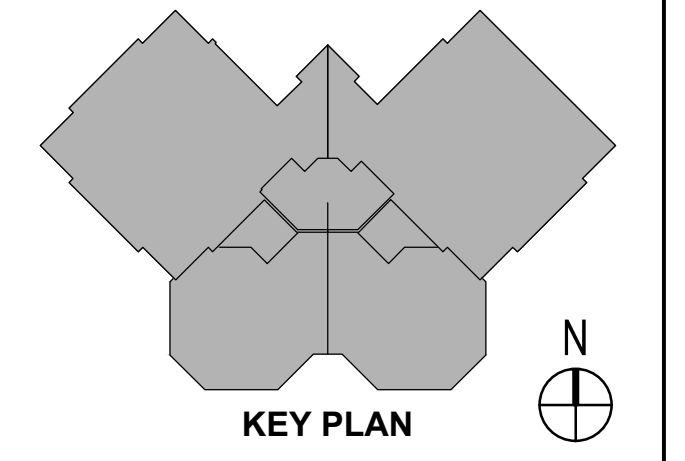
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1 SEVENTH FLOOR PLAN - PLUMBING
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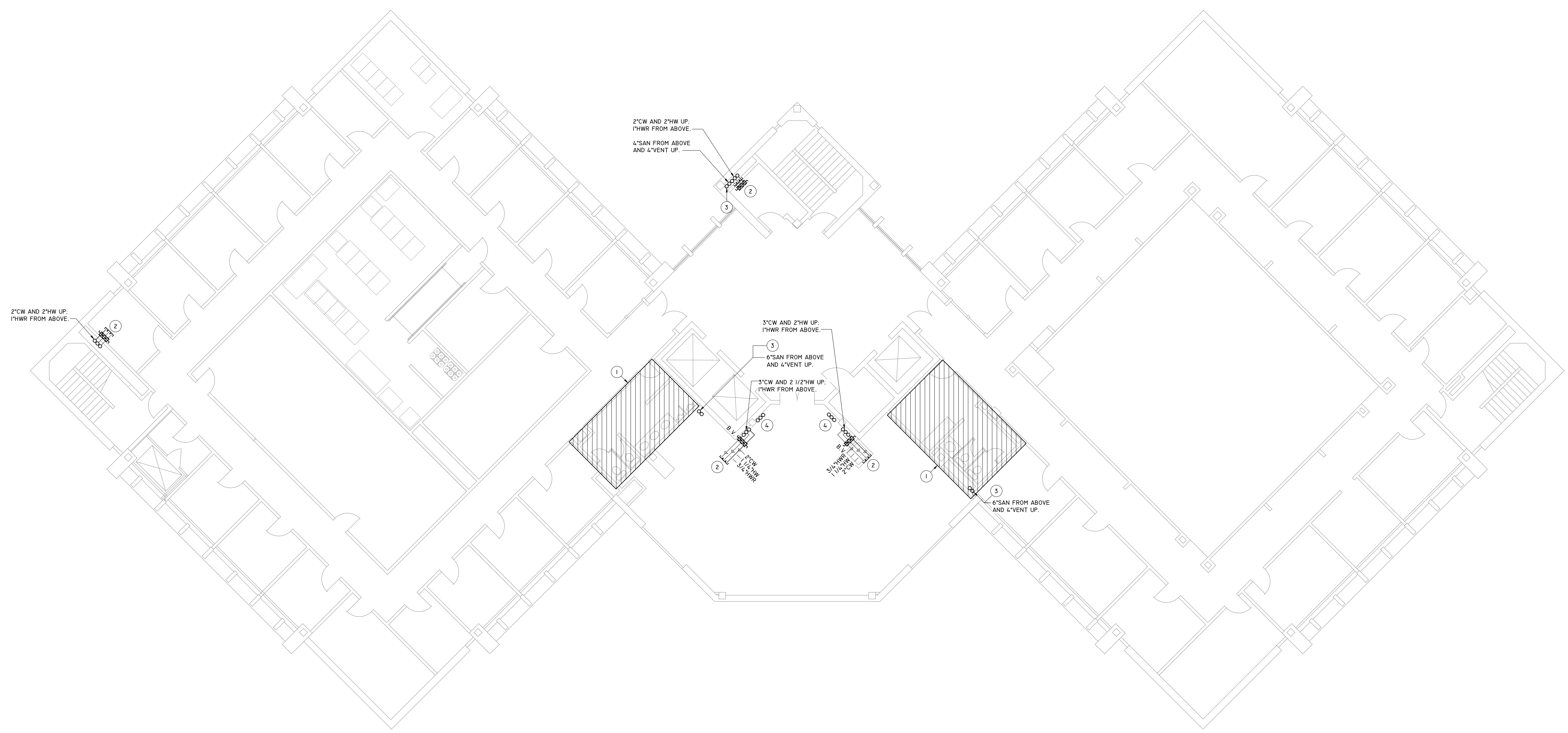
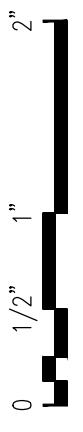


