

GENERAL NOTES

- I. **DESIGN CRITERIA**
- A. **GENERAL BUILDING CODE**
- The Documents are based on the requirements of the International Building Code 2012.
 - Hanging Ceiling and Mechanical Loads: An allowance of 20 PSF has been made for hanging ceiling and mechanical equipment loads such as duct work and sprinkler pipes.
- B. **LIVE LOADS**
- Design Live loads are based on the more restrictive of the uniform load listed below or the concentrated load listed acting over an area 2.5 feet.
 - Roofs: 20 PSF
 - Reduction of Live Loads:
 - Live loads have been reduced using the standard procedure from the building code.
- C. **WIND LOADS**
- Wind pressures are based on the provisions of the American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures, ASCE 7-10 and the following criteria:
 - Ultimate design wind speed (Vult): 139 MPH (3 second gust)
 - Building risk category: II
 - Wind exposure category: B

Notes:

 - Pressures act normal to the surface. Positive pressures act towards the surface and negative pressures act away from the surface.
 - Design pressure for components and cladding shall not be less than 16 PSF acting in either direction normal to the surface.
 - The design pressures listed above are calculated using a value of Kd of 0.85. The values must be increased by 18% unless load combinations specified in ASCE 7-10 are used in design.

- II. **NON-DESTRUCTIVE EVALUATION**
- A. **ITEMS EMBEDDED IN CONCRETE STRUCTURES**
- Items embedded in concrete structures shall not be damaged during repair work or installation of new members requiring post-installed anchors. Embedded items may include mild reinforcement, prestressing reinforcement, dowels, embedded connections, electrical conduits, plumbing, etc.
 - Items embedded in concrete shall be located by non-destructive evaluation prior to performing any work. Contractor shall mark on the structure the location of embedded prior to coring in concrete.
 - Contractor shall not start fabrication of new members until items embedded in concrete have been located. Contact Engineer if existing embedded items interfere with location of post-installed anchors specified in drawings.

- III. **SELECTIVE DEMOLITION**
- A. **RESPONSIBILITY OF THE CONTRACTOR FOR STABILITY OF THE STRUCTURE DURING DECONSTRUCTION / DEMOLITION**
- It is the responsibility of the Contractor to maintain the stability and safety of all structural elements during the demolition process.
- B. **MATERIAL OWNERSHIP**
- Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site. The materials removed shall be disposed in a proper and legal manner per federal/state or local ordinances.

- C. **QUALITY ASSURANCE**
- Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
 - Regulatory Requirements: Comply with governing Owner, Local, State, Federal, and EPA notifications and regulations before beginning selective deconstruction / demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

- D. **PROJECT CONDITIONS**
- Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72-hour notice to Owner of activities that will affect Owner's operations.
 - Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
 - Owner assumes no responsibility for condition of areas to be selectively demolished.
 - Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - Before selective demolition, Owner will remove items within space as needed.
 - If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. These materials shall be removed as disposed as approved by governing agency.

- E. **PREPARATION**
- Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
 - Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of adjacent facilities.
 - Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
 - Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and to prevent unexpected or uncontrolled movement or collapse of construction being demolished. Strengthen or add temporary supports when required during progress of selective demolition.

- F. **EXECUTION OF SELECTIVE DEMOLITION**
- General: Demolish existing construction as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - Use cutting methods least likely to damage construction to remain or adjoining construction.
 - Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - Maintain adequate ventilation when using cutting torches.
 - Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, slabs, or framing.
 - Dispose of demolished items and materials promptly.
 - Existing Facilities: Comply with Owner's requirements for using and protecting other building facilities during selective demolition operations.

- G. **DISPOSAL OF DEMOLISHED MATERIALS**
- General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
 - Burning: Do not burn demolished materials.
 - Disposal: Transport demolished materials off Owner's property and legally dispose of them.

- IV. **CONCRETE**
- A. **CONCRETE REPAIR MATERIALS**
- Concrete shall conform to the following requirements:

Classes of Concrete Matrix							
Location	Comp Strength PSI	Type	Exposure Class	Max W/C Ratio	Air Content	Max Agg. Size (in.)	Notes
Housekeeping Pads	3,000	LWC	-	0.45	-	3/4	-
Infill	4,000	NWC	CI	0.45	-	1	-

- B. **HORIZONTAL CONSTRUCTION JOINTS IN CONCRETE POURS**
- There shall be no horizontal construction joints in any concrete pours unless shown on the drawings. The Engineer shall approve all deviations or additional joints in writing.

- C. **REINFORCING STEEL**
- All Reinforcing Steel shall be ASTM A 615 Grade 60 unless noted otherwise on the drawings or in these notes.
 - Deformed Welded Wire Reinforcement: ASTM A 497, yield strength 70,000 PSI.

- D. **PLACEMENT OF WELDED WIRE REINFORCEMENT**
- Wherever welded wire reinforcement is specified as reinforcement, it shall be continuous across the entire concrete surface (and not interrupted by beams or girders) and properly lapped per ACI 318, 12.18 and 12.19.

- E. **REINFORCEMENT IN TOPPING SLABS**
- Provide minimum reinforcement as noted below in all topping slabs unless specified otherwise on the drawings
 - Welded smooth wire reinforcement 6x6-W2.9xW2.9.

- F. **REINFORCING STEEL COVERAGE**
- Reinforcing steel coverage should conform to the requirements specified on the drawings. Cover in structural members not specified in the details shall conform to the requirements of ACI 318 unless specified otherwise on the drawings.

V. **STRUCTURAL STEEL**

- A. **MATERIAL**
- Hot Rolled Structural Members: All hot rolled steel plates, shapes, sheet piling, and bars shall be new steel conforming to ASTM Specification A 6.
 - ASTM Specification and Grade: Clearly mark the grade of steel on each piece, with a distinguishing mark visible from floor surfaces, for the purpose of field inspection of proper grade of steel. Unless noted otherwise on the drawings, structural steel shall be as follows:
 - W- and WT-Shapes: ASTM A 992.
 - Plates: All plates shall conform to ASTM A 36 unless noted otherwise on the drawings.
 - Angles, Bent Plates: ASTM A 36.
 - Other Steel: Any other steel not indicated otherwise shall conform to ASTM A 992 or ASTM A 572, Grade 50, except plates and angles that shall be ASTM A 36.

- B. **STRUCTURAL BOLTS AND THREADED FASTENERS**
- A 325 Bolts: All bolts in structural connections shall conform to ASTM A 325 Type 1, unless indicated otherwise on the drawings.

- C. **WELDING**
- Unless noted otherwise, electrodes for welding shall conform to E70XX (SMAW), F7XX-EXXX (SAW), E70S-X (GMAW), or E7XT-X (FCM).

- D. **GROUT**
- Grout below structural steel base plates shall be non-metallic, non-shrink grout with a minimum strength of 8,000 psi.

- VI. **STEEL DECK**
- A. **COMPOSITE DECK**
- All deck shall be 40 KSI unless noted otherwise.

1. Attachment of Deck:
 - Minimum Attachment at Supports: Steel deck units shall be welded to the support members with 5/8" diameter puddle welds at each end of sheet and each intermediate support at each low flute, unless noted otherwise. At members parallel to deck span, welding of puddle welds shall be 12". A shear connector welded through the deck can replace a required deck weld.
 - Minimum Attachment at Side Laps: Side laps of adjacent units shall be fastened by welding, sheet metal screws, or button punching at a maximum of one-half the span or 36", whichever is less, unless noted otherwise.

VII. **SPECIAL INSPECTIONS**

- A. The Owner's testing laboratory shall provide special inspection services in accordance with the International Building Code for the items listed below. Special inspection shall be provided by an independent testing laboratory employed by the Owner.

- B. The Special Inspector shall furnish inspection reports to the Engineer of Record

- C. Once corrections are performed by the Contractor, the special inspector shall submit a final report to the Engineering that to the best of the Special Inspector's knowledge the work is in accordance with the construction documents and applicable workmanship.

- Steel Construction:
 - Welding Inspection
 - Periodic verification of welding procedure
 - Periodic verification of material type and grade
 - Periodic verification of welder qualifications
 - Continuous verification of fillet welds
 - High-Strength Bolting
 - Periodic verification of bolt size, location and torque
 - Steel members
 - Continuous verification of size and strength
- Concrete Construction:
 - Continuous Inspection of Reinforcing Steel Placing
 - Verify size, clearances and proper ties
 - Periodic Inspection of concrete mix
 - Verify mix design meets strength and exposure
 - Continuous Inspection of concrete placement/sampling
 - Include sampling for slump, strength and temperature

VIII. **SUBMITTALS**

- A. **SUBMITTAL LIST AND SCHEDULE**
- The Contractor shall prepare a detailed list and schedule of all submittal items to be sent to the Structural Engineer prior to the start of construction. This list shall be updated and revised and kept current as the job progresses. The submittal list shall be organized as shown below:

- a. Shop Drawings
b. Product Data, Certificates, Reports, and Other Literature
- B. **SUBMITTALS TO BE PROVIDED TO STRUCTURAL ENGINEER**
- The following submittals shall be provided:
 - Concrete mix.
 - Structural steel.
 - Roof (sheet metal, flashing etc...)

Notes:

- Items marked thus shall have the shop drawings and delegated design submittals (including calculations) sealed per the project specifications by an engineer registered in the state where the project is located.
- Items marked thus shall be submitted to Engineer for Record Only and will not have the Engineer's shop drawing stamp affixed.

- Submittal Requirements:
 - All shop drawings must be reviewed and electronically stamped by the Contractor prior to submittal.
 - Contractor shall provide the submittal in electronic portable document format (PDF) per the Specifications.
 - The omission from the shop drawings of any materials required by the Contract Documents to be furnished shall not relieve the Contractor of the responsibility of furnishing and installing such materials, regardless of whether the shop drawings have been reviewed and approved.

- C. **REPRODUCTION**
- The use of electronic files or reproductions of these contract documents by any contractor, subcontractor, erector, fabricator, or material supplier in lieu of preparation of shop drawings signifies their acceptance of all information shown hereon as correct, and obligates themselves to any job expense, real or implied, arising due to any errors that may occur hereon.

IX. **MISCELLANEOUS**

- A. **CONTRACT DOCUMENTS**
- It is the responsibility of the Contractor to obtain all Contract Documents and latest addenda and to provide such documents to all subcontractors and material suppliers prior to the submittal of shop drawings, fabrication of any structural members, and erection in the field.

- The contract structural drawings and specifications represent the alteration made to the structure, and, except where specifically shown, do not indicate the method or means of construction. The Contractor shall supervise and direct the work and shall be solely responsible for all construction means, methods, procedures, techniques, and sequence.

- Openings through floors, roofs, and walls for ducts, piping, and/or conduit shall be coordinated by the contractor. Contractor shall verify sizes and locations of holes and openings with the Mechanical, Electrical, Plumbing, and Fire Protection drawings and the respective subcontractors.

- B. **DRAWING CONFLICTS**
- The Contractor shall compare the Architectural and Structural drawings and report any discrepancy between each set of drawings and within each set of drawings to the Architect and Engineer prior to the fabrication and installation of any structural members.

- C. **CONFLICTS IN STRUCTURAL REQUIREMENTS**
- Where conflict exists among the various parts of the contract documents drawings, and general notes, the strictest requirements, as indicated by the Engineer, shall govern.

- D. **EXISTING CONDITIONS**
- The Contractor shall verify all dimensions and conditions of the existing building at the job site and report any discrepancies from assumed conditions shown on the drawings to the Engineer prior to the fabrication and erection of any members. Existing dimensions shown on the drawings are for general reference only and should not be used for final construction or detailing.

- Existing construction shown on the drawings was obtained from existing construction documents and limited site observation. These drawings of existing construction are available for contractor use and shall be referenced for familiarization with existing conditions. However, the available drawings of existing construction are not necessarily complete. The contractor is responsible for being knowledgeable on information presented in available drawings and shall field verify all pertinent information.
- Demolition, cutting, drilling, etc. of existing work shall be performed with great care so as not to jeopardize the structural integrity of the existing building. If any architectural, structural, or MEP members not designated for removal interfere with the new work, the Owner shall be notified immediately and approval obtained prior to removal of those members.

- The contractor shall perform a survey to locate all existing utilities (including underground utilities) prior to the start of construction and take care to protect utilities that are to remain in service. Existing civil, mechanical, electrical, plumbing, and emergency protection system servicing any areas outside the work area are to be maintained in operable condition throughout the duration of construction. Contractor shall make necessary temporary connections to maintain existing utilities in service during the work. Temporary, localized interruption of these systems shall require approval by the Owner.
- The contractor shall provide dust, odor, and noise protection, and safety measures as necessary for the duration of construction. Provide all measures necessary to protect the existing structure, building interior, facility patrons, and other persons during construction.
- The contractor shall repair all damage caused during construction with similar materials and workmanship to restore conditions to levels acceptable to the Owner.

E. **ADJACENT BUILDINGS AND PROPERTY**

- The Contractor shall ensure that all construction methods used will not cause damage to the adjacent buildings and property. This shall include all foundation installation.

- F. **RESPONSIBILITY OF THE CONTRACTOR FOR STABILITY OF THE STRUCTURE DURING CONSTRUCTION**
- Structural elements of the project have been designed by the Structural Engineer to resist the required code vertical and lateral forces that could occur in the final structure only. The ability of the structural frame to resist the required code forces derives from the complete installation of the new structural elements. It is the responsibility of the Contractor to provide all required bracing during construction to maintain the stability and safety of all structural elements during the construction.

- G. **RESPONSIBILITY OF THE CONTRACTOR FOR CONSTRUCTION LOADS**
- The structural elements has been designed for the loads identified within these drawings that are anticipated to be applied to the structure once work is completed. The Contractor shall not overload the structure during construction. The Contractor shall be responsible for checking the adequacy of the structure to support any applied construction loads. The Structural Engineer is not responsible to design or check the structure for loads applied to the structure for any construction activity.

H. **THE STRUCTURAL ENGINEER'S ROLE DURING CONSTRUCTION**

- The Engineer shall not have control nor charge of, and shall not be responsible for, construction means, methods, techniques, sequences, or procedures, for safety precautions and programs in connection with the work, for the acts or omission of the Contractor, Subcontractor, or any other persons performing any of the work, or for the failure of any of them to carry out the work in accordance with the contract documents.
- Periodic site observation by field representatives of Walter P. Moore and Associates is solely for the purpose of becoming generally familiar with the progress and quality of the Work completed and determining, in general, if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the structural contract documents. This limited site observation should not be construed as exhaustive or continuous to check the quality or quantity of the work, but rather periodic in an effort to guard the Owner against defects or deficiencies in the work of the Contractor.

I. **MAINTENANCE STATEMENT**

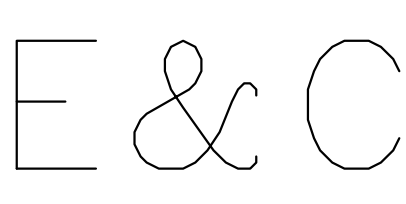
- All structures require periodic maintenance to extend lifespan and to ensure structural integrity from exposure to the environment. A planned program of maintenance shall be established by the Building owner. This program shall include such items such as but not limited to painting of structural steel, protective coating for concrete, sealants, caulked joints, expansion joints, control joints, spalls and cracks in concrete, and

pressure washing of exposed structural elements exposed to a salt environment or other harsh chemicals.

- X. **DRAWING INTERPRETATION**
- A. **DRAWING VIEWS LABELED AS "TYPICAL"**
- Partial plans, elevations, sections, details, or schedules labeled with "Typical" at the beginning of their title shall apply to all situations occurring on the project that are the same or similar to those specifically shown. The applicability of the content of these views to locations on the plan can be determined from the title of the views. Such views shall apply whether or not they are keyed in at each location. Decisions regarding applicability of these "Typical" views shall be determined by the Structural Engineer.

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Area	Rev.	Date	Description
		10/25/17	Progress Plot
		01/19/18	95% Construction
		04/13/18	Construction Drawings
		05/24/18	Addendum #01



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Date: 10/25/17
Drawn By: RC
Checked By: HB

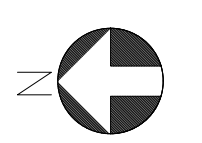
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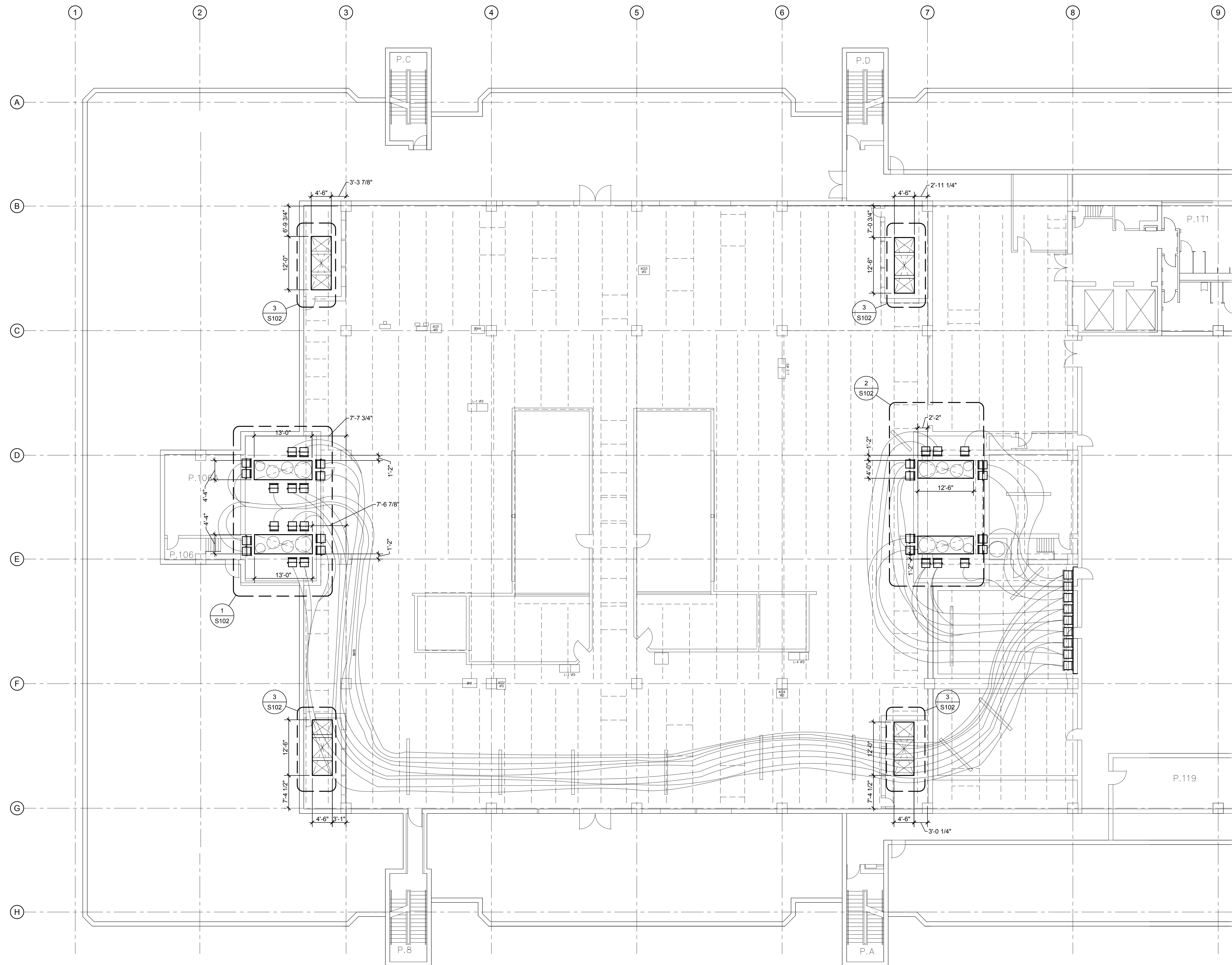
The University of Texas
Health Science Center at Houston

MEDICAL SCHOOL BUILDING
SOUTH PENTHOUSE

DRAWING TITLE
GENERAL NOTES

DRAWING NO.
S000

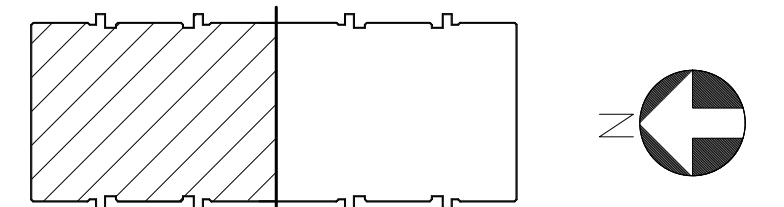




- NOTES:
- COORDINATE LOCATIONS AND SIZES OF OPENINGS WITH MEP DRAWINGS.
 - COORDINATE LOCATION OF HOLD DOWNS WITH MEP DRAWINGS.
 - FIELD VERIFY EXISTING DIMENSIONS AND CONDITIONS.
 - COORDINATE PHASING WITH MEP DRAWINGS.

1 PENTHOUSE ROOF PLAN
NO SCALE

Walter P. Moore and Associates, Inc.
TBPE Firm Registration No. 1856



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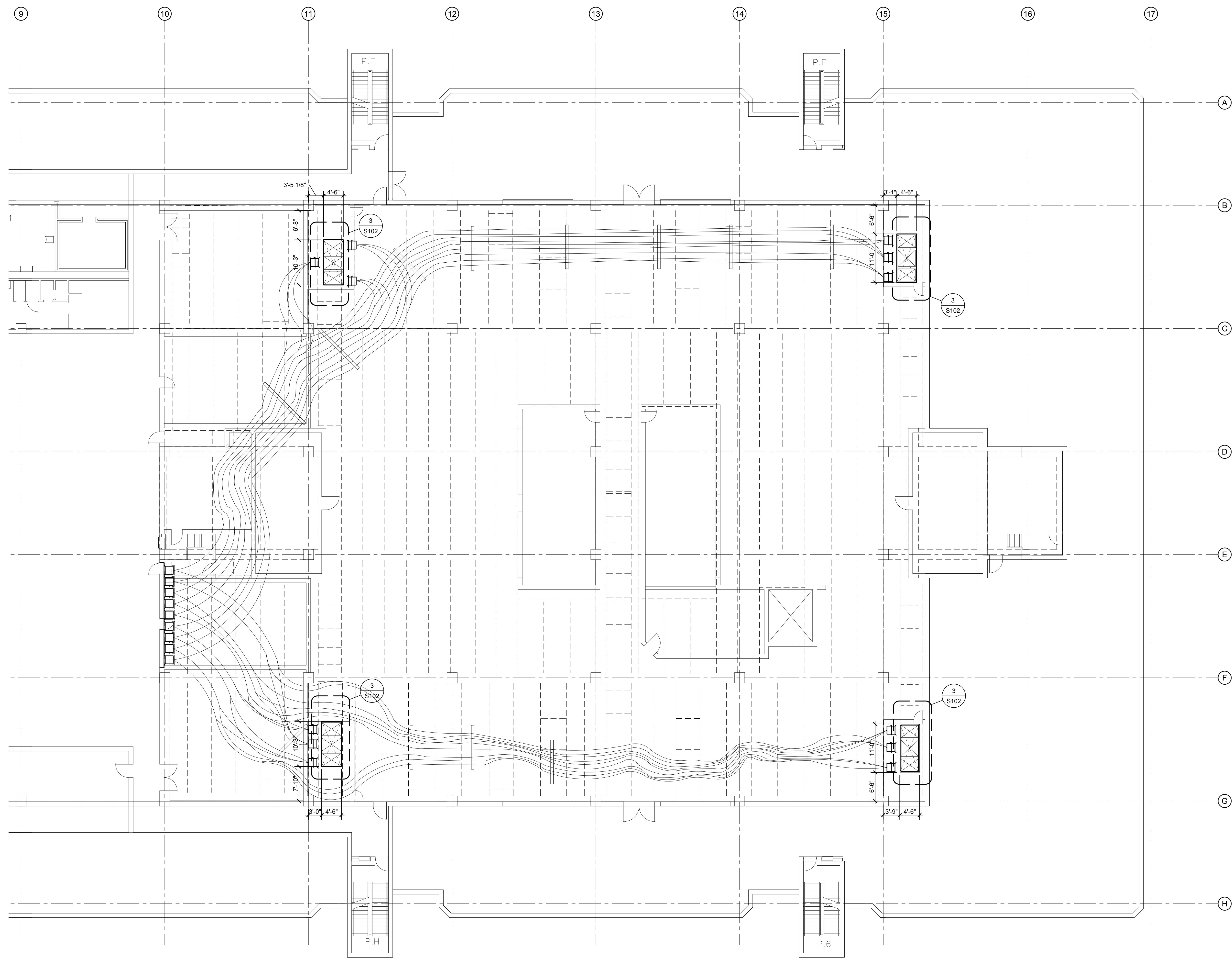
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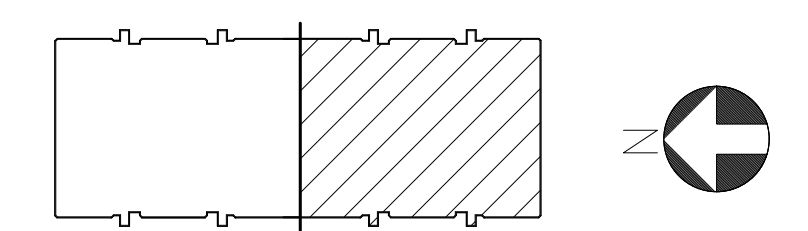
MEDICAL SCHOOL BUILDING
SOUTH PENTHOUSE

DRAWING TITLE
NORTH PLAN

DRAWING NO.
S100



2 PENTHOUSE ROOF PLAN (SOUTH)
NO SCALE



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Area	Rev	Date	Description
		10/25/17	Progress Plot
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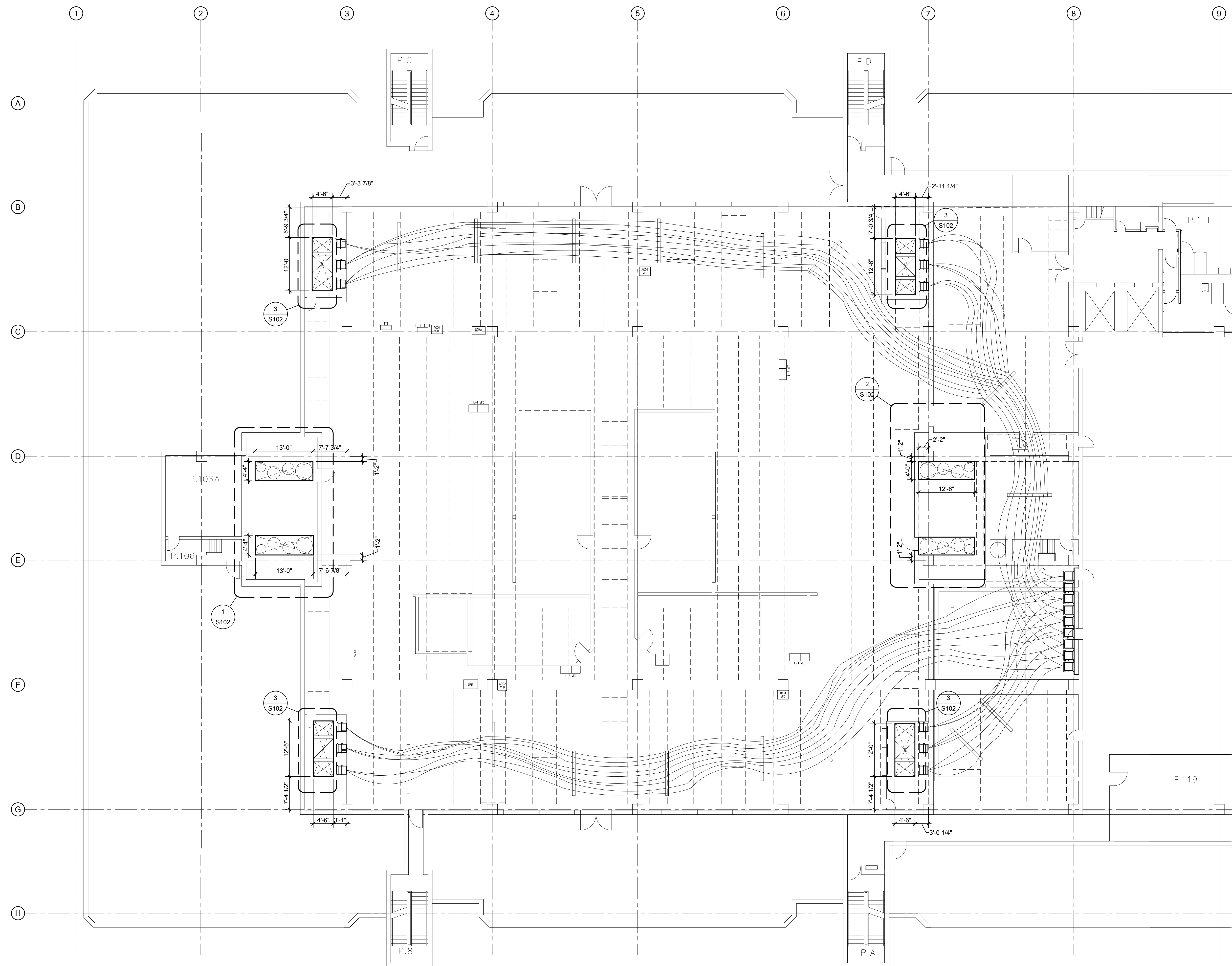
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MEDICAL SCHOOL BUILDING
SOUTH PENTHOUSE

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SOUTH PLAN

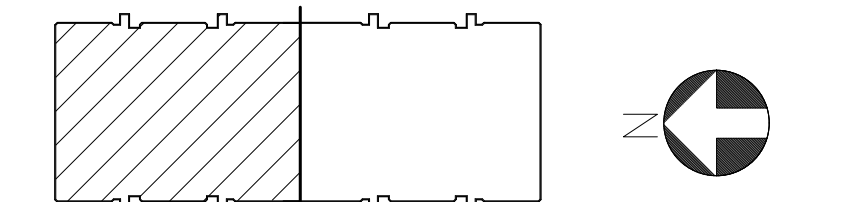
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- NOTES:
1. COORDINATE LOCATIONS AND SIZES OF OPENINGS WITH MEP DRAWINGS.
 2. COORDINATE LOCATION OF HOLD DOWNS WITH MEP DRAWINGS.
 3. FIELD VERIFY EXISTING DIMENSIONS AND CONDITIONS.
 4. COORDINATE PHASING WITH MEP DRAWINGS.

