22 00 00 PLUMBING
22 01 00 Operation and Maintenance of Plumbing
22 01 10 Operation and Maintenance of Plumbing Piping and Pumps
22 01 30 Operation and Maintenance of Plumbing Equipment
22 01 40 Operation and Maintenance of Plumbing Fixtures
22 01 50 Operation and Maintenance of Pool and Fountain Plumbing Systems
22 01 60 Operation and Maintenance of Laboratory and Healthcare Systems

22 05 00 Common Work Results for Plumbing

22 05 13 Common Motor Requirements for Plumbing Equipment
22 05 16 Expansion Fittings and Loops for Plumbing Equipment

SECTION 22 05 19
METERS AND GAGES FOR PLUMBING PIPING

CONSULTANT DESIGN GUIDELINE

Include meters for water and gas utilities as part of the construction contract.

The city of Fayetteville will furnish all water meters used on UofA projects. Specify water meter installation to comply with the Fayetteville Municipal Water Department's guidelines. City of Fayetteville reserves the right to size the water main tap and the water meter. The consultant will communicate with the City of Fayetteville engineering department in order to notify them of the future need and to acquire the most current design criteria for the construction of the taps, valves, and meter enclosures. In addition, the designer will contact the City of Fayetteville meter division for final approval of the planned locations of water taps, meter box sizes and shapes, before issuance to the contractor. Field location and sizing of taps is to be avoided.

Generally, SourceGas Arkansas, Inc. will furnish and size gas meters. In the event the Contractor furnishes the meter, it will require approval from SourceGas.

Gas meters to be Rockwell Type with direct reading index in cubic feet, to sit on a concrete pad furnished and installed by contractor. Meets source gas specification.

INCLUDE IN THE CONSTRUCTION DOCUMENTS

Include the estimated demand load of water and gas on the Utilities Plan.

EXECUTION

Locate all water meters outside of buildings; coordinate the location with City of Fayetteville water meter division and Facilities Management Planning Department.

END SECTION

22 05 23 General Duty Valves for Plumbing Piping

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

CONSULTANT DESIGN GUIDE

INCLUDE IN CONSTRUCTION DOCUMENTS

Plumbing piping hangers and supports design will follow the Arkansas Plumbing Code, section 308.

22 05 33 Heat Tracing for Plumbing Piping
22 05 48 Vibration and Seismic Controls for Plumbing Piping and Equipment
22 05 53 Identification for Plumbing Piping and Equipment

Identification of equipment:

The intent of this section is to enhance the new building turn over to the University. Identification/tagging/tracking of equipment that requires preventive maintenance, on some periodicity, to maximize its operational lifespan is essential. If the equipment will never require any service it need not be entered into our system. Our primary concern is to identify equipment (including mechanical, electrical, and plumbing) that needs to be checked and serviced on a regular basis. An online form [link provided below] facilitates entry of all information needed to input and track equipment in the UA Facilities Management Department's Computerized Maintenance Management System (CMMS). The following process, business rules, and information requirements apply.

I N F O R M A T I O N N E E D E D

1. Barcode tag number (see below for description of this item)
2. Equipment nomenclature
3. Manufacturer
4. Model
5. Serial number (if available)
6. Building name
7. Room number
8. Recommended preventive maintenance procedures and frequencies (i.e. monthly, quarterly, semi-annually, annually)
9. Parts requirements for procedures/frequencies stated in item eight
10. Special conditions for access, unusual tools needed, et cetera should be noted in comments.

11. If project is a renovation rather than new construction, report removed equipment by its (old) barcode tag number or by completing items two through seven of a data entry form for each piece of equipment being removed.

Link for the new equipment entry form for contractors to use to enter newly installed equipment on campus:

http://facilities.uark.edu/Forms/NewEquipmentEntryForm.htm

P R O C E S S

1. Consult business rules on how newly installed building components and equipment are categorized in FAMIS to determine new equipment count
2. Acquire the necessary number of barcode tags from the Facilities Management CMMS Administrator
3. Tag equipment and complete associated data entry forms
4. If project is a renovation rather than new construction, report removed equipment, by FAMIS number or by completed data entry form, to the Facilities Management CMMS Administrator
5. As a part of the close out process, coordinate work with the commissioning agent if project has one assigned to it, or if not, supply all applicable digitized owner's manuals, user's manuals, maintenance manuals, parts lists, et cetera to the Facilities Management Construction Coordinator who will then give a copy to the Facilities Management CMMS Administrator.

6. Resolve data discrepancies identified by the Facilities Management CMMS Administrator

B U S I N E S S R U L E S

1. Components that are cheaper to replace than maintain will not be included
    a. If in doubt, err on the side of identifying and documenting Components
2. Systems or Components with a minimum maintenance frequency of greater than one year will not be included
    a. If in doubt, err on the side of identifying and documenting Systems and Components
3. All inventory items will receive a new metal barcode tag
4. Barcode tags will be affixed using self-adhesive unless the inventory item is located outside or there is not an appropriate surface for adhesion
5. Use plastic zip ties or wire twist ties to affix the barcode tags to items described in the previous rule
6. Major Components of Parent Systems will be labeled according to the following rules:
    a. The Major Component has a replacement value of >= $500
    b. The frequency with which the Major Component is repaired/replaced is greater than the life of the Parent System

c. The Pump or Motor (Major Component) is >= 2 HP (This does not include Sump Pumps. Inventory all Sump Pumps)

d. The Equipment ID of the Parent System shall be recorded accordingly on the Inventory Template of the Major Component that is being barcoded