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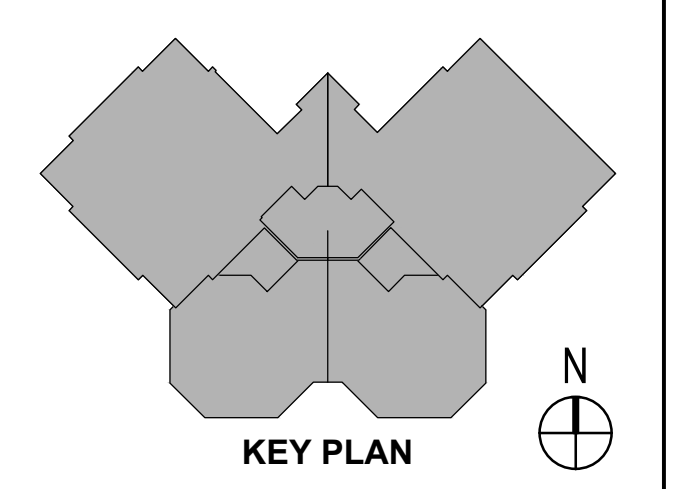
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1 EIGHTH FLOOR PLAN - PLUMBING
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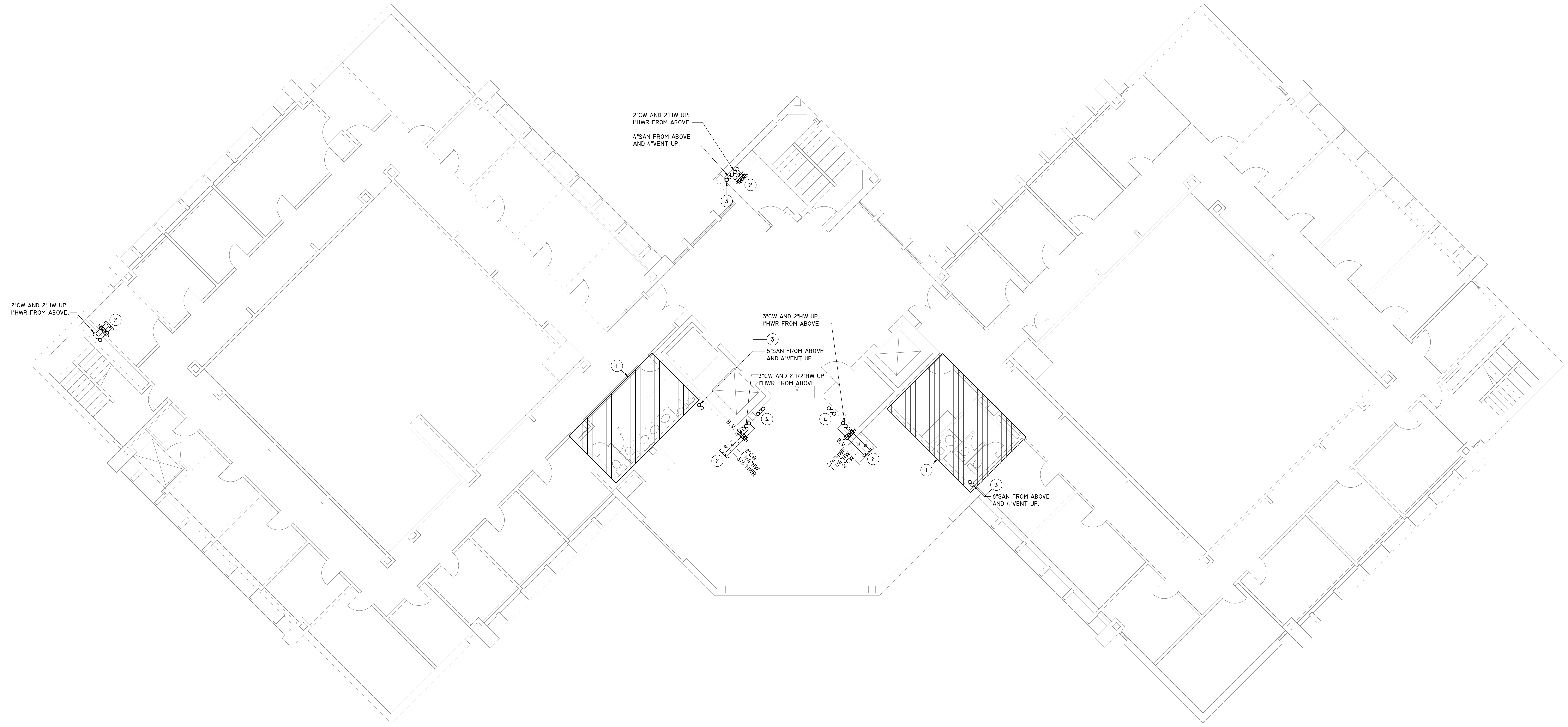
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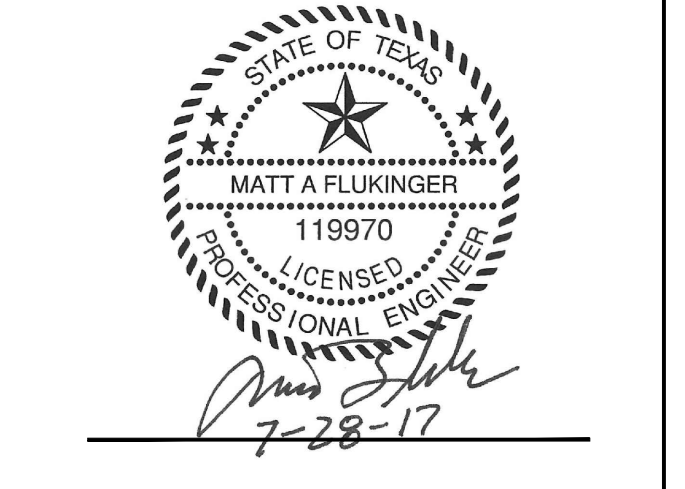
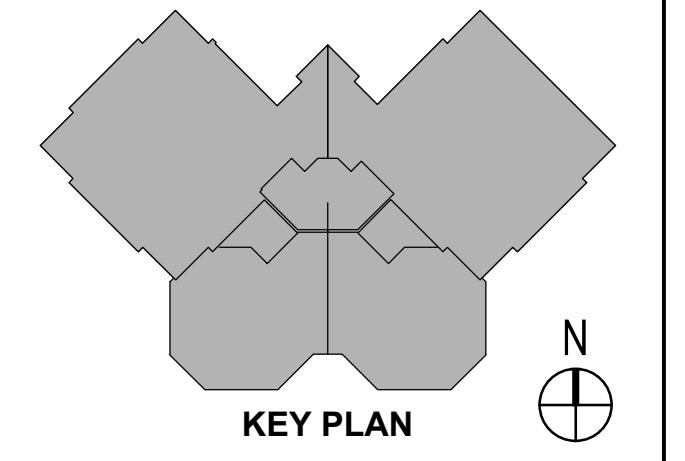
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1 NINTH FLOOR PLAN - PLUMBING
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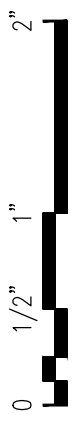