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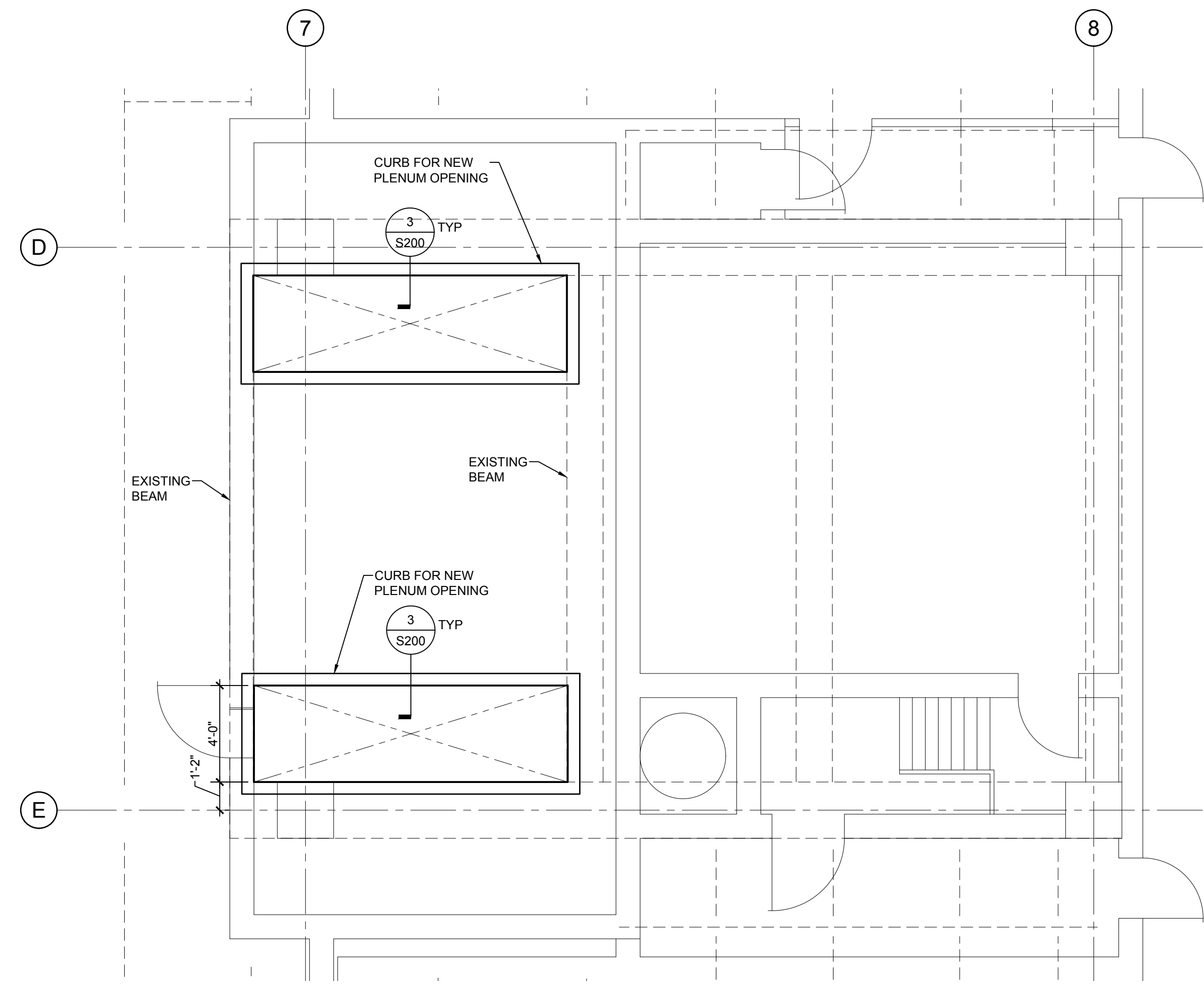
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E & C Project No.
3302.00
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MEDICAL SCHOOL BUILDING
SOUTH PENTHOUSE

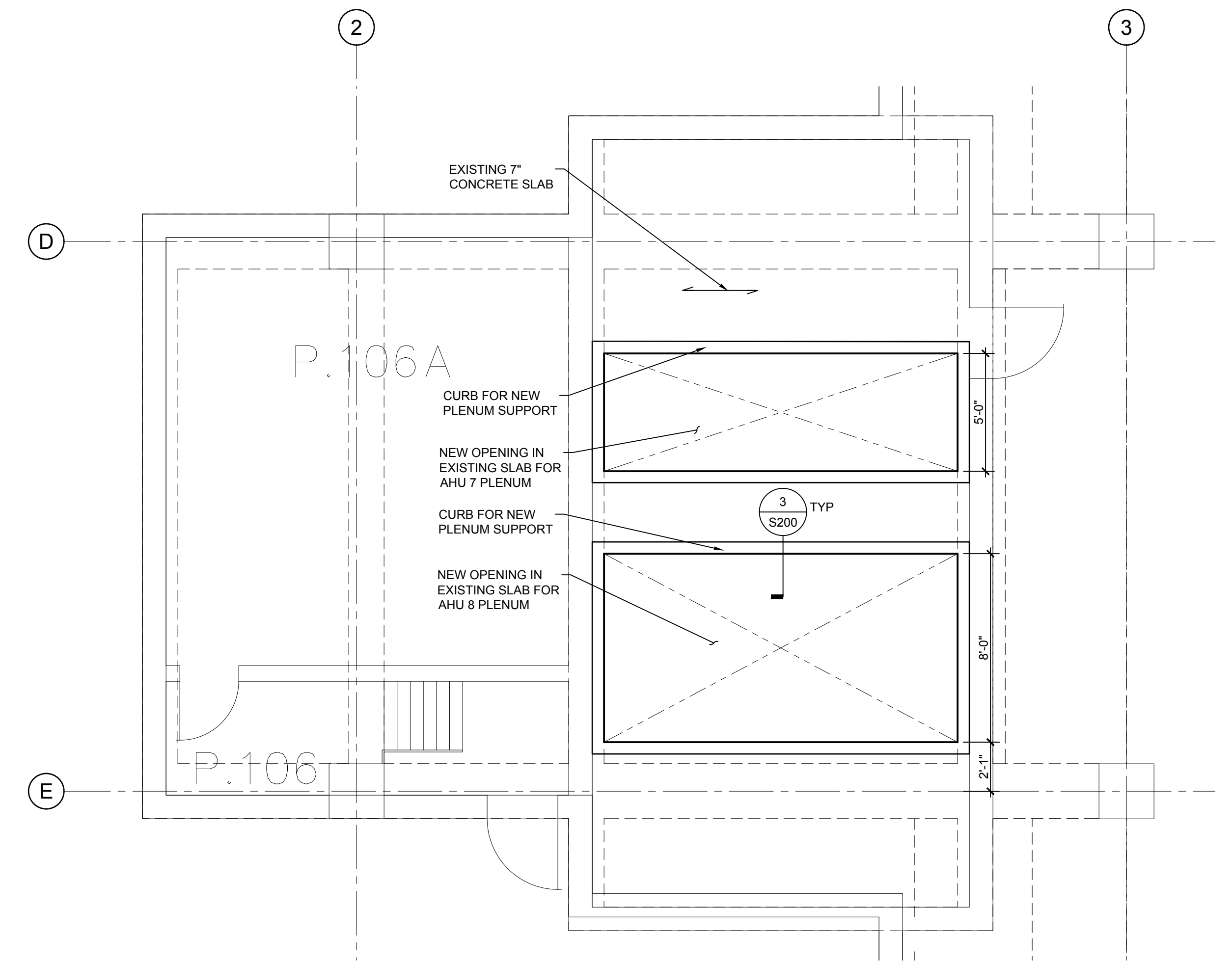
DRAWING TITLE
NORTH PLAN

DRAWING NO.
S102



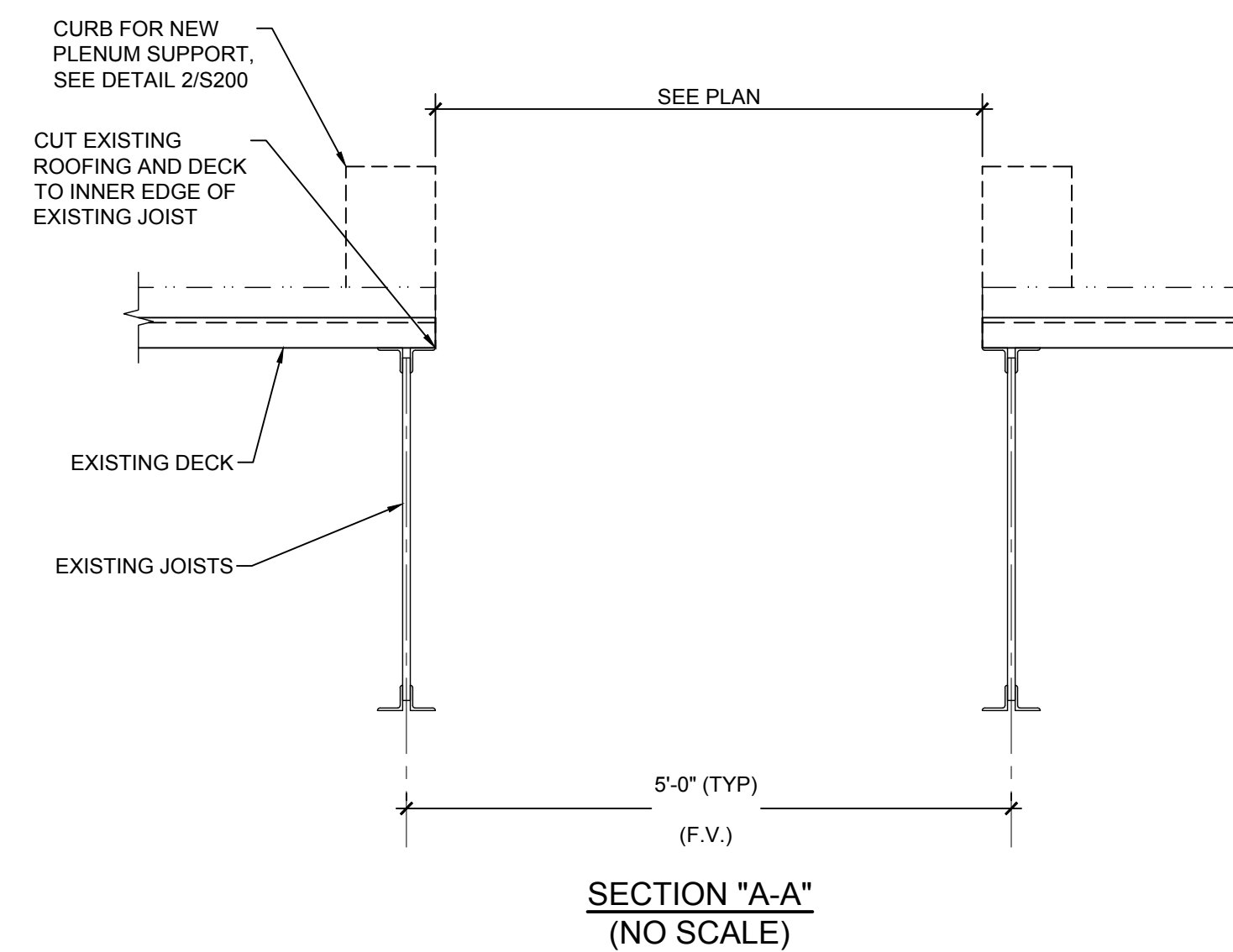
NOTES:
1. SEE NOTES ON 1/S102.

2 PARTIAL PLAN - PENTHOUSE 1
1/4" = 1'-0"



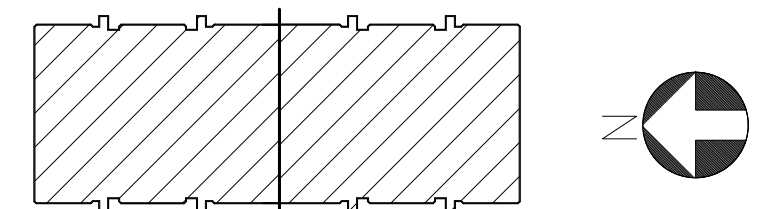
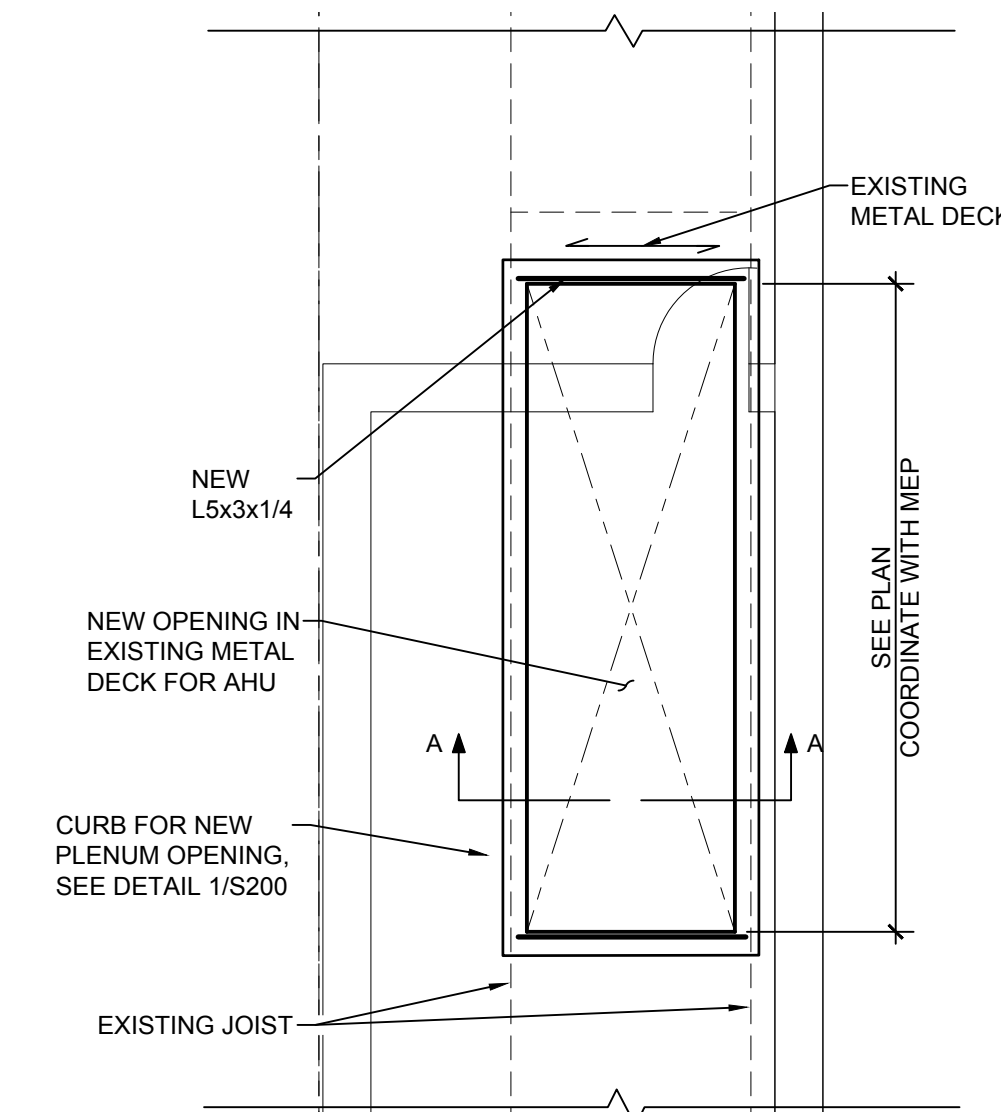
NOTES:
1. COORDINATE OPENING SIZE WITH MEP DRAWINGS.
2. COORDINATE LOCATION OF CURB WITH MEP DRAWINGS AND APPROVED EQUIPMENT SHOP DRAWINGS. CURB MAY BE SETBACK FROM OPENING EDGE.
3. DO NOT DAMAGE OR DISTURB THE EXISTING OPENING OR THE EXISTING DUCT.
4. FOR INFILL OF SLAB OPENING REFER TO DETAIL 7/S200.
5. DO NOT OVERCUT OPENINGS, CORE CORNERS, FIRST BEFORE SAW CUTTING OPENINGS.

1 PARTIAL PLAN - PENTHOUSE 2
1/4" = 1'-0"



2. FOR CURB SUPPORT AT EXISTING JOIST, SEE 2/S200.
3. FOR CURB SUPPORT AT NEW STEEL ANGLES, SEE 1/S200.
4. FOR CONNECTIONS OF NEW ANGLE TO JOIST SEE 9/S200.

3 PARTIAL PLAN - PENTHOUSE 3
1/4" = 1'-0"



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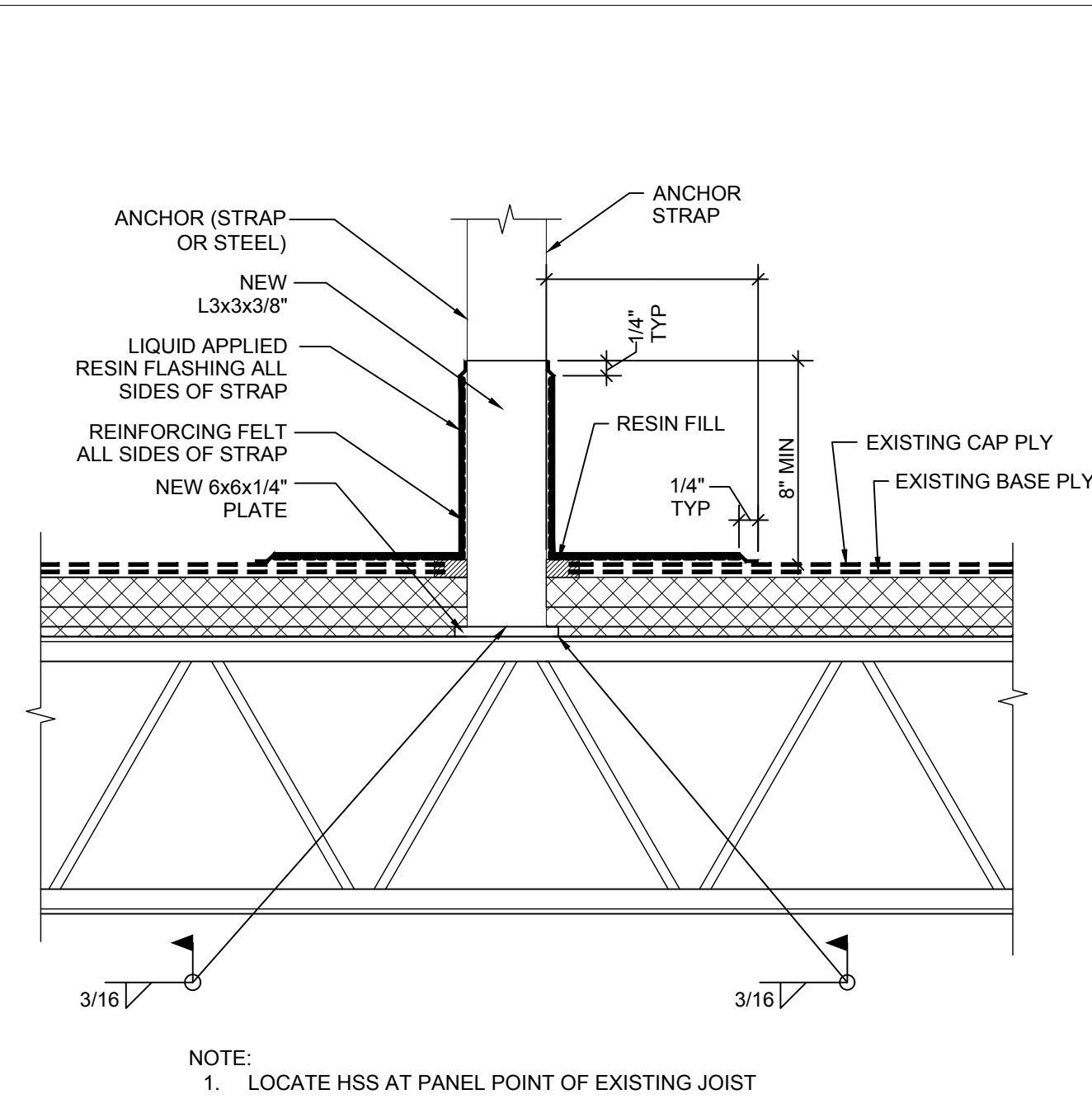
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MEDICAL SCHOOL BUILDING
SOUTH PENTHOUSE

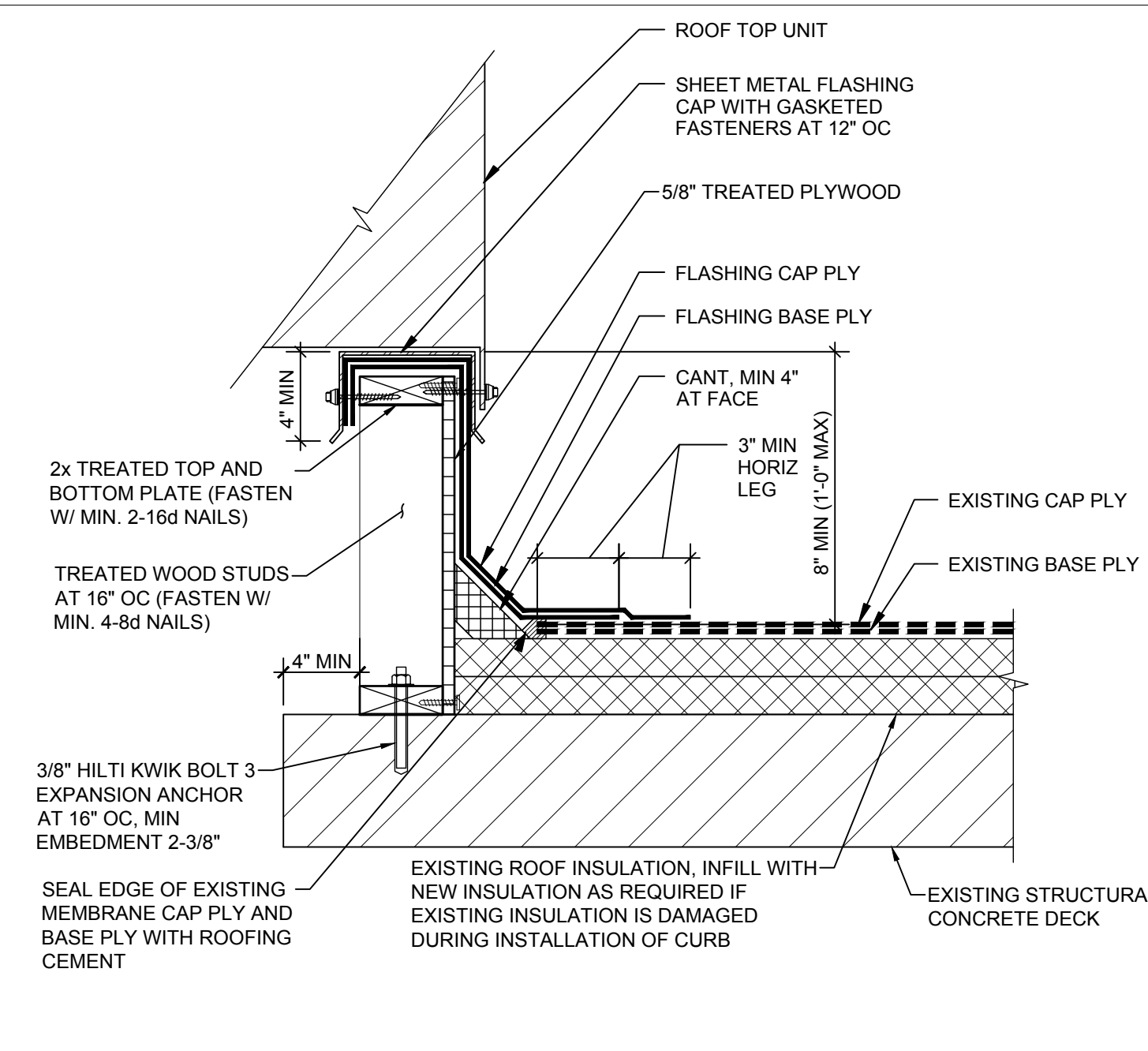
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PARTIAL PLANS

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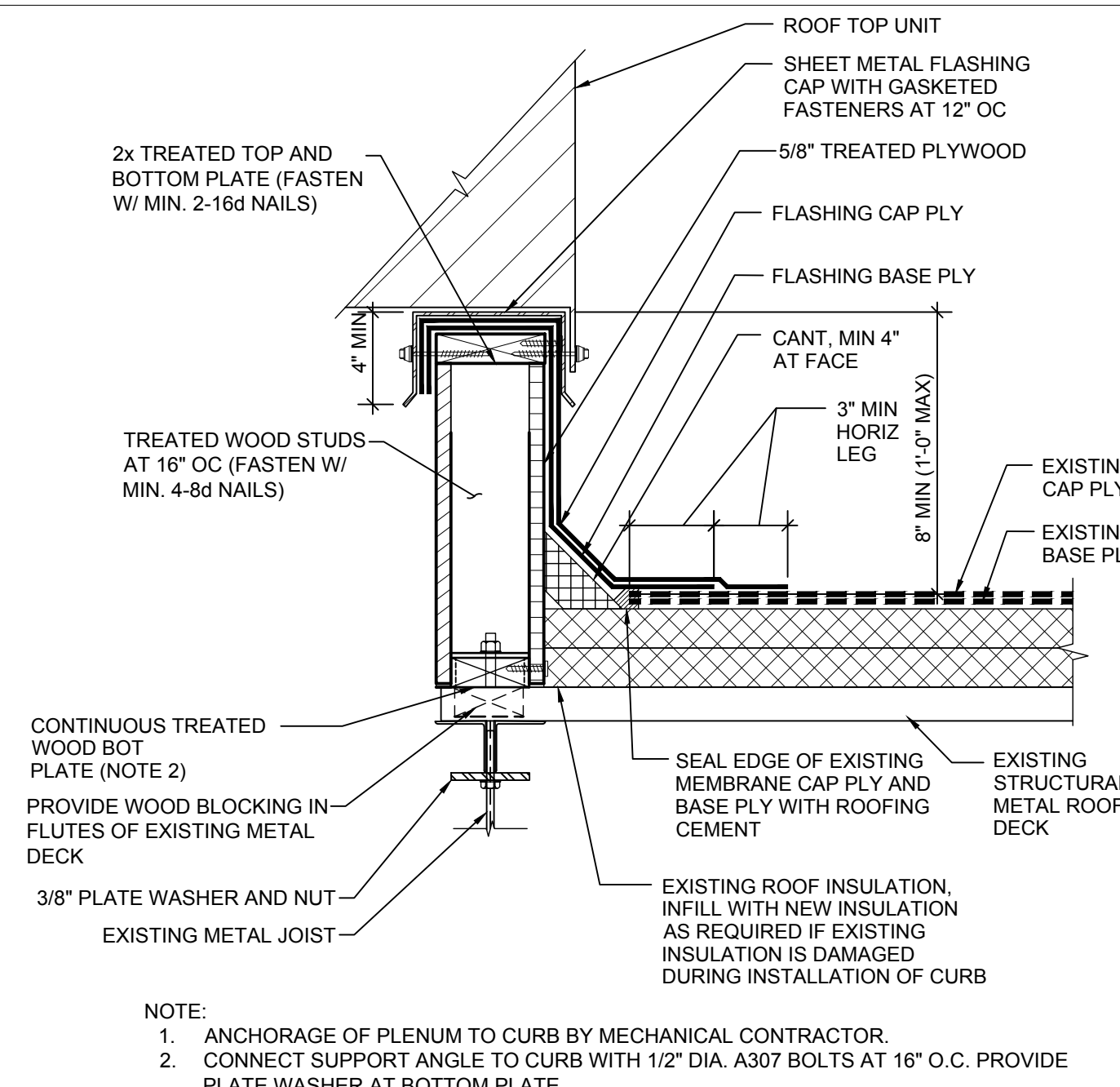


NOTE:
1. LOCATE HSS AT PANEL POINT OF EXISTING JOIST

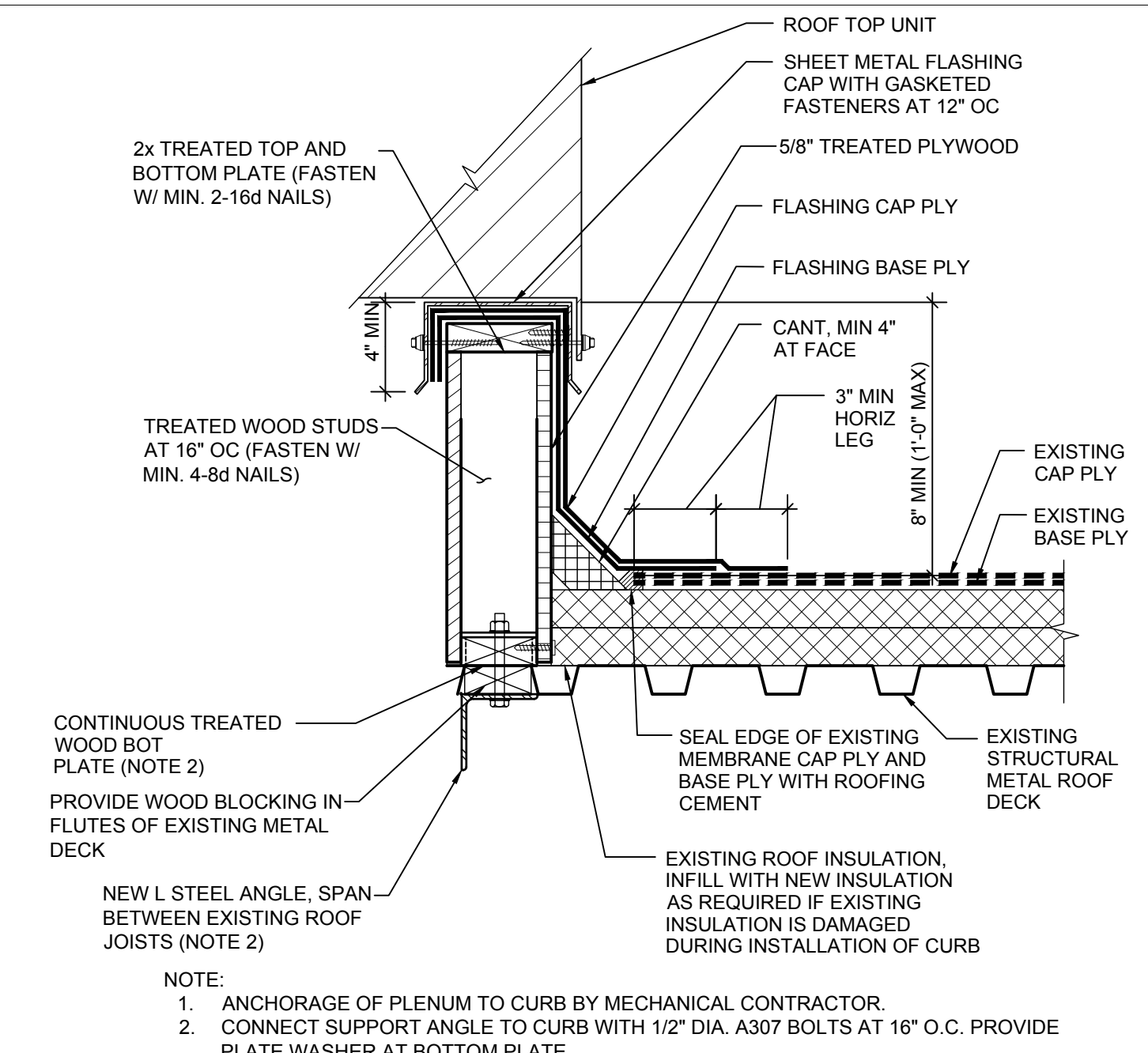
4 TYPICAL ANCHOR CONNECTION TO ROOF STRUCTURE
1 1/2" = 1'-0"



