

UNIVERSITY OF LOUISVILLE®

PROCUREMENT SERVICES ADDENDUM

Date of Notice:	3/10/2025
Solicitation No.:	IB-009-25
Title:	Life Sciences MEP Upgrades
Addendum No.:	2

The following pages shall clarify and/or modify the original bid document(s) as issued by the University of Louisville.

The due date has been extended to 3/18/2025 at 12:00PM, EST.

Proposer must acknowledge receipt of this and any addenda either with proposal or by separate letter. Acknowledgement must be received in the Department of Procurement Services, Service Complex Building, University of Louisville no later than **3/18/2025 at 12:00PM, EST**. If by separate letter, the following information must be placed in the lower left-hand corner of the envelope:

Solicitation No.:	IB-009-25
Title:	Life Sciences MEP Upgrades
Due Date:	3/18/2025 at 12:00PM, EST.

Authorized By:

Procurement Services	Evan Riddell Digitally signed by Evan Riddell Date: 2025.03.10 09:39:05 -04'00'
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Receipt Acknowledged:

Company	
Signature	
Name (print)	
Date	

Addendum 2

Questions

1. Reference duct spec 23 31 13.01 Section 2.3 Single-Wall Round Duct and Fittings. Construction method 2.3.C "Longitudinal Seams" is described, but spiral duct is more common for standard supply, return and clean air exhaust ducts. Would you please describe what type of duct, gauges, material and type of joints are required for: low pressure supply, return, non-laboratory exhaust, medium pressure round (upstream of VAV boxes)? **University Response:** Our specification does not exclude spiral wound duct. Ducts shall be constructed as stated in 2.3 Paragraph A: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated. Paragraph B and C cover additional requirements if/or where Transverse and/or longitudinal seams are used. Spiral duct is not excluded.
2. Reference spec section 23 31 13.01 Section 3.10.D Exhaust Ducts. This section does not assign class 1 and 2. Would you please describe what type of duct, gauges, material and type of joints are required for: rest room exhaust, exhaust from rooms (research labs, storage, corridors, janitor closets, fume hood branch ducts, main exhaust ducts that collect air from fume hoods and are routed up to the exhaust fans)? **University Response:** This section states that SMACNA Leakage Class 2 for rectangular and round is required in exhaust locations. New fume hood exhaust shall be welded stainless steel duct with welded longitudinal seam and welded transverse seam (not spiral). Thickness shall be determined based on the SMACNA standards for pressure class.
3. Reference M100B room LL12 as well as M021 airside insulation schedule, and 23 31 13.01 Section 3.2 Installation of Exposed Ductwork. Room LL12 appears to have exposed ductwork, and there may be additional locations. For these locations, we assume external insulation is required. If internal duct insulation is required, please provide a specification. **University Response:** Refer to sheet M100B in addendum #3. SA duct on system VAV-007 shall be double wall spiral insulated duct with perforated liner. Refer to specification section 233113.03 Metal Ducts Double Wall Round and Oval added in addendum #2.
4. After our site visit, we discovered there's quite a few mechanical, plumbing and electrical items in the way of the structural steel install mostly on the third-floor ceiling. Most of these items are not shown on the drawing as even being there. Moving these items out of the way and then reinstalling them could be close to \$100k of extra work the drawing don't even call out. If there's another addendum coming out it would be a good idea to address these items as a change after the bid on a case by case basis. I would think this would help keep the cost under control and would be fair to all bidding. **University Response:** MEP and Structural documents have been updated to coordinate and quantify conflicts with new structure. Refer to Addendum #2.

RE: University of Louisville – Life Sciences Building No. 18
2025-2026 Mechanical and Electrical Upgrades
214 W. Barbee Street Walk, Louisville KY 40208

SUBJECT: Addendum #2

TO: All Contract Bidders

The following shall be included in Contract Drawings and Specifications on the above referenced project. Contractors shall acknowledge receipt of this revision.

Drawings:

The following attached drawings have been revised/added in this addendum.

- | | |
|-----------------|------------------------|
| 1. S2.4 | 6. M103C |
| 2. S4.1 | 7. M103D |
| 3. M100B | 8. M203 |
| 4. M103A | 9. PME103 (NEW) |
| 5. M103B | |

Specifications:

The following attached specifications have been revised/added in this addendum.

1. SPEC INDEX
2. SECTION 233113.01 METAL DUCTS RECTANGULAR AND ROUND
3. SECTION 233113.03 METAL DUCTS DOUBLE WALL ROUND AND OVAL

Drawings:

Structural

1. Refer to attached drawings S2.4 and S4.1 for revised beam sizes, locations, and elevations.

Mechanical

1. Refer to attached drawing M100B for duct note in Research Lab LL12.
2. Refer to attached drawings M103A, M103B, M103C, M103D for new structural beam locations indicated for coordination.
3. Refer to attached drawing M203 for new structural beam locations indicated for coordination.
4. Refer to attached drawing PME103; add sheet to contract documents.

END OF ADDENDUM

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SECTION 233113.01 - METAL DUCTS: SINGLE WALL RECTANGULAR AND ROUND

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Single-wall round ducts and fittings.
 - 3. Sheet metal materials.
 - 4. Sealants and gaskets.
 - 5. Hangers and supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Adhesives.
 - 2. Sealants and gaskets.
- B. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 4. Elevation of top and bottom of ducts.
 - 5. Dimensions of main duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Penetrations through fire-rated and other partitions.
 - 10. Equipment installation based on equipment being used on Project.
 - 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

- B. Welding certificates.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- E. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
 - 2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal

Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1.

- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ductmate Industries, Inc.
 - b. McGill AirFlow LLC.
 - c. Nordfab Ducting.
 - d. Spiral Manufacturing Co., Inc.

- B. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

- D. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.
- D. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- E. Tie Rods: Galvanized steel, 1/4-inch-minimum diameter for lengths 36 inches or less; 3/8-inch-minimum diameter for lengths longer than 36 inches.

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 3 inches.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
- C. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 8. Service: Indoor or outdoor.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
 10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
 11. Service: Indoor or outdoor.
 12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 2. Either:
 - a. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 - b. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- D. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and

calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
- K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- M. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
- N. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 3. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 4. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 5. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 7. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 8. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 9. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.

- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section "Exterior Painting" and Section "Interior Painting."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - b. Supply Ducts with a Pressure Class of 4- Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - c. Return Ducts with a Pressure Class of 4- Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - d. Exhaust Ducts with a Pressure Class of 4- Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
 - 5. Test for leaks before applying external insulation.

6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
7. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean **new and existing** duct system(s) before testing, adjusting, and balancing

B. Use duct cleaning methodology as indicated in NADCA ACR.

C. Use service openings for entry and inspection.

1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

D. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

E. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.

5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

F. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.9 STARTUP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and downstream of VAV/FPT Terminal Units:
 - a. Pressure Class: Positive 1-inch wg.
 - b. SMACNA Leakage Class for Rectangular: 2.
 - c. SMACNA Leakage Class for Round: 2.
2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 4-inch wg.
 - b. SMACNA Leakage Class for Rectangular: 2.
 - c. SMACNA Leakage Class for Round: 2.
3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

- a. Pressure Class: Positive 4 inch wg.
 - b. SMACNA Leakage Class for Rectangular: 2.
 - c. SMACNA Leakage Class for Round: 2.
- 4. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2 inch wg.
 - b. SMACNA Leakage Class for Rectangular: 2.
 - c. SMACNA Leakage Class for Round: 2.
- C. Return and Outside Air Ducts:
 - 1. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Negative 4 inch wg.
 - b. SMACNA Leakage Class for Rectangular: 2.
 - c. SMACNA Leakage Class for Round: 2.
 - 2. Ducts Connected to Equipment Not Listed above:
 - a. Pressure Class: Negative 2 inch wg.
 - b. SMACNA Leakage Class for Rectangular: 2.
 - c. SMACNA Leakage Class for Round: 2.
- D. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. SMACNA Leakage Class for Rectangular: 2.
 - c. SMACNA Leakage Class for Round: 2.
 - 2. Ducts Connected to Fans Exhausting Fume Hood, Laboratory, and Process (ASHRAE 62.1, Class 3 and Class 4) Air:
 - a. Type 304, stainless-steel sheet.
 - 1) Exposed to View: No. 4 finish.
 - 2) Concealed: No. 2B finish.
 - b. Pressure Class: Positive or negative 3-inch wg.
 - c. Welded seams and joints.
 - d. SMACNA Leakage Class 2.
 - e. Airtight/watertight.
- E. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.