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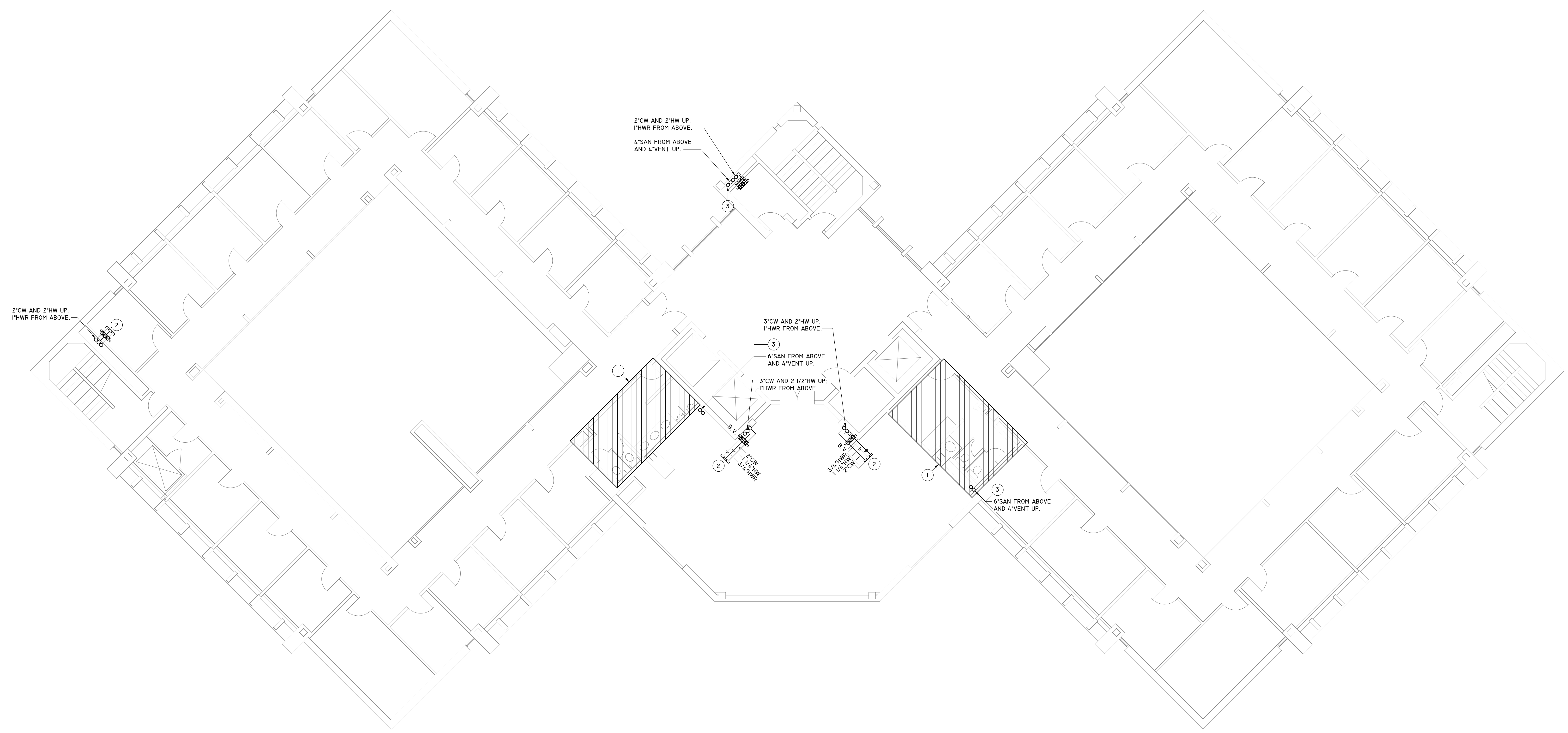
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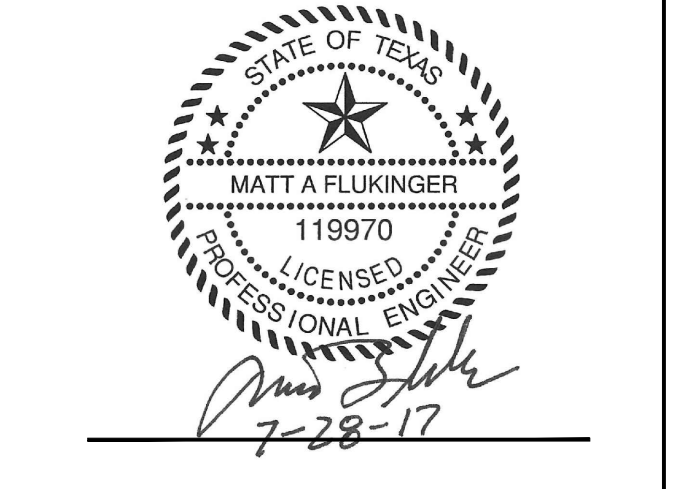
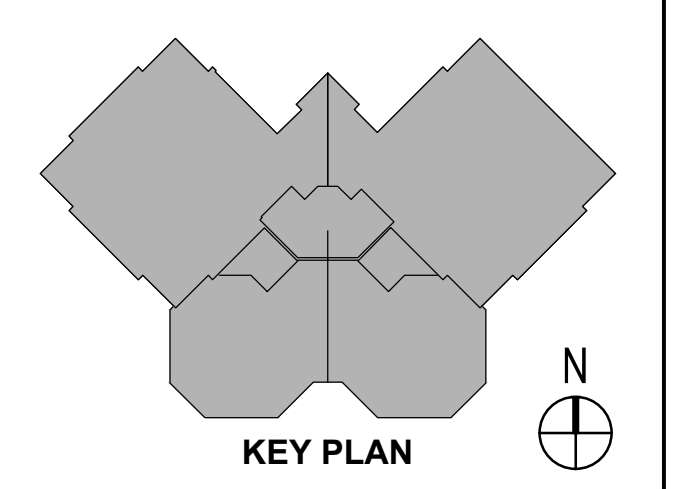
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- GENERAL NOTE:**
- EXISTING PLUMBING FIXTURE TO REMAIN, UNLESS OTHERWISE NOTED BY ARCHITECT.
 - ALL EXISTING CW, HW, HWR, SAN, AND VENT TO REMAIN IN SERVICE UNTIL THE END OF THE 'ADA RESTROOM PROJECT BY OTHER'. ROUTE PROPOSED CW, HW, HWR, SAN AND VENT LINES PARALLEL TO THE EXISTING PIPING WITH THE SAME SIZE PIPING. ROUTE MAIN WATER LINES AND RISERS AND PROVIDE NEW PENETRATIONS THRU EACH FLOOR. SEAL ALL PENETRATIONS WITH FIRE RATED SEALANT. PROVIDE A TAP WITH A SHUT OFF VALVE, CAP AND SEAL ON EACH LEVEL FOR EACH RISER. THE 'ADA PROJECT' SHALL CONNECT TO THE PROPOSED RISERS. UNDER THIS PROJECT THE CONTRACTOR SHALL DEMO ALL OLD HORIZONTAL AND VERTICAL RISERS THAT ARE NO LONGER IN USE. CONTRACTOR SHALL REPAIR WALLS, FLOORS, SLABS, CEILINGS TO MATCH EXISTING UNLESS OTHERWISE NOTED ON THE ARCHITECTURAL DRAWINGS.
- KEYED NOTE:**
- REFER TO OTHER PROJECT FOR WORK IN THIS AREA.
 - INSTALL NEW RISERS NEXT TO THE EXISTING RISERS WITH SAME SIZE LINES AS THE EXISTING. PROVIDE A TAP OFF CAP AND SEAL FOR THE NEXT PROJECT PROVIDE LINE SIZE BALL VALVES FOR EACH PIPE. THE EXISTING RISER SHALL REMAIN IN USE THRU OUT THIS PROJECT. PATCH AND REPAIR WALLS FLOORS AND CEILINGS TO MATCH THE EXISTING. ALL PENETRATIONS SHALL BE SEALED WITH FIRE SEALANT.
 - INSTALL PROPOSED SANITARY AND VENT PIPING RISERS NEXT TO THE EXISTING RISERS WITH SAME SIZE LINES AS THE EXISTING. PROVIDE A TAP OFF CAP AND SEAL FOR THE NEXT PROJECT. THE EXISTING RISER SHALL REMAIN IN USE THRU OUT THIS PROJECT. PATCH AND REPAIR WALLS FLOORS AND CEILINGS TO MATCH THE EXISTING. ALL PENETRATIONS SHALL BE SEALED WITH FIRE SEALANT.
 - EXISTING CW, HW AND HWR TO REMAIN UNTIL THE END OF THE 'ADA PROJECT' AFTER THAT PROJECT IS DONE CONTRACTOR SHALL DEMO EXISTING.