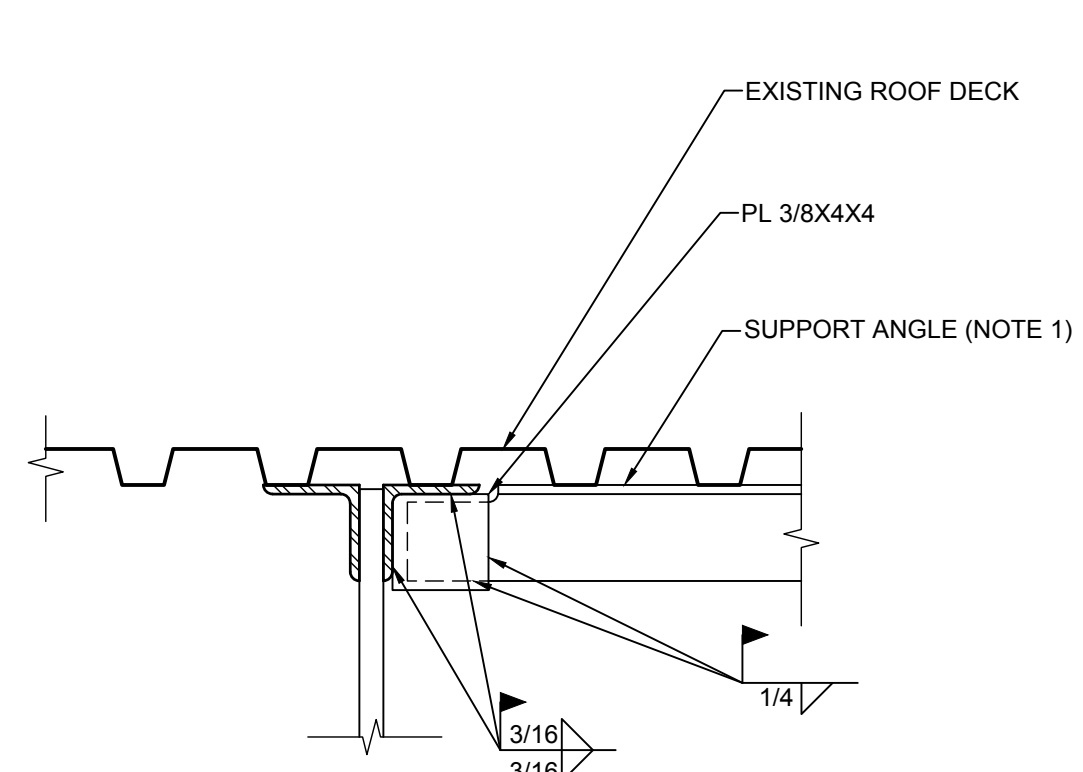
3 CURB DETAIL AT CONCRETE SLAB - WITH ROOF PENETRATION
1 1/2" = 1'-0"



2 CURB DETAIL AT STEEL DECK - JOIST AT END PLENUM WITH ROOF OPENING
1 1/2" = 1'-0"

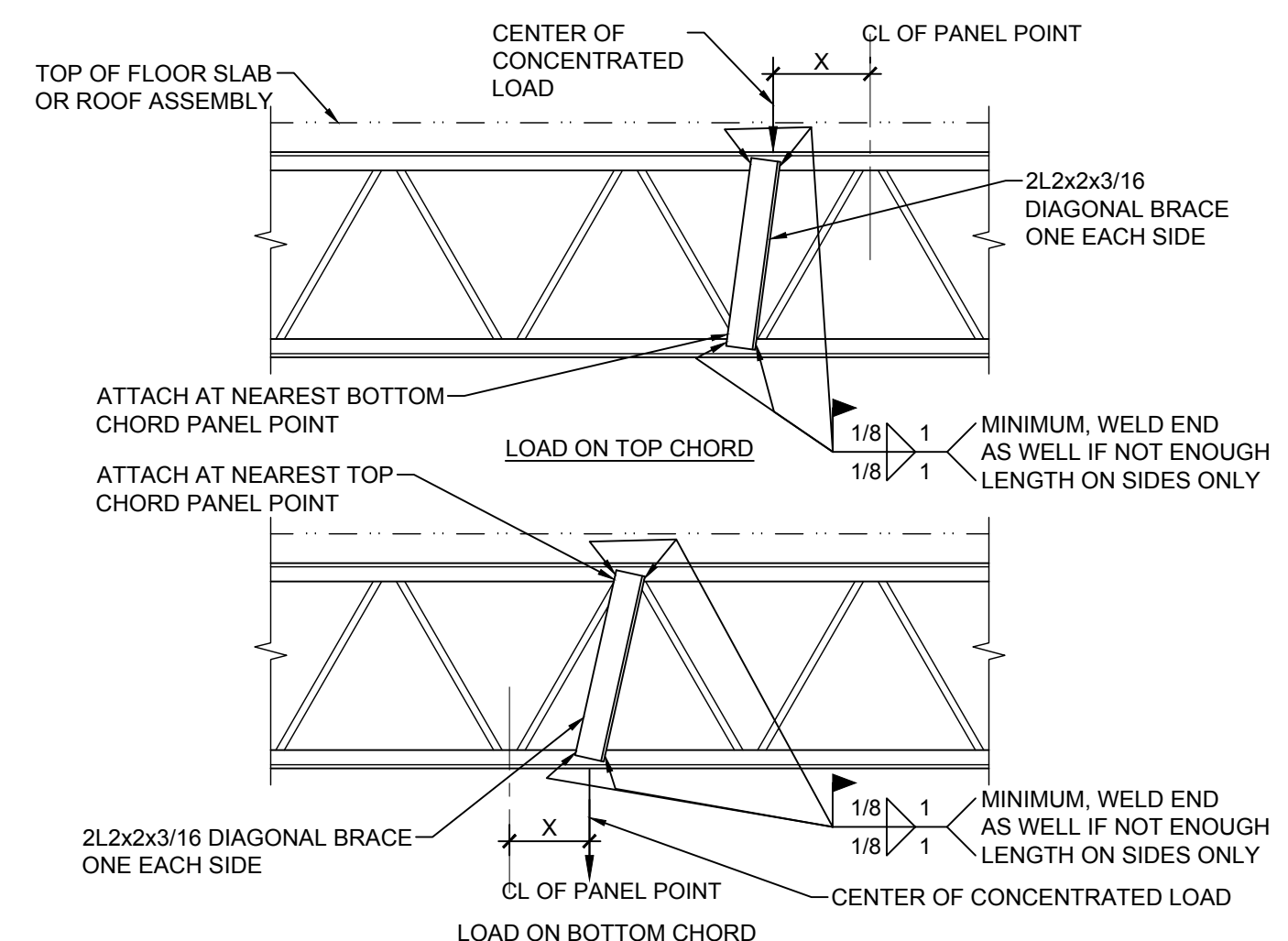


1 CURB DETAIL AT STEEL DECK - ANGLE AT END PLENUM WITH ROOF OPENING
1 1/2" = 1'-0"



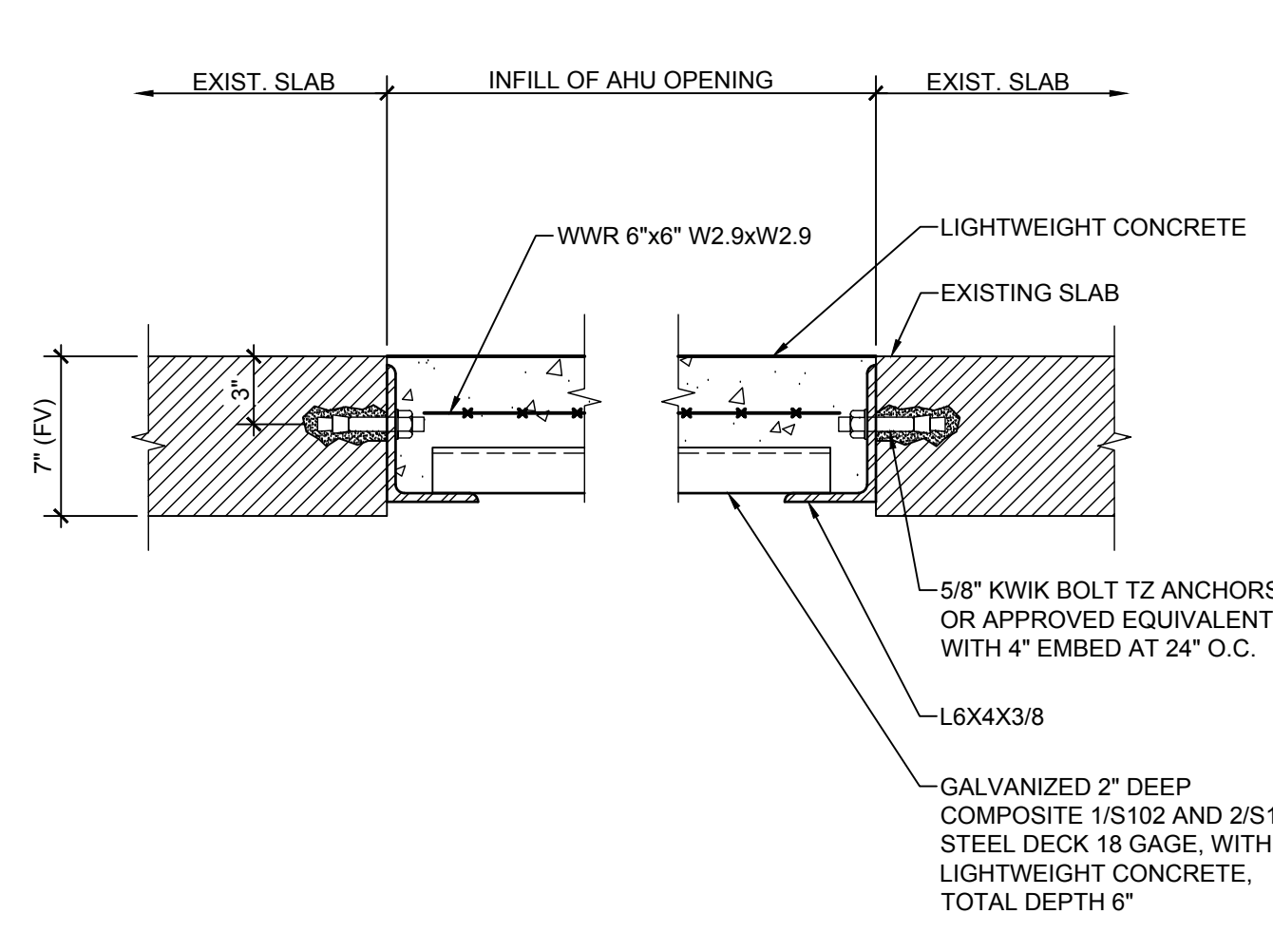
NOTES:
1. SEE DETAILS S84/S200 FOR INFORMATION ABOUT SUPPORT ANGLE.
2. APPLY THIS DETAIL AT ALL LOCATIONS OF ITEMS BEARING ON EXISTING STEEL ROOF DECK.
3. SEE PLAN AND MEP DRAWINGS FOR LOCATIONS OF ANY ITEMS REQUIRING SUCH SUPPORT.
4. SEE DETAIL S8/S200 FOR JOIST REINFORCEMENT AT LOCATION OF EACH NEW ANGLE.

9 ATTACHMENT OF SUPPORT ANGLE TO EXISTING JOISTS
1 1/2" = 1'-0"



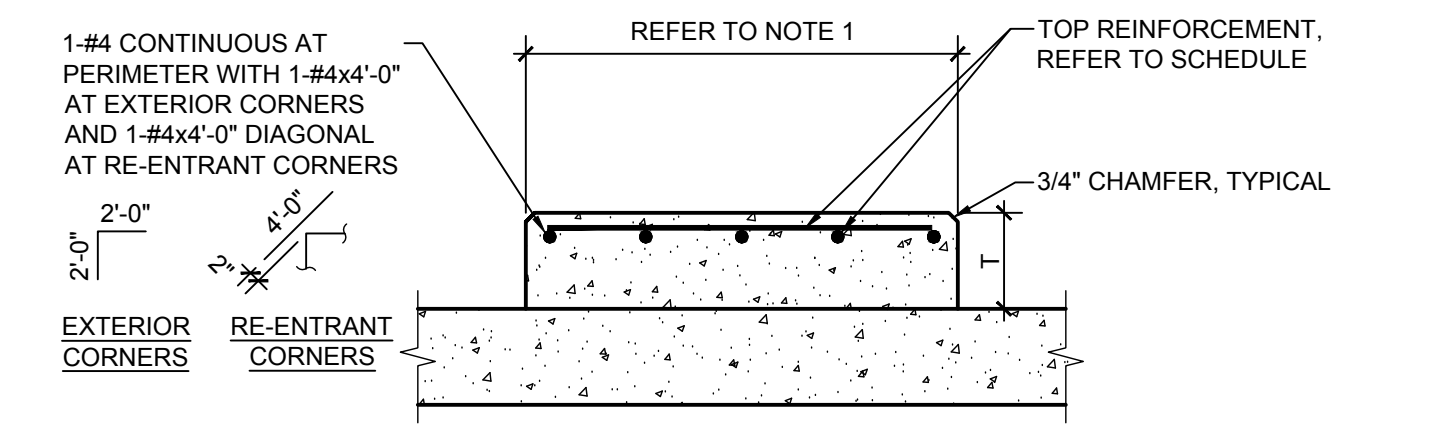
NOTES:
1. DIAGONAL BRACE IS NOT REQUIRED FOR "X" LESS THAN THREE INCHES.
2. PROVIDE DIAGONAL BRACE AT LOCATION OF CONCENTRATED LOADS SUCH AS PARTITIONS, HEAVY PIPES, MECHANICAL UNITS, HEAVY LIGHTS AND ANY OTHER CONCENTRATED LOADS AND AS NOTED ELSEWHERE IN THE STRUCTURAL DRAWINGS. LOADS MUST BE APPLIED CONCENTRICALLY TO JOIST BOTTOM CHORD.

8 TYPICAL STIFFENING OF JOIST FOR CONCENTRATED LOADS
NO SCALE



NOTES:
1. THIS DETAIL IS TO BE APPLIED AT THE AREAS OF SLAB OPENING (SHOWN ON S18/S200) WHICH WILL NEED TO BE INFILLED UPON COMPLETION OF WORK.
2. DECK SHALL NOT SPAN MORE THAN 8'-0\"/>

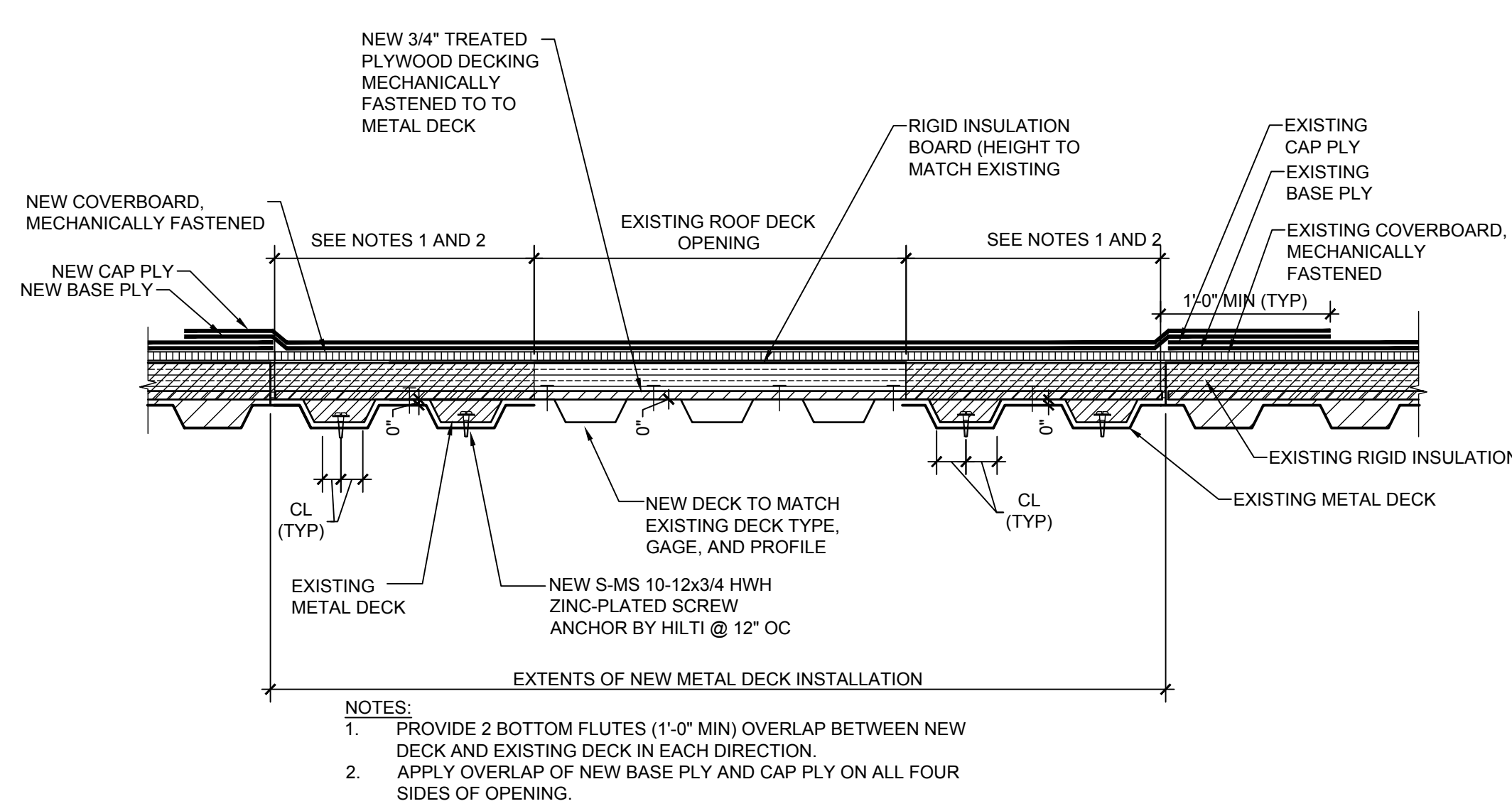
7 INFILL OF SLAB OPENING
1 1/2" = 1'-0"



NOTES:
1. REFER TO ARCHITECTURAL OR MEP DRAWINGS FOR HOUSEKEEPING PAD PLAN DIMENSIONS AND THICKNESS (4\"/>

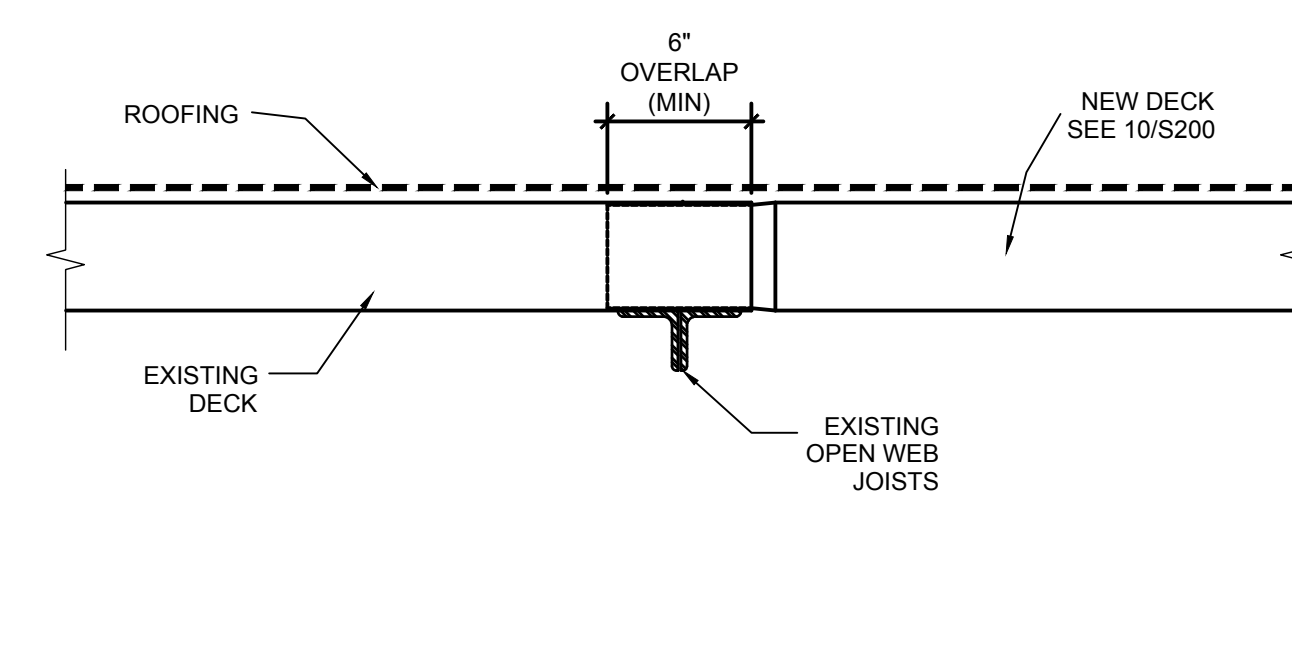
HOUSEKEEPING PAD REINFORCEMENT SCHEDULE		
PAD THICKNESS	TOP REINFORCEMENT	BOTTOM REINFORCEMENT
T = 4"	WWR 4x4-W2.9xW2.9 OR #3@12" EACH WAY	NONE
4" < T <= 6"	WWR 4x4-W4xW4 OR #4@18" EACH WAY	NONE
6" < T <= 8"	WWR 4x4-W6xW6 OR #4@12" EACH WAY	NONE

6 TYPICAL HOUSEKEEPING PAD OVER SLAB
NO SCALE



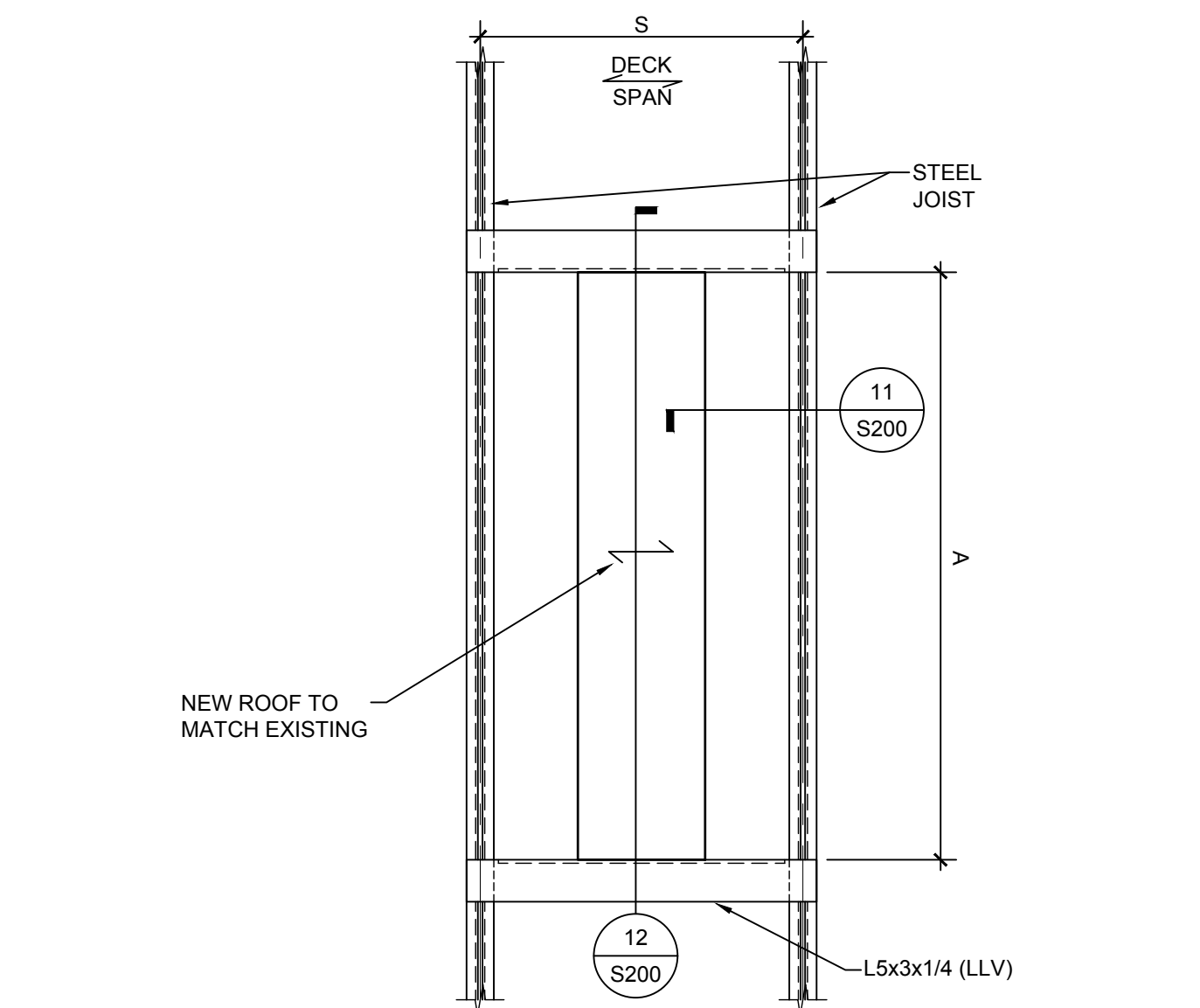
NOTES:
1. PROVIDE 2 BOTTOM FLUTES (1'-0\"/>

12 METAL DECK INFILL AT EXISTING ROOF DECK OPENING
NTS



NOTE:
1. OVERLAP NEW DECK WITH EXISTING AS SHOWN
2. SEE DETAIL 12/S200 FOR NEW ROOFING AND OVERLAP WITH EXISTING ROOFING

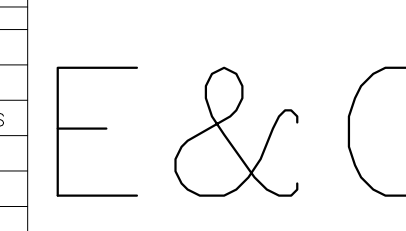
11 TITLE
1 1/2" = 1'-0"



NOTES:
1. COORDINATE OPENING SIZES AND LOCATIONS WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.
2. ROOF DECK SHALL BE CONTINUOUS OVER FRAMED OPENINGS. DO NOT CUT OPENINGS UNTIL IMMEDIATELY BEFORE THEY ARE NEEDED.
3. VERIFY FRAMING WITH ENGINEER WHERE DIMENSIONS EXCEED MAXIMUM DIMENSIONS SHOWN IN THIS DETAIL.
4. REFER TO SPECIFICATIONS FOR OPENINGS WHERE THE LONGEST DIMENSION IS 10\"/>

10 TYPICAL FRAMED OPENING IN ROOF DECK WITH JOIST CONSTRUCTION
NO SCALE

Area	Rev.	Date	Description
		10/25/17	Progress Plot
		01/19/18	95% Construction
		04/13/18	Construction Drawings
		05/24/18	Addendum #01



ENGINEERS & CONSULTANTS, INC.
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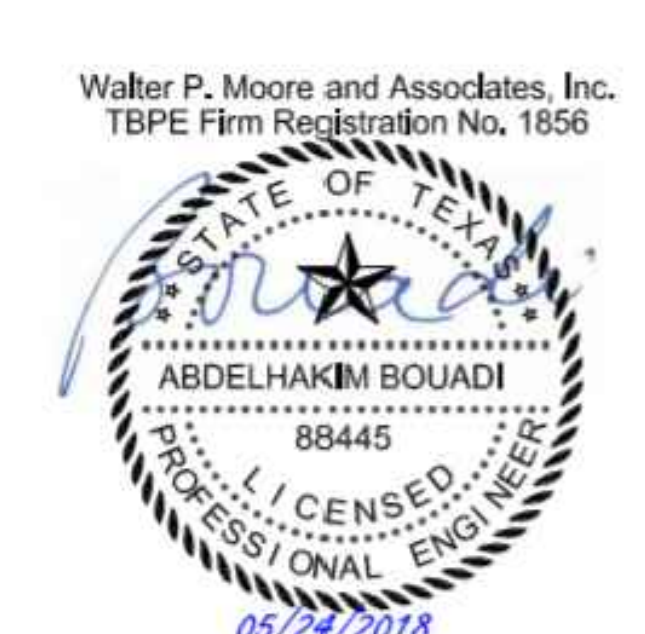
WALTER P MOORE
WALTER P. MOORE AND ASSOCIATES, INC.
1301 MOHNEY STREET, SUITE 1100
HOUSTON, TEXAS 77010.3064
PHONE: 713.630.7300 FAX: 713.630.7396