- b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- F. Branch Configuration:
- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Conical spin in.
 - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

- a. Velocity 1500 fpm or Lower: Conical tap.
- b. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113.01

SECTION 233113.03 - METAL DUCTS: DOUBLE WALL ROUND AND OVAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Double-wall round and flat-oval ducts and fittings.
 - 2. Sheet metal materials.
 - 3. Sealants and gaskets.
 - 4. Hangers and supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Double wall duct, insulation, and fittings.
 - 2. Liners and adhesives.
 - 3. Sealants and gaskets.
 - 4. Seismic-restraint devices.
- B. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 4. Elevation of top **[and bottom]** of ducts.
 - 5. Dimensions of **[main]** **[all]** duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Penetrations through fire-rated and other partitions.
 - 10. Equipment installation based on equipment being used on Project.
 - 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 12. Hangers and supports, including methods for duct and building attachment and vibration isolation.
- C. Delegated-Design Submittal:
 - 1. Sheet metal thicknesses.
 - 2. Joint and seam construction and sealing.
 - 3. Reinforcement details and spacing.

4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
- C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Rectangular Ducts: Fabricate ducts with indicated dimensions for clear internal dimensions of the inner duct.
- B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
 2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
 - 3.
- D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.
- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 3. Coat insulation with antimicrobial coating.
 4. Cover insulation with polyester film complying with UL 181, Class 1.
- F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
- G. Inner Duct: Minimum 24-gauge perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.

2.3 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
1. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
 - a. Construct ducts of galvanized sheet steel unless otherwise indicated.
 2. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
 3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
 4. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Inner Duct: Minimum 24-gauge perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.
- C. Interstitial Insulation: Fibrous-glass liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 3. Coat insulation with antimicrobial coating.
 4. Cover insulation with polyester film complying with UL 181, Class 1.
- D. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
- 2.4 SHEET METAL MATERIALS
- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
1. Galvanized Coating Designation: G90.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. Tie Rods: Galvanized steel, 1/4-inch-minimum diameter for lengths 36 inches or less; 3/8-inch-minimum diameter for lengths longer than 36 inches.

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 4 inches.
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: Minus 40 to plus 200 deg F.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Base: Synthetic rubber resin.
 3. Solvent: Toluene and heptane.
 4. Solids Content: Minimum 60 percent.
 5. Shore A Hardness: Minimum 60.
 6. Water resistant.
 7. Mold and mildew resistant.
 8. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
 9. Service: Indoor or outdoor.

- 10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- E. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
- K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- M. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
- N. Branch Connections: Refer to details on drawings for special cases. Use flared or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

- D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.

- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section "Interior Painting."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - b. Supply Ducts with a Pressure Class of 4- Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - c. Return Ducts with a Pressure Class of 4- Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - d. Exhaust Ducts with a Pressure Class of 4- Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - e. Outdoor-Air Ducts with a Pressure Class of 4- Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
5. Test for leaks before applying external insulation.
6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
7. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing **if duct cleanliness test above is not passed.**

B. Use duct cleaning methodology as indicated in NADCA ACR.

C. Use service openings for entry and inspection.

1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

D. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

E. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

F. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.9 STARTUP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

- B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and downstream of VAV/FPT Terminal Units:
 - a. Pressure Class: Positive 1-inch wg.
 - b. Minimum SMACNA Seal Class: A.

- c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
- 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 4-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
- 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: Positive 4-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
- 4. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
- C. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: Galvanized steel.
 - 2. PVC-Coated Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Galvanized.
 - 3. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Galvanized.
- D. Liner:
 - 1. Supply-Air Ducts: Fibrous glass, Type I, 1 inch (es thick.
- E. Double-Wall Duct Interstitial Insulation:
 - 1. Supply-Air Ducts: 1 inch (es thick.
- F. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:

- 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- G. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

- a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Conical spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
- a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113.03



1. ELEVATIONS SHOWN ARE TO THE TOP OF STEEL AND ARE REFERENCED FROM FINISHED FIRST FLOOR REFERENCE ELEVATION (0'-0").
2. SEE DWG S4.1 FOR GENERAL NOTES.
3. SEE DWG S4.2 FOR SPECIAL INSPECTION NOTES.
4. SEE DWG S4.1 FOR TYPICAL FRAMING DETAILS.
5. SIZE AND LOCATION OF ROOF TOP MECHANICAL UNITS SHALL BE COORDINATED WITH THE MECHANICAL CONTRACTOR. OPERATING WEIGHT OF UNIT (INCLUDING CURBS) SHALL NOT EXCEED WEIGHT SHOWN ON PLAN.

 STEEL BEAM SIZE.
 SERVICE LOAD REACTION (KIPS) EACH END.
 (+13'-7") = TOP OF STEEL BEAM ELEVATION REFERENCED FROM FINISHED FIRST FLOOR REFERENCE ELEVATION (0'-0").

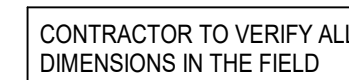
 = MOMENT CONNECTION. SEE DETAIL XXXX.

 = CONCRETE WALL.

 = WALL BELOW DECK.

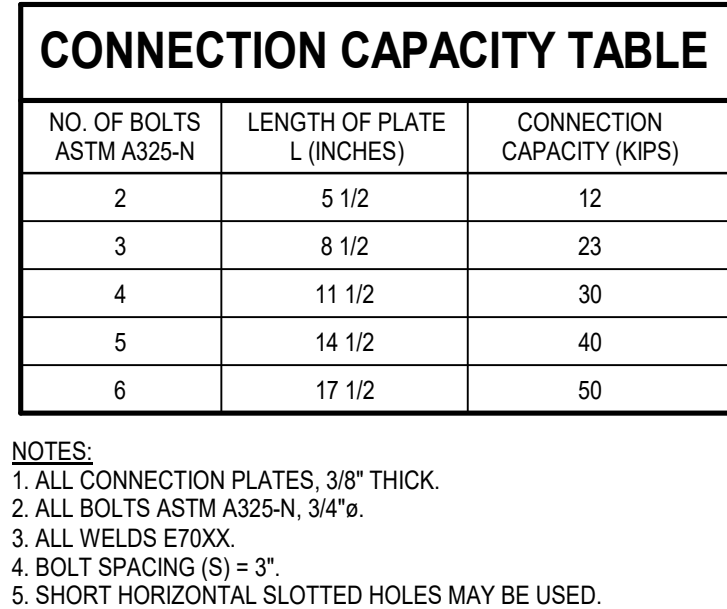
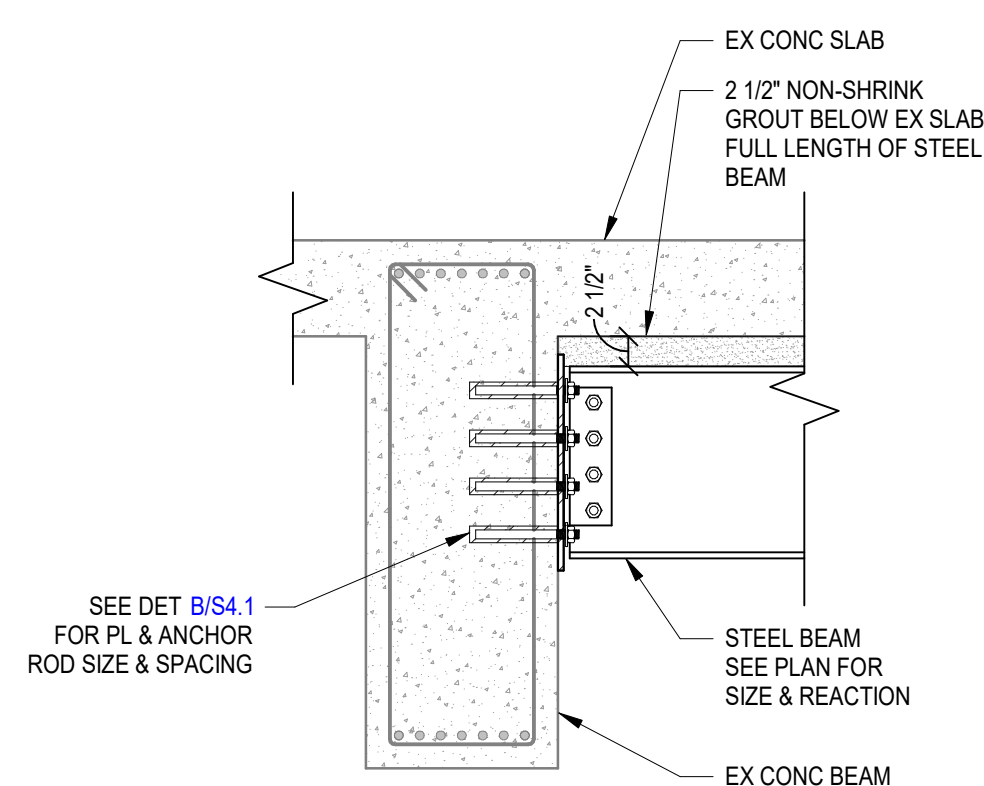
 = ROOF SLOPE.