1 TENTH FLOOR PLAN - PLUMBING
SCALE: 1/8" = 1'-0"



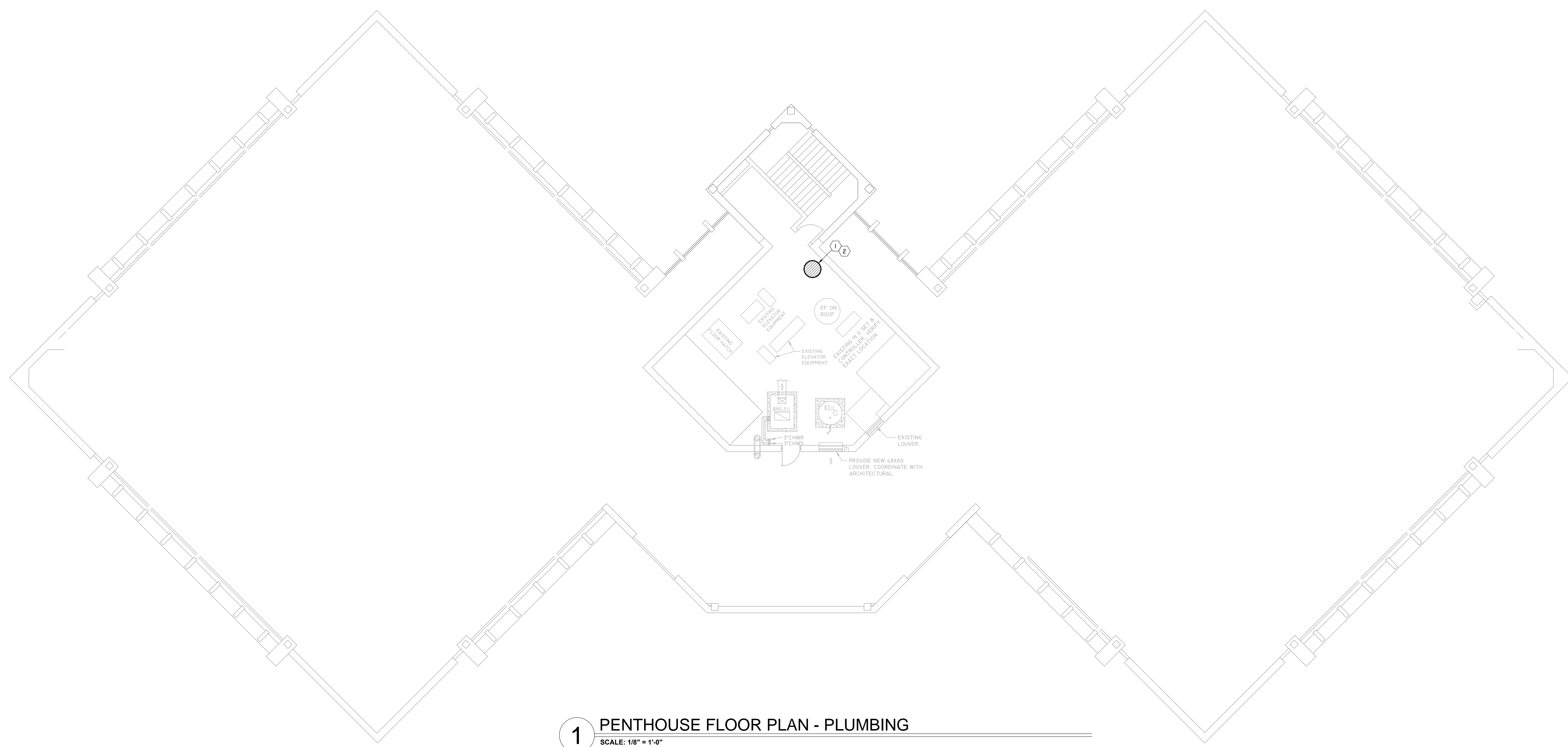
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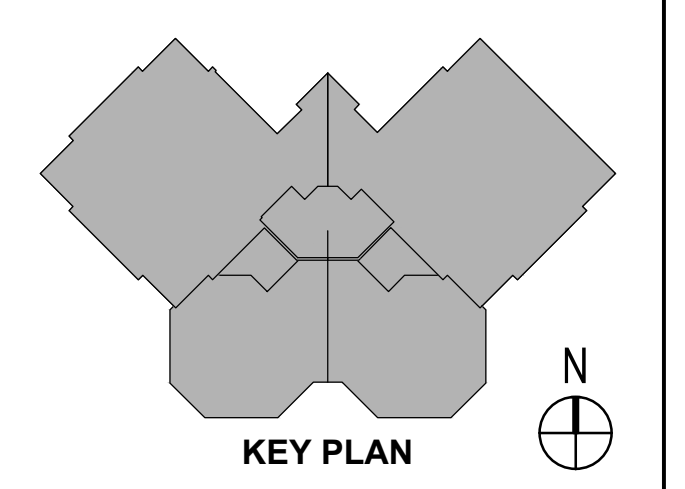
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- KEYED NOTES:**
- ① DEMO EXISTING EXPANSION TANK APPROXIMATELY AT THIS LOCATION. CONTRACTOR TO FIELD VERIFY EXACT LOCATION AND SIZE. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING WATER PIPING AND APPARATUSES SERVING EXISTING EXPANSION TANK AND DEMOLITION EXISTING APPARATUSES AND PIPING BACK TO MAIN COLD WATER STACK.
 - ② CONTRACTOR SHALL PROVIDE SAME MANUFACTURE, MODEL AND SIZE OF THE EXISTING EXPANSION TANK. CONTRACTOR SHALL REPLACE EXISTING DOMESTIC EXPANSION TANK AND UTILIZE THE EXISTING CONCRETE PAD. CONTRACTOR SHALL PROVIDE NEW WATER LINE WITH THE SAME SIZE AS EXISTING TO THE PROPOSED CW STACK, APPROXIMATELY 100' OF 3" CW LINE.