UTHealth
The University of Texas
Health Science Center at Houston

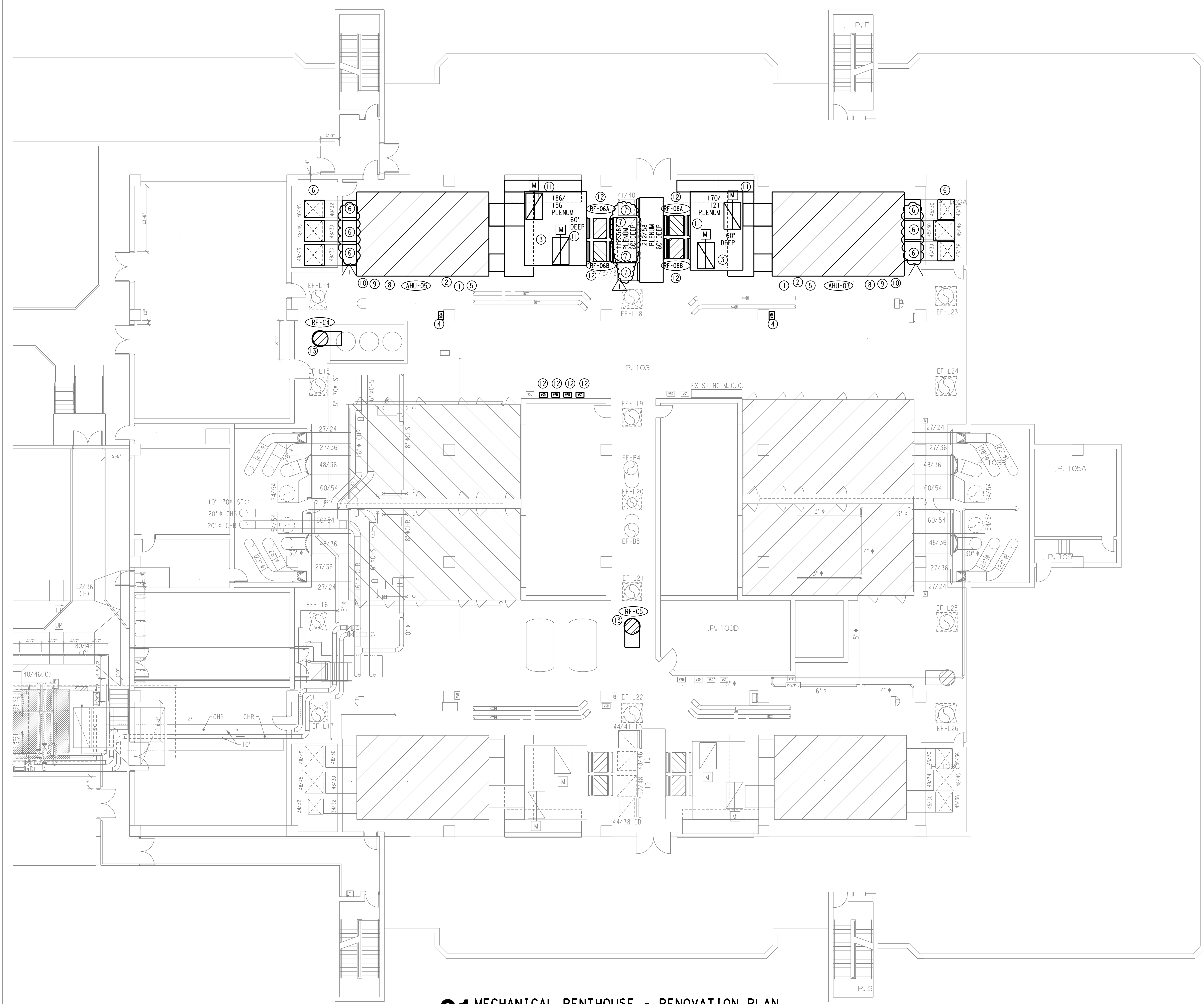
MEDICAL SCHOOL BUILDING
SOUTH PENTHOUSE

DRAWING TITLE
DETAILS

DRAWING NO.
S200

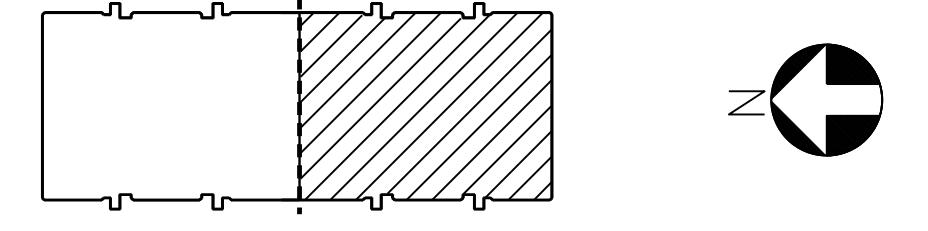


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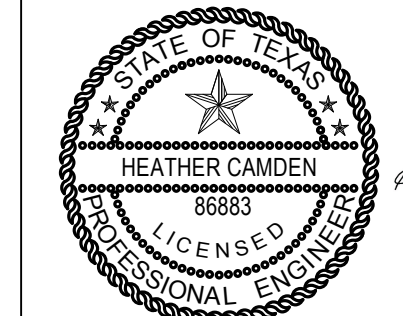
- DRAWING NOTES:**
- ONCE THE AHU HAS BEEN REPLACED, TIE BACK INTO THE CHILLED WATER, STEAM AND DUCTWORK. RECONNECT THE NEW FANS TO THE NEW VFD (REFER TO ELECTRICAL DRAWINGS). DE-ENERGIZE THE TEMPORARY UNIT AND REMOVE THE TEMPORARY DUCT FROM THE PLENUM TO THE RISERS AND CAP TO MATCH EXISTING. NEW COILS WILL BE IN DIFFERENT LOCATIONS. ROUTE PIPE THROUGH STRUCTURAL OPENINGS AS NECESSARY TO PROVIDE PIPING TO NEW UNITS. ALL CONTROL VALVING SHALL BE PIPED AT THE UNITS AS NOTED. REINSTALL THE SMOKE DETECTOR INTO THE NEW DUCTWORK.
 - NEW AHU SHALL BE STARTED UP WITH A REPRESENTATIVE FROM THE FACTORY AND COMMISSIONED WITH A MEMBER OF THE UTHSC-H STAFF IN ATTENDANCE.
 - REFER TO THE AHU DETAIL DRAWING FOR DUCTWORK ELEVATIONS SHOWING HOW THE OUTSIDE AIR, RETURN AIR, ECONOMIZER MODE OUTSIDE AIR AND RELIEF AIR DUCT AND PLENUMS AS WELL AS RELIEF/RETURN FANS ARE TO BE INSTALLED.
 - INSTALL NEW VSD. RECONNECT TO ELEC AS NEEDED.
 - CONTROL SEQUENCE FOR THE NEW AHU SHALL BE AS NOTED ON DRAWING M990 & M991 - CONTROL DIAGRAMS.
 - PROVIDE NEW DUCT AS NOTED FROM THE AHU TO THE CHASE CONNECTION. DUCT SHALL BE AS HIGH AS POSSIBLE OUT FROM THE UNIT AND TRANSITION DOWN TO THE EXISTING FIRE DAMPER. RELOCATE SPRINKLER HEADS AS NEEDED. TRYING TO MAINTAIN AS MUCH HEAD HEIGHT AS POSSIBLE CLOSE TO THE COLUMNS.
 - INSTALL NEW SMOKE DETECTORS IN THE RETURN AIR RISERS NEAR THE EXISTING ACCESS DOOR.
 - POUR NEW PADS 3" LARGER THAN THE AHU FOOTPRINT ON EACH SIDE AND 6" TALL. REFER TO STRUCTURAL.
 - REPIPE THE NEW UNIT AS NOTED ON M900 - MECHANICAL DETAILS AND AS REQUIRED FOR LOCATION OF THE NEW UNIT CONNECTIONS.
 - NEW CONDENSATE RETURN TO BE ROUTED AS TO PENETRATE THE FLOOR IN THE EXISTING LOCATION.
 - MOTORIZED DAMPERS SHALL BE ACCESSIBLE FROM THE ROOF THROUGH THE RELIEF VENTS.
 - ENSURE FANS ARE LOCATED WITH CLEARANCE UNDER FOR ACCESS. INSTALL NEW VFD FOR EACH FAN.
 - INSTALL NEW FAN. FLOOR-SUPPORTED. DUCT A 3'0" STRAIGHT DUCT OFF OF THE FAN OUTLET AND AN ELBOW TERMINATED IN BUGSCREEN TO SEMI-CONDITION THE PENTHOUSE. RECONNECT TO EXISTING UNIT ELECTRICAL. REINSTALL SMOKE DETECTOR FOR SHUT-DOWN.

01 MECHANICAL PENTHOUSE - RENOVATION PLAN
SCALE: 1/8" = 1'-0"



ISSUE FOR:	Area	Rev.	Date	Description
CONSTRUCTION		04/13/18		
ADDENDUM #1		05/24/18		

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Professional Engineer
86683
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Date: 04/13/2018
Drawn By: MHC
Checked By: HEC
Date: 2018.05.24
File Name: 3302.00C

UTHSC Project No. 730022
E & C Project No. 3302.00C



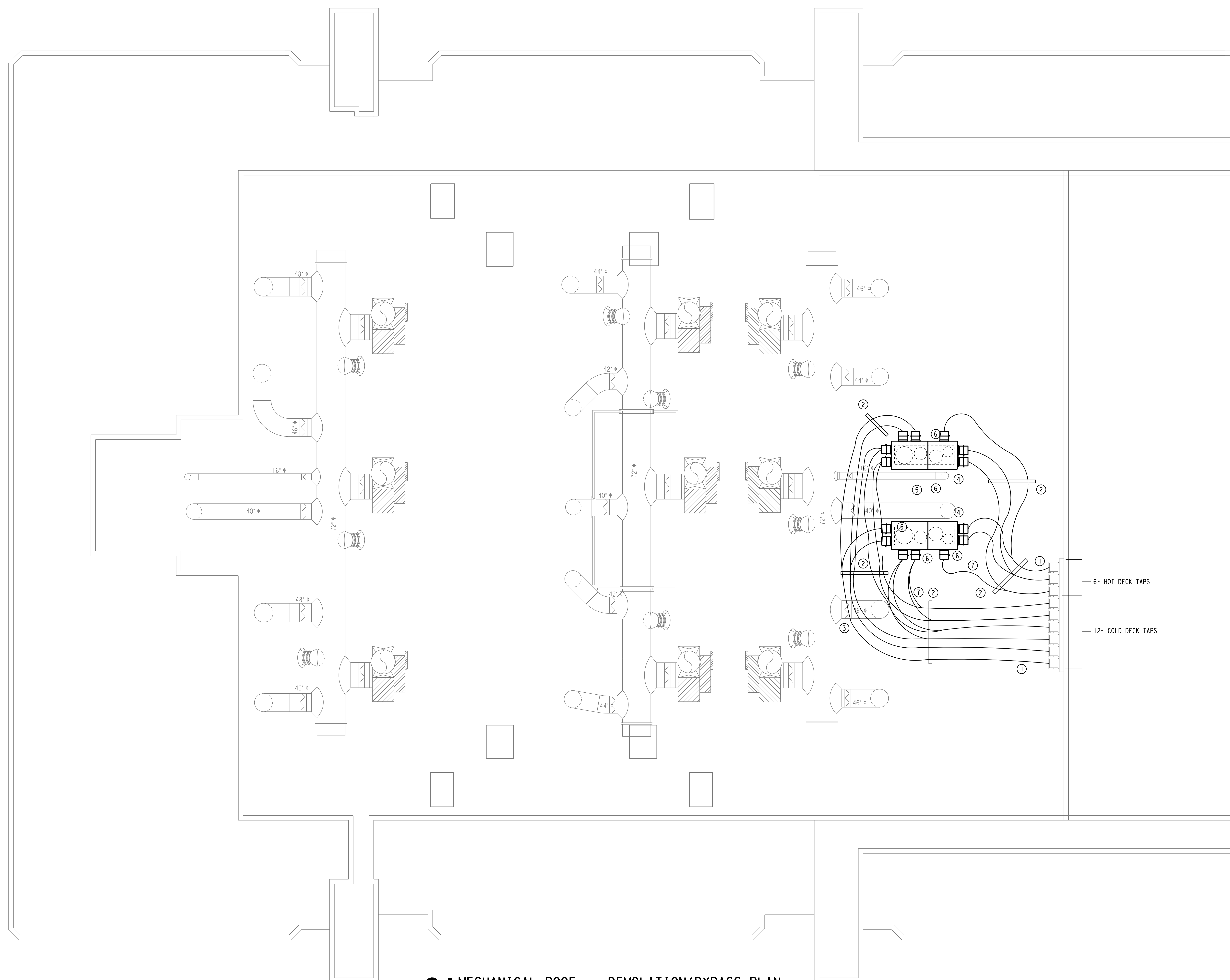
**MEDICAL SCHOOL BUILDING
PENTHOUSE
AHU REPLACEMENT**

DRAWING TITLE
**MECHANICAL PENTHOUSE
RENOVATION PLAN
PHASE 2 AHU-5 & 0-7**

DRAWING NO.
M218

Penthouse 3302 MEPV 05.7 Phase 2.dgn 5/24/2018 5:38:50 PM

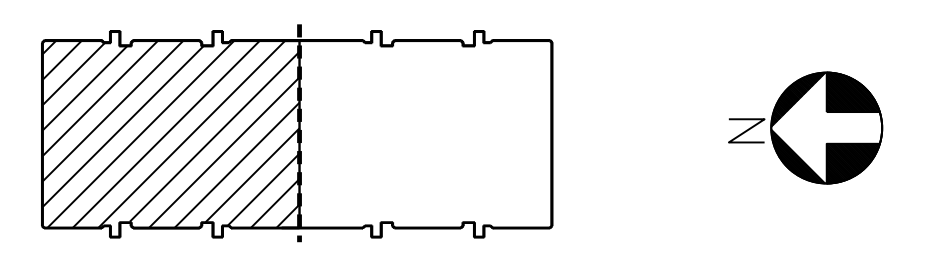
PERMANENT STEEL



- DRAWING NOTES:**
- 1 FLEX DUCTS SIMILAR TO MASTERDUCT MD ALL-WEATHER FLEXIBLE DUCT 282-500-825. FLEX TO BE 20%. FLEX FROM PREVIOUS PROJECT WILL BE STORED BY UTHSC-H. REUSE APPROXIMATELY 25%. THE ADDITIONAL WILL NEED TO BE NEW DUE TO DAMAGE.
 - 2 STRUCTURAL HOLD-DOWN LOCATIONS. REF. DETAIL 8 M901 & STRUCTURAL DRAWINGS.
 - 3 FLEX TO RUN UNDER MANIFOLDS.
 - 4 HOT DUCT.
 - 5 COLD DUCT.
 - 6 NEW MANIFOLD AS DETAILED IN M901 & M902.
 - 7 TAKE BOTTOM DUCTS OFF FOR CONNECTION TO PLENUM. RUN TOP DUCTS ON TO PLENUM FARTHER EAST.

6- HOT DECK TAPS
12- COLD DECK TAPS

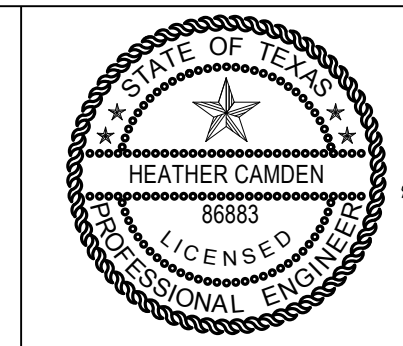
01 MECHANICAL ROOF - DEMOLITION/BYPASS PLAN
SCALE: 1/8" = 1' - 0"



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Area	Rev.	Date	Description
	1	04/13/18	CONSTRUCTION
		05/24/18	ADDENDUM #1

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Texas Firm Registration No. F-002061

Date: 04/13/2018
Drawn By: MHC
Checked By: HEC

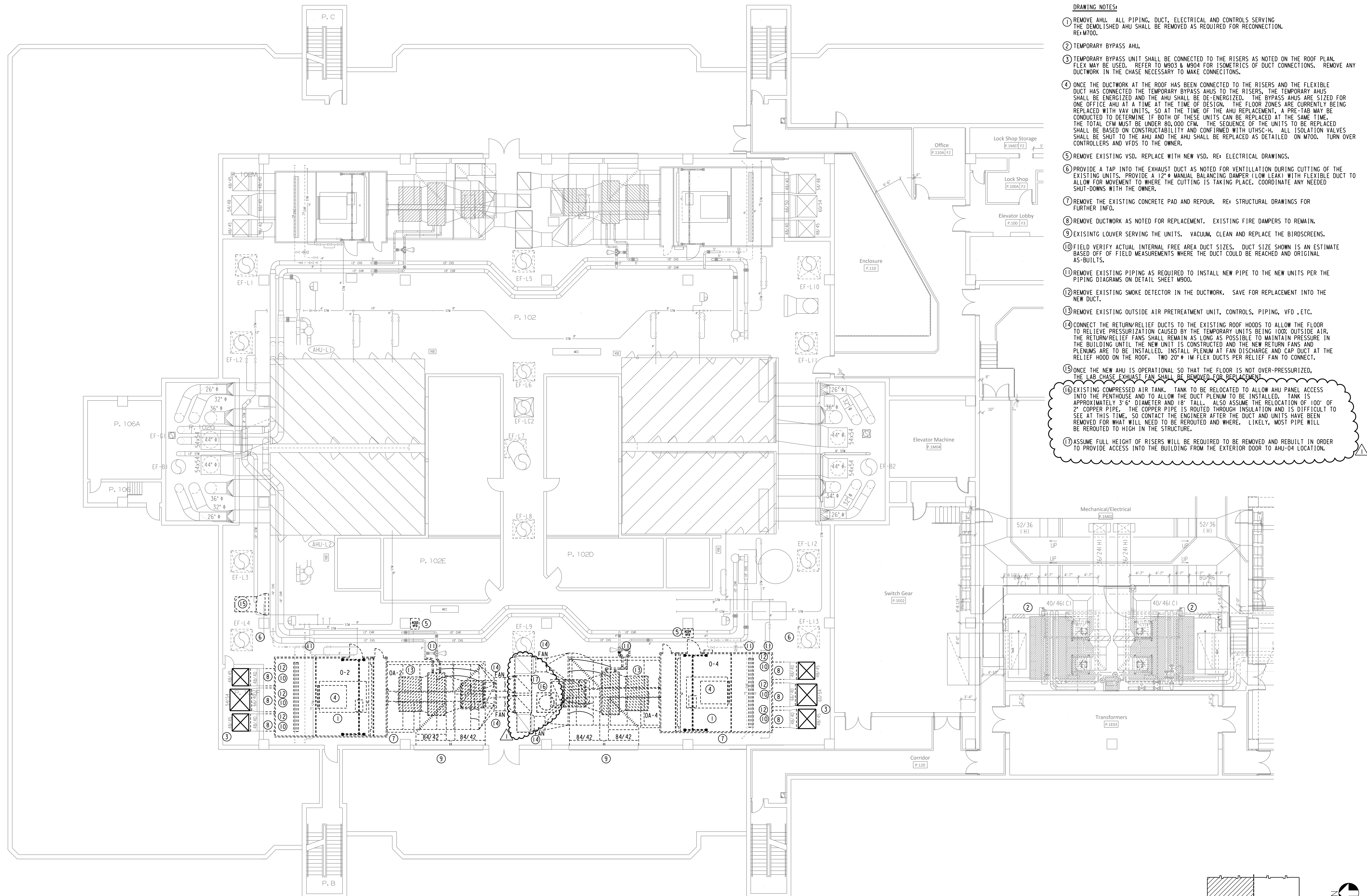
UTHSC Project No. 730022
E & C Project No. 3302.00C
File Name



**MEDICAL SCHOOL BUILDING
PENTHOUSE
AHU REPLACEMENT**

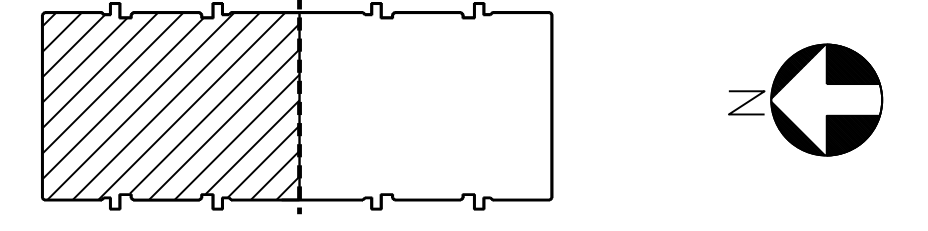
DRAWING TITLE
**MECHANICAL
DEMO/BYPASS PLAN
PHASE 3 AHU-L3 & L4**

DRAWING NO.
M309



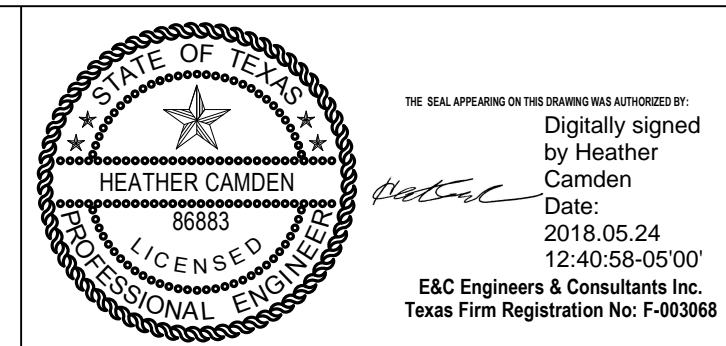
- DRAWING NOTES:**
- REMOVE AHU. ALL PIPING, DUCT, ELECTRICAL AND CONTROLS SERVING THE DEMOLISHED AHU SHALL BE REMOVED AS REQUIRED FOR RECONNECTION. RE=M700.
 - TEMPORARY BYPASS AHU.
 - TEMPORARY BYPASS UNIT SHALL BE CONNECTED TO THE RISERS AS NOTED ON THE ROOF PLAN. FLEX MAY BE USED. REFER TO M903 & M904 FOR ISOMETRICS OF DUCT CONNECTIONS. REMOVE ANY DUCTWORK IN THE CHASE NECESSARY TO MAKE CONNECTIONS.
 - ONCE THE DUCTWORK AT THE ROOF HAS BEEN CONNECTED TO THE RISERS AND THE FLEXIBLE DUCT HAS CONNECTED THE TEMPORARY BYPASS AHUS TO THE RISERS, THE TEMPORARY AHUS SHALL BE ENERGIZED AND THE AHU SHALL BE DE-ENERGIZED. THE BYPASS AHUS ARE SIZED FOR ONE OFFICE AHU AT A TIME AT THE TIME OF DESIGN. THE FLOOR ZONES ARE CURRENTLY BEING REPLACED WITH VAV UNITS. SO AT THE TIME OF THE AHU REPLACEMENT, A PRE-TAB MAY BE CONDUCTED TO DETERMINE IF BOTH OF THESE UNITS CAN BE REPLACED AT THE SAME TIME. THE TOTAL CFM MUST BE UNDER 80,000 CFM. THE SEQUENCE OF THE UNITS TO BE REPLACED SHALL BE BASED ON CONSTRUCTABILITY AND CONFIRMED WITH UTHSC-H. ALL ISOLATION VALVES SHALL BE SHUT TO THE AHU AND THE AHU SHALL BE REPLACED AS DETAILED ON M700. TURN OVER CONTROLLERS AND VFDs TO THE OWNER.
 - REMOVE EXISTING VSD. REPLACE WITH NEW VSD. RE= ELECTRICAL DRAWINGS.
 - PROVIDE A TAP INTO THE EXHAUST DUCT AS NOTED FOR VENTILLATION DURING CUTTING OF THE EXISTING UNITS. PROVIDE A 12" MANUAL BALANCING DAMPER (LOW LEAK) WITH FLEXIBLE DUCT TO ALLOW FOR MOVEMENT TO WHERE THE CUTTING IS TAKING PLACE. COORDINATE ANY NEEDED SHUT-DOWNS WITH THE OWNER.
 - REMOVE THE EXISTING CONCRETE PAD AND REPAIR. RE= STRUCTURAL DRAWINGS FOR FURTHER INFO.
 - REMOVE DUCTWORK AS NOTED FOR REPLACEMENT. EXISTING FIRE DAMPERS TO REMAIN.
 - EXISTING LOUVER SERVING THE UNITS. VACUUM, CLEAN AND REPLACE THE BIRDSCREENS.
 - FIELD VERIFY ACTUAL INTERNAL FREE AREA DUCT SIZES. DUCT SIZE SHOWN IS AN ESTIMATE BASED OFF OF FIELD MEASUREMENTS WHERE THE DUCT COULD BE REACHED AND ORIGINAL AS-BUILTS.
 - REMOVE EXISTING PIPING AS REQUIRED TO INSTALL NEW PIPE TO THE NEW UNITS PER THE PIPING DIAGRAMS ON DETAIL SHEET M900.
 - REMOVE EXISTING SMOKE DETECTOR IN THE DUCTWORK. SAVE FOR REPLACEMENT INTO THE NEW DUCT.
 - REMOVE EXISTING OUTSIDE AIR PRETREATMENT UNIT, CONTROLS, PIPING, VFD ,ETC.
 - CONNECT THE RETURN/RELIEF DUCTS TO THE EXISTING ROOF HOODS TO ALLOW THE FLOOR TO RELIEVE PRESSURIZATION CAUSED BY THE TEMPORARY UNITS BEING 100% OUTSIDE AIR. THE RETURN/RELIEF FANS SHALL REMAIN AS LONG AS POSSIBLE TO MAINTAIN PRESSURE IN THE BUILDING UNTIL THE NEW UNIT IS CONSTRUCTED AND THE NEW RETURN FANS AND PLENUMS ARE TO BE INSTALLED. INSTALL PLENUM AT FAN DISCHARGE AND CAP DUCT AT THE RELIEF HOOD ON THE ROOF. TWO 20" IM FLEX DUCTS PER RELIEF FAN TO CONNECT.
 - ONCE THE NEW AHU IS OPERATIONAL SO THAT THE FLOOR IS NOT OVER-PRESSURIZED, THE LAB CHASE EXHAUST FAN SHALL BE REMOVED FOR REPLACEMENT.
 - EXISTING COMPRESSED AIR TANK. TANK TO BE RELOCATED TO ALLOW AHU PANEL ACCESS INTO THE PENTHOUSE AND TO ALLOW THE DUCT PLENUM TO BE INSTALLED. TANK IS APPROXIMATELY 3' 6" DIAMETER AND 18" TALL. ALSO ASSUME THE RELOCATION OF 100' OF 2" COPPER PIPE. THE COPPER PIPE IS ROUTED THROUGH INSULATION AND IS DIFFICULT TO SEE AT THIS TIME. SO CONTACT THE ENGINEER AFTER THE DUCT AND UNITS HAVE BEEN REMOVED FOR WHAT WILL NEED TO BE REROUTED AND WHERE. LIKELY, MOST PIPE WILL BE REROUTED TO HIGH IN THE STRUCTURE.
 - ASSUME FULL HEIGHT OF RISERS WILL BE REQUIRED TO BE REMOVED AND REBUILT IN ORDER TO PROVIDE ACCESS INTO THE BUILDING FROM THE EXTERIOR DOOR TO AHU-04 LOCATION.