- 1 REINFORCE UNDERSIDE OF SLAB FOR NEW PENETRATIONS SEE DET F54.1 FOR ATTACHMENT SPECIFICATIONS
- 2 NEW EXHAUST FANS ATTACHED TO EXISTING WALL SEE DET E54.1 FOR ATTACHMENT SPECIFICATIONS
- 3 REUSE EXISTING SLAB PENETRATION.
- 4 NEW SLAB PENETRATION IN LINE WITH EXISTING SLAB PENETRATION. NO REINFORCEMENT NECESSARY. SLABS SPAN EAST-WEST. NEW PENETRATIONS SHALL BE CONTAINED WITHIN THE LIMITS (NORTH-SOUTH EXTENTS) OF EXISTING ADJACENT PENETRATIONS.
- 5 STEEL BEAM TO EX CONC BEAM CONNECTION. SEE DET C54.1



IMPORTANT NOTE:
UNLESS OTHER ARRANGEMENTS ARE MADE PRIOR TO BID, GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING EXISTING CONDITIONS AND DIMENSIONS, INCLUDING EXISTING STRUCTURAL LAYOUTS AND ELEVATIONS. PRIOR TO SUBMITTING SHOP DRAWINGS, ACTUAL DIMENSIONS/ELEVATIONS SHALL BE MARKED ON SHOP DRAWINGS PRIOR TO SUBMITTAL TO ARCHITECT/ENGINEER. SUBCONTRACTORS SHALL COORDINATE WITH FIELD-VERIFIED CONDITIONS RELATIVE TO THEIR WORK.

ALL EXTERIOR STEEL & HARDWARE SHALL BE GALVANIZED


$$\frac{3}{4}'' = 1'-0''$$


B

C



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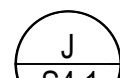
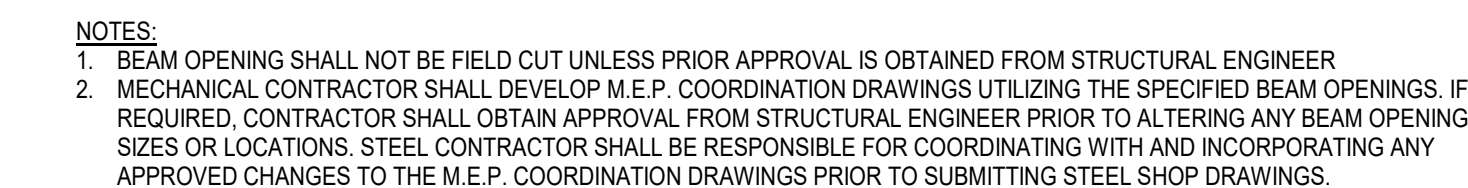


A diagram showing a semi-circle with a horizontal base and a curved top. The radius is labeled with the letter F .

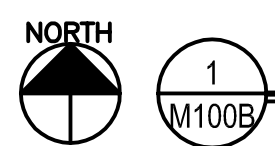
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(H)