1 PENTHOUSE FLOOR PLAN - PLUMBING
SCALE: 1/8" = 1'-0"



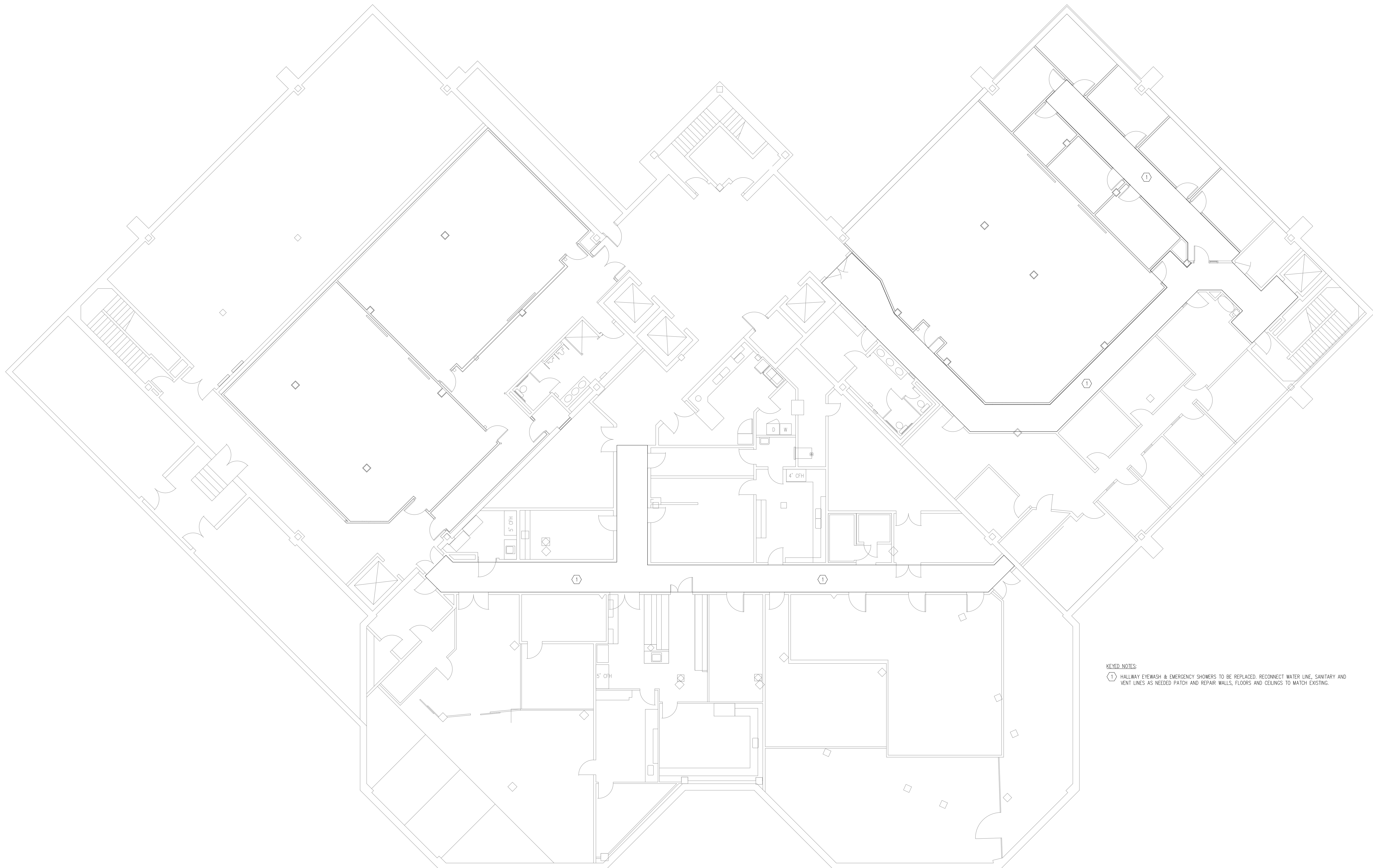
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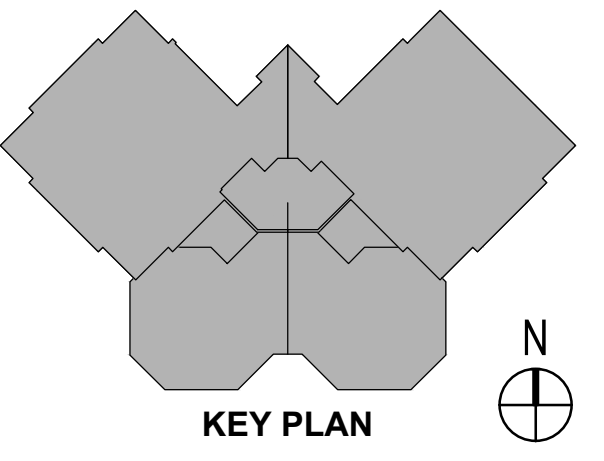


KEYED NOTES:
① HALLWAY EYEWASH & EMERGENCY SHOWERS TO BE REPLACED. RECONNECT WATER LINE, SANITARY AND VENT LINES AS NEEDED PATCH AND REPAIR WALLS, FLOORS AND CEILINGS TO MATCH EXISTING.

1 BASEMENT FLOOR PLAN - PLUMBING - PROPOSED NEW PIPING
SCALE: 1/8" = 1'-0"

Infrastructure Associates
INFRASTRUCTURE ASSOCIATES, INC.
617 RICHMOND AVENUE, SUITE 200
HOUSTON, TEXAS 77057
TYPE REGISTRATION NO. F-4506
(713) 622-0120 PH (713) 622-0557 FAX
WWW.IAHOUSTON.COM

UTHealth
The University of Texas
Health Science Center at Houston
School of Public Health
**UT HEALTH
SCIENCE
SCHOOL OF
PUBLIC HEALTH**
1200 PRESSLER ST.
HOUSTON, TX 77030



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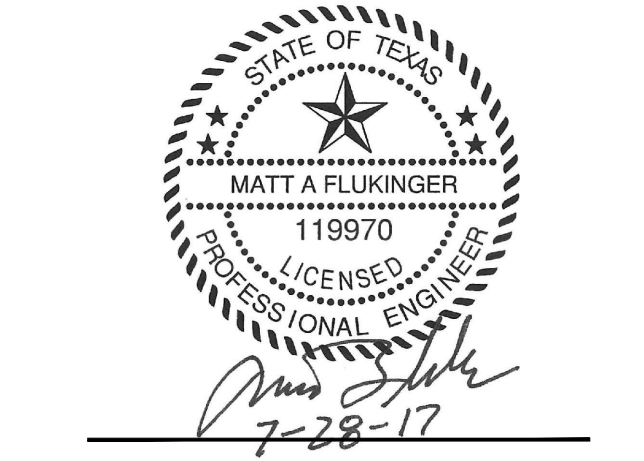
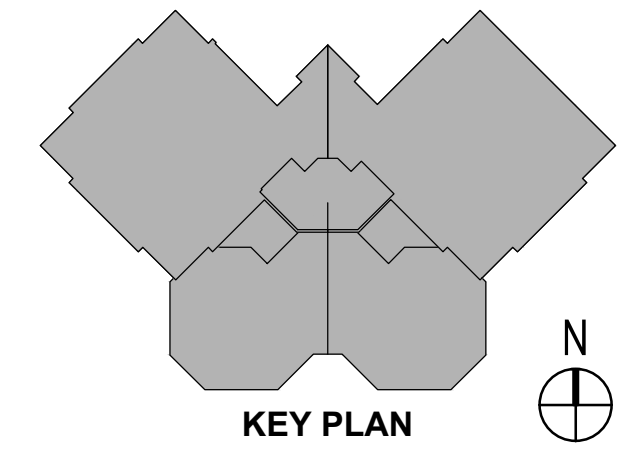
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BASEMENT FLOOR
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KEYED NOTES:
 ① HALLWAY EYEWASH & EMERGENCY SHOWERS TO BE REPLACED. RECONNECT WATER LINE, SANITARY AND VENT LINES AS NEEDED PATCH AND REPAIR WALLS, FLOORS AND CEILINGS TO MATCH EXISTING.