01 MECHANICAL PENTHOUSE - DEMOLITION/BYPASS PLAN
SCALE: 1/8" = 1' - 0"



ISSUE FOR:	Area	Rev.	Date	Description
CONSTRUCTION		04/13/18		
ADDENDUM #1		05/24/18		

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Date: 04/13/2018
Drawn By: MHC
Checked By: HEC
UTSC Project No.: 730022
E & C Project No.: 3302.00C
File Name:

UTHealth
The University of Texas
Health Science Center at Houston

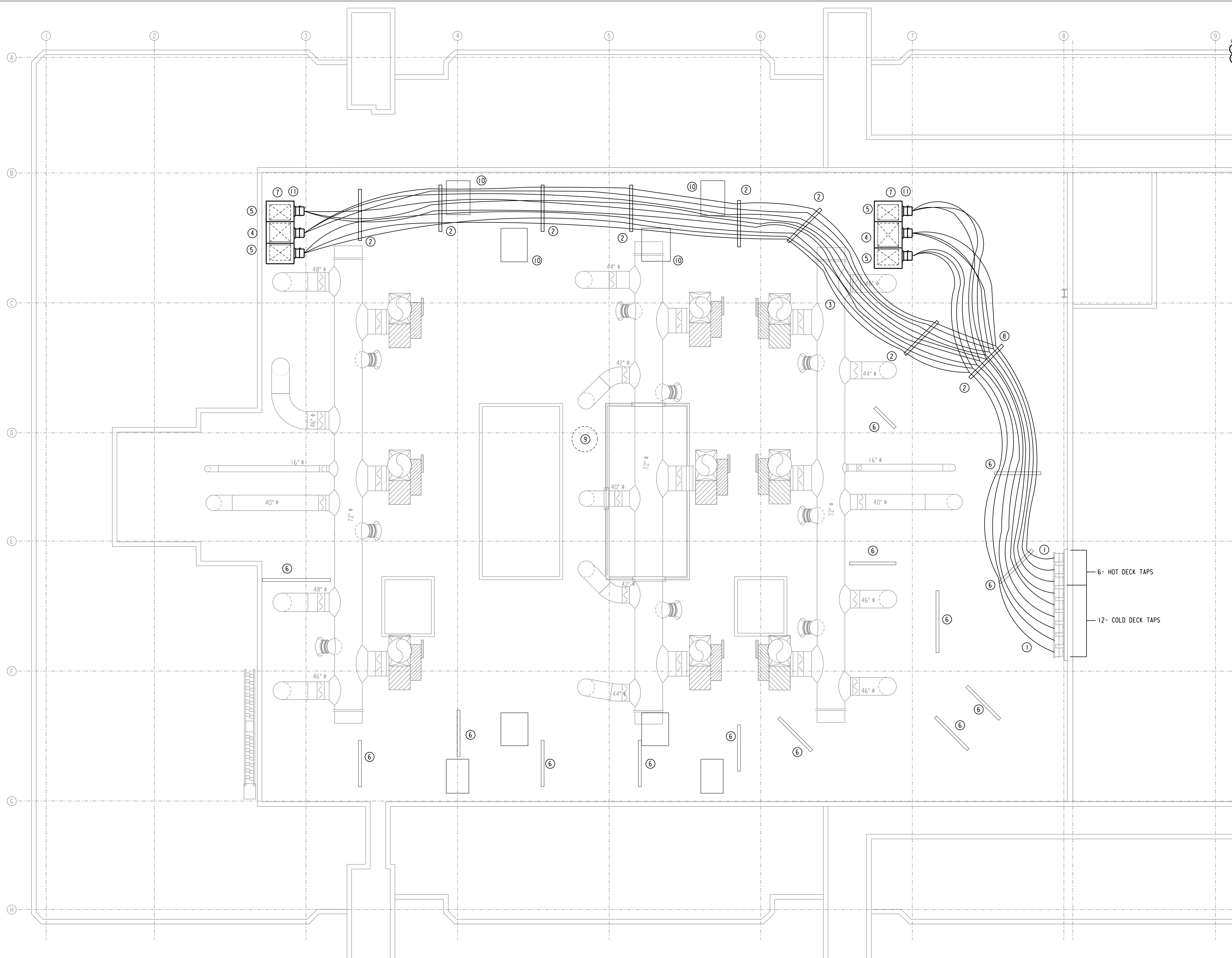
**MEDICAL SCHOOL BUILDING
PENTHOUSE
AHU REPLACEMENT**

DRAWING TITLE
**MECHANICAL PENTHOUSE
DEMO/BYPASS PLAN
PHASE 5 AHU-02 & 0-4**

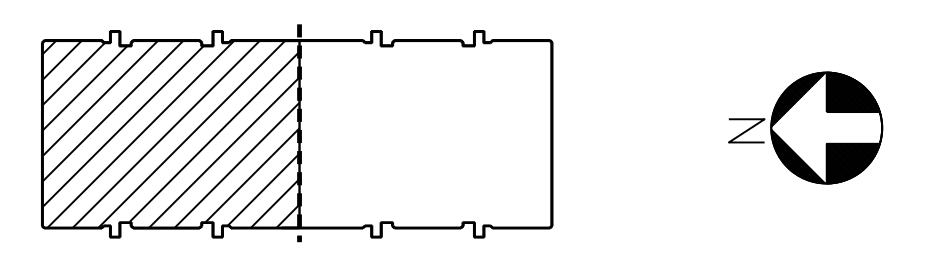
DRAWING NO.
M508

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- DRAWING NOTES**
- ① FLEX DUCTS SIMILAR TO MASTERDUCT MD ALL-WEATHER FLEXIBLE DUCT 282-500-825. FLEX TO BE 20" Ø. FLEX FROM PREVIOUS PROJECT WILL BE STORED BY UTHSC-H. REUSE APPROXIMATELY 25%. THE ADDITIONAL WILL NEED TO BE NEW DUE TO DAMAGE.
 - ② STRUCTURAL HOLD-DOWN LOCATIONS. REF. DETAIL 8 M901 & STRUCTURAL DRAWINGS.
 - ③ FLEX TO RUN UNDER MANIFOLDS.
 - ④ HOT DUCT.
 - ⑤ COLD DUCT.
 - ⑥ EXISTING STRUCTURAL TIE-DOWNS.
 - ⑦ NEW MANIFOLD AS DETAILED IN M901 & M902.
 - ⑧ TAKE BOTTOM DUCTS OFF FOR CONNECTION TO PLENUM. RUN TOP DUCTS ON TO PLENUM FARTHER NORTH.
 - ⑨ REMOVE EXISTING CHASE EXHAUST VENT HOOD AND PATCH THE ROOF TO MATCH EXISTING.
 - ⑩ ENSURE VENTS ARE CLEAR FOR RELIEF OF BUILDING.
 - ⑪ ONCE THE FIRST UNIT IS COMPLETE, THE SECOND UNIT MAY BEGIN. EACH UNIT WILL REQUIRE CONNECTIONS OF 8 COLD DECK (FOUR PER RISER) AND 4 HOT DECK FLEX CONNECTIONS.

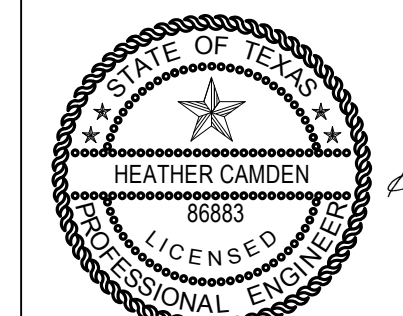


01 MECHANICAL ROOF - DEMOLITION/BYPASS PLAN
 SCALE: 1/8" = 1' - 0"



Area	Rev.	Date	Description
	1	04/13/18	CONSTRUCTION
	2	05/24/18	ADDENDUM #1

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Date: 04/13/2018
 Drawn By: MHC
 Checked By: HEC

UTHSC Project No. 730022
 E & C Project No. 3302.00C
 File Name



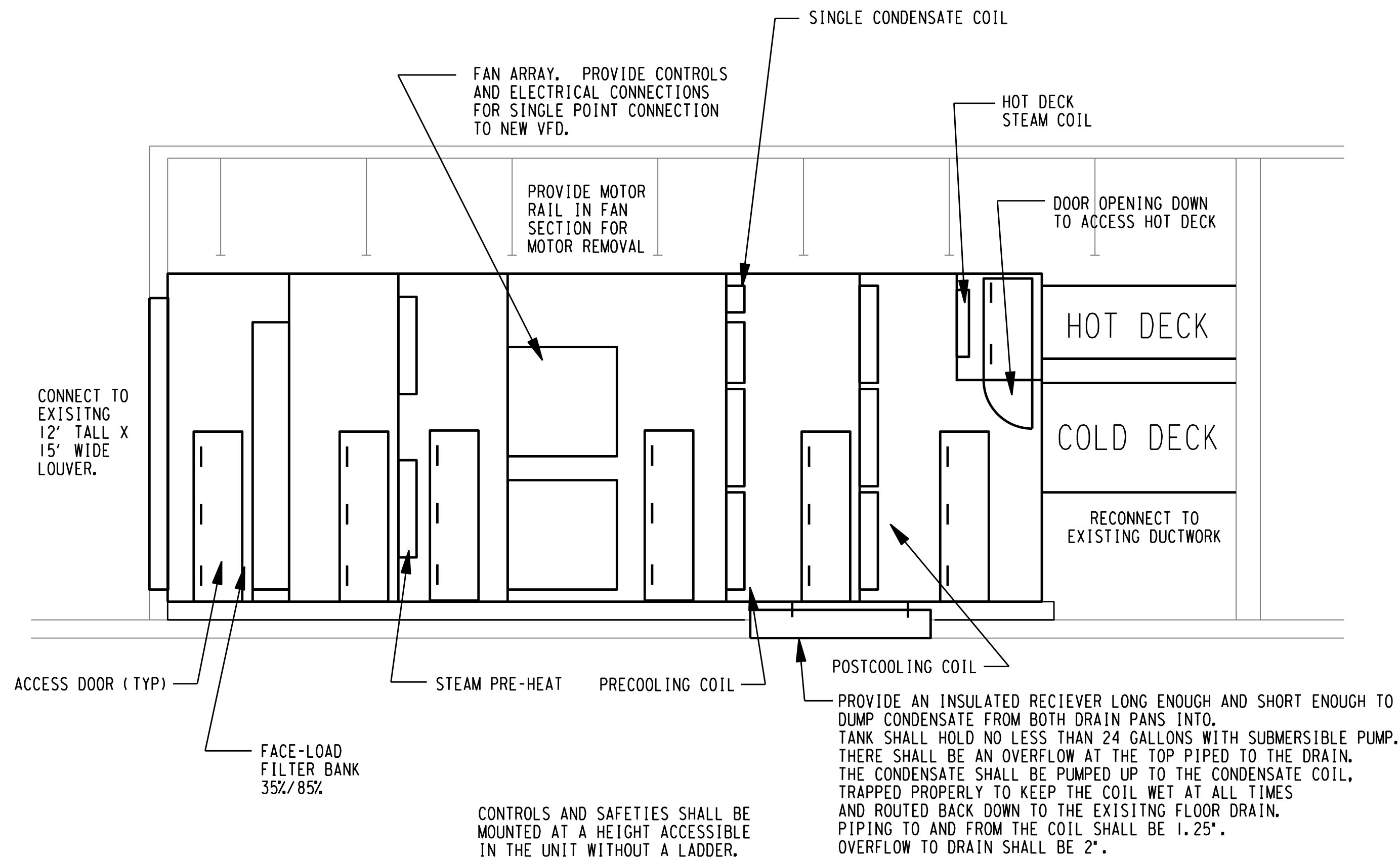
**MEDICAL SCHOOL BUILDING
 PENTHOUSE
 AHU REPLACEMENT**

DRAWING TITLE
**MECHANICAL
 DEMO/BYPASS PLAN
 PHASE 6 AHUO-1 & 0-3**

DRAWING NO.
M609

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PROVIDE FANS WITH BALANCE STREAM DAMPERS



02 LABORATORY REPLACEMENT UNIT
DETAIL W/ CONDENSATE RECOVERY
NOT TO SCALE

ALL LAB UNITS MAXIMUM DIMENSIONS ARE:
14' 0" TALL
36' 0" LONG
18' 6" WIDE

ALL OFFICE UNITS MAXIMUM DIMENSIONS ARE:
14' 0" TALL
27' 6" LONG
17' 6" WIDE

DUCT PENETRATIONS INTO CHASE APPROXIMATE LOCATIONS - FIELD VERIFY:

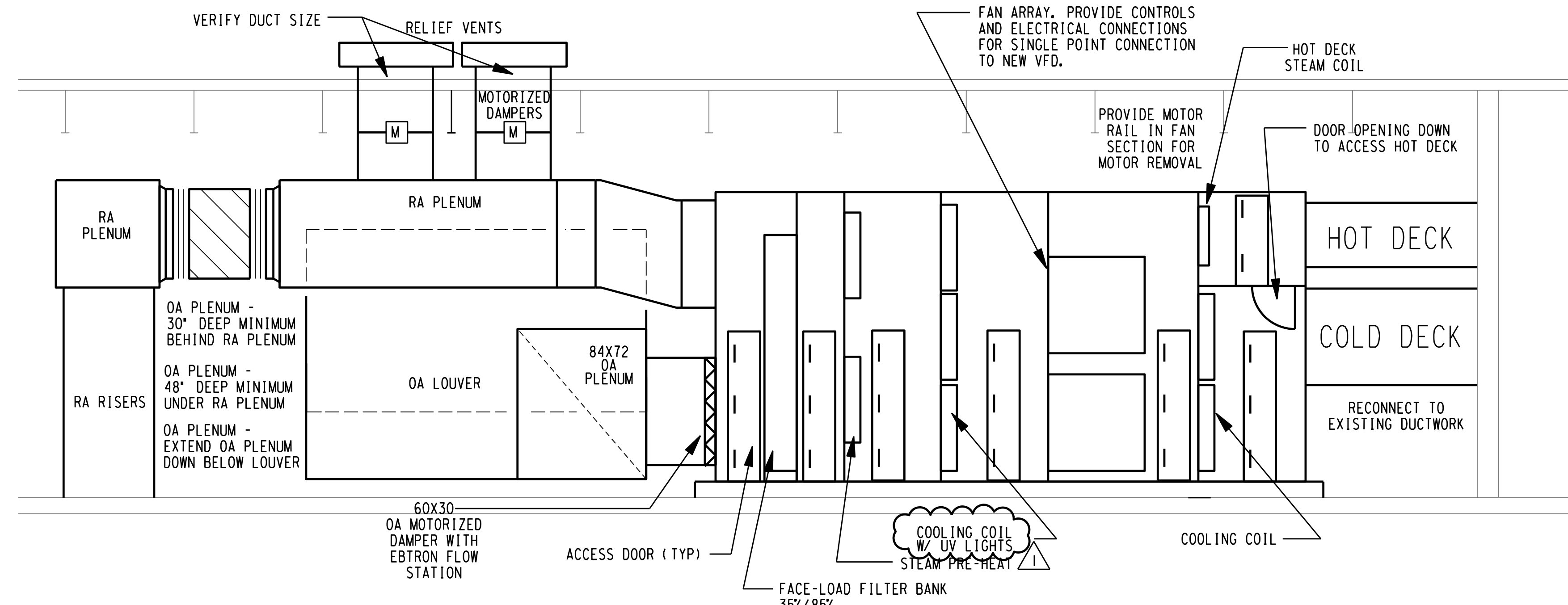
- BOTTOM OF HOTDECK L1 EAST - 11' 8"
- BOTTOM OF COLDDECK L1 EAST - 5' 2"
- BOTTOM OF HOTDECK L1 WEST - 10' 2"
- BOTTOM OF COLDDECK L1 WEST - 4' 9"
- BOTTOM OF HOTDECK L2 EAST - 4' 9"
- BOTTOM OF HOTDECK L2 EAST - 10' 2"
- BOTTOM OF COLDDECK L2 WEST - 5' 7"
- BOTTOM OF HOTDECK L2 WEST - 11' 11"
- BOTTOM OF HOTDECK L3 EAST - ?
- BOTTOM OF COLDDECK L3 EAST - 5' 2"
- BOTTOM OF HOTDECK L3 WEST - ?
- BOTTOM OF COLDDECK L3 WEST - 4' 9"
- BOTTOM OF COLDDECK L4 EAST - 4' 9"
- BOTTOM OF HOTDECK L4 EAST - ?
- BOTTOM OF COLDDECK L4 WEST - 5' 2"
- BOTTOM OF HOTDECK L4 WEST - ?

- BOTTOM OF COLDDECK 01 EAST - 6' 2"
- BOTTOM OF HOTDECK 01 - 10' 6"
- BOTTOM OF COLDDECK 01 WEST - 6' 2"
- BOTTOM OF COLDDECK 02 EAST - 6' 9"
- BOTTOM OF HOTDECK 02 - 11' 10"
- BOTTOM OF COLDDECK 02 WEST - 6' 9"
- BOTTOM OF COLDDECK 03 EAST - 6' 3"
- BOTTOM OF HOTDECK 03 - 10' 4"
- BOTTOM OF COLDDECK 03 WEST - 6' 3"
- BOTTOM OF COLDDECK 04 EAST - 5' 9"
- BOTTOM OF HOTDECK 04 - 10' 1"
- BOTTOM OF COLDDECK 04 WEST - 5' 9"
- BOTTOM OF COLDDECK 05 EAST - 6' 6"
- BOTTOM OF HOTDECK 05 - 10' 2"
- BOTTOM OF COLDDECK 05 WEST - 6' 6"
- BOTTOM OF COLDDECK 06 EAST - 6' 6"
- BOTTOM OF HOTDECK 06 - 10' 5"
- BOTTOM OF COLDDECK 06 WEST - 6' 6"
- BOTTOM OF COLDDECK 07 EAST - 6' 6"
- BOTTOM OF HOTDECK 07 - 10' 2"
- BOTTOM OF COLDDECK 07 WEST - 6' 6"
- BOTTOM OF COLDDECK 08 EAST - 6' 6"
- BOTTOM OF HOTDECK 08 - 10' 2"
- BOTTOM OF COLDDECK 08 WEST - 6' 6"

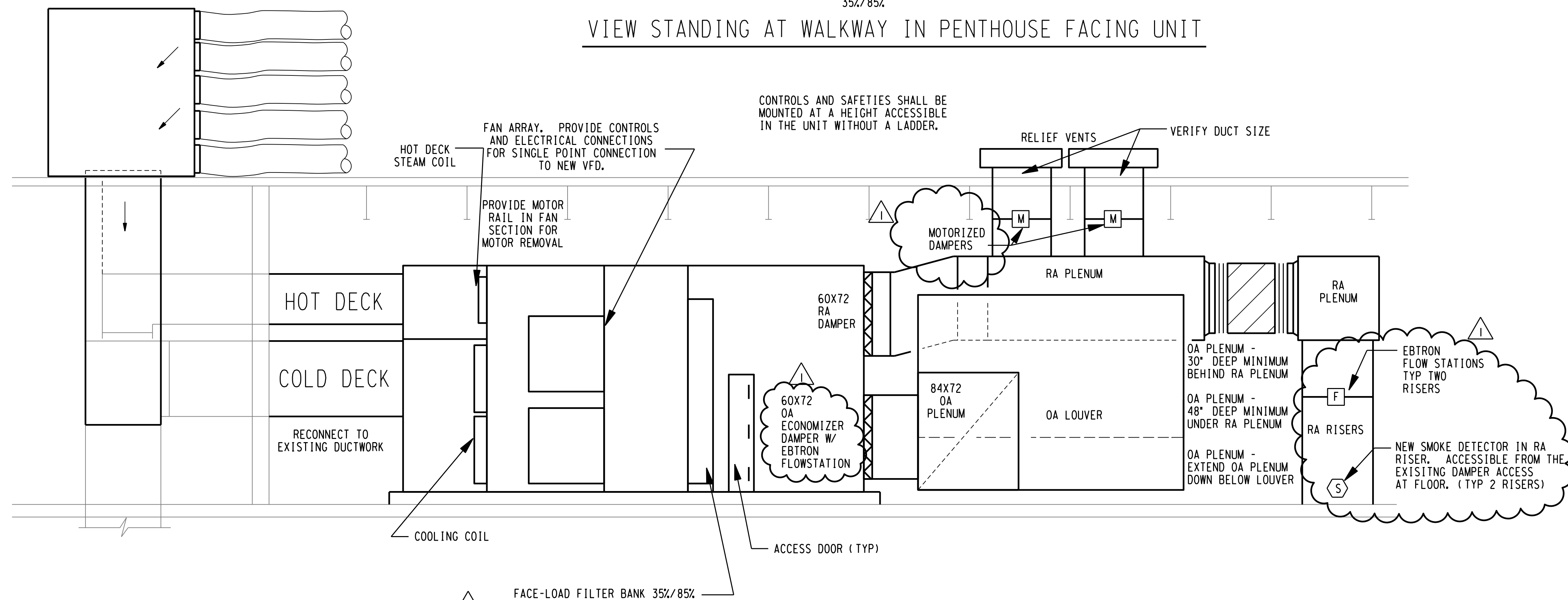
UNIT WILL SIT ON A 6" HOUSEKEEPING PAD.

LAB AHU COIL PIPING IS HOUSED INSIDE THE UNIT. THERE SHALL BE ONE PIPING INLET TO THE AHU ON EACH SIDE SERVED FROM THE TOP OF THE UNIT. THE MANIFOLD SHALL DROP AND COIL ISOLATION AND BALANCING VALVES SHALL BE ACCESSED INSIDE THE UNIT. COILS SHALL BE INTERNALLY DEMOUNTABLE TO BE REMOVED FROM INSIDE THE UNIT FORWARD AND OUT THE CLOSEST ACCESS DOOR.

REFER TO THE FLOOR PLANS TO NOTE WHERE DOORS ARE REQUIRED TO BE ON ONE OR BOTH SIDES OF THE UNIT.



VIEW STANDING AT WALKWAY IN PENTHOUSE FACING UNIT

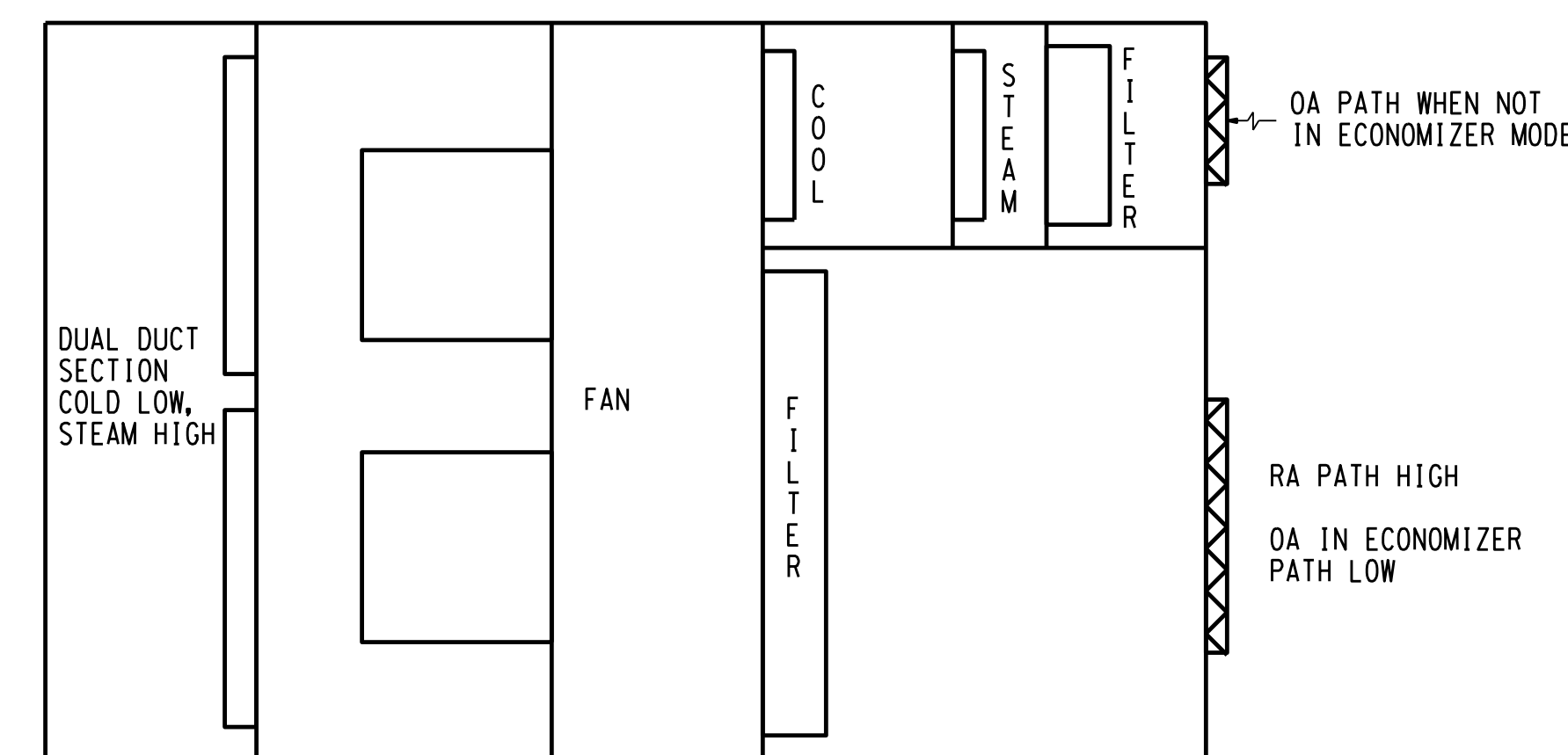


VIEW STANDING AT EXTERIOR WALL FACING UNIT

TYPICAL OF ALL UNITS:

DAMPERS ON THE OUTSIDE AIR AND RETURN AIR SIDE OF THE UNIT SHALL BE PROVIDED BY THE AHU MANUFACTURER AS LOW-LEAKAGE DAMPERS. ACTUATORS SHALL BE PROVIDED BY THE CONTROLS CONTRACTOR.

FAN ARRAY SHALL BE PROVIDED WITH AIRFLOW MONITORING AT THE FANS.



PLAN VIEW DOWN ON UNIT

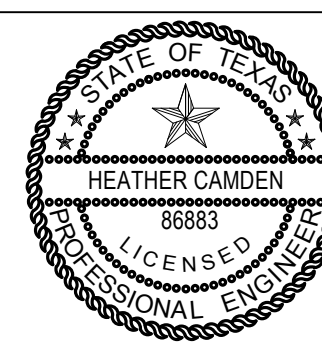
TYPICAL OF 0-6 AND 0-7
0-5 & 0-8 ARE MIRRORED

01 REPLACEMENT UNIT DETAIL
NOT TO SCALE

ISSUE FOR:	Area	Rev.	Date	Description
CONSTRUCTION <td></td> <td>04/13/18</td> <td></td> <td></td>		04/13/18		
ADDENDUM #1		05/24/18		



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HEATHER CAMDEN
Professional Engineer
E&C Engineers & Consultants Inc.
Texas Firm Registration No. F-02081

Date: 04/13/2018
Drawn By: MHC
Checked By: HEC

UTHC Project No. 730022
E & C Project No. 3302.00C
File Name



MEDICAL SCHOOL BUILDING
PENTHOUSE
AHU REPLACEMENT

DRAWING TITLE
MECHANICAL
AHU DETAILS

DRAWING NO.
M700

AIR HANDLING UNIT SCHEDULE	
UNIT INFORMATION	
UNIT NO.	AHU-01, 2, 3, 4, 5, 6, 7 & 8
OPERATION TYPE	NORMAL
LOCATION	SOUTH PENTHOUSE OFFICE UNITS
MANUFACTURER (BASIS OF DESIGN)	TEMPROL
TYPE	WELDED FRAME OR BUILT ON SITE
CONFIGURATION	FANWALL DUAL DUCT
SERVICE	OFFICES
SUPPLY FAN DESIGN INFORMATION	
DESIGN SET FAN AIR QUANTITY	60,000
DESIGN MINIMUM FLOW	17,500
OUTSIDE AIR MIN	17,500
OUTSIDE AIR MAX	60,000
TOTAL STATIC PRESSURE (IN.W.G.)	6.5
EXTERNAL STATIC PRESSURE (IN.W.G.)	3
BASIS OF DESIGN	FANWALL
FAN DESCRIPTION	4@ PF11-30-74
VOLTAGE/PH/Hz	460/3/60
ARRAY	2 ROWS 2 COL
FAN MAX RPM	1,750
FAN OPERATING RPM	1,750
TOTAL BRAKE HP	90.04
TOTAL NOMINAL MOTOR HP	100
VFD SIZING HP	100
NOMINAL MOTOR RPM	1,750
EMERGENCY POWER REQUIRED (YES/NO)	NO
VFD REQUIRED	YES
DRIVE ARRANGEMENT TYPE	DIRECT DRIVE
OA PREHEAT COIL DESIGN INFORMATION	
COIL POSITION	OUTSIDE AIR PATH HEATING
COIL DESCRIPTION	9NS-42X48X1-4AL
CASE MATERIAL	16 GA. 304 S.S.
QUANTITY OF COILS	2.0
COIL AIRFLOW AT FULL HEATING	17,500
MAX FACE VELOCITY AT FULL HEATING	625.0
MINIMUM NUMBER ROWS	1
MAXIMUM NUMBER OF FINS PER INCH	6
MAXIMUM AIR PRESSURE DROP AT FULL HEAT	0.12
ENTERING AIR TEMP (DB) (F)	18.0
LEAVING AIR TEMP (DB) (F)	51.0
STEAM PRESSURE	10#
CONDENSATE RATE (LB/HR)	729.0
MINIMUM COIL SENSIBLE HEAT (MBTU)	694.6
TUBE/FIN MATERIAL	CU/AL
UV LIGHTS (YES/NO)	NO
OA PRECOOLING COIL DESIGN INFORMATION	
COIL POSITION	OUTSIDE AIR PATH COOLING
COIL DESCRIPTION	5WC-10-45X50X6-8CU
CASE MATERIAL	16 GA. 304 S.S.
QUANTITY OF COILS	3.0
COIL AIRFLOW	17,500
MAX FACE VELOCITY	373.0
MINIMUM NUMBER ROWS	6
MAXIMUM NUMBER OF FINS PER INCH	8
MAXIMUM AIR PRESSURE DROP	0.4
ENTERING AIR TEMP (DB) (F)	95.0
ENTERING AIR TEMP (WB) (F)	80.0
LEAVING AIR TEMP (DB) (F)	52.4
LEAVING AIR TEMP (WB) (F)	52.2
ENTERING WATER TEMP (F)	42.0
LEAVING WATER TEMP (F)	56.0
CHILLED WATER PRESSURE DROP (FT OF WATER)	16.3
MAXIMUM GPM	227.2
MINIMUM COIL LATENT HEAT (MHB)	825
MINIMUM COIL SENSIBLE HEAT (MBH)	771
MINIMUM COIL TOTAL HEAT (MBH)	1,596
TUBE MATERIAL / FIN MATERIAL	CU / CU
UV LIGHTS (YES/NO)	YES
COOLING COIL DESIGN INFORMATION	
COIL POSITION	COLD DECK
COIL DESCRIPTION	5WC-10-51X84X6-8CU
CASE MATERIAL	16 GA. 304 S.S.
QUANTITY OF COILS	4.0
COIL AIRFLOW	60,000
MAX FACE VELOCITY	504.0
MINIMUM NUMBER ROWS	6
MAXIMUM NUMBER OF FINS PER INCH	8
MAXIMUM AIR PRESSURE DROP	0.86
ENTERING AIR TEMP (DB) (F)	69.0
ENTERING AIR TEMP (WB) (F)	62.0
LEAVING AIR TEMP (DB) (F)	51.1
LEAVING AIR TEMP (WB) (F)	50.7
ENTERING WATER TEMP (F)	42.0
LEAVING WATER TEMP (F)	56.0
CHILLED WATER PRESSURE DROP (FT OF WATER)	16.0
MAXIMUM GPM	268.1
MINIMUM COIL LATENT HEAT (MHB)	719
MINIMUM COIL SENSIBLE HEAT (MBH)	1,165
MINIMUM COIL TOTAL HEAT (MBH)	1,883
TUBE MATERIAL / FIN MATERIAL	CU / CU
UV LIGHTS (YES/NO)	NO
HEATING COIL DESIGN INFORMATION	
COIL POSITION	HOT DECK HEATING
COIL DESCRIPTION	9NS-33X84X1-4AL
CASE MATERIAL	16 GA. 304 S.S.
QUANTITY OF COILS	2.0
COIL AIRFLOW AT FULL HEATING	30,000
MAX FACE VELOCITY AT FULL HEATING	779.0
MINIMUM NUMBER OF FINS PER INCH	6
MAXIMUM AIR PRESSURE DROP AT FULL HEAT	0.23
ENTERING AIR TEMP (DB) (F)	55.0
LEAVING AIR TEMP (DB) (F)	96.2
STEAM PRESSURE	10#
CONDENSATE RATE (LB/HR)	1449.0
MINIMUM COIL SENSIBLE HEAT (MBTU)	1384.4
TUBE/FIN MATERIAL	CU/AL
UV LIGHTS (YES/NO)	NO
FILTER SECTION	
2" - 30% PLEATED PRE-FILTER	YES
4" - FINAL FILTER	YES - 85%
NOTES	
UNIT SHALL BE PROVIDED WITH FACTORY INSTALLED JUNCTION BOXES AUXILIARIES.	
FACTORY INSTALLED JUNCTION BOXES ARE FOR CONNECTION BY DIVISION 26. DIVISION 26 IS NOT TO PENETRATE AIR HANDLING UNIT HOUSING. WIRING FROM JUNCTION BOX TO LOAD INSIDE AIR HANDLING	
ALL POWER WIRING BETWEEN VARIABLE FREQUENCY DRIVES, MOTOR CONTROLLERS AND MOTORS SHALL BE COMPLETED BY THE ELECTRICAL CONTRACTOR.	
INFORMATION SHOWN IS PER UNIT.	
REFER TO PLANS, DETAILS & CONTROLS DIAGRAM FOR FURTHER INFORMATION.	