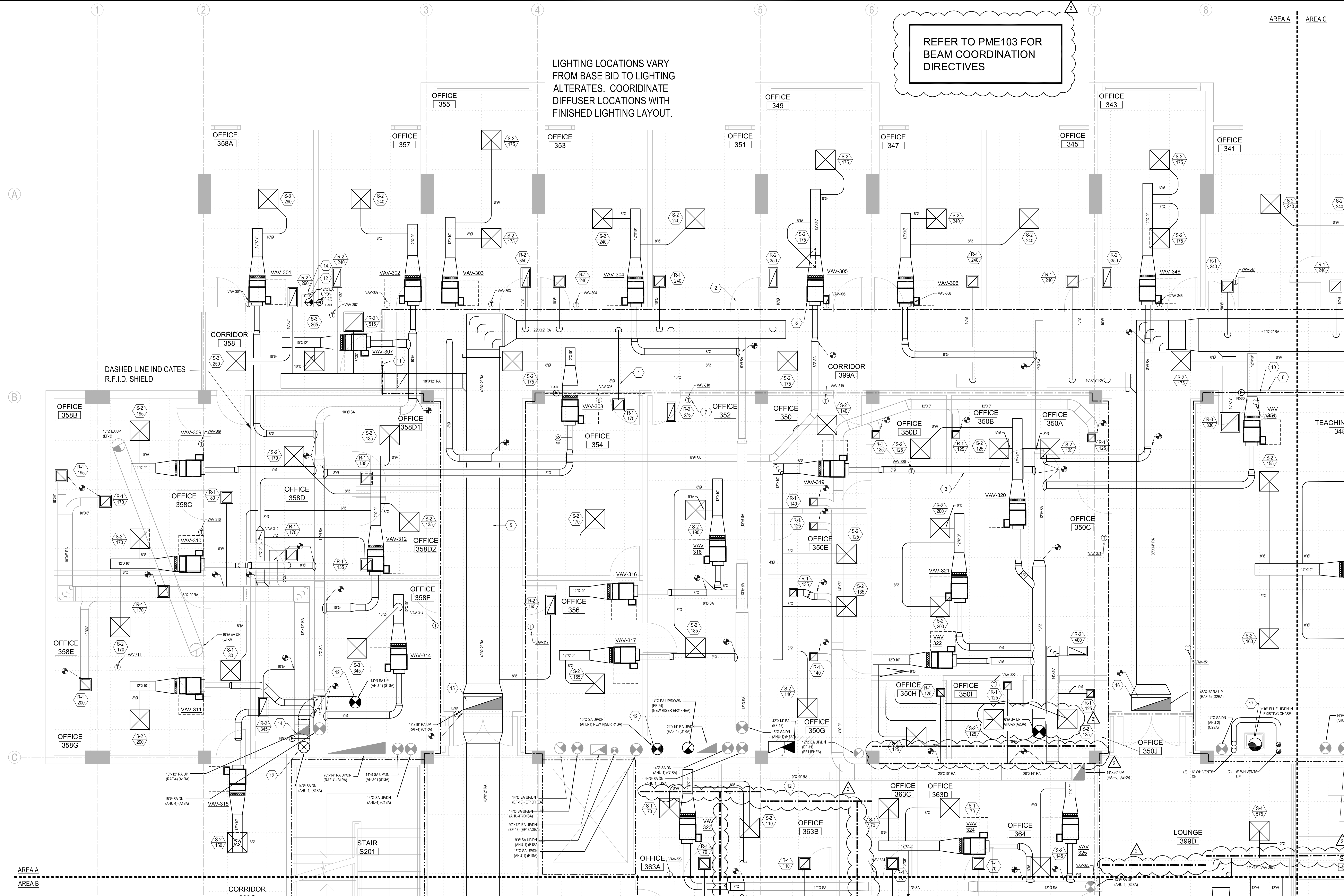


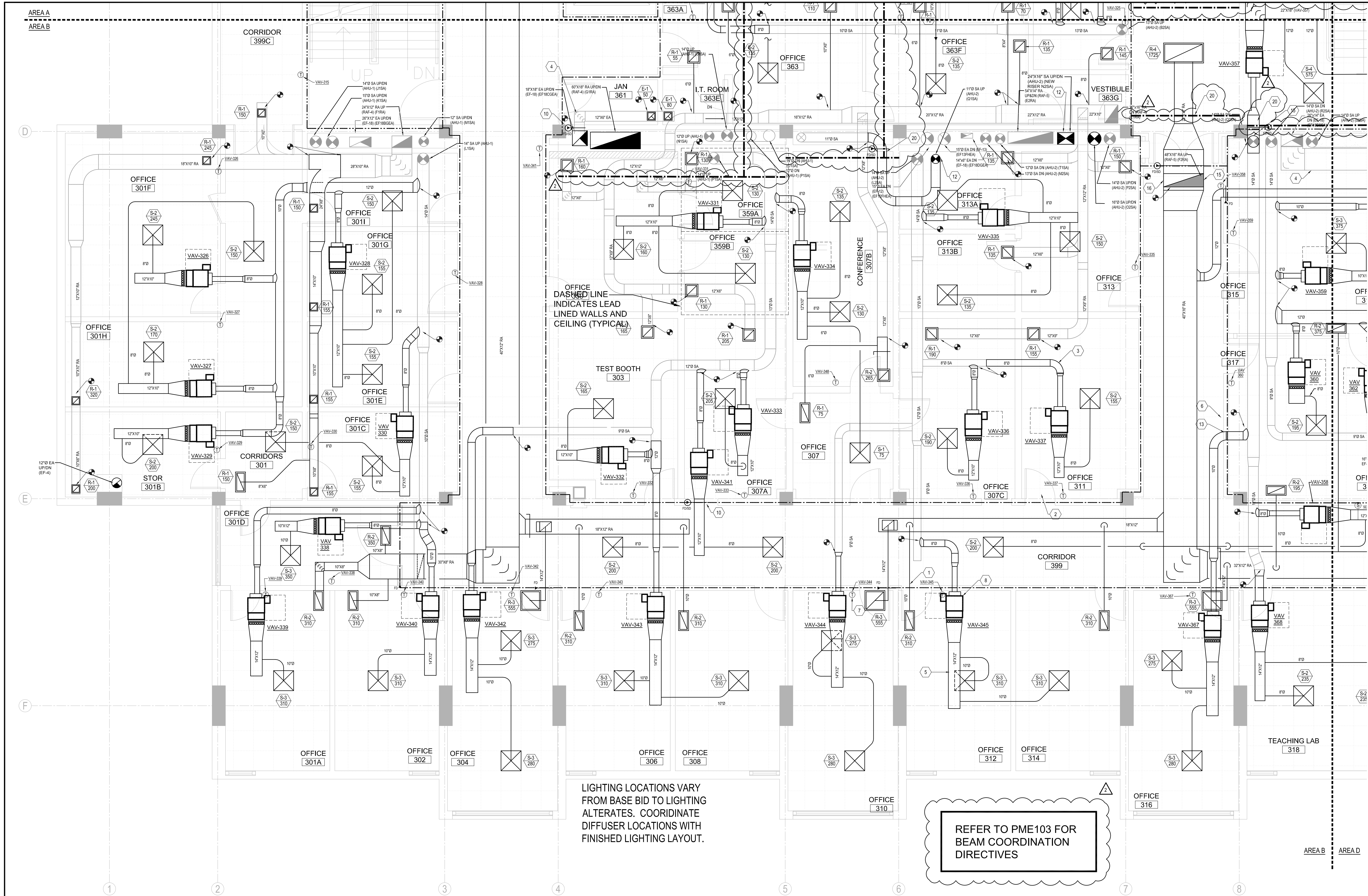
NOT TO SCALE



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

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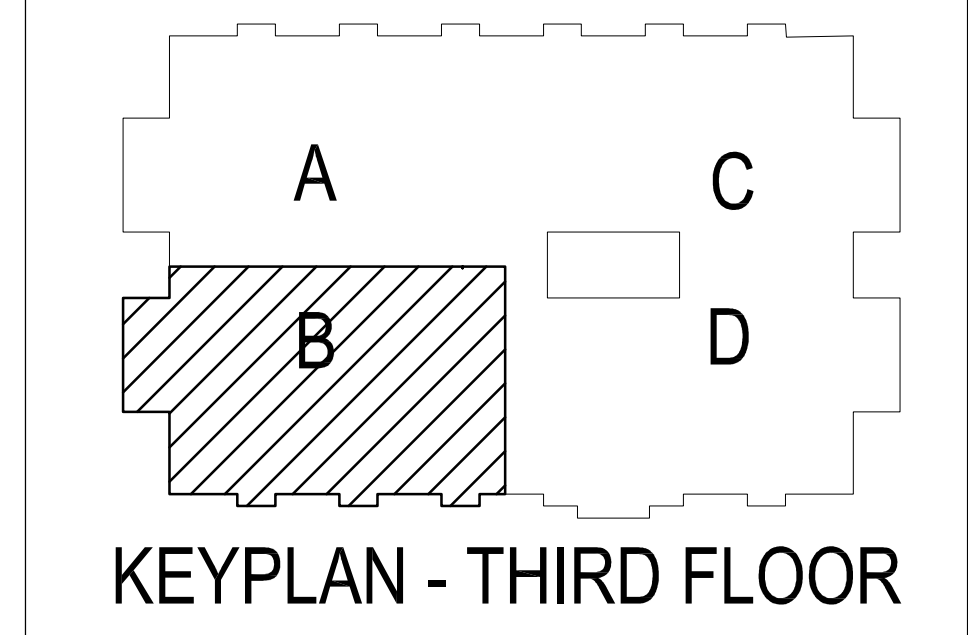


THIRD FLOOR PLAN - MECHANICAL DUCTWORK - AREA B

WALL RATING LEGEND	
	2-HOUR SEPARATION
	1-HOUR SEPARATION

- KEY NOTES:**
- DUCTS 100 SQ. INCHES OR LESS DO NOT REQUIRE FIRE DAMPER AT PENETRATION THROUGH 1 HOUR RATED PARTITION. REFER TO DETAIL FOR PENETRATION REQUIREMENTS. (TYPICAL)
 - TRANSFER AIR GRILLES IN EXISTING DOORS SHALL BE CLOSED WITH SHEET METAL FIELD. VERIFY STEEL SHEET DIMENSIONS REQUIRED FOR EACH DOOR. PAINT TO MATCH EXISTING GRILL FRAME COLOR. (TYPICAL)
 - MEDIUM PRESSURE SUPPLY FROM AHU TO VAV/CAV BOXES SHALL BE INTERNALLY CLEANED, DISINFECTED, AND SEALED WITH ANTI-MICROBIAL COATING. BASED ON FIELD OBSERVATIONS, THE DUCTWORK IS EXTERNAL INSULATED IF INTERNAL INSULATION IS FOUND DURING CLEANING. PLEASE NOTIFY ENGINEER IN WRITING INCLUDING LOCATION AND LENGTHS OF LINED DUCT. (TYPICAL)
 - EXISTING EA DUCT SHALL BE CLEANED, DISINFECTED, AND SEALED. (TYPICAL)
 - INSULATE DUCTWORK AS INDICATED ON DWG M-021 INSULATION SCHEDULE AND IN COMPLIANCE WITH ASTM-E-84 FOR DEVELOPED SMOKE/FLAME CHARACTERISTICS OF 2550. (TYPICAL)
 - DO NOT ROUTE DUCTWORK/PIPPING ABOVE ELECTRICAL PANELS AND EQUIPMENT. COORDINATE WITH EC AND FIELD TO VERIFY EXACT LOCATION PRIOR TO DUCT INSTALLATION. (TYPICAL)
 - INSTALL NEW THERMOSTAT IN GENERAL LOCATION OF EXISTING THERMOSTATS WHERE POSSIBLE. REFER TO GENERAL NOTES FOR SPECIFIC THERMOSTAT, ZONE CONTROLS, ETC. DEVICE INSTALLATION INSTRUCTIONS. (TYPICAL)
 - SUSPEND CAV/VAV FROM STRUCTURE WITH ALL THREAD ROD AND UNISTRUT. CAV/VAV UNITS THAT ARE CONCEALED ABOVE CEILING SHALL BE INSTALLED NO MORE THAN 18" ABOVE CEILING FOR SERVICE ACCESS. DO NOT LOCATE UNITS ABOVE LIGHTS AND COORDINATE ACCESS WITH LIGHTING CHANGES IN THE FIELD. MAINTAIN SERVICE CLEARANCE THAT IS RECOMMENDED BY MANUFACTURER. (TYPICAL)
 - INDICATES SMOKE DAMPER IN DUCT. REFER TO DETAILS FOR ADDITIONAL REQUIREMENTS. (TYPICAL)
 - INDICATES COMBINATION FIRE SMOKE DAMPER AT RATED WALL PENETRATION. DAMPER SHALL BE DYNAMIC (BLADES MOUNTED OUT OF AIRSTREAM) AND SHALL BE FURNISHED WITH DUCT ACCESS DOORS. ACCESS DOORS SHALL HAVE THE SAME RATING OF THE CEILING/WALL BEING PENETRATED. REFER TO DETAILS FOR ADDITIONAL REQUIREMENTS. (TYPICAL)
 - INDICATES FIRE DAMPER AT RATED WALL PENETRATION. DAMPER SHALL BE DYNAMIC (BLADES MOUNTED OUT OF AIRSTREAM) AND SHALL BE FURNISHED WITH DUCT ACCESS DOORS. ACCESS DOORS SHALL HAVE THE SAME RATING OF THE CEILING/WALL BEING PENETRATED. REFER TO DETAILS FOR ADDITIONAL REQUIREMENTS. (TYPICAL)
 - NEW FLOOR PENETRATION.
 - ROUTE DUCT THROUGH EXISTING CONCRETE BEAM OPENING.
 - ACCESS DOOR IN WALL FOR DAMPER INSPECTION. COORDINATE COLOR WITH OWNER. (TYPICAL)
 - INSTALL NEW TEE AT BOTTOM OF RISER.
 - INSTALL NEW ELBOW AT BOTTOM OF RISER.
 - INSTALL NEW BOILER FLUE / LINER IN EXISTING CHIMNEY.
 - HIGH SIDE PRESSURE REFERENCE SHALL BE INSTALLED IN THE MIDDLE OF THE STRAIGHT SECTION. LOW PRESSURE SIDE SHALL BE PIPED TO PRESSURE PORT IN THE CORRIDOR CEILING.
 - LOW SIDE PRESSURE REFERENCE SHALL BE LOCATED IN PRESSURE PORT PLATE IN THE CORRIDOR CEILING.
 - COORDINATE DUCT ELEVATION WITH NEW STRUCTURAL SUPPORT BEAM.