7. Barcode and record all Heat Pumps, Evaporators and Condensing Units individually if their capacity exceeds 5 tons

8. Please record the following inventory items on a per floor basis, using one barcode tag per floor. Record locations of individual units and any unusual access or tool requirements individually in comments.

a. Fan Coil Units
b. Exit Lighting & Emergency Egress Lighting
c. Eye Wash Stations
d. Emergency Showers
e. Electronic Handicapped Access Door Operators

9. Please record the following inventory items on a per building basis, using one barcode tag per category. Record locations of individual units and any unusual access or tool requirements individually in comments.

a. Emergency Egress Doors
b. Heat Pumps, Evaporators and Condensing Units with a capacity of <= 5 tons
c. Bathrooms
d. Drinking Fountains
e. Recirculating Pumps
f. Interior Doors
g. Fire Doors

10. Major Systems or Components (i.e. Elevators and Sprinkler Risers) of value >= $1,000 shall be considered an inventory item even if the PM is outsourced

11. All Regulatory Code Reporting Items, such as backflow protection devices, expansion tanks, flash tanks, and steam converters) shall be included in the inventory

12. Individual pumps in duplexed configurations shall each be tagged as individual pieces of equipment. Note duplexed installations in comments.

End of Section

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

CONSULTANT DESIGN GUIDELINE

INCLUDE IN CONTRUCTION DOCUMENTS

Identification of potable and non-potable water will follow the Arkansas Plumbing Code, section 608.8.

Identify all domestic cold water, hot water, and hot water return pipingor its insulated covering, with the name of the liquid, vapor, or gas being carried. Indicate direction of flow by arrows. Specify the identification applied on the entering and leaving side of all equipment, where pipes pass through a wall, floor, or ceiling and on long runs of pipe. Identifications shall be visible from the floor, painted on in a color contrasting to the adjacent material, and composed of Helvetica medium graphic letters.

Specify the equipment in mechanical rooms to be equipped with protected equipment nameplates to prevent them from becoming illegibledue to paint coating.

END SECTION

22 05 73 Facility Drainage Manholes

SECTION 22 05 76
FACILITY DRAINAGE PIPING CLEANOUTS

CONSULTANT DESIGN GUIDELINE

Floor cleanouts shall have cast iron body and frame with adjustable scoriated nickel bronze top. Unit shall be vertically adjustable for a minimum of two inches. When using waterproof membrane in floor, provide clamping collars on cleanouts. Cleanouts shall consist of wye fittings and bends with brass or bronze screw plugs. Provide cleanouts in resilient tile floors and ceramic tile floors with square top covers recessed for tile insertion. Furnish nickel-bronze square frame and cover with minimum opening of 6" by 6" at each wall cleanout. In horizontal runs above grade, cleanouts shall consist of cast brass screw plug-in fitting or in caulk cast iron ferrule.

Floor Drains shall have 6" diameter, adjustable, nickel-plated brass strainer, cast iron body, caulking flange for connection to cast iron pipe, screwed outlets for connection to steel pipe, and side outlet. Provide suitable clamping device and extensions if required, where installed in connection with waterproofing membrane. Submit detailed shop drawings of these drains. Do not puncture membrane other than for drain opening. Double drainage pattern floor drains

shall have integral seepage pan for embedding in floor construction, and weep holes to provide adequate drainage from pan to drain pipe.

Traps for floor drains shall incorporate a method for keeping the trap full or primed, or other method to prevent sewer gasses escaping into the space.

Traps shall be heavy-duty type.

END SECTION

22 06 00 Schedules for Plumbing
22 06 10 Schedules for Plumbing Piping and Pumps
22 06 10.13 Plumbing Pump Schedule
22 06 12 Schedules for Facility Potable Water Storage
22 06 15 Schedules for General Service Compressed Air Equipment
22 06 30 Schedules for Plumbing Equipment
22 06 30.13 Domestic Water Heater Schedule
22 06 40 Schedules for Plumbing Fixtures
22 06 40.13 Plumbing Fixture Schedule
22 06 50 Schedules For Pool and Fountain Plumbing Systems
22 06 60 Schedules For Laboratory and Healthcare Systems

SECTION 22 07 00
PLUMBING INSULATION

22 07 16 Plumbing Equipment Insulation

SECTION 22 07 19
PLUMBING PIPING INSULATION

CONSULTANT DESIGN GUIDELINE

Pipe insulation thickness shall be ½":

Roof drainpipe insulation shall be pre-formed fiberglass with "K" value of 0.24 at 100°F mean temperature. Insulation shall have "All Service Jacket" (ASJ).

Domestic water piping insulation shall be either fiberglass as specified above or it shall be closed cell foamed polyolefin. "K" value shall be 0.26 maximum.

All pipe insulation shall comply with FHC 25/50 per ASTM E84, NFPA 255 and UL 723 surface

burning characteristics. Water vapor permeance shall be 0.02 perms, maximum.