1 THIRD FLOOR PLAN - EXISTING EYE WASH & SAFETY SHOWER IN LABS
 SCALE: 1/8" = 1'-0"

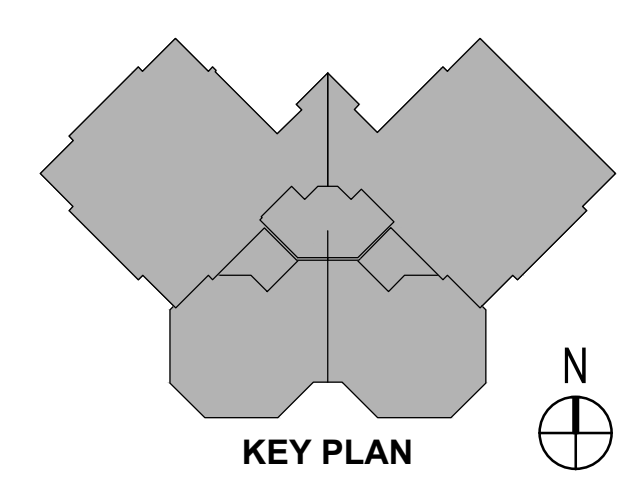
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**THIRD FLOOR PLAN -
 EXISTING EYE WASH &
 SAFETY SHOWER IN
 LABS**

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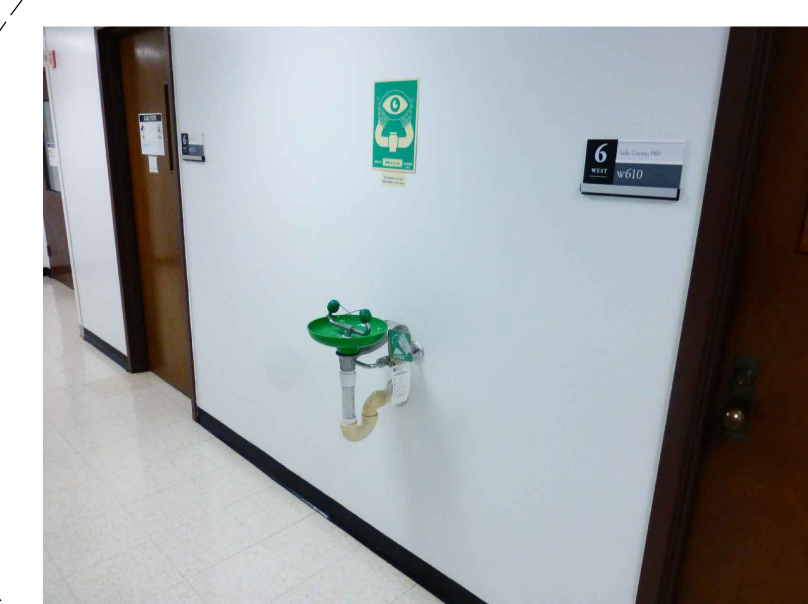
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SIXTH FLOOR PLAN - EXISTING EYE WASH & SAFETY SHOWER IN LABS