AIR HANDLING UNIT SCHEDULE - REPLACEMENT	
UNIT INFORMATION	
UNIT NO.	AHU-L-1, 2, 3, 4
OPERATION TYPE	NORMAL
LOCATION	NORTH PENTHOUSE
MANUFACTURER (BASIS OF DESIGN)	TEMPROL
TYPE	WELDED FRAME OR BUILT ON SITE
CONFIGURATION	FANWALL DUAL DUCT
SERVICE	ORANGE AND YELLOW CHASES
SUPPLY FAN DESIGN INFORMATION	
DESIGN SET FAN AIR QUANTITY	79,800
MAX OA	79,800
TOTAL STATIC PRESSURE (IN.W.G.)	5.50
BASIS OF DESIGN	TEMPROL FAN ARRAY 6@ PF11-27
FAN DESCRIPTION	6 @ 27" MAXIMUM DIAMETER
FAN TYPE	PLUG FAN ARRAY (PF)
FAN RPM	1696
BRKE HP	16.9 MAX/FAN
NOMINAL MOTOR HP	20 MAXIMUM / FAN
NOMINAL MOTOR RPM	1750 MAX
VOLTAGE/PH/Hz	480/3
EMERGENCY POWER REQUIRED (YES/NO)	NO
VFD REQUIRED	YES - NEW 125HP
DRIVE ARRANGEMENT TYPE	DIRECT
COOLING COIL DESIGN INFORMATION	
COIL POSITION	PRE COOLING
COIL DESCRIPTION	5@5WC-4-48X84X4-8CU
CASE MATERIAL	16 GA. 304 S.S.
QUANTITY OF COILS	3LH3RH
COIL AIRFLOW	79800
MAX FACE VELOCITY	475.0
MINIMUM NUMBER ROWS	4
MAXIMUM NUMBER OF FINS PER INCH	8
MAXIMUM AIR PRESSURE DROP	0.42
ENTERING AIR TEMP (DB) (F)	98.0
ENTERING AIR TEMP (WB) (F)	80.0
LEAVING AIR TEMP (DB) (F)	67.5
LEAVING AIR TEMP (WB) (F)	65.3
ENTERING WATER TEMP (F)	50.1
LEAVING WATER TEMP (F)	62.0
MINIMUM COIL LATENT HEAT (MHB)	1,858,928.0
MINIMUM COIL SENSIBLE HEAT (MBH)	2,504,846.0
MINIMUM COIL TOTAL HEAT (MBH)	4,363,574.0
MAX WATER FLOW (GPM)	731.2
CHILLED WATER TEMP DIFFERENCE (F)	11.9
MAX WATER PRESSURE DROP (FT OF WATER)	10.11
TUBE MATERIAL / FIN MATERIAL	CU / CU
UV LIGHTS (YES/NO)	YES
COOLING COIL DESIGN INFORMATION	
COIL POSITION	POST COOLING
COIL DESCRIPTION	6@5WC-4-48X84X4-8CU
CASE MATERIAL	16 GA. 304 S.S.
QUANTITY OF COILS	3LH3RH
COIL AIRFLOW	79800
MAX FACE VELOCITY	475.0
MINIMUM NUMBER ROWS	4
MAXIMUM NUMBER OF FINS PER INCH	8
MAXIMUM AIR PRESSURE DROP	0.42
ENTERING AIR TEMP (DB) (F)	67.5
ENTERING AIR TEMP (WB) (F)	65.3
LEAVING AIR TEMP (DB) (F)	52.7
LEAVING AIR TEMP (WB) (F)	52.7
ENTERING WATER TEMP (F)	42.0
LEAVING WATER TEMP (F)	50.1
MINIMUM COIL LATENT HEAT (MHB)	1,687,739.0
MINIMUM COIL SENSIBLE HEAT (MBH)	1,285,264.0
MINIMUM COIL TOTAL HEAT (MBH)	2,973,003.0
MAX WATER FLOW (GPM)	731.2
CHILLED WATER TEMP DIFFERENCE (F)	8.1
MAX WATER PRESSURE DROP (FT OF WATER)	10.36
TUBE MATERIAL / FIN MATERIAL	CU / CU
UV LIGHTS (YES/NO)	YES
HEATING COIL DESIGN INFORMATION	
COIL POSITION	PREHEAT
COIL DESCRIPTION	4@9NS-48X78X1-4AL
CASE MATERIAL	16 GA. 304 S.S.
QUANTITY OF COILS	4
COIL AIRFLOW IN FULL HEATING	79,800
MAX FACE VELOCITY AT FULL HEATING	787
MINIMUM NUMBER OF ROWS	1
MAXIMUM NUMBER OF FINS PER INCH	6
MAXIMUM AIR PRESSURE DROP AT FULL HEAT	0.18
ENTERING AIR TEMP (DB) (F)	18
LEAVING AIR TEMP (DB) (F)	52.5
STEAM PRESSURE	10#
CONDENSATE RATE	3478#HR
MINIMUM COIL SENSIBLE HEAT (MBH)	3,314,717.0
TUBE MATERIAL / FIN MATERIAL	CU/AL
UV LIGHTS (YES/NO)	NO
HEATING COIL DESIGN INFORMATION	
COIL POSITION	REHEAT
COIL DESCRIPTION	2@9NS-48X84X1-6AL
CASE MATERIAL	16 GA. 304 S.S.
QUANTITY OF COILS	2
COIL AIRFLOW IN FULL HEATING	40,000
MAX FACE VELOCITY AT FULL HEATING	714
MINIMUM NUMBER OF ROWS	1
MAXIMUM NUMBER OF FINS PER INCH	6
MAXIMUM AIR PRESSURE DROP AT FULL HEAT	0.2
ENTERING AIR TEMP (DB) (F)	52.5
LEAVING AIR TEMP (DB) (F)	96.1
STEAM PRESSURE	10#
CONDENSATE RATE	2052#HR
MINIMUM COIL SENSIBLE HEAT (MBH)	1,358,840.0
TUBE MATERIAL / FIN MATERIAL	CU/AL
UV LIGHTS (YES/NO)	NO
FILTER SECTION	
2" - 30% PLEATED PRE-FILTER	YES
4" - 85% FINAL FILTER	YES
NOTES	
UNIT SHALL BE PROVIDED WITH FACTORY INSTALLED JUNCTION BOXES AUXILIARIES, RECEPTACLES, SERVICING LIGHTS, ETC. RE: ELECTRICAL DRAWINGS FOR FURTHER INFORMATION.	
FACTORY INSTALLED JUNCTION BOXES ARE FOR CONNECTION BY DIVISION 26. DIVISION 26 IS NOT TO PENETRATE AIR HANDLING UNIT HOUSING. WIRING FROM JUNCTION BOX TO LOAD INSIDE AIR HANDLING UNIT SHALL BE BY THE MANUFACTURER.	
ALL POWER WIRING BETWEEN VARIABLE FREQUENCY DRIVES, MOTORCONTROLLERS AND MOTORS SHALL BE COMPLETED BY THE ELECTRICAL CONTRACTOR.	
INFORMATION SHOWN IS PER UNIT.	
PROVIDE WITH BALANCE STREAM DAMPERS ON FANS	

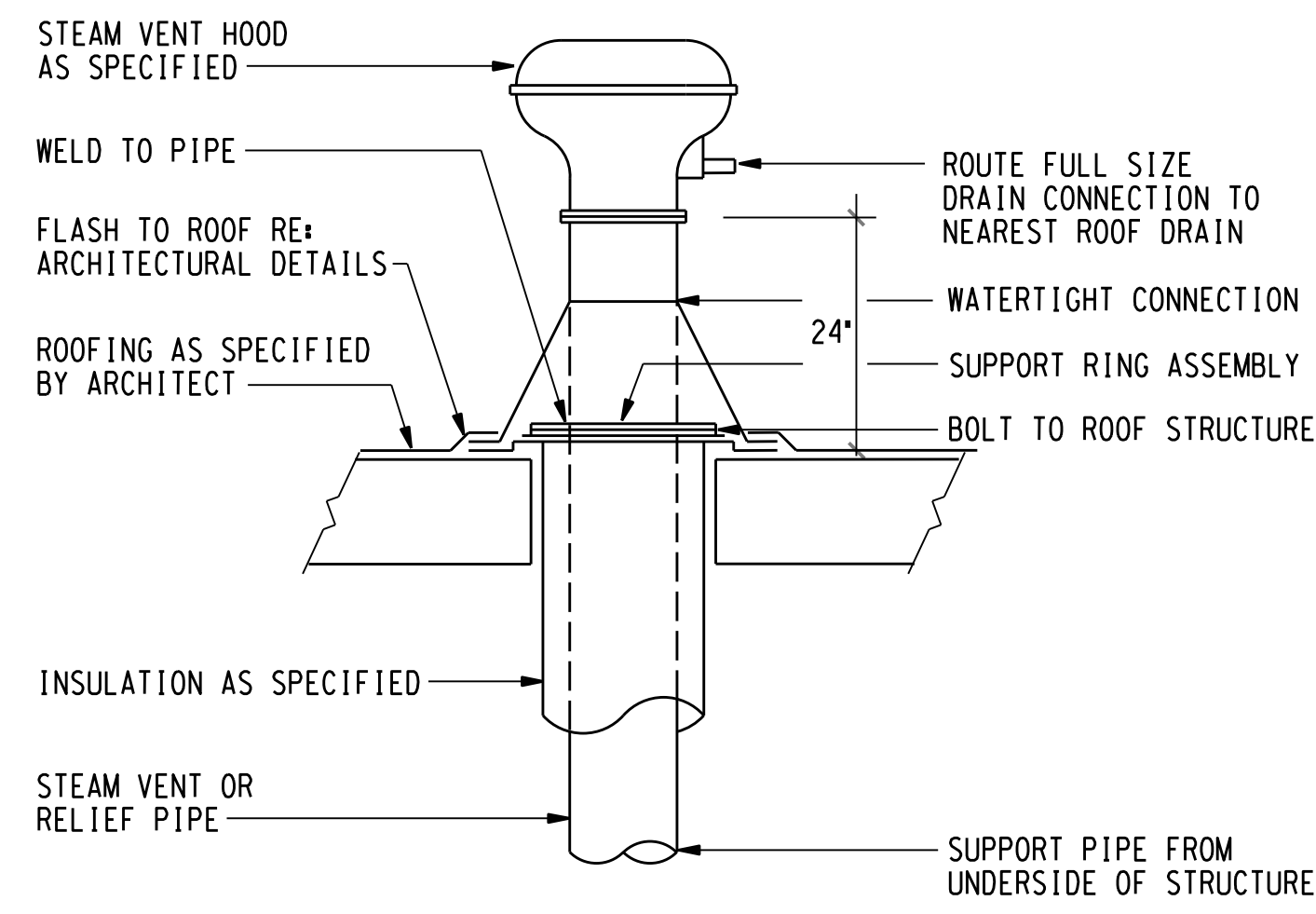
RETURN AIR FAN SCHEDULE																	
UNIT NO.	LOCATION	SERVICE	TOTAL CFM	TOTAL S.P. IN W.G.	RPM	TYPE	WHEEL DIA. IN.	CLASS	MOTOR					MANUFACTURER	MODEL/SERIES	VFD REQUIRED	REMARKS
									BHP	HP	RPM	VOLTS @ 60 HZ	PH				
RF-01A & B	IN-LINE	RETURN AIR	22,500	1.00	846	VANE AXIAL	44.0	-	6.4	7.5	1750	480	3	COOK	44AVAD-28008	YES	1,2
RF-02A & B	IN-LINE	RETURN AIR	22,500	1.00	846	VANE AXIAL	44.0	-	6.4	7.5	1750	480	3	COOK	44AVAD-28008	YES	1,2
RF-03A & B	IN-LINE	RETURN AIR	22,500	1.00	846	VANE AXIAL	44.0	-	6.4	7.5	1750	480	3	COOK	44AVAD-28008	YES	1,2
RF-04A & B	IN-LINE	RETURN AIR	22,500	1.00	846	VANE AXIAL	44.0	-	6.4	7.5	1750	480	3	COOK	44AVAD-28008	YES	1,2
RF-05A & B	IN-LINE	RETURN AIR	22,500	1.00	846	VANE AXIAL	44.0	-	6.4	7.5	1750	480	3	COOK	44AVAD-28008	YES	1,2
RF-06A & B	IN-LINE	RETURN AIR	22,500	1.00	846	VANE AXIAL	44.0	-	6.4	7.5	1750	480	3	COOK	44AVAD-28008	YES	1,2
RF-07A & B	IN-LINE	RETURN AIR	22,500	1.00	846	VANE AXIAL	44.0	-	6.4	7.5	1750	480	3	COOK	44AVAD-28008	YES	1,2
RF-08A & B	IN-LINE	RETURN AIR	22,500	1.00	846	VANE AXIAL	44.0	-	6.4	7.5	1750	480	3	COOK	44AVAD-28008	YES	1,2
RF-C1	IN-LINE	CHASE RELIEF	4,000	1.00	860	VANE AXIAL	35.0	-	1.48	2	1750	480	3	COOK	35AVAD-19008	NO	1,2
RF-C2	IN-LINE	CHASE RELIEF	4,000	1.00	860	VANE AXIAL	35.0	-	1.48	2	1750	480	3	COOK	35AVAD-19008	NO	1,2
RF-C3	IN-LINE	CHASE RELIEF	4,000	1.00	860	VANE AXIAL	35.0	-	1.48	2	1750	480	3	COOK	35AVAD-19008	NO	1,2
RF-C4	IN-LINE	CHASE RELIEF	4,000	1.00	860	VANE AXIAL	35.0	-	1.48	2	1750	480	3	COOK	35AVAD-19008	NO	1,2
RF-C5	IN-LINE	CHASE RELIEF	4,000	1.00	860	VANE AXIAL	35.0	-	1.48	2	1750	480	3	COOK	35AVAD-19008	NO	1,2
RF-C6	IN-LINE	CHASE RELIEF	4,000	1.00	860	VANE AXIAL	35.0	-	1.48	2	1750	480	3	COOK	35AVAD-19008	NO	1,2

NOTES: 1. PROVIDE UNIT MOUNTED NEMA 1 DISCONNECT.
2. PROVIDE MINIMUM SCCR RATING XX,XXX K/VIC

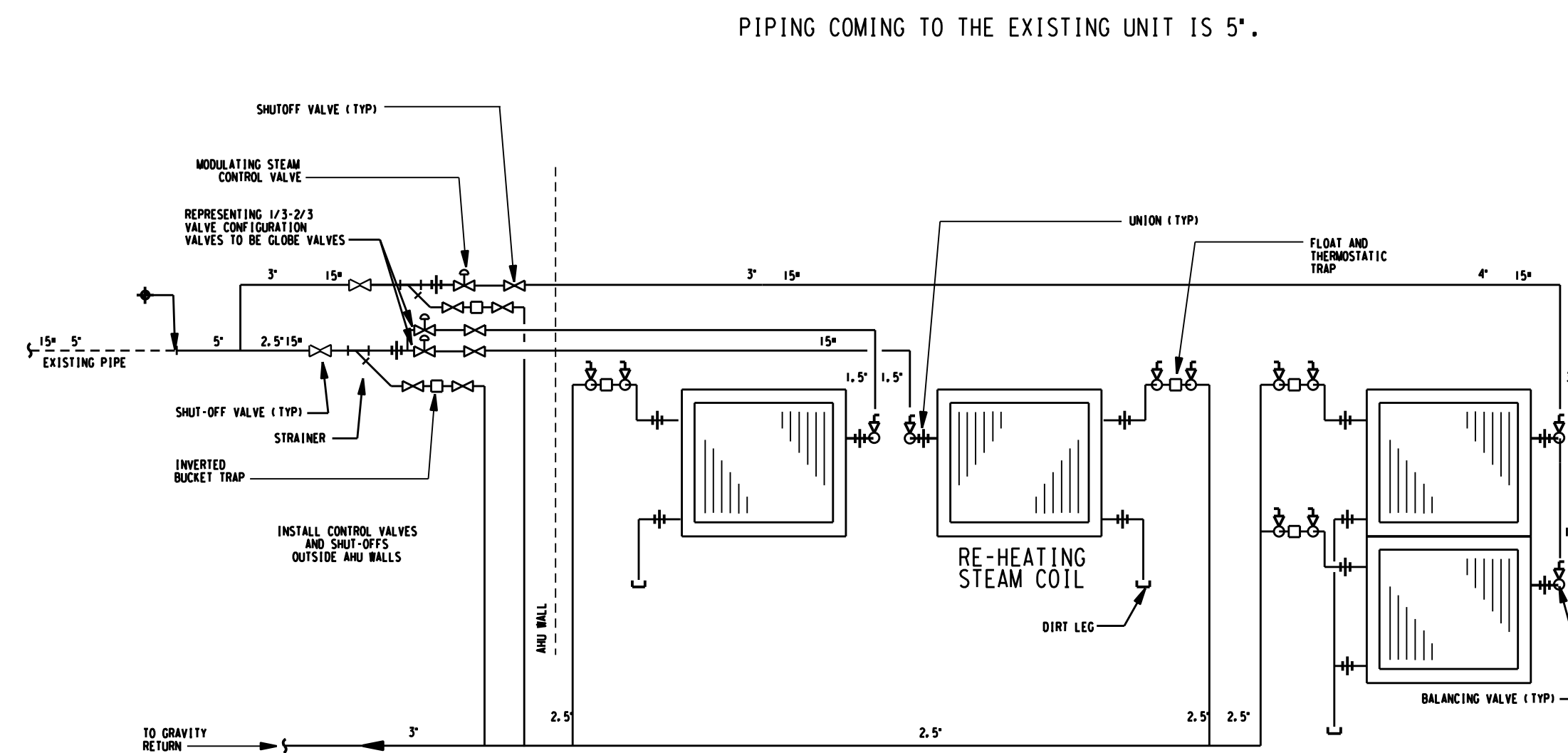
COIL SCHEDULE - CONDENSATE		
THE 6TH TOP EXTERIOR PRE-COOLING COIL SHALL SPLIT THE SPACE WITH A CONDENSATE BC/OIL AS FOLLOWS:		
UNIT NO.	AHU-L-1, 2, 3 & 4	
COOLING COIL DESIGN INFORMATION		
COIL POSITION	COOLING - CONDENSATE	
COIL DESCRIPTION	1@5WC-8-6X84X6-8CU	
CASE MATERIAL	16 GA. 304 S.S.	
QUANTITY OF COILS	2LH2RH	
COIL AIRFLOW	1370	
MAX FACE VELOCITY	391	
MINIMUM NUMBER ROWS	8	
MAXIMUM NUMBER OF FINS PER INCH	8	
MAXIMUM AIR PRESSURE DROP	0.42	
ENTERING AIR TEMP (DB) (F)	98.0	
ENTERING AIR TEMP (WB) (F)	80.0	
LEAVING AIR TEMP (DB) (F)	67.4	
LEAVING AIR TEMP (WB) (F)	66.7	
ENTERING WATER TEMP (F)	55.0	
LEAVING WATER TEMP (F)	72.1	
MINIMUM COIL LATENT HEAT (MHB)	25,521.0	
MINIMUM COIL SENSIBLE HEAT (MBH)	43,076.0	
MINIMUM COIL TOTAL HEAT (MBH)	68,597.0	
MAX WATER FLOW (GPM)	8.0	
CHILLED WATER TEMP DIFFERENCE (F)	17.1	
MAX WATER PRESSURE DROP (FT OF WATER)	6.2	
TUBE MATERIAL / FIN MATERIAL	CU / CU	
UV LIGHTS (YES/NO)	YES	
COOLING COIL DESIGN INFORMATION		
COIL POSITION	COOLING	
COIL DESCRIPTION	1@5WC-4-42X84X4-8CU	
CASE MATERIAL	16 GA. 304 S.S.	
QUANTITY OF COILS	3LH3RH	
COIL AIRFLOW	11,930	
MAX FACE VELOCITY	487.0	
MINIMUM NUMBER ROWS	4	
MAXIMUM NUMBER OF FINS PER INCH	8	
MAXIMUM AIR PRESSURE DROP	0.42	
ENTERING AIR TEMP (DB) (F)	98.0	
ENTERING AIR TEMP (WB) (F)	80.0	
LEAVING AIR TEMP (DB) (F)	67.8	
LEAVING AIR TEMP (WB) (F)	65.5	
ENTERING WATER TEMP (F)	50.1	
LEAVING WATER TEMP (F)	60.7	
MINIMUM COIL LATENT HEAT (MHB)	273,027.0	
MINIMUM COIL SENSIBLE HEAT (MBH)	370,848.0	
MINIMUM COIL TOTAL HEAT (MBH)	643,875.0	
MAX WATER FLOW (GPM)	131.8	
CHILLED WATER TEMP DIFFERENCE (F)	10.6	
MAX WATER PRESSURE DROP (FT OF WATER)	19.1	
TUBE MATERIAL / FIN MATERIAL	CU / CU	
UV LIGHTS (YES/NO)	YES	

PUMP SCHEDULE - CONDENSATE													
UNIT NO.	LOCATION	SERVICE	TYPE	GPM	FT. HEAD H ₂ O	SHUT OFF HEAD FT. H ₂ O	DESIGN PRESSURE PSI	MOTOR					REMARKS
								BHP	HP	RPM	VOLTS @ 60 HZ	PH	
CP-L1	CONDENSATE RECEIVER	CONDENSATE	SUBMERSIBLE	8.5	20.0	22.0	150	4.0	1/6	3450	120	1	SIMILAR TO FLINT & WALLING ECP062S
CP-L2	CONDENSATE RECEIVER	CONDENSATE	SUBMERSIBLE	8.5	20.0	22.0	150	4.0	1/6	3450	120	1	SIMILAR TO FLINT & WALLING ECP062S
CP-L3	CONDENSATE RECEIVER	CONDENSATE	SUBMERSIBLE	8.5	20.0	22.0	150	4.0	1/6	3450	120	1	SIMILAR TO FLINT & WALLING ECP062S
CP-L4	CONDENSATE RECEIVER	CONDENSATE	SUBMERSIBLE	8.5	20.0	22.0	150	4.0	1/6	3450	120	1	SIMILAR TO FLINT & WALLING ECP062S

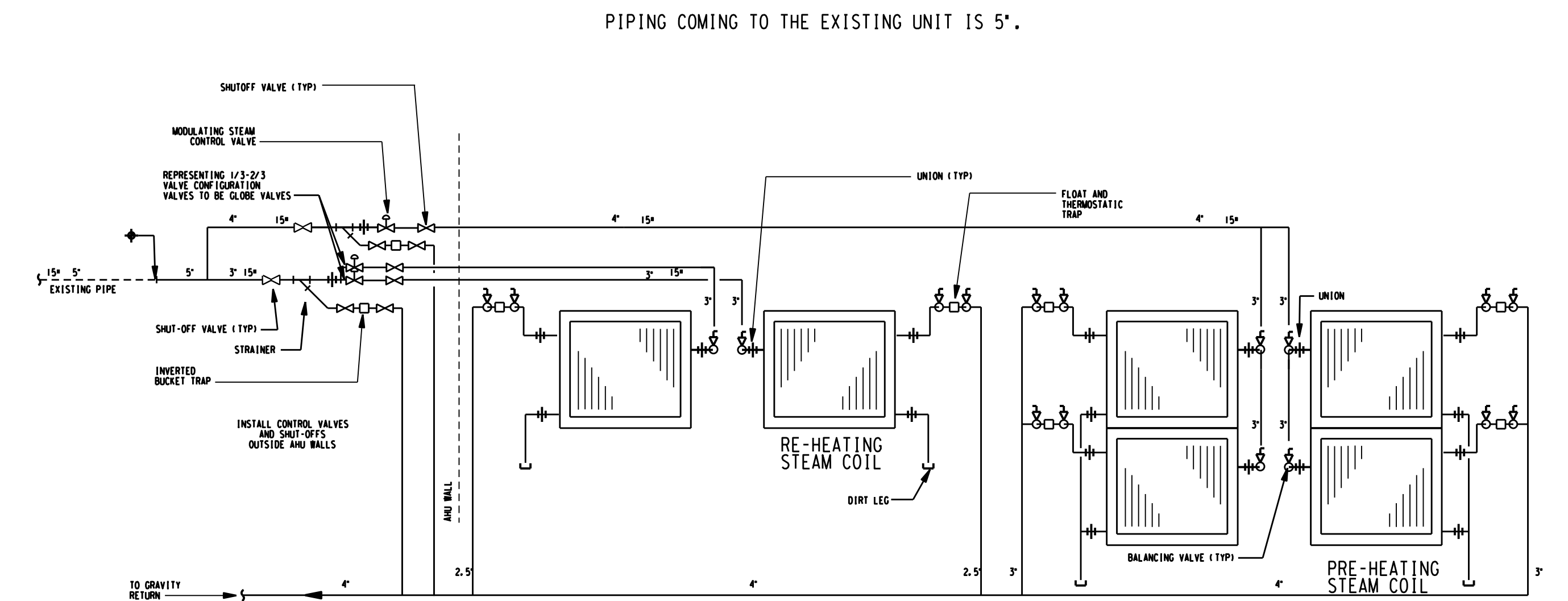
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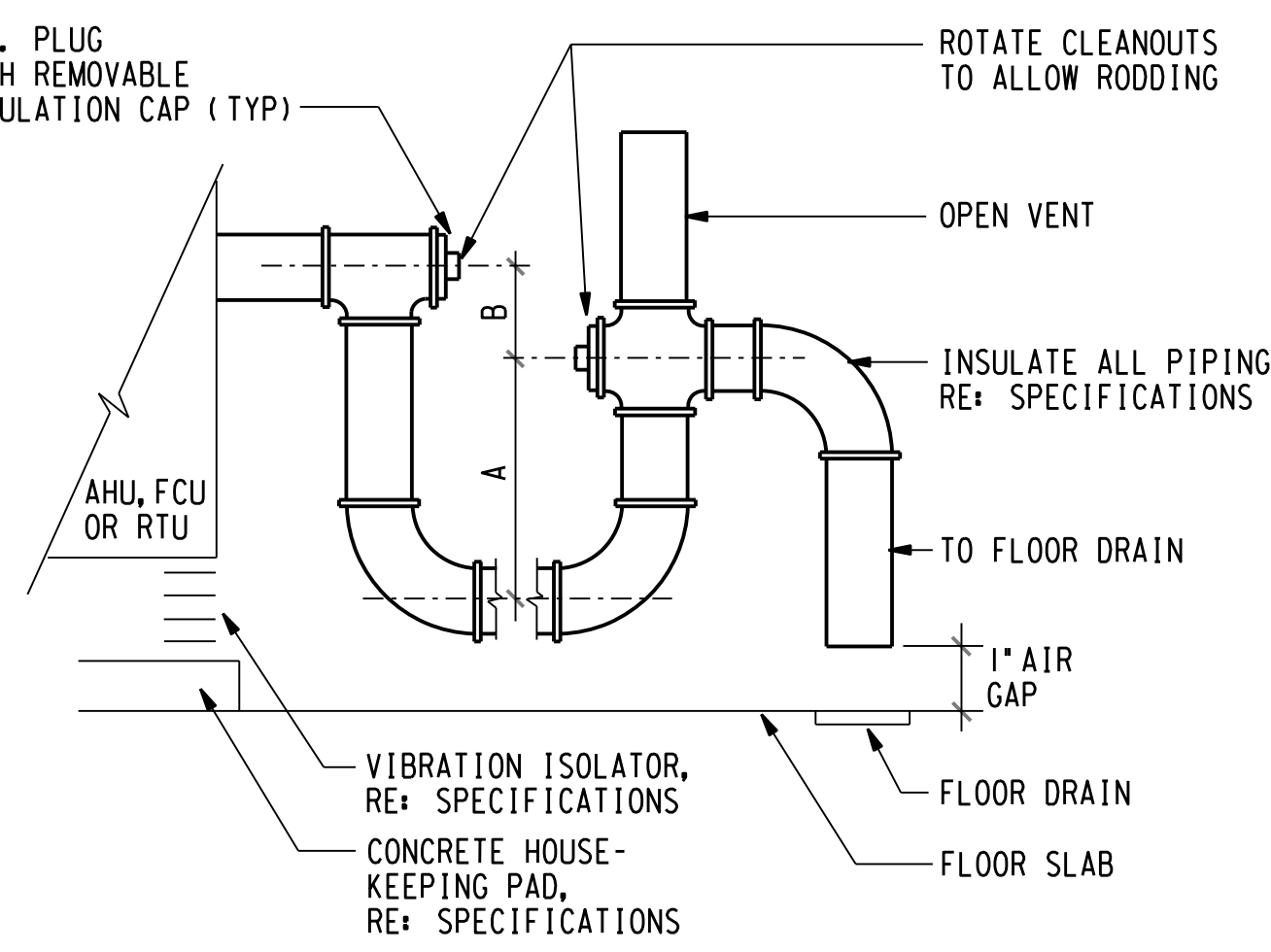
10 TYPICAL STEAM VENT THRU ROOF ASSEMBLY
NOT TO SCALE