REVISION	DESCRIPTION	DATE
1	ADDENDUM #1	02/14/25
2	ADDENDUM #2	03/07/25



THIRD FLOOR PLAN - MECHANICAL DUCTWORK - AREA B

LIFE SCIENCES - BUILDING NO.18

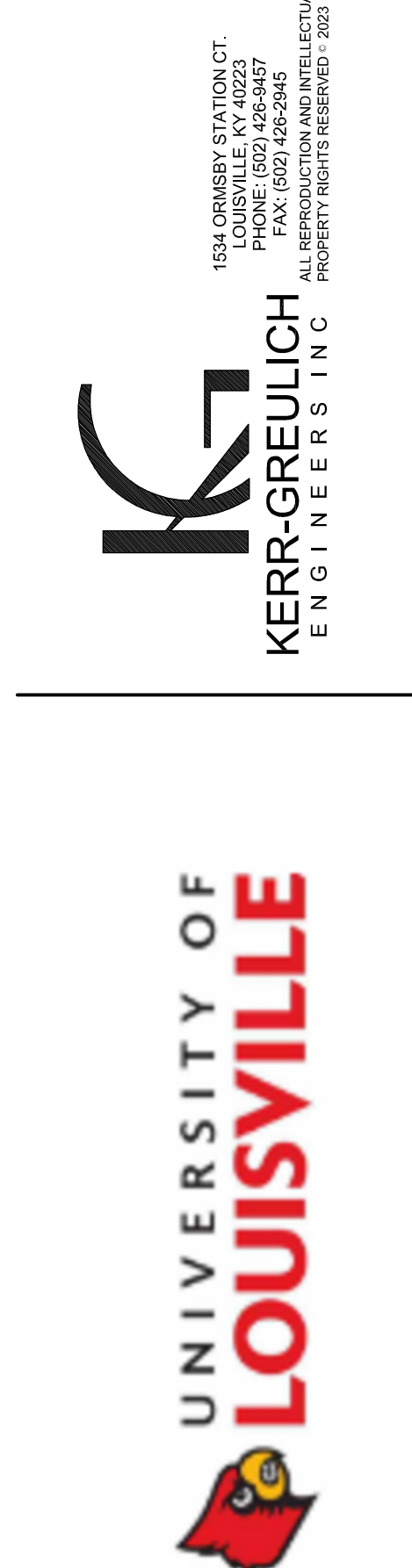
2024 MECHANICAL & ELECTRICAL UPGRADES

214 W. BARBEE STREET WALK, LOUISVILLE, KY 40208

2023-8298

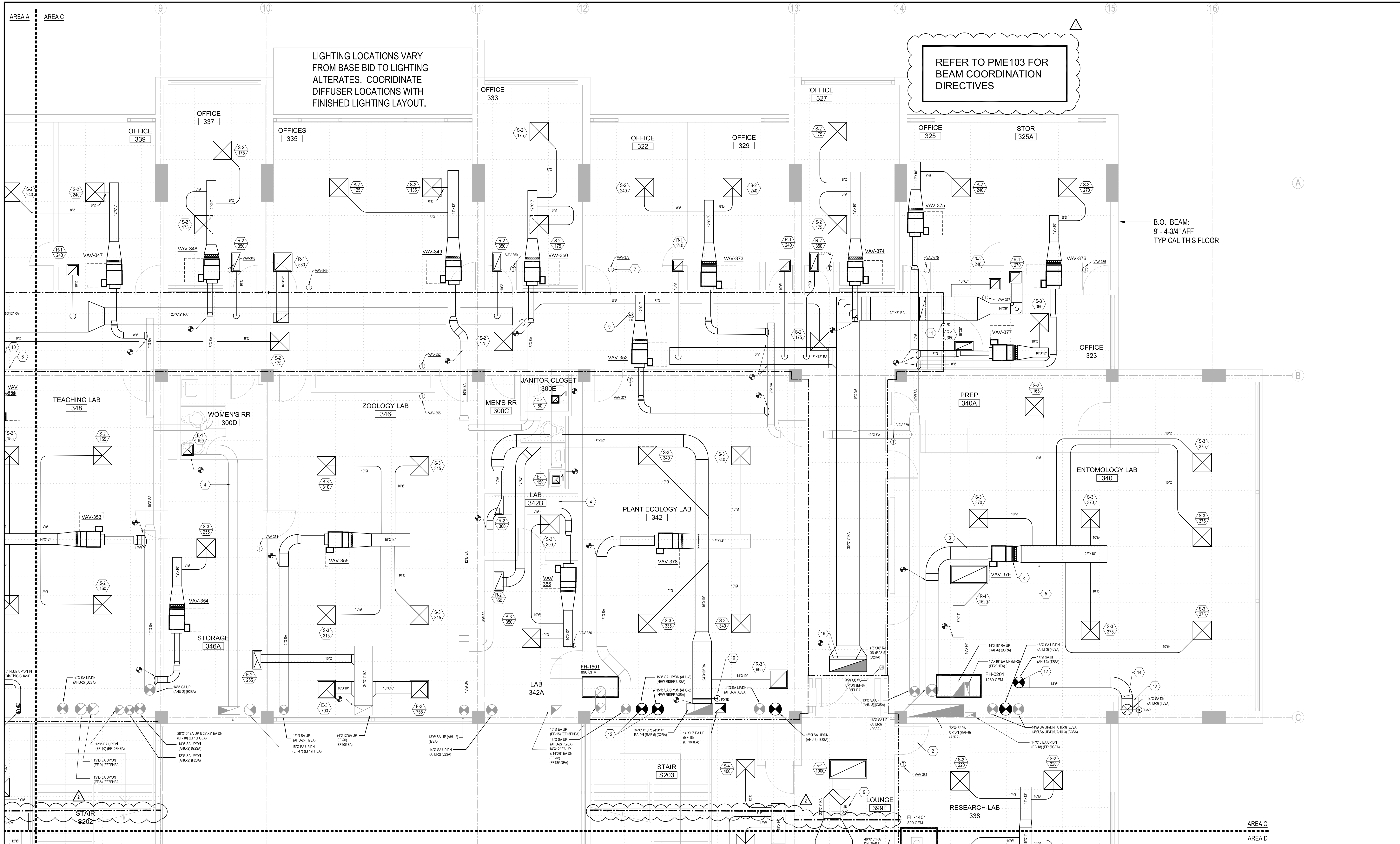
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DESIGNED: KJMM
DRAWN: KOTTS
APPROVED: LM

M103B



REVISION	DESCRIPTION	DATE
1	ADDENDUM #1	02/14/25
2	ADDENDUM #2	03/07/25

1534 CRANBY STATION CT.
LOUISVILLE, KY 40203
PHONE: (502) 436-2800
FAX: (502) 436-2807
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THIRD FLOOR PLAN - MECHANICAL DUCTWORK - AREA C

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

WALL RATING LEGEND

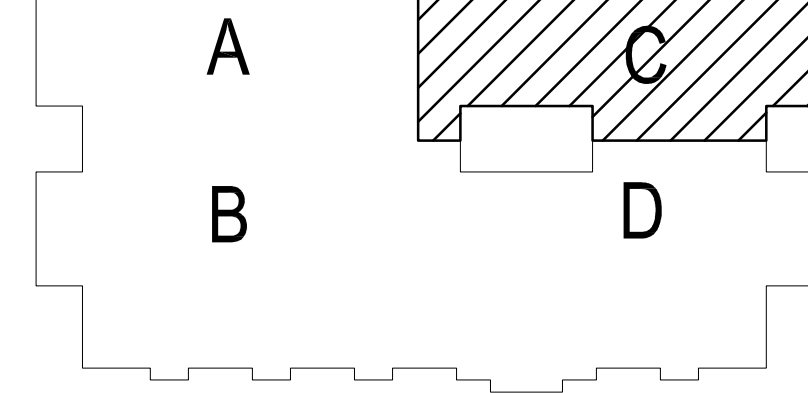
2-HOUR SEPARATION
1-HOUR SEPARATION

KEY NOTES:

- DUCTS 100 SQ. INCHES OR LESS DO NOT REQUIRE FIRE DAMPER AT PENETRATION THROUGH 1 HOUR RATED PARTITION. REFER TO DETAIL FOR PENETRATION REQUIREMENTS. (TYPICAL)
- TRANSFER AIR GRILLES IN EXISTING DOORS SHALL BE CLOSED WITH SHEET METAL FIELD VERIFY STEEL SHEET DIMENSIONS REQUIRED FOR EACH DOOR. PAINT TO MATCH EXISTING GRILL FRAME COLOR. (TYPICAL)
- MEDIUM PRESSURE SUPPLY FROM AHU TO VAV/CAV BOXES SHALL BE INTERNALLY CLEANED, DISINFECTED, AND SEALED WITH ANTIMICROBIAL COATING BASED ON FIELD OBSERVATIONS. THE DUCTWORK IS EXTERNAL INSULATED IF INTERNAL INSULATION IS FOUND DURING CLEANING. PLEASE NOTIFY ENGINEER IN WRITING INCLUDING LOCATION AND LENGTHS OF LINED DUCT. (TYPICAL)
- EXISTING EA DUCT SHALL BE CLEANED, DISINFECTED, AND SEALED. (TYPICAL)
- INSULATE DUCTWORK AS INDICATED ON DWG M-221 INSULATION SCHEDULE AND IN COMPLIANCE WITH ASTM-E-84 FOR DEVELOPED SMOKE/FLAME CHARACTERISTICS OF 25/50. (TYPICAL)
- DO NOT ROUTE DUCTWORK/PIPPING ABOVE ELECTRICAL PANELS AND EQUIPMENT. COORDINATE WITH EC AND FIELD TO VERIFY EXACT LOCATION PRIOR TO DUCT INSTALLATION. (TYPICAL)
- INSTALL NEW THERMOSTAT IN GENERAL LOCATION OF EXISTING THERMOSTATS WHERE POSSIBLE. REFER TO GENERAL NOTES FOR SPECIFIC THERMOSTAT, ZONE CONTROLS, ETC. DEVICE INSTALLATION INSTRUCTIONS. (TYPICAL)
- SUSPEND CAV/AV FROM STRUCTURE WITH ALL THREAD ROD AND UNISTRUT. CAV/AV UNITS THAT ARE CONCEALED ABOVE CEILING SHALL BE INSTALLED NO MORE THAN 18" ABOVE CEILING FOR SERVICE ACCESS. DO NOT LOCATE UNITS ABOVE LIGHTS AND COORDINATE ACCESS WITH LIGHTING CHANGES IN THE FIELD. MAINTAIN SERVICE CLEARANCE THAT IS RECOMMENDED BY MANUFACTURER. (TYPICAL)
- INDICATES SMOKE DAMPER IN DUCT. REFER TO DETAILS FOR ADDITIONAL REQUIREMENTS. (TYPICAL)
- INDICATES COMBINATION FIRE SMOKE DAMPER AT RATED WALL PENETRATION. DAMPER SHALL BE DYNAMIC (BLADES MOUNTED OUT OF AIRSTREAM) AND SHALL BE FURNISHED WITH DUCT ACCESS DOORS. ACCESS DOORS SHALL HAVE THE SAME RATING OF THE CEILING/WALL BEING PENETRATED. REFER TO DETAILS FOR ADDITIONAL REQUIREMENTS. (TYPICAL)
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- NEW FLOOR PENETRATION.
- ROUTE DUCT THROUGH EXISTING CONCRETE BEAM OPENING.
- ACCESS DOOR IN WALL FOR DAMPER INSPECTION. COORDINATE COLOR WITH OWNER. (TYPICAL)
- INSTALL NEW TEE AT BOTTOM OF RISER.
- INSTALL NEW ELBOW AT BOTTOM OF RISER.
- INSTALL NEW BOILER FLUE / LINER IN EXISTING CHIMNEY.
- HIGH SIDE PRESSURE REFERENCE SHALL BE INSTALLED IN THE MIDDLE OF THE STRAIGHT SECTION. LOW PRESSURE SIDE SHALL BE PIPED TO PRESSURE PORT IN THE CORRIDOR CEILING.
- LOW SIDE PRESSURE REFERENCE SHALL BE LOCATED IN PRESSURE PORT PLATE IN THE CORRIDOR CEILING.
- COORDINATE DUCT ELEVATION WITH NEW STRUCTURAL SUPPORT BEAM.

3/7/2025	ADDENDUM #2
2/14/2025	ADDENDUM #1
DATE	DESCRIPTION

SHEET REVISION LOG



KEYPLAN - THIRD FLOOR

THIRD FLOOR PLAN - MECHANICAL DUCTWORK - AREA C

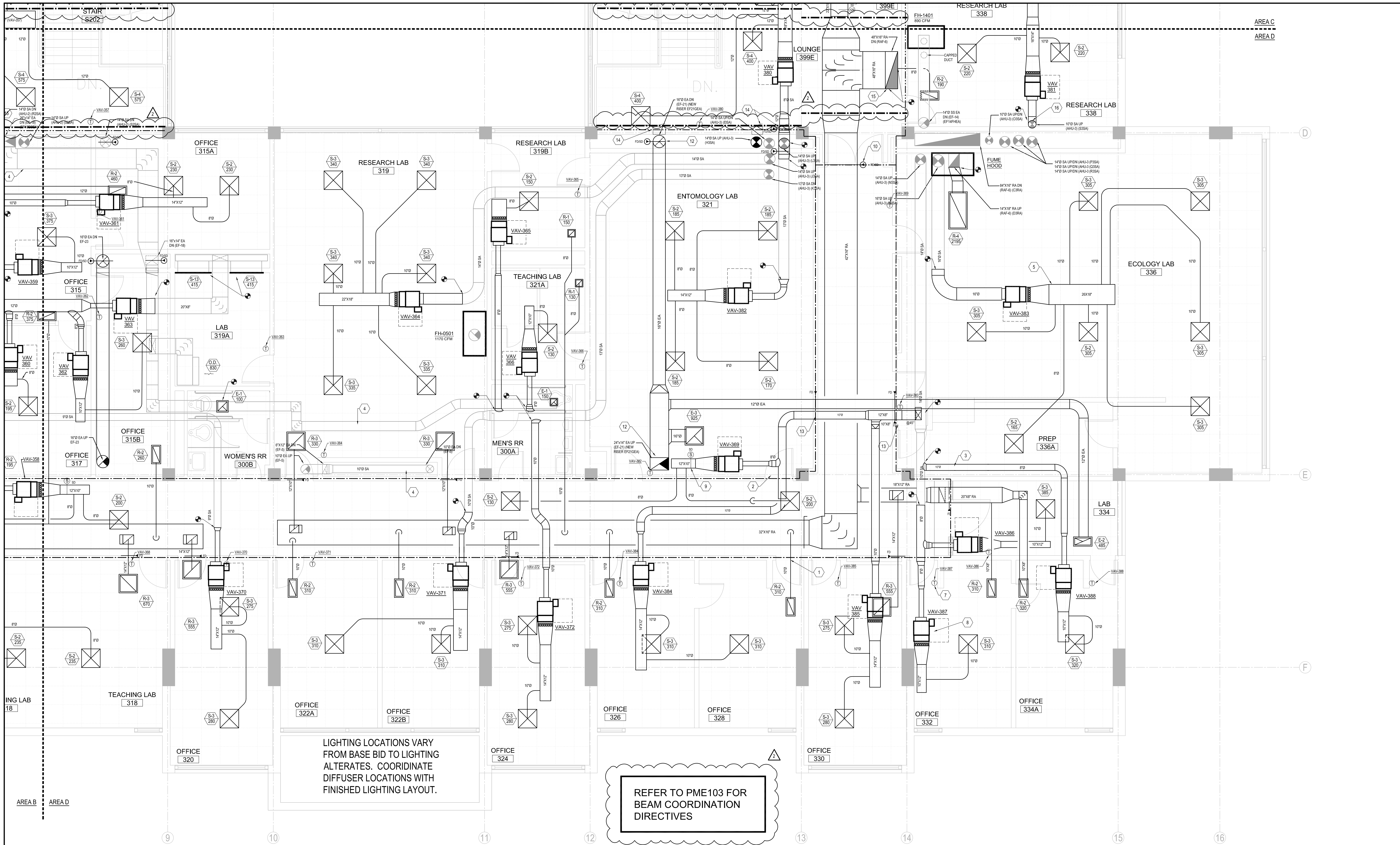
LIFE SCIENCES - BUILDING NO.18
2024 MECHANICAL & ELECTRICAL UPGRADES
214 W. BARBEE STREET WALK, LOUISVILLE, KY 40208

2023-8298

DATE: 11-19-2024 100% CDS
DESIGNED: KOURI
DRAWN: KOTS
APPROVED: LM

M103C

REVISION	DESCRIPTION	DATE
1	ADDENDUM #1	02/14/25
2	ADDENDUM #2	03/07/25



THIRD FLOOR PLAN - MECHANICAL DUCTWORK - AREA D

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

WALL RATING LEGEND

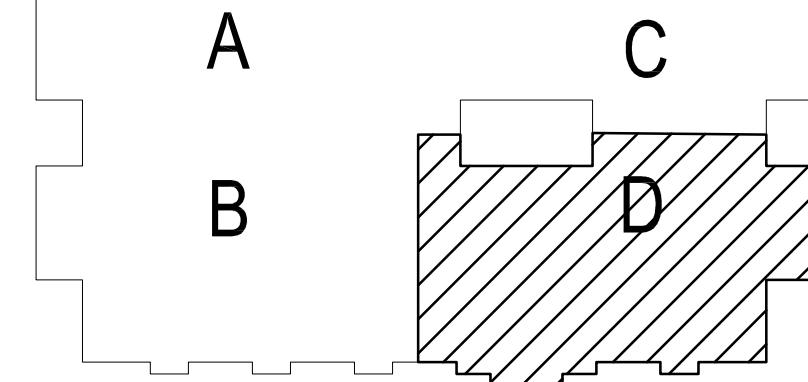
24-HOUR SEPARATION
1-HOUR SEPARATION

KEY NOTES:

- DUCTS 100 SQ. INCHES OR LESS DO NOT REQUIRE FIRE DAMPER AT PENETRATION THROUGH 1 HOUR RATED PARTITION. REFER TO DETAIL FOR PENETRATION REQUIREMENTS. (TYPICAL)
- TRANSFER AIR GRILLES IN EXISTING DOORS SHALL BE CLOSED WITH SHEET METAL FIELD VERIFY STEEL SHEET DIMENSIONS REQUIRED FOR EACH DOOR. PAINT TO MATCH EXISTING GRILL FRAME COLOR. (TYPICAL)
- MEDIUM PRESSURE SUPPLY FROM AHU TO VAV/CAV BOXES SHALL BE INTERNALLY CLEANED, DISINFECTED, AND SEALED WITH ANTI-MICROBIAL COATING. BASED ON FIELD OBSERVATIONS. THE DUCTWORK IS EXTERNAL INSULATED IF INSULATION IS FOUND DURING CLEANING. PLEASE NOTIFY ENGINEER IN WRITING INCLUDING LOCATION AND LENGTHS OF LINED DUCT. (TYPICAL)
- EXISTING EA DUCT SHALL BE CLEANED, DISINFECTED, AND SEALED. (TYPICAL)
- INSULATE DUCTWORK AS INDICATED ON DWG M-201 INSULATION SCHEDULE AND IN COMPLIANCE WITH ASTM-E-84 FOR DEVELOPED SMOKE/FLAME CHARACTERISTICS OF 2550. (TYPICAL)
- DO NOT ROUTE DUCTWORK/PIPING ABOVE ELECTRICAL PANELS AND EQUIPMENT. COORDINATE WITH EC AND FIELD TO VERIFY EXACT LOCATION PRIOR TO DUCT INSTALLATION. (TYPICAL)
- INSTALL NEW THERMOSTAT IN GENERAL LOCATION OF EXISTING THERMOSTATS WHERE POSSIBLE. REFER TO GENERAL NOTES FOR SPECIFIC THERMOSTAT, ZONE CONTROLS, ETC. DEVICE INSTALLATION INSTRUCTIONS. (TYPICAL)
- SUSPEND CAV/VAV FROM STRUCTURE WITH ALL THREAD ROD AND UNISTRUT. CAV/VAV UNITS THAT ARE CONCEALED ABOVE CEILING SHALL BE INSTALLED NO MORE THAN 18" ABOVE CEILING FOR SERVICE ACCESS. DO NOT LOCATE UNITS ABOVE LIGHTS AND COORDINATE ACCESS WITH LIGHTING CHANGES IN THE FIELD. MAINTAIN SERVICE CLEARANCE THAT IS RECOMMENDED BY MANUFACTURER. (TYPICAL)
- INDICATES SMOKE DAMPER IN DUCT. REFER TO DETAILS FOR ADDITIONAL REQUIREMENTS. (TYPICAL)
- INDICATES COMBINATION FIRE SMOKE DAMPER AT RATED WALL PENETRATION. DAMPER SHALL BE DYNAMIC (BLADES MOUNTED OUT OF AIRSTREAM) AND SHALL BE FURNISHED WITH DUCT ACCESS DOORS. ACCESS DOORS SHALL HAVE THE SAME RATING OF THE CEILING/WALL BEING PENETRATED. REFER TO DETAILS FOR ADDITIONAL REQUIREMENTS. (TYPICAL)
- INDICATES FIRE DAMPER AT RATED WALL PENETRATION. DAMPER SHALL BE DYNAMIC (BLADES MOUNTED OUT OF AIRSTREAM) AND SHALL BE FURNISHED WITH DUCT ACCESS DOORS. ACCESS DOORS SHALL HAVE THE SAME RATING OF THE CEILING/WALL BEING PENETRATED. REFER TO DETAILS FOR ADDITIONAL REQUIREMENTS. (TYPICAL)
- NEW FLOOR PENETRATION.
- ROUTE DUCT THROUGH EXISTING CONCRETE BEAM OPENING.
- ACCESS DOOR IN WALL FOR DAMPER INSPECTION. COORDINATE COLOR WITH OWNER. (TYPICAL)
- INSTALL NEW TEE AT BOTTOM OF RISER.
- INSTALL NEW ELBOW AT BOTTOM OF RISER.
- INSTALL NEW BOILER FLUE / LINER IN EXISTING CHIMNEY.
- HIGH SIDE PRESSURE REFERENCE SHALL BE INSTALLED IN THE MIDDLE OF THE STRAIGHT SECTION. LOW PRESSURE SIDE SHALL BE PIPED TO PRESSURE PORT IN THE CORRIDOR CEILING.
- LOW SIDE PRESSURE REFERENCE SHALL BE LOCATED IN PRESSURE PORT PLATE IN THE CORRIDOR CEILING.
- COORDINATE DUCT ELEVATION WITH NEW STRUCTURAL SUPPORT BEAM.

	3/7/2025	ADDENDUM #2
	2/14/2025	ADDENDUM #1
DATE	DESCRIPTION	

SHEET REVISION LOG



KEYPLAN - THIRD FLOOR

THIRD FLOOR PLAN - MECHANICAL DUCTWORK - AREA D

LIFE SCIENCES - BUILDING NO.18

2024 MECHANICAL & ELECTRICAL UPGRADES

214 W. BARBEE STREET WALK, LOUISVILLE, KY 40208

2023-8298

DATE: 11-19-2024 100% CDS
DESIGNED: KOURI
DRAWN: KOTS
APPROVED: LM

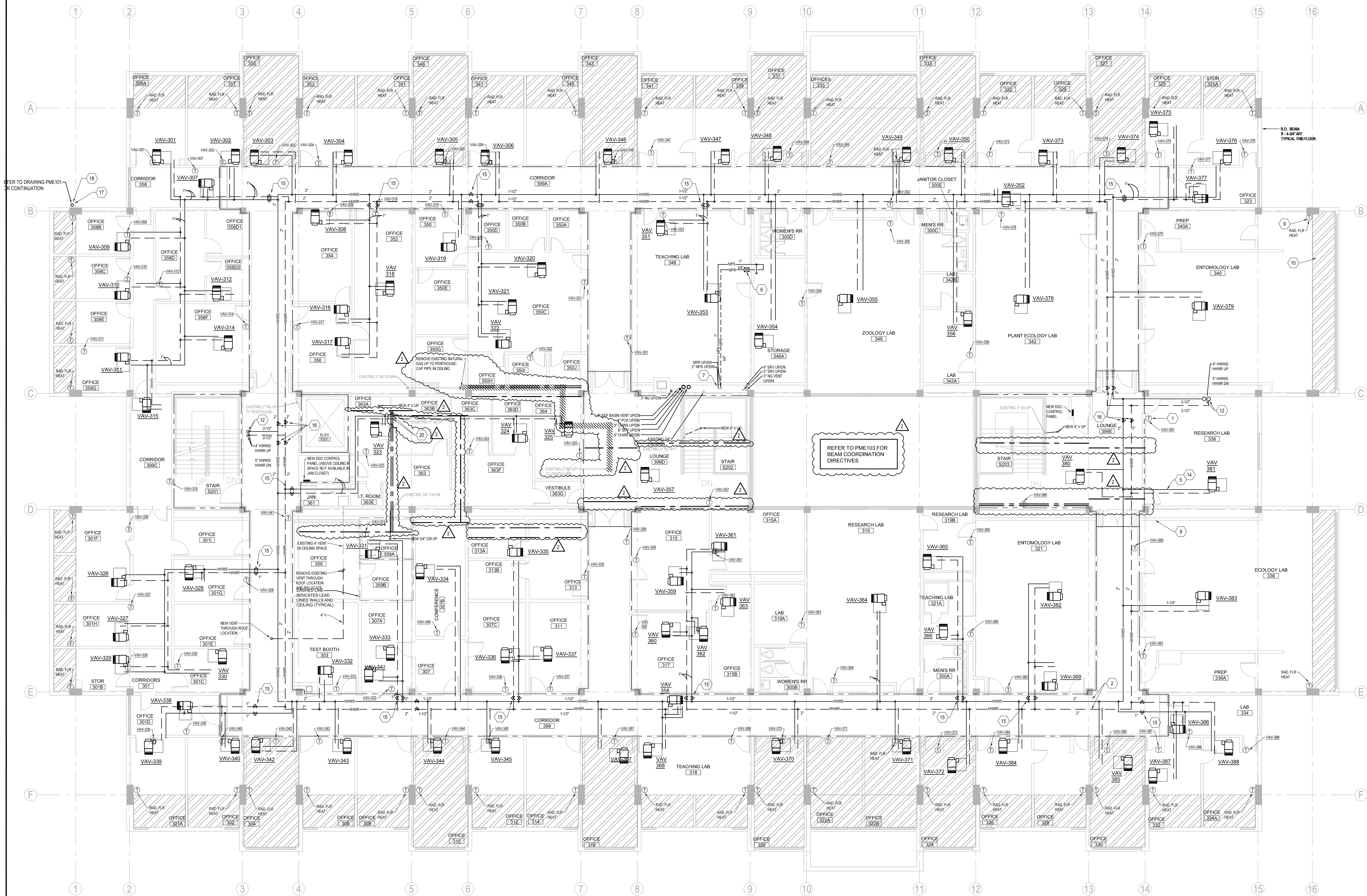
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REVISION	DESCRIPTION	DATE
1	ADDENDUM #1	02/14/25
2	ADDENDUM #2	03/07/25