END SECTION

22 08 00 Commissioning of Plumbing
22 09 00 Instrumentation and Control for Plumbing

22 10 00 PLUMBING PIPING AND PUMPS

SECTION 22 11 00
FACILITY WATER DISTRIBUTION

CONSULTANT DESIGN GUIDELINE

Exterior Hose Bibbs: In all new buildings, provide exterior freeze proof hose bibbs to provide for building perimeter landscape watering. Height should be 18" off finished grade.

Hose bibbs shall have integral vacuum breaker and loose key handle. Brass casting shall have chrome finish.

Water Supply Lines. Water supply lines to each building should be of size and capacity to install present or future fire sprinkler systems. Normally parallel lines are required. If doing new installation or upgrade, check with owner to see if a parallel line should be installed to serve as a future fire line.

SECTION 22 11 13
FACILITY WATER DISTRIBUTION PIPING

CONSULTANT DESIGN GUIDELINE

Adhere to all plumbing code requirements -
Copper tubing above grade shall be type "L" hard drawn copper tubing with wrought copper solder-joint fittings.

Copper tubing below grade outside the building shall be type “K” hard drawn copper solder-joint fittings. All copper tubing installed in concrete slabs or in earth inside the building lines should be type ”K” soft drawn copper tubing with all joints made above grade.

Specify all cast iron soil pipe 6” and smaller installed above grade for drainage to be a hubless cast iron pipe as approved in the Hubless Cast Iron Soil Pipe Institute Standards 301-67T.

Specify all cast iron soil pipe 8” and larger and all sizes installed in earth used for drainage to be centrifugally cast service weight bell and spigot cast iron pipe, coated inside and outside with coal varnish, smooth inside, with outer and inner surfaces concentric, sound and free from defects.

Specify all fittings for cast iron soil pipe to be coated cast iron soil pipe fittings of the same diameter as the pipe with which they are used and of equal quality and weight throughout.

Rough-in piping for water closets shall be 4”.

Facility Water Distribution Piping will follow the Arkansas Plumbing Code with the exception that concrete pipe and vitrified clay pipe will not be allowed for sewer pipe.

END SECTION

SECTION 22 11 16
DOMESTIC WATER PIPING

INCLUDE IN CONSTRUCTION DOCUMENTS

Exterior domestic water pipe 4" and larger shall be class 50 ductile iron with mechanical joints. Pipe 3" and smaller shall be type K or L drawn copper with "Sil-fos" soldered joints. All pipe located in easements shall be installed in compliance with City of Fayetteville specifications.

Interior domestic water piping below floor slab shall be type K soft drawn copper. Interior domestic water piping above floor slab shall be type L hard drawn copper. Flexible, bellows type, or vinyl-coated tubing not permitted.

Solder shall be composition Sb5, "Sil-fos.” Provide non-corrosive flux.

Brazing alloy shall be silver, AWS A5.8, Classification BCuP-3, BCup-4, or BCuP-5.

END SECTION

22 11 19 Domestic Water Piping Specialties

SECTION 22 11 23
DOMESTIC WATER PUMPS

CONSULTANT DESIGN GUIDELINES

Minimum domestic water pressure on the top floor of buildings shall be 45 PSIG. Install a domestic water pressure booster system as needed to provide the required pressure at the expected flow demand. In calculating head, figure water pressure drop through the backflow preventer to be 20 feet (9 PSIG).

INCLUDE IN CONSTRUCTION DOCUMENTS

Connect to Metasys for time scheduling control.

System shall have vertical bladder type tank rated for 150 PSIG service.

Plumb system with schedule 40 copperpipe. Unions or flanges shall provide a single point of connection to the building's water piping.

System shall have a check valve and isolation valves.

Power and control panel shall be UL listed and shall have a NEMA 1 cabinet. Panel will provide single point of connection for pump system. Controls will alternate service between the two pumps. Controls will include a transformer, pump run indicator, low suction alarm, and H-O-A selector. Provide system with starters with 3-leg overload protection.

System manufactured by Tiger Flow or Facilities Management approved equal.

EXECUTION

Pumpsshall anchored to a 3½" concrete housekeeping pad.

END SECTION

22 11 23.13Domestic Water Packaged Booster Pumps
22 11 23.23 Close Coupled, In-Line, Sealless Centrifugal Domestic Water Pumps
22 11 23.26 Close Coupled, Horizontally Mounted, In-Line Centrifugal Domestic Water Pumps
22 11 23.29 Close Coupled, Vertically Mounted, In-Line Centrifugal Domestic Water Pumps
22 11 23.33 Separately Coupled, In-Line Centrifugal Domestic Water Pumps
22 11 23.36 Separately Coupled, Horizontally Mounted, In-Line Centrifugal Domestic Water Pumps

22 12 00 Facility Potable Water Storage Tanks

22 12 13 Facility Roof Mounted, Potable Water Storage Tanks
22 12 16 Facility Elevated, Potable Water Storage Tanks
22 12 19 Facility Ground Mounted, Potable Water Storage Tanks
22 12 23 Facility Indoor Potable Water Storage Tanks
- 22 12 23.13 Facility Steel, Indoor Potable Water Storage Pressure Tanks
- 22 12 23.16 Facility Steel, Indoor Potable Water Storage Non-Pressure Tanks
- 22 12 23.23 Facility Plastic, Indoor Potable Water Storage Pressure Tanks
- 22 12 23.26 Facility Plastic, Indoor Potable Water Storage Non-Pressure Tank

22 13 00 Facility Sanitary Sewage
22 13 13 Facility Sanitary Sewers

CONSULTANT DESIGN GUIDELINE

All mechanical room floor drains and sumps serving building functions including elevator pits shall discharge to sanitary sewers. A separate sump pump system should be designed to handle footing drains or other rainwater disposal to the storm water system.