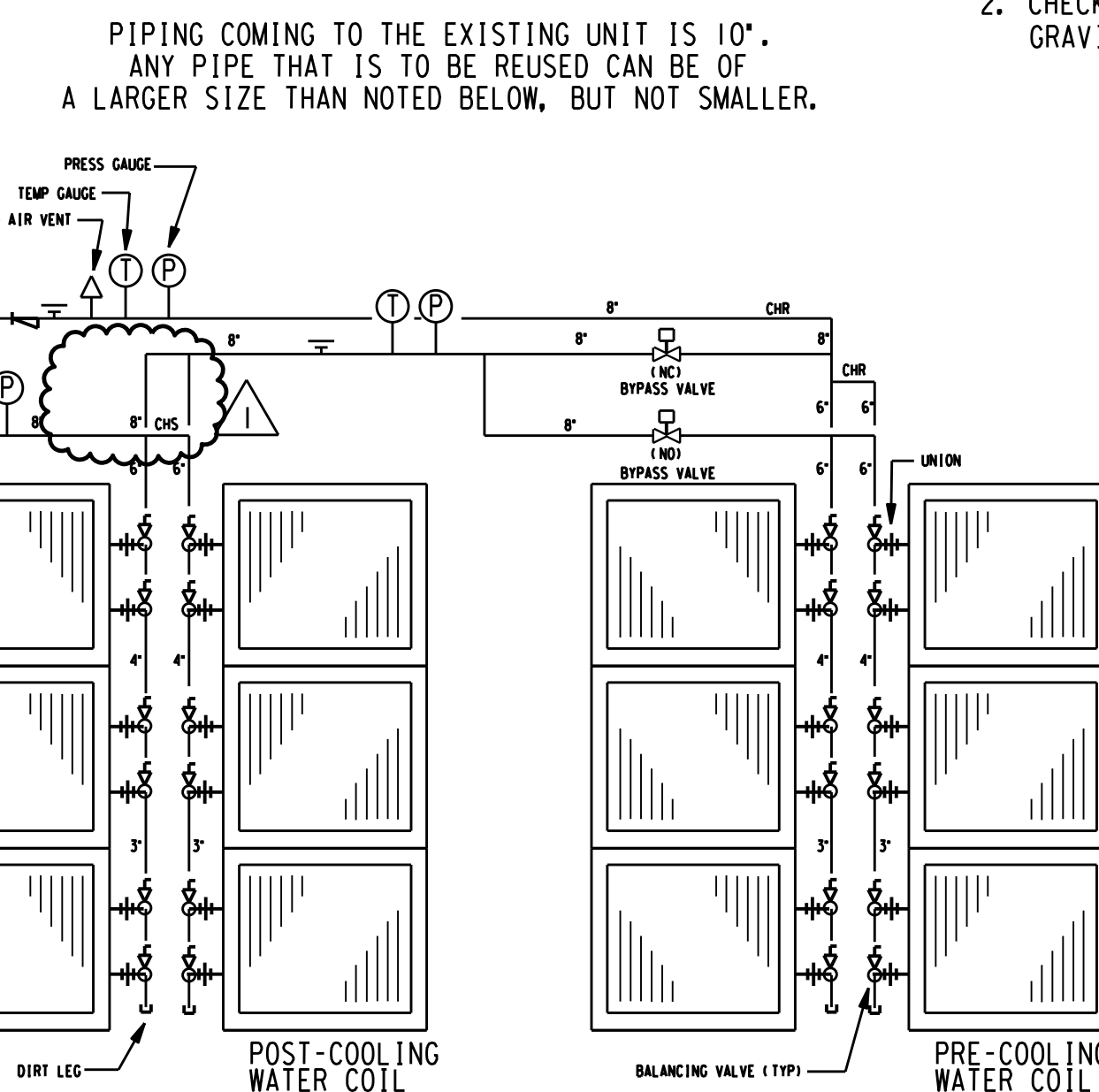
8 TYPICAL OFFICE AIR HANDLING UNIT STEAM COIL PIPING
NOT TO SCALE



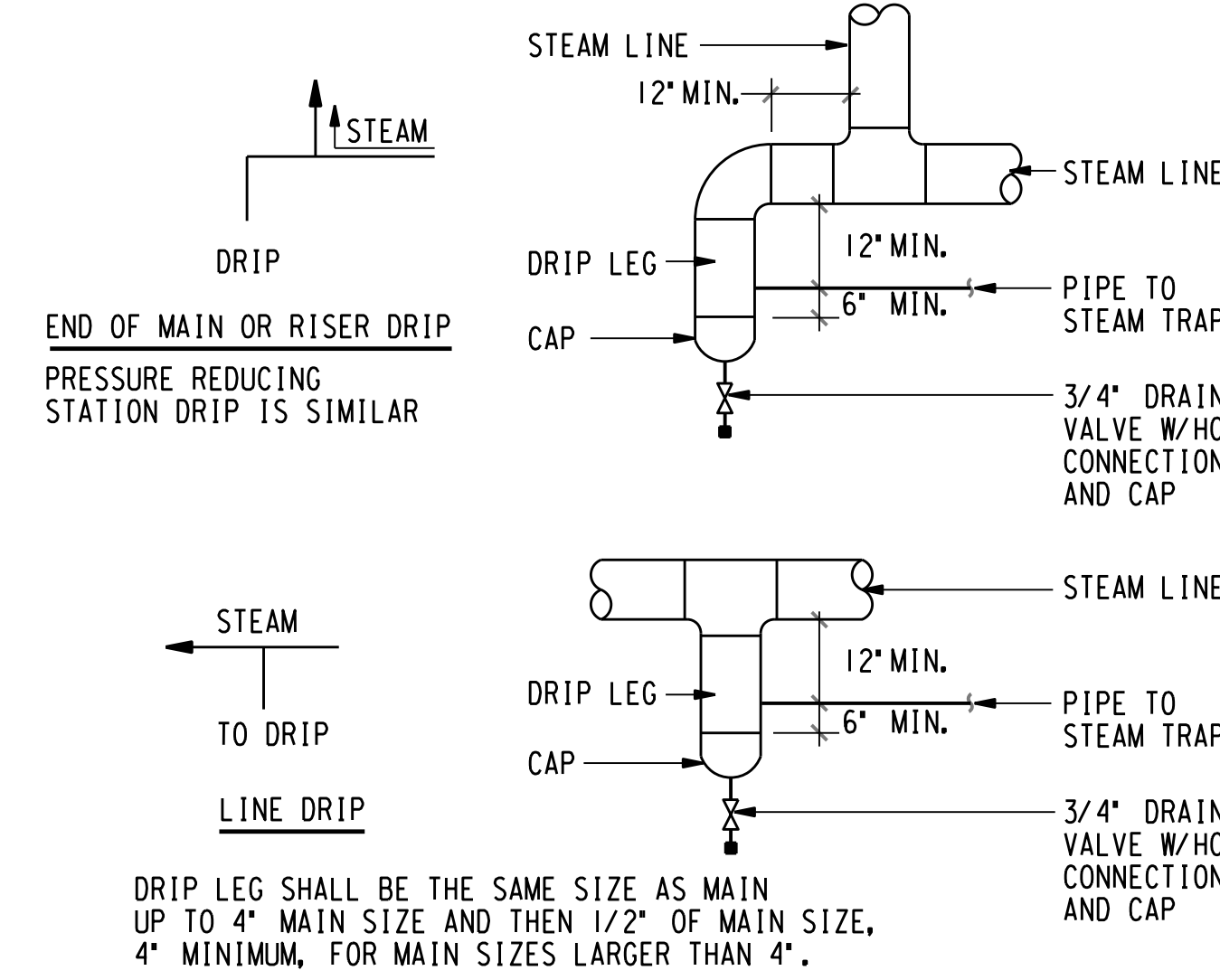
3 TYPICAL LAB AIR HANDLING UNIT STEAM COIL PIPING
NOT TO SCALE



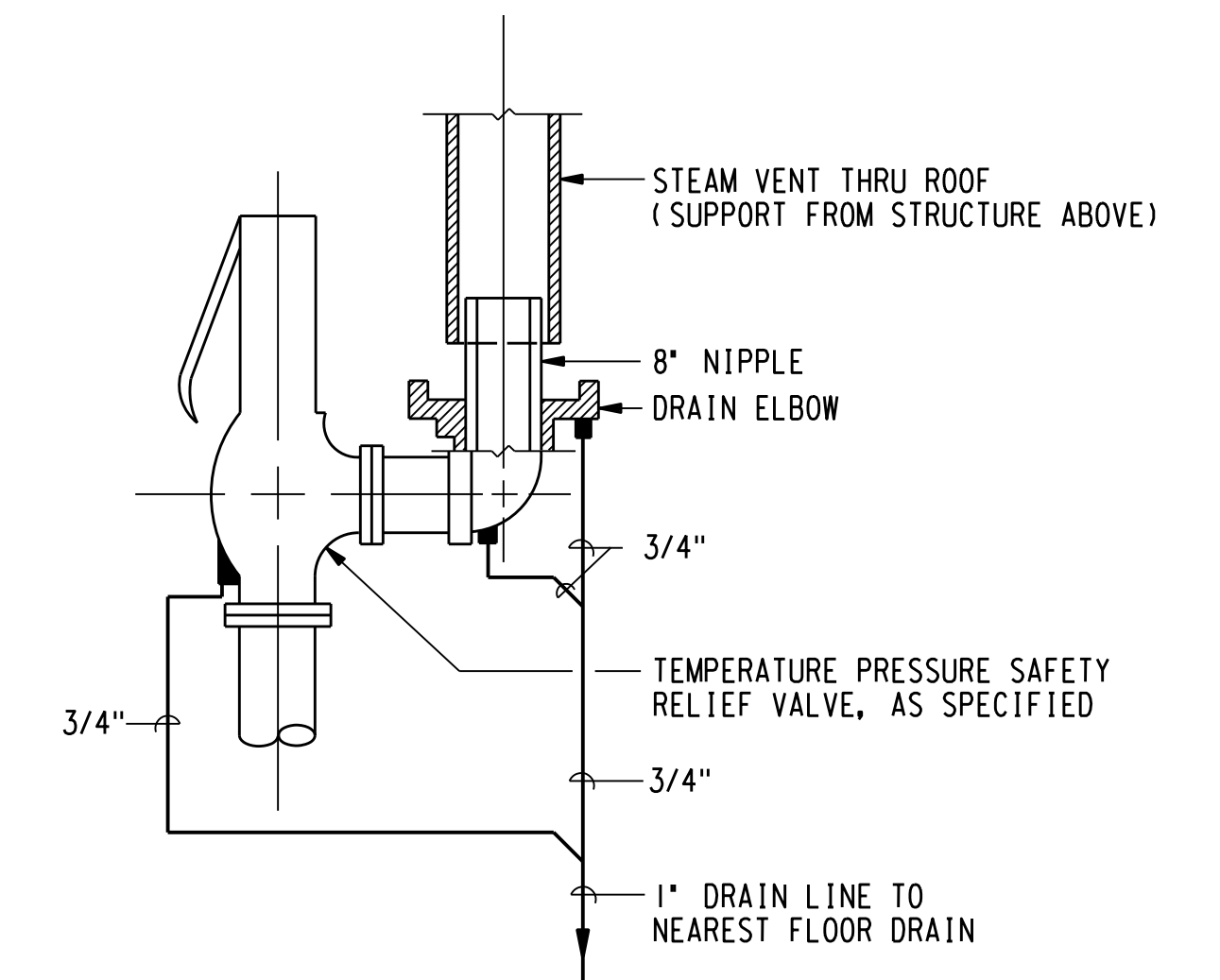
9 TYPICAL CONDENSATE DRAIN PIPING
NOT TO SCALE



7 TYPICAL STEAM DRIFT TRAP PIPING
NOT TO SCALE



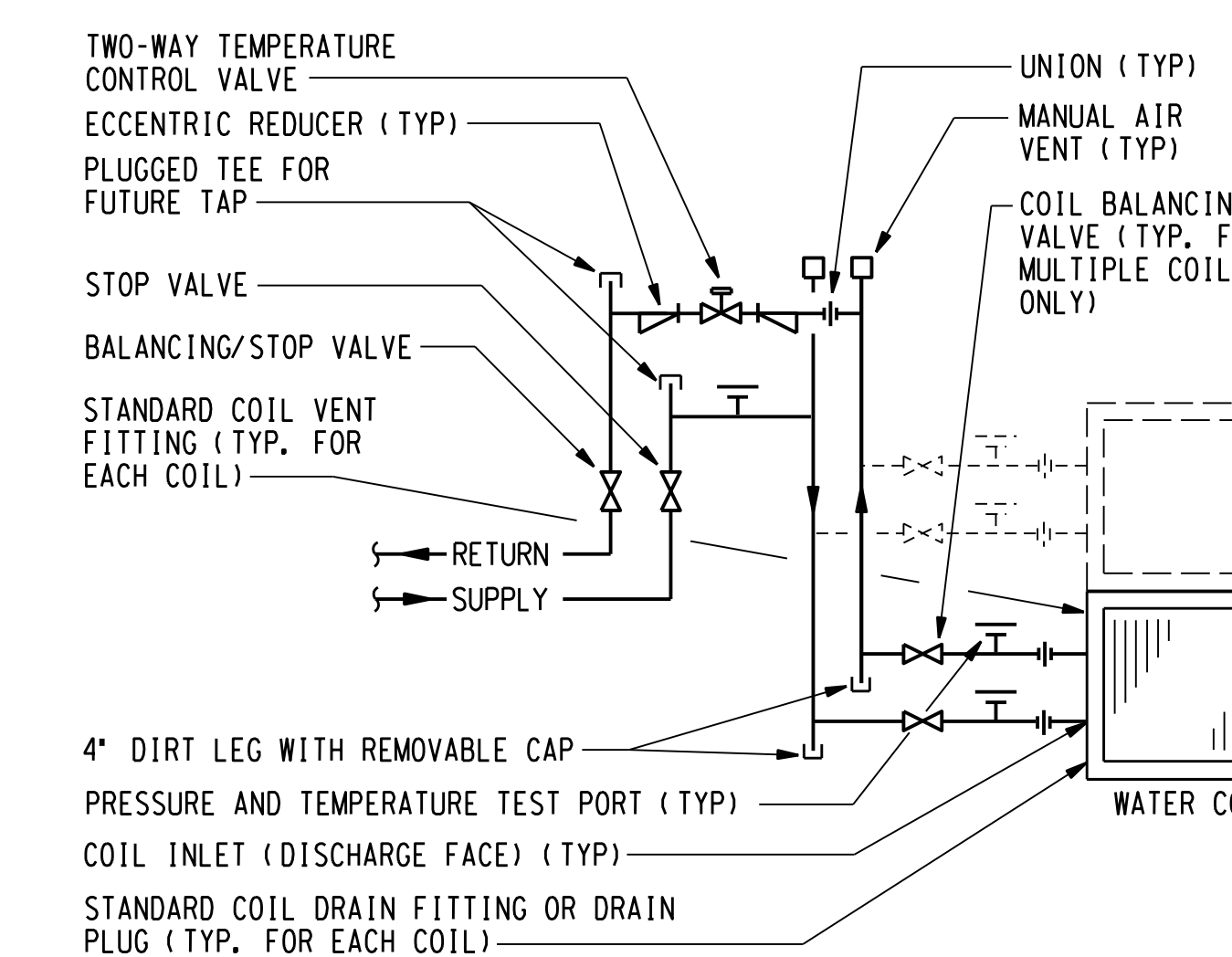
5 TYPICAL STEAM SAFETY RELIEF VALVE
NOT TO SCALE



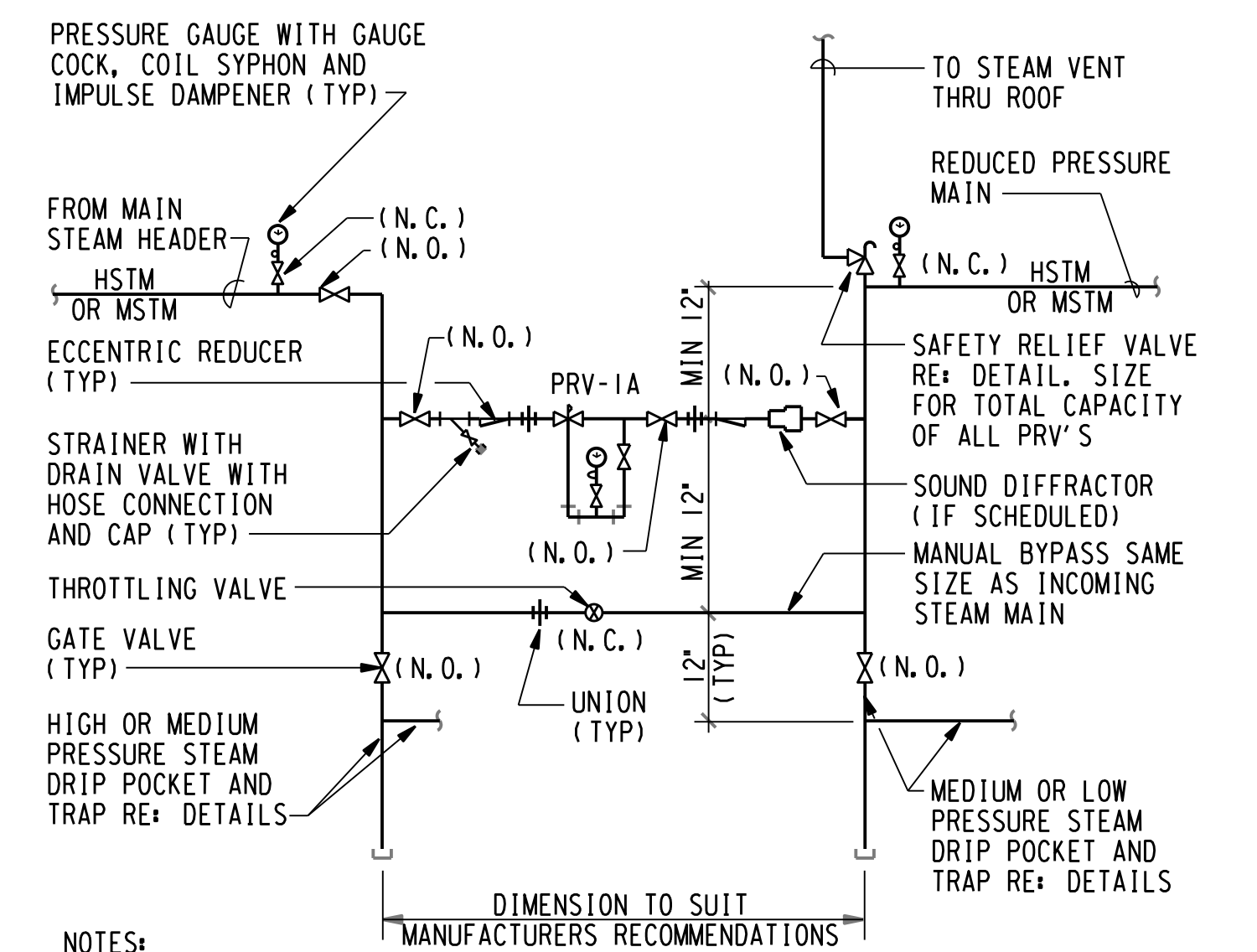
2 TYPICAL STEAM SAFETY RELIEF VALVE
NOT TO SCALE

NOTES:
1. INSULATE ALL PIPING, VALVES, FITTINGS AND ACCESSORIES. RE+ SPECIFICATIONS.
2. INSTALL TEST PORTS IN EASILY ACCESSIBLE LOCATIONS WITH MINIMUM OF 12" CLEARANCE ABOVE AND IN FRONT OF PORTS.

TYPICAL AIR HANDLING UNIT COIL PIPING
NOT TO SCALE



4 TYPICAL AIR HANDLING UNIT COIL PIPING
NOT TO SCALE



NOTES:
1. SIZE PRV-1A SIZED FOR 100% OF REDUCED PRESSURE STEAM LOAD.
2. HIGH PRESSURE TO MEDIUM PRESSURE OR MEDIUM PRESSURE TO LOW PRESSURE. DO NOT USE FOR HIGH PRESSURE TO LOW PRESSURE.

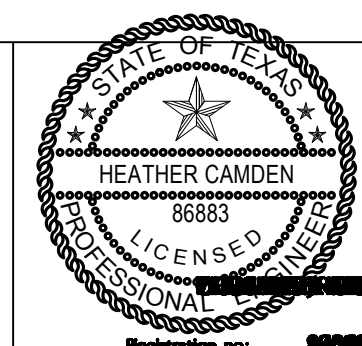
1 TYPICAL SINGLE STAGE STEAM PRESSURE REDUCING STATION
NOT TO SCALE

06 AIR HANDLING UNIT WITH SERIES COILS CHILLED WATER COIL PIPING DETAIL (REPLACEMENT UNIT)
NOT TO SCALE

ISSUE FOR:	Area	Rev.	Date	Description
			04/13/18	CONSTRUCTION
			05/24/18	ADDENDUM #1

E & C

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Date: 04/13/2018
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UTSOC Project No. 730022
E & C Project No. 3302.00C
File Name



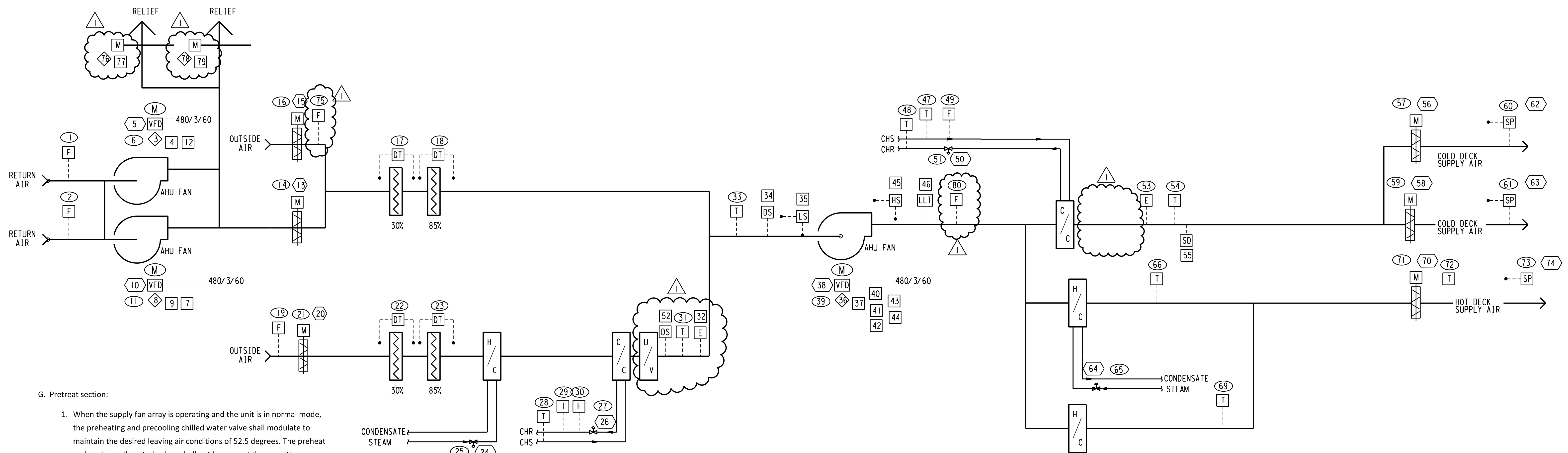
MEDICAL SCHOOL BUILDING
PENTHOUSE
AHU REPLACEMENT

DRAWING TITLE
**MECHANICAL
DETAILS**

DRAWING NO.
M900

AIR HANDLING UNIT

- A. This unit shall be a medium pressure, dual duct, blow-through unit serving multiple dual duct boxes. The unit shall consist of an economizer/mixing box, 30%/85% filter bank, a steam preheat coil, fan array section, pre and post cooling coils and a dual duct section with steam heating coils.
- B. When the VFD - H-O-A switch is in automatic, the BAS system shall start and stop the supply fan by way of a signal to the VFD control input port. When the switch is in hand, the supply fan shall start and run at the set speed. When in the bypass mode the fan shall start and run at full speed.
- C. For the supply fans to start in either hand or automatic, the following permissives shall be satisfied:
 - 1. the smoke detector in the unit discharge.
 - 2. supply air duct high pressure switch is closed indicating a safe operating condition.
 - 3. the door switches are closed.
 - 4. the unit RA and OA dampers are open per control sequence.
- D. When the supply fan array is off, the heating coils and chilled water valves shall be closed to the coils, except in freeze protection mode. In freeze protection mode, the preheat coil valves shall be open if the low limit switch shows a temperature under 36 degrees. When the supply fan array is off, all outside air and return air dampers shall be shut and the return/relief fans shall be de-energized.
- E. Upon a signal to start the fan array, the fan array shall be energized and ramp up to control speed through the VFD to maintain the riser pressure requiring the highest speed to achieve the static pressure setpoint (Owner adjustable setpoint).
- F. Economizer Dampers:
 - 1. Normal Operation:
 - i. When the supply fan is in operation, the outside air and return air dampers along with the return air fans shall modulate to maintain the required outside air flow per the schedule. The return air damper shall be 100% open and the VFDs for the fans shall modulate in parallel to maintain the proper return air volume (total flow-outside air) while the outside air damper modulates to maintain the proper outside air flow per the schedule.
 - ii. If the outside air damper is 100% open and the VFDs are at minimum flow, the return air damper shall modulate to close to provide the additional static needed to reduce the return air flow. If the damper modulates to 15% open or less, the fan shall be de-energized, and the AHU fan shall ramp up to achieve the required static while the outside air damper modulates to meet the outside air. If in this mode, the outside air cannot meet the flow at 100% open, the return air damper shall again begin to close to meet setpoint. When the return air damper is 100% open and the outside air is 50% or more closed, the return fans shall be re-energized to operate as noted.
 - 2. Economizer Mode:
 - i. When the supply fan is in operation and the outside air enthalpy is less than 28 Btu/lb and the dry bulb is greater than 50 degrees, the system shall enter into economizer mode.
 - ii. The outside air damper shall fully close and the precooling and preheating coil shall be off.
 - iii. The AHU return air damper shall fully close.
 - iv. The outside air economizer damper shall fully open and the AHU shall operate as designed.
 - v. The relief damper shall open and the return air fans shall modulate in parallel to control the total cfm of relief to the equivalent of the required relief air (total AHU cfm - outside air design cfm per schedule). If the return air fans are at minimum speed on the VFD and less return air is called for, the relief damper shall begin to close to create the additional static pressure to reduce the total flow. If the damper is 15% open and the relief air flow requirement is still less than the flow, the fan shall be de-energized and the relief air damper shall modulate to maintain the required flow. The fan shall re-energize when the damper is fully open and the relief air flow is 1,000 cfm less than the required flow.
 - vi. When the enthalpy of the outside air rises above 28 Btu/lb or the outside air temperature falls below 50 degrees, the unit shall return to normal mode.



- G. Pretreat section:
 - 1. When the supply fan array is operating and the unit is in normal mode, the preheating and precooling chilled water valve shall modulate to maintain the desired leaving air conditions of 52.5 degrees. The preheat and cooling coil control valves shall not be open at the same time.
 - 2. When the supply fan array is de-energized or the unit is in economizer mode, the pretreat section with preheat coil and precooling coil, shall have the valves closed.
- H. Dual Deck Section:
 - 3. When the supply fan array is operating and the unit is in normal or economizer mode, the cooling coil shall modulate to maintain a leaving air temperature of 51.5 degrees and the steam heating shall modulate to maintain a linear hot deck temperature reset of 95 degrees when the outdoor temperature is 35 degrees or less to a temperature of 80 degrees when the temperature is 85 degrees or greater.

- I. All temperature setpoints shall be owner adjustable.
- J. A current sensing relay shall independently indicate status of each of the supply fans, or if the AHU manufacturer provides a control panel that is bacnet compatible, the BAS shall provide the status of each fan through the AHU control panel. Status shall be input to the BAS system and to the fire alarm system.
- K. The filter bank shall have a differential pressure sensor to indicate high differential pressure across the filters. The switch shall be an alarm input to the BAS system.
- L. The supply air duct shall have a pressure sensor to indicate duct static pressure at the discharge of the unit on both the hot and cold decks. The pressure sensor shall provide an input to the BAS system.
- M. The supply air duct shall have an adjustable pressure switch to indicate high pressure downstream of the fan and a low pressure switch upstream of the fan. The switches shall be an alarm input to the BAS system and shall be an interlock for the supply air fan.
- N. There shall be a discharge smoke detector interlocked with the fire alarm system to shut the system down in the event of smoke in the fan discharge.
- O. There shall be a low temperature limit switch that shall be before the inlet of each cooling coil. Upon a signal from the switch that the temperature is below 35 degrees, the outside air damper and outside air economizer damper shall shut and an alarm shall be sent to the BAS. If the temperature remains below the limit of 35 degrees for more than 1 minute after the outside air damper is shut, the fan shall be de-energized and the cooling coil shall open fully to circulate water to avoid freezing the coil.
- P. There shall be a door switch on the fan section. When the door switch is open, the fan shall be de-energized for safety.
- Q. There shall be a door switch on the cooling coil section. When the door switch is open, the UV lights shall be de-energized for safety. Otherwise, the UV lights shall be on if the AHU is operational. A toggle switch shall also be provided.
- R. There shall be a contractor-provided Nutech venturi flowmeter installed in the chilled water supply or return line with high and low-pressure points (contractor option based on ease of installation). Controls contractor to connect to the ports and provide flow to the BAS.
- S. If Alternate A1 is selected, the risers will be set with a minimum and maximum SP setpoint. Once the worst-case riser is satisfied to the minimum SP setpoint, the dampers at the unit discharge will operate to maintain static pressure between the minimum and maximum for that riser.