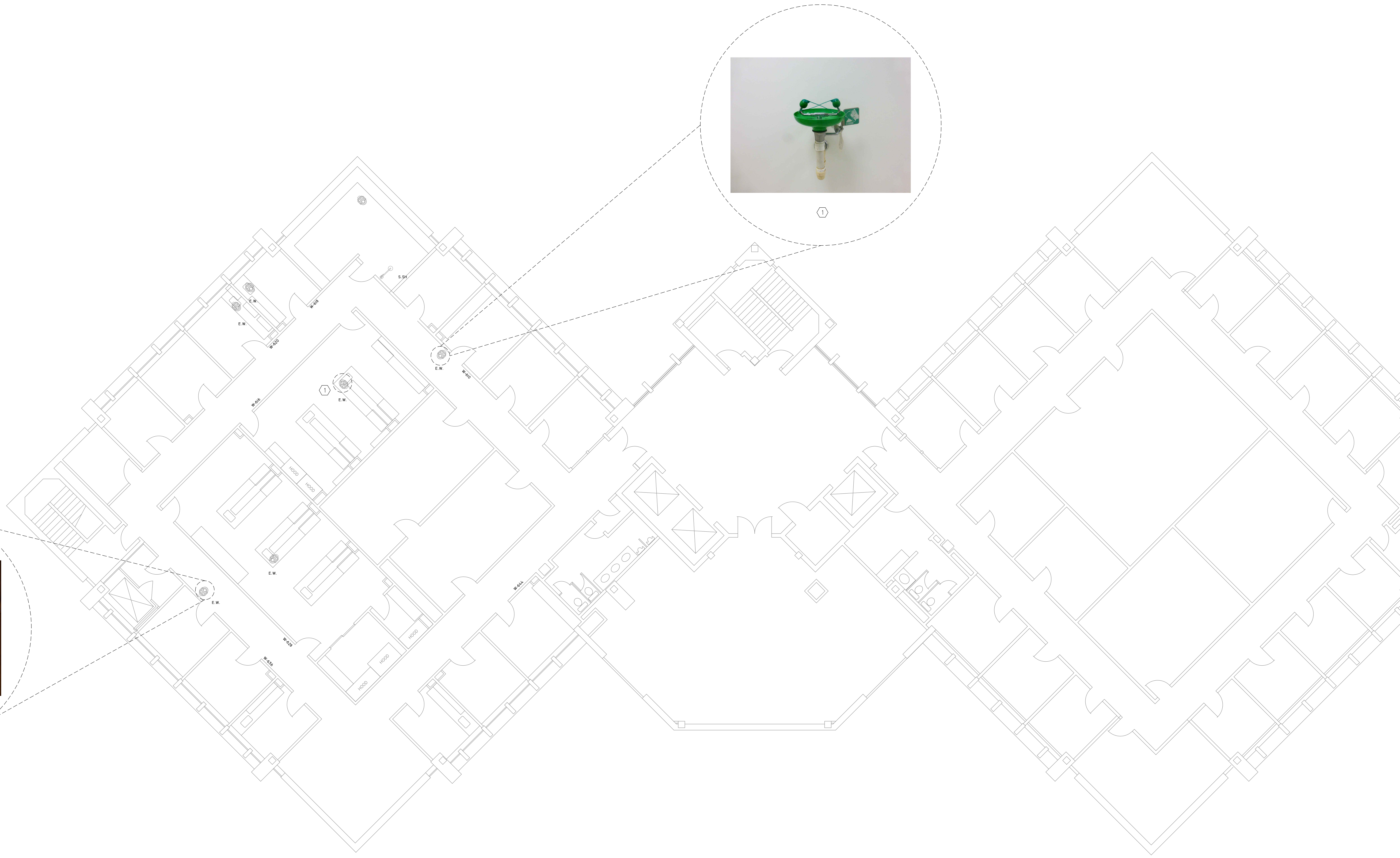
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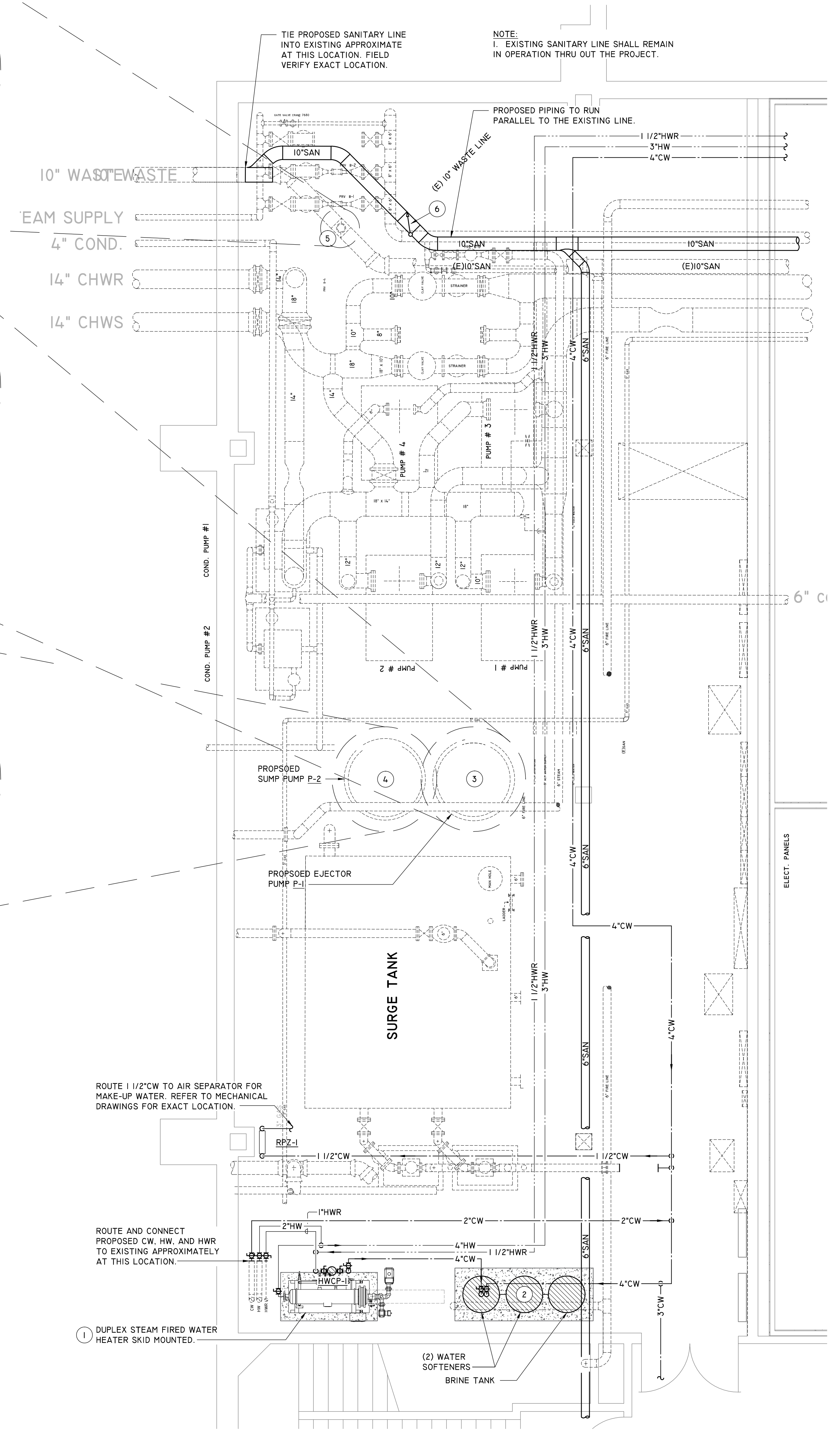
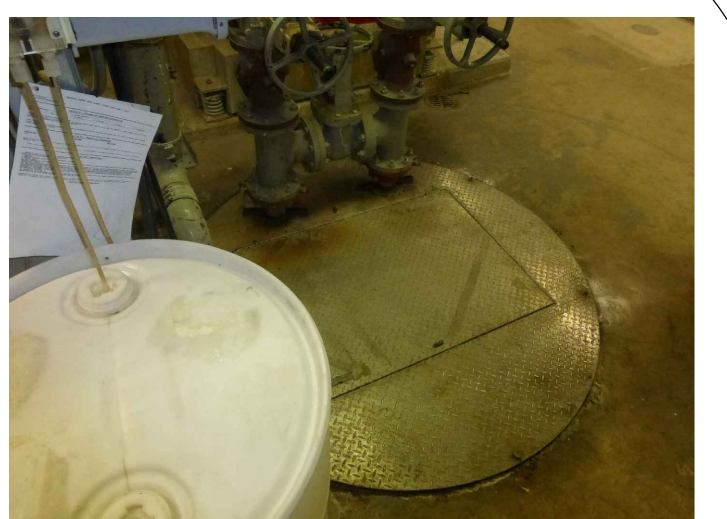
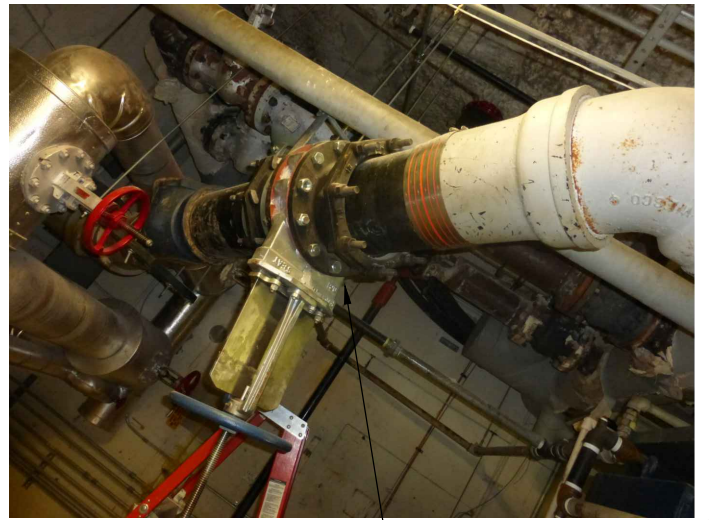
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GENERAL NOTES:
 ① EXISTING EYE WASH IN LAB HALLWAYS SHALL BE REPLACED WITH A NEW ONE.