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

CONSULTANT DESIGN GUIDELINE

All waste pipes downstream of a water closet shall be 4", minimum.

All waste pipe, fittings, and glands shall be by one manufacturer.

Polypropylene "blue plastic" acid waste pipe joints shall be fused by manufacturer approved methods rather than be joined by mechanical fittings. Mechanical fittings will be acceptable for silicon impregnated cast iron (Duriron) pipe.

Waste and vent piping, both inside and outside the building, shall be service weight, hub and spigot cast iron soil pipe and fittings. Plain end (no-hub) pipe may be used to connect branch pipes to existing waste pipes inside the building; it may also be used for vent piping at Plumbing Contractor's option. Prior to use of no-hub pipe, the Plumbing Contractor shall obtain approval from the designer and Facilities Management. PVC or other plastic pipe may be acceptable in certain circumstances with approval of Facilities Management.

Piping slopes shall conform to the Arkansas Plumbing Code section 703& 704.

Per Standard Plumbing Code, only route waste from pot sinks and the floor drain nearest pot sinks to the grease interceptor. Do not permit waste from any other fixtures to flow through the grease interceptor unless the local authority having jurisdiction gives specific written instructions to do so.

Cleanouts shall be easily accessible. Provide a minimum of 24" clearance for rodding. In carpeted areas, use cleanout cover as a template to cut the carpet. Bond the carpet to the

cleanout cover with carpet adhesive and install carpet marker in cleanout cover. Provide cleanouts at base of vertical stacks with cleanout plug located approximately 30" above floor. Extend cleanouts to wall access cover. Cleanouts shall consist of sanitary tees.

Vent all floor drains.

END SECTION

22 13 19 Sanitary Waste Piping Specialties
- 22 13 19.13 Sanitary Drains
- 22 13 19.23 Fats, Oils, and Grease Disposal Systems
- 22 13 19.26 Grease Removal Devices
- 22 13 19.33 Backwater Valves
- 22 13 19.36 Air Admittance Valves

22 13 23 Sanitary Waste Interceptors
22 13 26 Sanitary Waste Separators
22 13 29 Sanitary Sewerage Pumps
- 22 13 29.13Wet Pit-Mounted, Vertical Sewerage Pumps
- 22 13 29.16 Submersible Sewerage Pumps
- 22 13 29.23 Sewerage Pump Reverse-Flow Assemblies
- 22 13 29.33 Sewerage Pump Basins and Pits

22 13 33 Packaged, Submersible Sewerage Pump Units
22 13 36 Packaged, Wastewater Pump Units
22 13 43 Facility Packaged Sewage Pumping Stations
- 22 13 43.13 Facility Dry-Well Packaged Sewage Pumping Stations
- 22 13 43.16 facility Wet-Well Packaged Sewage Pumping Stations

22 14 00 Facility Storm Drainage

SECTION 22 14 13
FACILITY STORM DRAINAGE PIPING

CONSULTANT DESIGN GUIDE

Above-grade storm drain piping shall be cast iron bell and spigot or no-hub. Contractor has the option to use insulation wrapped PVC if insulation is sufficient to improve its flame spread rating to a level that is acceptable to all codes and local authorities having jurisdiction.

Below-grade storm drain piping shall be PVC.

END SECTION

22 14 16 Rainwater Leaders
22 14 19 Sump Pump Discharge Piping
22 14 23 Storm Drainage Piping Specialties

SECTION 22 14 26
FACILITY STORM DRAINS

22 14 26.13 Roof Drains

CONSULTANT DESIGN GUIDELINE

On flat roofs, provide one 4" roof drain per 1800 square feet. Consolidate drains as needed and size pipe to comply with 4" rainfall per hour tables.

Roof drains shall be cast iron with flange, flashing ring, gravel stop, and galvanized cast iron dome. Secure dome to body in order to be vandal resistant.

END SECTION

22 14 26.16 Facility Area Drains
22 24 26.19 Facility Area Trench Drains
22 14 29 Sump Pumps
22 14 29.13 Wet Pit-Mounted, Vertical Sump Pumps
22 14 29.16 Submersible Sump Pumps
22 14 29.19 Sump Pump Basins and Pits
22 14 33 Packaged, Pedestal Drainage Pump Units
22 14 36 Packaged, Submersible, Drainage Pump Units

22 15 00 General Service Compressed Air Systems
22 15 13 General Service Compressed Air Piping
22 15 16 General Service Compressed Air Valves
22 15 19 General Service Packaged Air Compressors and Receivers
22 15 19.13 General Service Packaged Reciprocating Air Compressors
22 15 19.16 General Service Packaged Liquid-Ring Air Compressors
22 15 19.19 General Service Packaged Rotary-Screw Air Compressors
22 15 19.23 General Service Packaged Sliding-Vane Air Compressors

SECTION 22 30 00PLUMBING EQUIPMENT

22 31 00 Domestic Water Softeners
22 31 13 Residential Domestic Water Softeners
22 31 16 Commercial Domestic Water Softeners