POINT NO.	POINT	DESCRIPTION	UNIT OF MEASURE	CONTROL SYSTEM TYPE	ALARM
1,2	RAF	RETURN AIR FLOW	CFM	A/I	
3,8	FAN_C	RETURN AIR FAN COMMAND	ON/OFF	D/O	
4,9	FAN_S	RETURN AIR FAN STATUS	ON/OFF	D/I	X
5,10	VFD_C	VFD COMMAND	%	A/O	
6,11	VFD_FB	VFD FEEDBACK	%	A/I	
7,12	VFD_AL	VFD GENERAL ALARM	NORMAL/ALARM	D/I	X
13	RA_D_C	RA DAMPER COMMAND	%	A/O	
14	RA_D_FB	RA DAMPER FEEDBACK	%	A/I	
15	OAE_D_C	OA ECONOMIZER DAMPER CONTROL	%	A/O	
16	OAE_D_FB	OA ECONOMIZER DAMPER FEEDBACK	%	A/I	
17	PRE_RAFIL_D	RETURN AIR PREFILTER DP	"WC	A/I	X
18	FIN_RAFIL_D	RETURN AIR FINAL FILTER DP	"WC	A/I	X
19	OA_D_C	OUTSIDE AIR DAMPER COMMAND	%	A/O	
20	OA_D_FB	OUTSIDE AIR DAMPER FEEDBACK	%	A/I	
21	OA_F	OUTSIDE AIR FLOW	CFM	A/I	
22	PRE_OAFIL_D	OUTSIDE AIR PREFILTER DP	"WC	A/I	X
23	FIN_OAFIL_D	OUTSIDE AIR FINAL FILTER DP	"WC	A/I	X
24	PH_V_C	PREHEAT VALVE COMMAND	%	A-O	
25	PH_V_FB	PREHEAT VALVE FEEDBACK	%	A/I	
26	CC_V_C	OA COOLING VALVE COMMAND	%	A/O	
27	CC_V_FB	OA COOLING VALVE FEEDBACK	%	A/I	X
28	CHW_S_T	CHILLED WATER SUPPLY TEMP	"F	A/I	
29	CHW_R_T	CHILLED WATER RETURN TEMP	"F	A/I	
30	CHW_FL	CHILLED WATER FLOW	%	A/I	
31	OA_CON_T	CONDITIONED OA TEMP	"F	A/I	
32	OA_COND_E	CONDITIONED OA DEWPOINT	"F	A/I	
33	MA_T	MIXED AIR TEMP	"F	A/I	
34	DS1	FAN DOOR SWITCH	OPEN/CLOSE	D/O	
35	PRES_LL	LOW PRESSURE ALARM	NORMAL/ALARM	D/I	X
36	FAN_C	FAN ARRAY COMMAND	ON/OFF	D/O	
37	FAN_S	FAN ARRAY STATUS	ON/OFF	D/I	X
38	VFD_C	FAN ARRAY VFD COMMAND	%	A/O	
39	VFD_FB	FAN ARRAY VFD FEEDBACK	%	A/I	
40	VFD_AL	FAN ARRAY VFD GENERAL ALARM	NORMAL/ALARM	D/I	X
41, 42, 43, 44	FAS	FAN STATUS IN ARRAY	NORMAL/ALARM	D/I	X
45	SP_HL	HIGH STATIC LIMIT SWITCH	NORMAL/ALARM	D/I	X
46	LLT	LOW TEMP SWITCH	NORMAL/ALARM	D/I	X
47	CHW_S_T	CHILLED WATER SUPPLY TEMP	"F	A/I	
48	CHW_R_T	CHILLED WATER RETURN TEMP	"F	A/I	
49	CHW_FL	CHILLED WATER FLOW	%	A/I	
50	CC_V_C	COLD DECK VALVE COMMAND	%	A/O	
51	CC_V_FB	COLD DECK VALVE FEEDBACK	%	A/I	X
52	DS2	FAN DOOR SWITCH	OPEN/CLOSE	D/O	
53	CD_E	COLD DECK DEWPOINT	"F	A/I	
54	CD_T	COLD DECK TEMPERATURE	"F	A/I	
55	SA	SMOKE ALARM	NORMAL/ALARM	D/I	X
56/58	CD_D_C	COLD DECK DAMPER CONTROL	%	A/O	
57/59	CD_D_FB	COLD DECK DAMPER FEEDBACK	%	A/I	
60/61	CD1_P	COLD DECK PRESSURE	"WC	A/O	
62/63	CD1_P_SP	COLD DECK PRESSURE SETPOINT	"WC	A/I	
64/67	HD_C	HOT DECK VALVE CONTROL	%	A/O	
65/68	HD_FB	HOT DECK VALVE FEEDBACK	%	A/I	
66/69	HD_T	HOT DECK DISCHARGE TEMP	"F	A/I	
70	HD_D_C	HOT DECK DAMPER CONTROL	%	D/O	
71	HD_D_FB	HOT DECK DAMPER FEEDBACK	%	A/I	
72	HD_T	HOT DECK TEMP	"F	A/I	
73	HD_P	HOT DECK PRESSURE	"WC	A/I	
74	HD1_P_SP	HOT DECK PRESSURE SETPOINT	"WC	A/I	
75	OA_E_F	OUTSIDE AIR FLOW - ECONOMIZER	CFM	A/I	
76/78	RA_C	RELIEF DAMPER CONTROL	"WC	D/O	
77/79	RA_FB	RELIEF DAMPER FEEDBACK	"WC	D/I	
80	TOT_F	TOTAL AIR FLOW (FROM FAN ARRAY MEASURING STATION)	"WC	A/O	

POINTS 60-63, 70-71 AND 73-74 SHALL BE PART OF ALTERNATE PRICING A1. VERIFY NAMING ON ALL POINTS WITH UTHSC-H PRIOR TO PROGRAMMING.

GENERAL NOTES:

1. ALL SET POINTS SHALL BE REPORTED AS DISPLAYED.
2. ALL ALARMS SHALL BE REPORTED AND DISPLAYED.
3. ALL ALARM SETTINGS SHALL BE DISPLAYED.
4. REFER TO PIPING DIAGRAMS FOR ACTUAL PIPING DETAILS.
5. ALL CONTROLS EQUIPMENT REQUIRED TO PROVIDE THE SEQUENCE OF OPERATION IS REQUIRED TO BE PROVIDED BY THE CONTRACTOR EVEN IF NOT SPECIFICALLY SHOWN ON THE DRAWING OR POINTS LIST.

01 AHU CONTROL DIAGRAM AHU-01, 2, 3, 4, 5, 6, 7, & 8
NOT TO SCALE

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 E & C Project No. 3302.00C
 Checked By: File Name

UTHealth
 The University of Texas
 Health Science Center at Houston

**MEDICAL SCHOOL BUILDING
 PENTHOUSE
 AHU REPLACEMENT**

DRAWING TITLE: **MECHANICAL CONTROL DIAGRAMS**
 DRAWING NO.: **M991**

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INDEX: Division 23-Mechanical

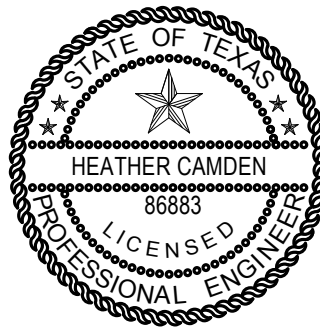
23 00 00	Basic Mechanical Requirements
23 05 13	Motors
23 05 29	Sleeves, Flashings, Supports and Anchors
23 05 48	Vibration Isolation
23 05 53	Mechanical Identification
23 05 93	Testing, Adjusting and Balancing
23 05 93A	Preparation for System Testing, Adjusting and Balancing
23 06 20	Hydronic Specialties
23 07 13	Ductwork Insulation
23 07 16	Equipment Insulation
23 07 19	Piping Insulation
23 09 23	Direct Digital Control Systems
23 20 00A	Piping, Valves and Fittings
23 21 00	Hydronic Piping
23 22 00	Steam and Steam Condensate Piping
23 22 00A	Steam and Steam Condensate Specialties
23 29 23	Variable Speed Drives
23 31 00	Ductwork
23 33 00	Ductwork Accessories
23 34 00	Fans
23 41 00	Filters
23 73 23	Air Handling Units and Outside Air Handling Units
23 82 16	Air Coils

INDEX: Division 26-Electrical

26 00 00	Basic Electrical Requirements
26 00 00.01	Electrical Demolition
26 05 00	Basic Electrical Materials and Method
26 05 19	Cable, Wire and Connectors, 600 Volts
26 05 26	Grounding
26 05 29	Securing and Supporting Methods
26 05 33	Raceways, Conduit and Boxes
26 05 53	Electrical Identification
26 05 73	Short Circuit Analysis and Coordination Studies
26 24 16	Panelboards

26 25 01	Feeder and Plug-in Busway
26 27 26	Wiring Devices and Floor Boxes
26 51 00	Interior and Exterior Lighting
28 31 00	Fire Alarm and Smoke Detection

For Construction
E&C Engineers & Consultants, Inc.
TX Firm Registration No: F-003068
Date: 05/24/2018
Engineer of Record: Heather Camden
State: Texas
License no: 86883



THE SEAL APPEARING ON THIS DRAWING WAS AUTHORIZED BY:

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SECTION 23 73 23
AIR HANDLING UNITS

PART 1 GENERAL

1.00 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

1.01 SECTION INCLUDES

- A. Packaged air handling units.
- B. Factory installed fans.
- C. Dampers.
- D. Filters.
- E. Coils.
- F. Drives.

1.02 RELATED SECTIONS

- A. Section 23 00 00- Basic Mechanical Requirements.
- B. Section 23 05 13 - Motors.
- C. Section 21 05 48 - Vibration Isolation.
- D. Section 23 07 13 - Ductwork Insulation.
- E. Section 23 82 16 - Air Coils.
- F. Section 23 41 00 - Filters.
- G. Section 23 31 00 - Ductwork.
- H. Section 23 33 00 - Ductwork Accessories: Flexible duct connections.

1.03 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 435 - Application of Central-Station Air-Handling Units.
- J. ARI 610 - Central System Humidifiers.
- K. NEMA MG1 - Motors and Generators.
- L. NFPA 70 - National Electrical Code.
- M. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- N. UL 900 - Test Performance of Air Filter Units.

1.04 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/UTHSC-H Construction 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.

1.05 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.

1.06 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.

1.07 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. For panelized units, components may come palletized, in crates or on skids. 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.

1.08 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.

1.09 EXTRA MATERIALS

- A. Furnish under provisions of Section 23 00 00.
- B. Provide one year of filters for each unit (start-up filters, plus 4 additional sets of MERV 8 for change-out each 3 months, and one additional set of MERV 13 for change-out one year from turn-over). 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 other sets shall be scheduled for delivery at the times noted for change-out, one MERV 8 at 3 months from start-up, one MERV 8 at 6 months from start-up, one MERV 8 at 9 months from start-up and a MERV 8 and MERV 13 at 12 months from start-up. Coordinate exact delivery date with UTHSC-H 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.

1.12 WARRANTY:

- A. Unit shall have a 5-year warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Laboratory Units:
 - a. Climate Craft only per UTHSC-H Agreement. Price shall be submitted as a separate price from the base bid.
- B. Office Units – These units shall also be provided as a separate price from the base bid:
 - a. Climate Craft
 - b. Temtrol
 - c. Thermal
 - d. JCI
 - e. Trane
- B. **NOTE:** Units must meet the size restrictions. In addition, each manufacturer must verify the shipping and delivery sizes of the components and coordinate exactly how the units will get to the building's penthouse and ultimately get to the location of the replacement.
- C. 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.

2.02 GENERAL DESCRIPTION

- A. Configuration: Fabricate with fan and coil sections as scheduled plus accessories, including sections as detailed per unit.
- 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.

2.03 AIR HANDLER CASING AND GENERAL CONSTRUCTION:

- A. Unit casing exterior (walls and roof) shall be a minimum 18-gauge thickness galvanized steel insulated internally, throughout (double wall construction with no thru metal). Internal insulation shall have an R-value of at least 10, with foil facing, neoprene or anti-microbial hardcoat protected unless specifically noted otherwise, and shall be fire and fungus proof. Foam may be used as an alternate as long as it is also anti-microbial protected and fire and

- fungus proof. All internal insulation shall be protected with solid galvanized sheet metal, of a minimum of 20-gauge thickness. 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 sealant 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.
- 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. If all components of the fan section can be removed through the door, removable panels will not be necessary.
- C. Drain pan liners shall be constructed of No. 16-gauge 316-L-L stainless steel or heavier as standard with the manufacturer, and shall be non-skid or be provided with protective grating. Drain pan shall be non-skid and extend up to the fan section on draw-thru units. Entire drain pan, and shall be insulated with R-8 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.
- D. Unit shall have a complete perimeter channel base of at least 6" galvanized steel, 8" tube steel or 6" carbon steel with marine quality primer. The unit manufacturer shall provide a condensate drain trap calculation that ensures there will be ample trapping height when the unit is sitting on a 5-1/2" concrete pad. Base channels shall be sized no less than 6", but shall be extended to provide proper trapping. All floors shall be insulated with R-10 insulation with 14-gauge non-skid galvanized floor (or equivalent aluminum). An 18-gauge galvanized sheet shall enclose and form a vapor barrier for the insulation on the bottom of the unit. If a foamed-in-place closed cell insulation is used, the lower metal enclosure may be eliminated. All points of contact between the floor, vapor barrier and structure shall be thermally isolated with gasketing of closed cell soft rubber or EPDM.
- ~~1. Provide Alternate D2 for lighter base channel with description and cut sheets.~~
- 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 thermal break construction. Door size shall be at least 18" wide and full height of the panel up to 5' 0" tall. 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 6-inch 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, adjustable cast aluminum hinges, 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 from within the unit so that they may be removed through the access doors without removing any unit panels or piping exterior to the unit and shall not be used to provide structural stability for the casing. All coils shall be arranged for and piped to provide counterflow operation. 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. Maximum deflection at any joint on the unit casing shall be limited to L /250th of the overall panel width or height.
- H. Panel construction shall provide the following acoustical performance.

a. Sound Transmission Loss (dB) per ASTM E-90 & E-413

Octave	2	3	4	5	6	7	STC+
Coated Liner	22	26	37	44	53	55	39
Solid Liner	22	38	49	50	57	62	42

b. Sound Absorption Coefficients per ASTM C-423 & E-795

Octave	2	3	4	5	6	7	NRC+
No liner	.26	.71	1.09	1.02	.96	.83	.95
Coated Liner	.25	.79	1.06	1.06	1.04	.78	1.00

The above ratings represent minimum performance. Unit manufacturer shall submit full sound performance data to the project sound consultant for evaluation.

- 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. Equivalent aluminum material may be used where galvanized steel panel components are called for.
- 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.

2.04 FANS:

- A. Shall be both dynamically and statically balanced. Housed fans shall be equipped with quick opening access doors in the fan scroll. 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. Units shall be direct drive only.
- B. The fan unit bearings shall be of the antifriction type, either ball or roller, lubricated at the factory, and shall be equipped with means for lubrication with a grease fitting on the outside of the bearing housing. Both inboard and outboard bearings shall be the same, identical

size. The bearings shall be a catalogued type as manufactured by Fafnir, SKF, Sealmaster, or approved equal, and stocked locally. Bearings shall have an L-10 minimum life of 200,000 hours. Intermediate bearings will not be acceptable. Grease fittings for bearings shall be remotely mounted within line of sight of the bearing, where possible. Where it is not possible, then the fitting shall be mounted where it is most easily accessible for service. The tubing used for remoting the fitting shall be stainless steel. Provide AEGIS bearing protection on all shafts.

- C. After assembly, the unit manufacturer shall balance the fan (per ANSI/AMCA 204-96 fan application category BV-3) 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.
- D. Plug fans installed in walk-in units shall be provided with a safety cage around the wheel or with a fan shut down switch in the access door. Cage shall be large enough to allow working room for wheel and bearing service and shall have removable sections to allow wheel removal.
- E. Direct drive fans shall have fan wheels cut to provide proper matching of the motor and fan rpm.
- F. Multiple Fan/Motor VFD Control: The fan array shall consist of multiple fan and motor "cubes", spaced in the air way tunnel cross section to provide uniform airflow and velocity profile across the entire airway tunnel section and components contained therein. Each fan cube shall be individually wired to a control panel containing power lock-disconnects for individual motors and a single VFD controlling all fan motors in the fan array. Refer to Specifications Section 23 2923 – "Variable Frequency Drives" for requirements. Controls on laboratory units (AHU-L1, 2, 3 & 4) shall allow the unit to reduce to no less than 15% of the design flow and remain stable. This shall be provided by the balance stream option. Office units (AHU-O1, 2, 3, 4, 5, 6, 7 & 8) shall allow the unit to reduce to no less than 30% of design flow and remain stable.

2.05 DAMPERS

- A. Damper Leakage: Section with factory built, factory mounted outside and return air dampers of galvanized steel and edge seals in galvanized frame, with galvanized steel axles in self-lubricating nylon bearings, in opposed blade arrangement with damper blades positioned across short air opening dimension. Maximum 4 CFM/Sq. Ft. at 4 inch WG differential pressure. Dampers shall be sized for 2000 fpm maximum face velocity.
- B. Isolation Dampers: Factory mounted isolation dampers downstream or backdraft dampers upstream of the fan section shall be governed by the low-leakage damper specification in section 23 33 00.
- C. Face and Bypass Dampers (Heat Recovery Units): Factory mounted in casing field mounted with access doors, of galvanized steel blades, and edge seals, galvanized steel frame, and axles in self-lubricating nylon bearings, arranged to match coil face with bypass, blank-off and division sheets, external linkage, access doors, and adjustable resistance plate. Dampers shall be low-leakage type.

2.06 DRIVES:

B. Variable speed drives: See Section 23 29 23. Drive shall be supplied by the VFD manufacturer and shall be connected in the field. The AHU manufacturer shall coordinate with the drive manufacturer to ensure the motor will not over-amp in bypass mode.

2.07 COILS:

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

2.08 FILTERS:

A. Units shall have a MERV 8 and MERV 13 filter bank. Refer to Section 23 41 00 - Filters, and Unit Schedules for requirements.

2.10 ELECTRICAL

A. Fan motors shall be factory mounted and wired to an external disconnect switch adjacent to the motor access door. Fan motors shall be interlocked with fan access door to shut down when door is opened. For units with one VFD, the disconnects shall be in the fan array overload panels.

B. Vapor proof lights (mounted at 88" above floor or as high as possible for units shorter than 88") shall be provided in each compartment. Lights shall have a switch at each door into the compartment with access doors. 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) for connection by Division 26.

C. UV lights shall be provided in each outside air cooling coil compartment downstream of the coil. This includes all cooling coils on laboratory units and only the pretreated outside air path in the office units. Lights shall have a switch at each door into the compartment with access doors along with an automatic door switch that will shut off the UV lights when the access door is open. Provide warning stickers for the doors. The lights shall provide a minimum of 5W/sqft of the coil. Wire lights and outlets to external 120v, 20a power connections for connection by Division 26. Provide a comprehensive wiring diagram for the light fixtures showing number of 20A circuits required, how the door switches are to be wired and verify the door switch is installed in such a way as to not exceed the switch's rated amperage.

D. 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.

E. Motors – Motors shall be provided to match the direct-drive requirements of the AHU without overamping in bypass mode. See Section 23 05 13 for additional requirements.

F. Motor/VFD/Fan – The fan wheel shall be cut so that maximum motor/fan rpm does not exceed the motor rated horsepower when the variable frequency drive is placed into bypass.

2.11 FINISH

A. All external parts of the unit shall be Brite G-90 galvanized. No painting will be required.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Field assembly of the unit shall be the responsibility of the contractor and shall be supervised by the manufacturer.
- B. Install in conformance with ARI 435.
- C. Assemble high pressure units by bolting sections together.

3.02 TESTING

- A. Units with cabinet mounted fans shall be tested and certified at rated conditions using AMCA 210 and AMCA 300 test procedures with fan mounted in the cabinet. Bare fan data will not be accepted.
- B. Casing Deflection Test
 - 1. Deflection limit of L/250 shall be demonstrated in the field after installation and witnessed by a representative of the Owner's Test and Balance Consultant.
 - 2. 'L' is defined as the height of the largest panel on the sides, width across the top of the largest panel on the unit, and the smaller of width or height of the largest panel for the ends. These are known as the governing panels.
 - 3. That portion of the unit after the fan discharge shall be tested at positive pressure. The remainder of the unit shall be tested at negative pressure.
 - 4. Measurements shall be taken at mid point of 'L' using dial indicators reading in 1/1000ths. Mounting of dial indicators shall be independent of the unit casing. Multiple measurements shall be made. Dial indicator shall be mounted at mid point of 'L'. Measurements shall then be spaced along the sides, ends and top at mid point and quarter points of the negative section and the positive section. Spacing shall be adjusted to fall on nearest flange or panel joint. Any section of less than five feet shall require only one measurement at the center.
 - 5. Unit shall be furnished with proper blank offs to facilitate the pressure testing.
 - 6. In order to reduce the number of pressure cycles, it is recommended that multiple dial indicators be used at the measurement points. Separate set-ups will be required for the positive pressure tests and the negative pressure tests.
- 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 pressurizing to 2.5 times rated pressure (defined as total static pressure of unit) or 10" WG, whichever is smaller. Maximum allowable leakage rate is 1.5% of rated unit flow. 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.

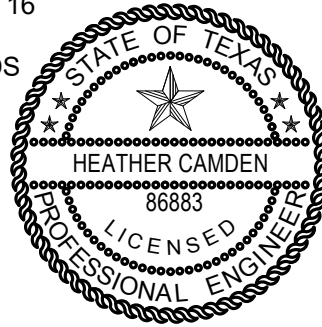
- D. Fan/Motor Vibration Test. With the unit set in place, leveled, and ductwork attached, the manufacturer shall perform a final dynamic vibration trim balance to verify the fan/motor vibration velocity limit over the following operating speed range: Fans with VFDs shall be checked from 40 to 110% of 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. This testing shall be witnessed by a representative of the Owner's Test and Balance firm.
- E. Failure of the leakage and/or deflection test shall require sealing and bracing of the unit and retesting until criteria is met. Failure of the trim balance to confirm 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, including travel and hourly costs associated with the representatives of the Owner's Test and Balance firm.

END OF SECTION

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SECTION 26 24 16

PANELBOARDS



THE SEAL APPEARING ON THIS DRAWING WAS AUTHORIZED BY:

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by Heather
Camden
Date:
2018.05.24
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E&C Engineers & Consultants Inc.
Texas Firm Registration No: F-003068

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Distribution panelboards.
- B. Branch circuit panelboards.

1.2 REFERENCES

- A. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
- B. NAME KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- C. NEMA PB 1 - Panelboards.
- D. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- E. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment.
- F. NEMA AB 3 – Molded Case Breakers and Their Application
- G. ANSI/UL 67 – Electric Panelboards
- H. ANSI/UL 50 – Cabinets and Boxes
- I. ANSI/UL 508 – Industrial Control Equipment

1.3 SUBMITTALS

- A. Provide submittals in accordance with and in additional to Section 26 00 00.UT, Basic Electrical Requirements, and Division 01 for submittal requirement.
- B. Submit dimensioned drawings showing size, circuit breaker arrangement and equipment ratings including, but not limited to, voltage, main bus ampacity, integrated short circuit ampere rating, and temperature rating of circuit breaker terminations.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver distribution panelboards in factory-fabricated water-resistant wrapping.
- B. Handle panelboards carefully to avoid damage to material component, enclosure and finish.
- C. Store in a clean, dry space and protected from the weather.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Square D Company
- B. General Electric Company
- C. Other manufacturers equal in design and function will be considered upon A/E approval following substitution procedure in 26 00 00, and Division 01 for substitution requirement.

2.2 PANELBOARD CONSTRUCTION

- A. General: Provide flush or surface mounted, or surface mounted deadfront circuit breaker type distribution or branch circuit panelboards with electrical ratings and configurations, as

indicated on the drawings and schedules. Load center type of panelboards are not acceptable.

B. Enclosure:

1. Enclosure shall be proper NEMA type as shown on the drawings.
2. NEMA 1
 - a. Back box shall be galvanized steel for flush mounted branch circuit panelboards. Back box shall have gray enamel electro-deposited finish over cleaned phosphatized steel for all other type panelboards.
 - b. Provide panelboard fronts with screw cover and hinged door with flush lock.
 - c. Where power monitors or metering are specified on the Drawings, the manufacturer shall cut the doors for field mounting of the unit.
3. NEMA 3R, 3S and 12
 - a. Enclosure and doors shall have gray enamel electro-deposited finish over cleaned phosphatized steel.
 - b. Doors shall be gasketed and equipped with tumbler type vault lock and two trunk latches where required by UL standard. Interior trim shall consist of four pieces, each covering one gutter top, bottom and both sides.
4. Construct cabinet in accordance with UL 50. Use not less than 16-gauge galvanized sheet steel, with all cut edge galvanized. Provide a minimum 4-inch gutter wiring space on each side. Provide large gutter where required to accommodate the size and quantity of conductors to be terminated in the panel, and where required by code.
5. Exterior and interior steel surfaces shall be cleaned and finished with gray enamel over rust inhibiting phosphatized coating. Color shall be ANSI 61 gray.
6. Doors shall be equipped with flush-type combination catch and key lock. All locks shall be keyed alike.
7. Branch circuit panelboards shall be 5 ¾ inches deep.
8. A directory holder with heavy plastic plate, metal frame, and index card shall be mounted inside of each door.
9. Reinforce enclosure and securely support bus bars and overcurrent devices to prevent vibration and breakage in handling.
10. Rating: Minimum integrated short-circuit rating, voltage and current rating as shown on drawings.
11. Labeling: The Contractor shall furnish and install engraved, laminated plastic nameplates on the trim per Section 26 05 53.UT, Electrical Identification

C Bus:

1. Provide panelboards with rounded edge phase, neutral and ground buses, rated full capacity as scheduled on drawings. Buses shall be full-length copper and braced for the maximum available fault current as shown on drawings. Neutral bus shall be 200% rated for those panels feeding non-linear loads.
2. Phase bussing shall be stacked front-to-back, A-B-C.
3. The neutral and ground bus bars shall have termination locations for each of the individual feeders and the lugs sized appropriately. In addition, space shall be provided to terminate the neutrals and grounds in two feeders equal to the largest size

circuit breaker that can be installed in the panelboard. The ground bus shall be mounted in the panelboard, opposite the incoming line and neutral lugs and shall be accessible to allow easy installation of bolts, nuts and lock washers used to attach ground lugs. The neutral and ground buses in branch circuit panelboards shall have spaces to terminate 42 neutral and 42 ground wires.

4. Where isolated ground buses are specified or indicated, provide copper grounding bus bars mounted in the panelboard on insulated standoffs to ensure isolation from equipment ground potential. Isolated ground buses shall be drilled and tapped as appropriate for connection of the individual isolated grounding conductors.
5. All lugs for phase, neutral, and ground buses shall be tin-plated copper.
6. Panelboard shall be rated SE where required for service Entrance duty.

2.3 SWITCHING AND OVERCURRENT PROTECTIVE DEVICES

- A. Provide molded case circuit breakers with manufacturer's standard construction, bolt on type, with integral inverse time delay thermal and instantaneous magnetic trip in each pole. Circuit breakers shall be constructed using glass reinforced polyester insulating material providing superior dielectric strength. Provide circuit breakers UL listed as Type HACR for air-conditioning equipment branch circuits.
- B. Circuit breakers shall have an over center, trip-free, toggle operating mechanism that will provide a quick-make, quick-break contact action.
- C. Provide handle padlock attachments on circuit breakers where indicated on drawings. Device shall be capable of accepting a single padlock. All circuit breakers shall be capable of being individually padlocked in the off position.
- D. The circuit breakers shall be connected to the bus by means of solidly bolted connection. In multi-pole breakers, the phase connections on the bussing shall be made simultaneously without additional connectors or jumpers. Multi-pole breakers shall be two or three pole as specified. Handle ties are not permitted. The circuit breaker shall have common tripping for all poles.
- E. All circuit breakers shall be provided with visible ON and OFF indications.
- F. Provide GFI circuit breakers as indicated on drawing or per NEC requirement.
- G. Breaker voltage and trip rating shall be per drawings. Breaker faceplate shall indicate UL certificate standards with applicable voltage systems and corresponding short current rating as per drawings.
- H. Molded Case Circuit Breakers:
 1. Breakers 400 ampere frame and less shall be manufacturer's standard industrial construction, bolt-on type, integral inverse time delay thermal and instantaneous magnetic trip. Breakers 225 ampere through 400 ampere shall have continuously adjustable magnetic pick-ups of approximately five to ten times trip rating.
 2. Breakers 600 ampere frame and above shall be equipped with solid-state trip complete with built-in current transformers, solid-state trip unit and flux transfer shunt trip.
- I. Current Limiting Molded Case Circuit Breakers:
 1. Breakers 100 ampere frame shall be inverse time delay thermal and instantaneous magnetic trip.
 2. Breakers 250 ampere and 400 ampere frame shall be solid-state trip with built-in current transformers, solid-state trip unit and flux transfer shunt trip.

3. Current limiting breakers shall protect downstream molded case breakers. Submit manufacturer's test data proving the protection, from both peak currents and I²T energy of downstream devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with manufacturer's written instructions and the applicable requirements of the NEC, NEMA, ANSI and the National Electrical Contractors Association's "Standard of Installation".
- B. Anchor enclosed firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secured. Direct attachment to dry wall is not permitted. Freestanding panelboards shall be installed on a concrete housekeeping pad with anchors per manufacturer's recommendation.
- C. Mounting height:
 1. Distribution Panelboards: As per Drawings, but such that highest operating handle is no greater than 79 inches above finished floor.
 2. Branch Circuit Panelboards: As per Drawings, but such that highest operating handle is no greater than 79 inches above finished floor.
 3. Where panelboards occur in groups, the tops shall be aligned if it can be done without exceeding items 1 and 2 above.
- D. Install panelboards plumb. Adjust trim to cover all openings. Seal all conduit openings and cap all used knockout holes.
- E. Provide blank plates for unused open spaces in panelboards. Keep the front door closed after work to protect from damage, dirt, and debris at all times.
- F. Install identification nameplates in accordance with Section 26 05 53.UT, Electrical Identification.

3.2 FIELD QUALITY CONTROL

- A. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers and lugs.
- B. Provide testing and start-up as indicated in Section 26 08 00 – Commissioning of Electrical Systems.

3.3 PANELBOARD SCHEDULE

- A. The Contractor shall provide engraved, laminated plastic nameplates for circuit identification as indicated on the Drawings for distribution panelboards.
- B. The Contractor shall fill the index directory inside the front door of branch circuit panelboards identifying each circuit as shown on Panel Schedule drawings. Where changes are made, the schedule shall reflect the changes. At the end of the job, these schedules shall reflect as-built record conditions.

END OF SECTION