1 SIXTH FLOOR PLAN - EXISTING EYE WASH & SAFETY SHOWER IN LABS
 SCALE: 1/8" = 1'-0"

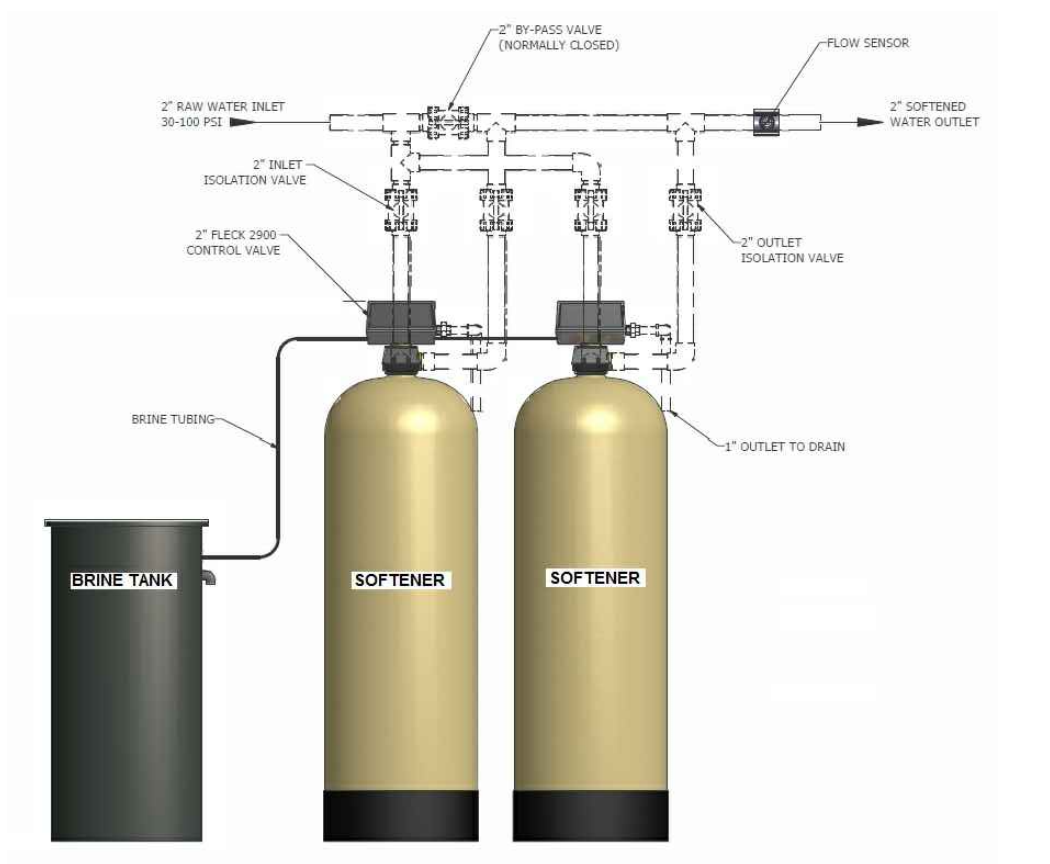
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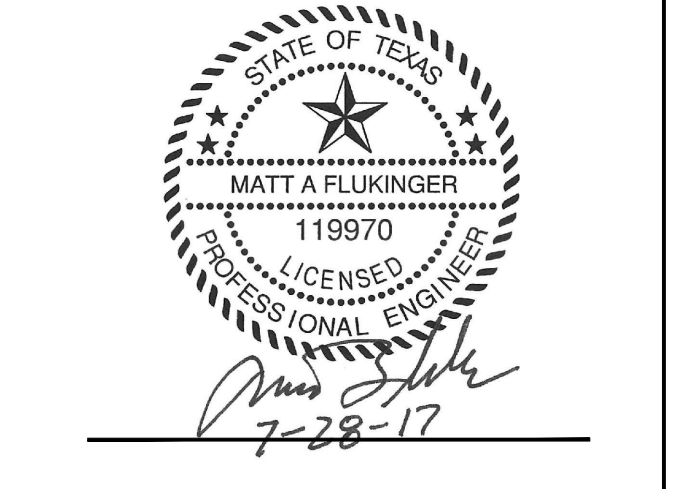
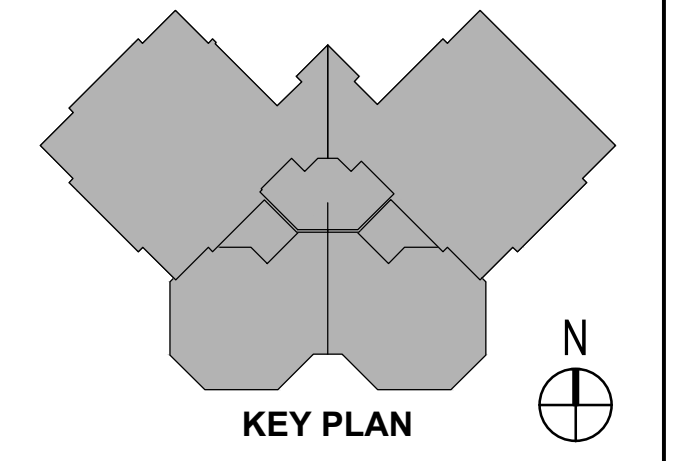
1 ENLARGED BASEMENT FLOOR PLAN - PLUMBING
SCALE: 1/8" = 1'-0"

KEYED NOTE:

- 1 PROPOSED HORIZONTAL DUAL SKID MOUNTED DOMESTIC HOT WATER SYSTEM PIPING AND ASSOCIATED APPARATUS. HOT WATER RE-CIRCULATING SYSTEM SHALL BE REPLACED WITH SAME SIZE AS EXISTING REFER TO PROPOSED DRAWINGS FOR NEW LOCATION. CONTRACTOR SHALL COORDINATE WITH OWNER PHASING SCHEDULE TO DETERMINE MINIMAL DOWNTIME IN THE HOT WATER SYSTEM.
- 2 REPLACE WATER SOFTENER TANK WITH SAME SIZE TANKS.
- 3 REPLACE EXISTING "EJECTOR PUMP P-1" 1/2" 125GPM @30' HEAD, 4" DISCHARGE 5 HP, 1750 RPM, 480V, 3 P, 60HZ, MOTOR CHICAGO TYPE V.C.S. NO CLOG PUMP MODEL LMC4 DUPLEX, 1" SUBMERSIBLE DUPLEX SUMP PUMPS AND ASSOCIATED PIPING. COORDINATE WITH PROJECT PHASING SCHEDULE TO MINIMIZE OUTAGE TIME.
- 4 REPLACE EXISTING "SUMP PUMP P-2" 200 GPM @ 32' HEAD, 4" DISCHARGE 3 HP 1750 RPM, 480V 3P, 60HZ, MOTOR CHICAGO TYPE "L" MODEL LB4 DUPLEX PUMPS - DUPLEX SUMP PUMPS AND ASSOCIATED PIPING. COORDINATE WITH PROJECT PHASING SCHEDULE TO MINIMIZE OUTAGE TIME.
- 5 EXISTING 10" MANUAL VALVE TO REMAIN ALONG WITH THE EXISTING SANITARY LINE.
- 6 PROVIDE NEW INLINE 10" SANITARY BACK WATER VALVE BY MIFAB MODEL BV1000 ON THE PROPOSED SANITARY LINE. PROVIDE SUPPORTS ON BOTH SIDES OF THE PROPOSED VALVE.



2 WATER SOFTENER PIPING DETAIL
SCALE: N.T.S.



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ENLARGED FLOOR PLAN AND DETAILS - PLUMBING