22 32 00 Domestic Water Filtration Equipment
22 32 13 Domestic Water Bag-Type Filters
22 32 16 Domestic Water Freestanding Cartridge Filters
22 32 19 Domestic Water Off-Floor Cartridge Filters

22 32 23 Domestic Water Carbon Filters
22 32 26 Domestic Water Sand Filters
22 32 26.13 Domestic Water Circulating Sand Filters
22 32 26.16 Domestic Water Multimedia Sand Filters
22 32 26.19 Domestic Water Greensand Filters

22 33 00 Electric Domestic Water Heaters

CONSULTANT DESIGN GUIDELINE

1.0 **Domestic Water Heating Equipment**

1.01 Locations: Domestic water heating equipment including water heaters, domestic hot water return pumps, and tempering valves shall be located in a mechanical room.

1.02 General: Domestic hot water systems shall use central water heating equipment with recirculation. Water heaters shall be steam-fired. Domestic hot water shall be generated and stored at a minimum temperature of 140 deg. F.

1.03 On buildings with electric tanks, provide a contactor wired to Metsys so that the tank can be time scheduled for UNOCC periods as well as for demand load control.

1.04 Acceptable Manufacturers

1.04.01 Water Heaters: Acceptable manufacturers for storage type water heaters are Armstrong or approved equal. Acceptable manufacturers for instantaneous water heaters are Aerco, P-K, and Leslie.

1.04.02 Tempering Valves: Acceptable manufacturers of tempering valves are Holby, Leslie, and Powers.

1.04.03 Domestic Hot Water Return Pumps: Acceptable manufacturers of domestic hot water return pumps are PACO, TACO, Grundfos, Bell & Gossett, Armstrong, Peerless, and Aurora.

1.05 Water Heating Equipment:

1.05.01 General: Waters may be of the storage type or instantaneous type depending upon the specific application.

1.05.02 Storage Type: Storage type water heaters shall be horizontal or vertical storage tanks with steam tube bundles. Recovery rates shall be determined in accordance with standard engineering practice based upon the number and type of fixtures and the selected storage tank volume. Storage type water heaters shall be selected to provide the design recovery rate using 2 psig saturated steam with 60 deg. F entering domestic cold water and 140 deg. F domestic hot water.

1.05.03 Instantaneous Water Heaters: If sufficient space is not available for a storage tank, water heaters may be of the steam-fired instantaneous type without storage. Recovery rates shall be determined in accordance with standard engineering practice based upon the number and type of fixtures. Instantaneous water heaters shall be selected to provide the design

recovery rate using 50 psig saturated steam with 60 deg. F entering domestic cold water and 140 deg. F domestic hot water.

1.06 Return Pumps: Temperature maintenance in domestic hot water systems shall be provided by recirculation. Each system shall utilize two (2) pumps. Each pump shall be capable of providing the design recirculation flow rate. The design recirculation flow rate shall be calculated based upon the expected system heat loss with 110 deg. F domestic hot water supply temperature and 100 deg. F domestic hot water return temperature. Domestic hot water return pumps shall be vertical in-line pumps with close-coupled motors.

1.07 Tempering Valves: Tempering valves shall be used to blend 140 deg. F domestic hot water from the water heater with recirculated domestic hot water and domestic cold water to produce 110 deg. F domestic hot water for the building fixtures. Each domestic hot water system shall utilize two (2) tempering valves. Each valve shall be capable of accommodating the design domestic hot water system flow rate. Tempering valves shall be of the self-contained type.

1.08 Special Applications: In special applications requiring domestic hot water supply temperatures in excess of 110 deg. F such as a commercial kitchen, domestic hot water system shall include separate recirculation systems for each water supply temperature (140 deg. F and 110 deg. F, for example). Recirculation piping shall be carefully designed such that higher temperature returns and lower temperature returns are each connected to the water heater in the correct location. Lower temperature returns must be connected such that the lower temperature return water and the make-up water are connected both to the water heater and cold water inlets of the lower temperature tempering valves without first mixing with the higher temperature returns.

1.09 Sequences of Operation

1.09.01 General: Domestic hot water system sequences of operation shall be in accordance with the standard system control diagrams included in the UAF IDIQ contract for automatic temperature controls.

1.09.02 Water Heater: Steam control valve shall be modulated as required to maintain the domestic hot water supply temperature at the discharge of the storage tank at 140 deg. F. Steam valve control shall be overridden as required to prevent the domestic hot water supply temperature to the fixtures from exceeding 120 deg. F[1].

1.09.03 Tempering Valves: Tempering valves shall mix 140 deg. F domestic hot water from the water heater with cold water and recirculated water as required to maintain the domestic hot water supply temperature to the fixtures at 110 deg. F.

1.09.04 Domestic Hot Water Return Pumps: Domestic hot water return pumps shall be sequenced in a lead-standby manner. Lead pump shall typically be in operation at all times. In the event of a lead pump failure, standby pump shall be automatically started and operated. Lead and standby pumps shall be automatically alternated on a regular basis to equalize wear.

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[1] This feature provides a safeguard from elevated domestic hot water supply temperatures to the building fixtures caused by a tempering valve failure.

1.09.05 Domestic Hot Water Return Control Valves: Domestic hot water return control valves shall be modulated as required to maintain the domestic hot water return temperature at setpoint of 100 deg. F.