THIRD FLOOR PLAN - MECHANICAL PIPING

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

WALL RATING LEGEND

--- 2-HOUR SEPARATION
--- 1-HOUR SEPARATION

KEY NOTES:

NOTE: ALL NOTES MAY NOT APPLY TO ALL SHEETS

- INSTALL NEW THERMOSTAT IN GENERAL LOCATION OF EXISTING THERMOSTATS WHERE POSSIBLE. REFER TO GENERAL NOTES FOR SPECIFIC THERMOSTAT, ZONE CONTROLS, ETC. DEVICE INSTALLATION INSTRUCTIONS. (TYPICAL)
- ROUTE THROUGH EXISTING BEAM PENETRATIONS. (TYPICAL THROUGHOUT BUILDING)
- CONNECT NEW HWSR TO EXISTING MAIN RISER AND SEAL WATER TIGHT.
- CONNECT NEW LPS / LPR TO EXISTING MAIN RISER AND SEAL WATER TIGHT.
- EXTEND 1" HWSR TO VAV COIL AND CONNECT. REFER TO DETAIL AND SCHEDULE. (TYPICAL)
- INDICATES STEAM TRAP. INSTALL PER MANUFACTURER'S INSTALLATION INSTRUCTIONS.
- CONNECT NEW MPS / MPR TO EXISTING MAIN RISER AND SEAL WATER TIGHT.
- DO NOT ROUTE PIPING OVERTOP OF ELECTRICAL PANELS. (TYPICAL)
- INDICATES NEW RADIANT FLOOR HEAT TEMPERATURE CONTROLLER. (TYPICAL FOR FLOORS 2 & 3)
- INDICATES EXISTING RADIANT FLOOR HEAT ZONE. (TYPICAL FOR FLOORS 2 & 3)
- EXTEND AND CONNECT TO EXISTING TERMINAL.
- PIPING EXPOSED IN PUBLIC AREAS SHALL BE INSULATED PER THE INSULATION SCHEDULE AND SHALL BE PROVIDED WITH A PVC JACKET. (TYPICAL ALL OCCUPIED SPACES)
- INSTALL TEE WITH VALVE AND HOSE CONNECTION AT BOTTOM OF RISER.
- INSULATE COIL HEADERS. (TYPICAL)
- ISOLATION VALVE FOR SECTIONS OF 2" PIPE TO PRESSURE TEST PIPE.
- INSTALL VALVE WITH THREADED DRAIN TAP.
- NATURAL GAS PIPING UP AND DOWN.
- PAINTER SHALL PRIME AND PAINT ALL EXPOSED NATURAL GAS PIPING WITH (2) COATS OF RUST INHIBITOR PAINT. COLOR TO BE SELECTED BY OWNER.
- PLUMBING CONTRACTOR SHALL PROVIDE PROTECTIVE ALUMINUM CHANNEL FOR EXTERIOR NATURAL GAS ROUTE. PAINT CHANNEL TO MATCH EXISTING ADJACENT SURFACE.
- OFFSET PIPES TO COORDINATE WITH NEW BEAM INSTALLATION.

3/7/2025	ADDENDUM #2
2/14/2025	ADDENDUM #1
TAG	DATE
DATE	DESCRIPTION

SHEET REVISION LOG

THIRD FLOOR PLAN - MECHANICAL PIPING

LIFE SCIENCES - BUILDING NO. 18
2024 MECHANICAL & ELECTRICAL UPGRADES
214 W. BARBEE STREET WALK, LOUISVILLE, KY 40208

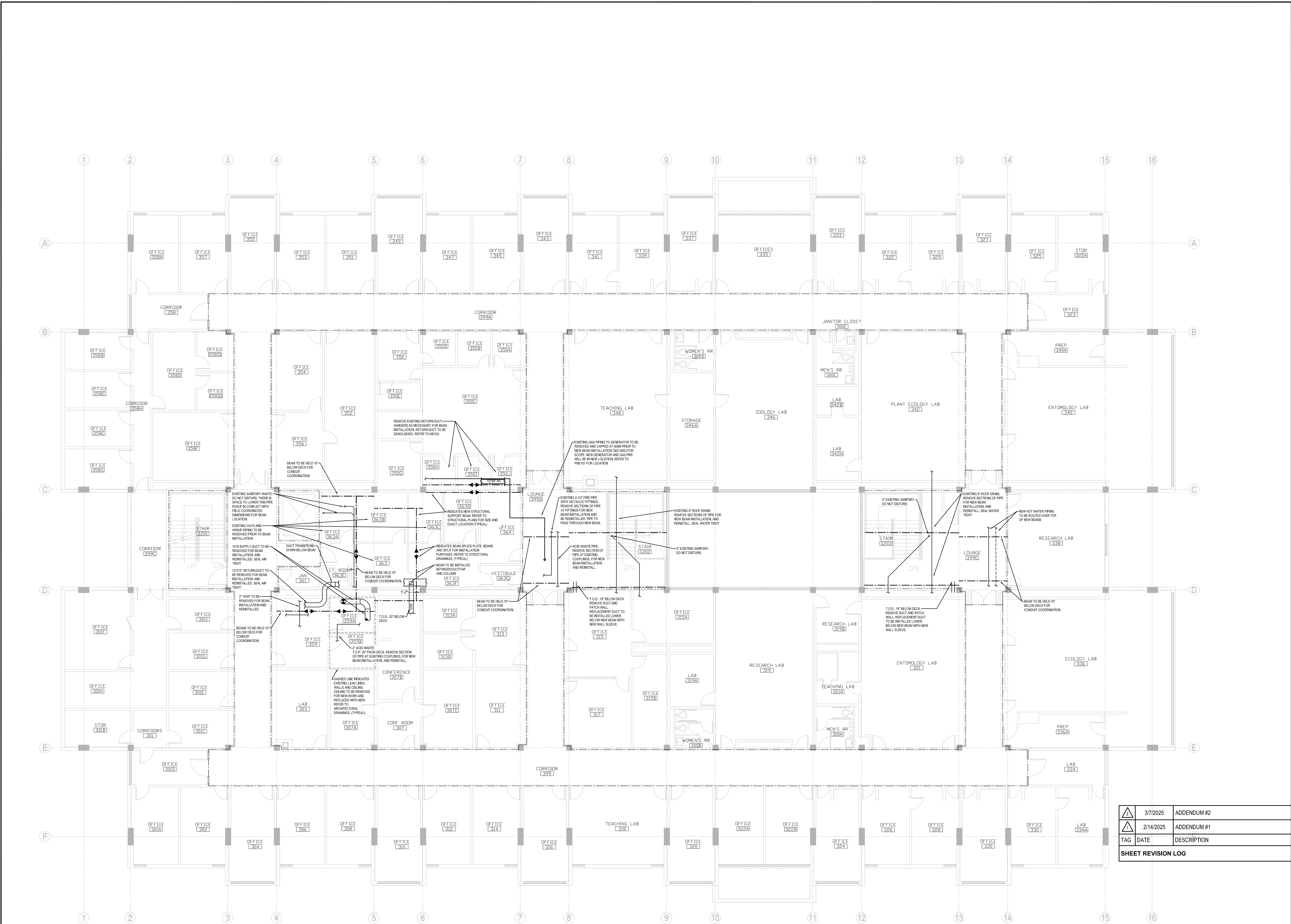
2023-8298

DATE: 11-19-2024 100% CDS
DESIGNED: KOURI
DRAWN: KOTS
APPROVED: LM

M203



REVISION	DESCRIPTION	DATE
1	ADDENDUM #1	02/14/25
2	ADDENDUM #2	03/07/25



ROOF & PENTHOUSE FRAMING COORD. IN 3RD FLOOR CEILING CAVITY

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

3/7/2025	ADDENDUM #2
2/14/2025	ADDENDUM #1
TAG	DATE
	DESCRIPTION

SHEET REVISION LOG



REVISION	DESCRIPTION	DATE
1	ADDENDUM #1	02/14/25
2	ADDENDUM #2	03/07/25

LIFE SCIENCES - BUILDING NO.18
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