1.10 Sample Water Heating Equipment Schedules: Refer to Appendix F for sample water heater and domestic hot water return pump schedules.

1.11 Sample Water Heating Equipment Specifications: Refer to Appendix J for sample water heating equipment specifications including water heater, tempering valves, and domestic hot water return pump.

1.12 Sample Water Heating System Piping Diagram: Refer to Appendix H for sample water heating system piping diagrams (standard and dual temperature systems).

1.13 Sample Water Heating System Details: Refer to Appendix I for sample water heating system details including water heater, domestic hot water return pump, tempering valve, and domestic hot water return control valve.

22 33 13 Instantaneous Electric Domestic Water Heaters
22 33 13.13 Flow Control, Instantaneous Electric Domestic Water Heaters
22 33 13.16 Thermostat Control, Instantaneous Electric Domestic Water Heaters
22 33 30 Residential, Electric Domestic Water Heaters
22 33 30.13 Residential, Small Capacity Electric domestic Water Heaters
22 33 30.16 Residential, Storage Electric Domestic Water Heaters
22 33 30.23 Residential, Collector-to-Tank, Solar Electric Domestic Water Heaters
22 33 30.26 Residential, Collector-to-Tank, Heat Exchanger Coil, Solar Electric Domestic Water Heaters
22 33 33 Light Commercial Electric Domestic Water Heaters

CONSULTANT DESIGN GUIDELINE

Acceptable manufacturer is Marathon or approved equal.

22 33 36 Commercial Domestic Water Electric Booster Heaters
22 33 36.13 Commercial Domestic Water Electric Booster Heaters
22 33 36.16 Commercial Storage Electric domestic Water Heaters

CONSULTANT DESIGN GUIDELINE

Acceptable manufacturer is Marathon or approved equal.

22 34 00 Fuel Fired Domestic Water Heaters

CONSULTANT DESIGN GUIDELINE

2.0 Domestic Water Heating Equipment

2.01 Locations: Domestic water heating equipment including water heaters, domestic hot water return pumps, and tempering valves shall be located in a mechanical room.

2.02 General: Domestic hot water systems shall use central water heating equipment with recirculation. Water heaters shall be steam-fired. Domestic hot water shall be generated and stored at a minimum temperature of 140 deg. F.

2.03 Acceptable Manufacturers

2.03.01 Water Heaters: Acceptable manufacturers for storage type water heaters are Armstrong or approved equal. If gas, acceptable manufacturers are Bradford White or Lochinvar. Acceptable manufacturers for instantaneous water heaters are Aerco, P-K, and Leslie.

2.03.02 Tempering Valves: Acceptable manufacturers of tempering valves are Holby, Leslie, and Powers.

2.03.03 Domestic Hot Water Return Pumps: Acceptable manufacturers of domestic hot water return pumps are PACO, TACO, Grundfos, Bell & Gossett, Armstrong, Peerless, and Aurora.

2.04 Water Heating Equipment:

2.04.01 General: Waters may be of the storage type or instantaneous type depending upon the specific application.

2.04.02 Storage Type: Storage type water heaters shall be horizontal or vertical storage tanks with steam tube bundles. Recovery rates shall be determined in accordance with standard engineering practice based upon the number and type of fixtures and the selected storage tank volume. Storage type water heaters shall be selected to provide the design recovery rate using 2 psig saturated steam with 60 deg. F entering domestic cold water and 140 deg. F domestic hot water.

2.04.03 Instantaneous Water Heaters: If sufficient space is not available for a storage tank, water heaters may be of the steam-fired instantaneous type without storage. Recovery rates shall be determined in accordance with standard engineering practice based upon the number and type of fixtures. Instantaneous water heaters shall be selected to provide the design recovery rate using 50 psig saturated steam with 60 deg. F entering domestic cold water and 140 deg. F domestic hot water.

2.05 Return Pumps: Temperature maintenance in domestic hot water systems shall be provided by recirculation. Each system shall utilize two (2) pumps. Each pump shall be capable of providing the design recirculation flow rate. The design recirculation flow rate shall be calculated based upon the expected system heat loss with 110 deg. F domestic hot water supply temperature and 100 deg. F domestic hot water return temperature. Domestic hot water return pumps shall be vertical in-line pumps with close-coupled motors.

2.06 Tempering Valves: Tempering valves shall be used to blend 140 deg. F domestic hot water from the water heater with recirculated domestic hot water and domestic cold water to produce 110 deg. F domestic hot water for the building fixtures. Each domestic hot water system shall utilize two (2) tempering valves. Each valve shall be capable of accommodating the design domestic hot water system flow rate. Tempering valves shall be of the self-contained type.

2.07 Domestic Hot Water Return Control Valves: Domestic hot water return balancing shall be provided by automatic control valves and temperature sensors located on each floor. Domestic hot water return control valves shall be of the 2-way type with modulating electronic actuators. Domestic hot water return control valves shall be designed for the appropriate flow rate[2] and a maximum water pressure drop of 5 psig.

2.08 Special Applications: In special applications requiring domestic hot water supply temperatures in excess of 110 deg. F such as a commercial kitchen, domestic hot water system shall include separate recirculation systems for each water supply temperature (140 deg. F and 110 deg. F, for example). Recirculation piping shall be carefully designed such that higher temperature returns and lower temperature returns are each connected to the water heater in the correct location. Lower temperature returns must be connected such that the lower temperature return water and the make-up water are connected both to the water heater and cold water inlets of the lower temperature tempering valves without first mixing with the higher temperature returns.

2.09 Sequences of Operation

2.09.01 General: Domestic hot water system sequences of operation shall be in accordance with the standard system control diagrams included in the UAF IDIQ contract for automatic temperature controls.

2.09.02 Water Heater: Steam control valve shall be modulated as required to maintain the domestic hot water supply temperature at the discharge of the storage tank at 140 deg. F. Steam valve control shall be overridden as required to prevent the domestic hot water supply temperature to the fixtures from exceeding 120 deg. F[3].

2.09.03 Tempering Valves: Tempering valves shall mix 140 deg. F domestic hot water from the water heater with cold water and recirculated water as required to maintain the domestic hot water supply temperature to the fixtures at 110 deg. F.

2.09.04 Domestic Hot Water Return Pumps: Domestic hot water return pumps shall be sequenced in a lead-standby manner. Lead pump shall typically be in operation at all times. In the event of a lead pump failure, standby pump shall be automatically started and operated. Lead and standby pumps shall be automatically alternated on a regular basis to equalize wear.

2.09.05 Domestic Hot Water Return Control Valves: Domestic hot water return control valves shall be modulated as required to maintain the domestic hot water return temperature at setpoint of 100 deg. F.

2.10 Sample Water Heating Equipment Schedules: Refer to Appendix F for sample water heater and domestic hot water return pump schedules.

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[2] Domestic hot water return flow rates shall be calculated based upon the piping heat loss and a 10 deg. F ΔT.

[3] This feature provides a safeguard from elevated domestic hot water supply temperatures to the building fixtures caused by a tempering valve failure.

2.11 Sample Water Heating Equipment Specifications: Refer to Appendix J for sample water heating equipment specifications including water heater, tempering valves, and domestic hot water return pump.

2.12 Sample Water Heating System Piping Diagram: Refer to Appendix H for sample water heating system piping diagrams (standard and dual temperature systems).

2.13 Sample Water Heating System Details: Refer to Appendix I for sample water heating system details including water heater, domestic hot water return pump, tempering valve, and domestic hot water return control valve.

22 34 13 Instantaneous, Tankless, Gas Domestic Water Heaters
22 34 30 Residential Gas Domestic Water Heaters
- 22 34 30.13 Residential, Atmospheric, Gas Domestic Water Heaters
- 22 34 30.16 Residential, Direct Vent, Gas Domestic Water Heaters
- 22 34 30.19 Residential, Power Vent, Gas Domestic Water Heaters

22 34 36 Commercial Gas Domestic Water Heaters
- 22 32 36.13 Commercial, Atmospheric, Gas Domestic Water Heaters
- 22 32 36.16 Commercial, Power Burner, Gas Domestic Water Heaters
- 22 32 36.19 Commercial, Power Vent, Gas Domestic Water Heaters
- 22 32 36.23 Commercial, High Efficiency, Gas Domestic Water Heaters
- 22 32 36.26 Commercial, Coil Type, Finned Tube, Gas Domestic Water Heaters
- 22 32 36.29 Commercial, Grid Type, Finned Tube, Gas Domestic Water Heaters

22 34 46 Oil Fired Domestic Water Heaters
- 22 32 46.13 Large Capacity, Oil Fired, Domestic Water Heaters

22 34 56 Dual Fuel Fired Domestic Water Heaters

22 35 00
DOMESTIC WATER HEAT EXCHANGERS

WATER HEATERS

CONSULTANT DESIGN GUIDELINE

Where possible, use a shell-in-tube heat exchanger and tank to generate domestic hot water. Step tube bundle's steam pressure down to five (5) PSIG.

Limit domestic water discharge temperature to 110°F in order to avoid potential liabilities from scalding. If water hotter than 110° is needed for a particular application, use point-of-use booster heaters.

In the event central utility's steam is not available, use a gas-fired water heater.

In the event the application is an isolated single fixture such as a lavatory, use an instantaneous, tankless, electric water heater.

Design a hot water return system where domestic hot water pipe exceeds 30' in length.

INCLUDE IN CONSTRUCTION DOCUMENTS

Gas fired water heaters will be commercial/industrial grade with a 10-year warranty.

EXECUTION

Install water heater tanks on a concrete pad. Install horizontal tank with a pair of saddles.

END SECTION

22 35 13 Instantaneous Domestic Water Heat Exchangers
- 22 35 13.13 Heating Fluid-in-Coil, Instantaneous Domestic Water Heat Exchangers
- 22 35 13.16 Domestic Water-in-Coil, Instantaneous Domestic Water Heat Exchangers
- 22 35 13.19 Heating-Fluid-in-U-Tube-Coil, Instantaneous Domestic Water Heat Exchangers

22 35 23 Circulating, Domestic Water Heat Exchangers
- 22 35 23.13 Circulating, Compact Domestic Water Heat Exchangers
- 22 35 23.16 Circulating, Storage Domestic Water Heat Exchangers

22 35 29 Noncirculating, Domestic Water Heat Exchangers
- 22 35 29.13 Noncirculating, Compact Domestic Water Heat Exchangers
- 22 35 29.16 Noncirculating, Storage Domestic Water Heat Exchangers

22 35 36 Domestic Water Brazed Plate Heat Exchangers
22 35 39 Domestic Water Frame-and-Plate Heat Exchangers
22 35 43 Domestic Water Heat Reclaimers

SECTION 22 40 00
PLUMBING FIXTURES

CONSULTANT DESIGN GUIDELINE

Die-cast zinc alloy, plastic, or painted trim shall not be accepted. Faucets manufactured by Chicago, T&S, or of the same manufacturer as the respective fixture. Traps and tailpieces manufactured by Chicago, McGuire, T&S, or of the same manufacturer as the respective fixture.

Plumbing fixtures designated as "disabled" shall comply with the AMERICANS WITH DISABILITIES ACT (ADA) of 1990.

INCLUDE IN THE CONSTRUCTION DOCUMENTS

Water closets intended for disabled use shall have elongated bowl and 18" rim height.

Urinals intended for disabled use shall have elongated rim.

Lavatories and sinks intended for disabled use shall have "gooseneck" faucet with paddle type handles. Use carriers to mount elongated lavatories in toilets having stud walls.

Provide lock-shield loose key or screwdriver pattern angle stops, or stops integral with faucet, with each compression type faucet, including sinks in wood and metal casework. Locate stops centrally above or below fixture in accessible location. Furnish keys for lock shield stops to Facilities Management.

Escutcheons shall be heavy type, chrome plated, with setscrews.

Where water closet, lavatory, or sink installation is back-to-back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers.

The following are specifications for water conservation fixtures:

- Lavatory sinks with 1/2 gallon per minute vandal proof spray moderators.

  Kitchen sinks with 1.5 gallon per minute vandal proof laminar flow moderators.
- Elongated bowl wall-mounted water closets with 1.6 gpf flushometers.
- Wall-mounted urinals 1/8 gpf flushometers

Water closets shall be white vitreous china and elongated bowl. Seats shall be white, solid molded plastic, elongated bowl, open frontless, without lid. Hinges and posts shall be either chromium plated copper alloy or plastic covered steel. Water closet fittings and accessories shall include bolts with ceramic nut covers. Flush valve type fixtures shall have Sloan, Delany, or equal flush valves mounted 11½" above rim. Seat bumpers shall be integral part of flush valve. Fixtures shall be American Standard, Crane, Eljer, or Facilities Management approved equal. Wall mounted toilets preferred.

Urinals shall be white vitreous china with flushing rim, and 1¼" inlet spud. Urinals shall have integral trap. Urinals that require exposed P-traps are not accepted. Fixtures shall be American Standard, Crane, Eljer, or Facilities Management approved equal. Flush valves shall be Delany, Sloan, Zurn, or Facilities Management approved equal. Exposed mounting nuts shall be chrome-plated cap.

Lavatory fixtures shall be white vitreous china. Support wall hung lavatories to wall with steel wall plate. Vanity type lavatories shall be oval shaped self-rimming. Faucets shall be cast or wrought brass, combination faucet with replaceable seat and centrally exposed spout. Provide laminar flow control device to limit faucet discharge to two (2) GPM. Control shall be integral with faucet. Use cast handles on faucets, formed or drop forged brass. Faucet, wall, and floor escutcheons shall have a smooth bright finish. Drains will be stationary. Pop-up drains are not acceptable. Strainer and tailpiece shall have bright finish. Stops shall be lock shield, loose key, angle with copper alloy control valve bodies, stems and gland nuts. Traps shall be 1¼" by 1½", 17 gauge cast brass P-trap, adjustable with connected elbow and nipple to wall. Exposed metal trap surfaces, plugs, and connection hardware shall be chromium plated with a smooth bright finish. Fixtures shall be American Standard, Crane, Eljer, or Facilities Management approved equal.

Mop basin shall be floor mounted with 8" minimum curb height. Minimum dimensions shall be

24" x 24". Mop hangers(two) shall be mounted on the wall high enough to allow the mops to drain into the basin and the mop hangs three inches from the wall. Fixture may be either fiberglass or enameled cast iron at Designer's option. Mop basin shall have 3" drain with strainer. Faucet shall have top brace, 4-foot hose, and integral vacuum breaker. Enameled cast iron type fixtures shall have vinyl coated rim guard. Fixtures shall be American Standard, Crane, Eljer, Fiat, Williams, or Facilities Management approved equal.

Sinks shall be 18-gauge minimum seamless stainless steel, self-rimming type with coated underside, 3½" drain opening and brushed satin finish. All sinks shall have only three faucet holes unless noted otherwise on drawings. Due to excessive maintenance, spray hose attachments are not acceptable. Due to difficulties in installing sinks in standard cabinets that have both a backsplash board and an overhanging countertop ledge, all sinks will have a front-to-back dimension of not greater than 19½". Faucets cast or wrought brass, combination faucet with replaceable seats and pivotal spout. Faucet will have smooth chrome plated finish. Stops will be loose key angle type with brass control valve bodies, stems, and gland nuts. Stop and escutcheons will have chrome plated finish. Traps will be 1½, 17 gauge cast brass P-trap. Traps, plugs, connection hardware, and escutcheons will have smooth chrome plated finish. Fixtures will be Elkay, Just, or Facilities Management approved equal.

END SECTION

22 41 00 Residential Plumbing Fixtures
22 41 13 Residential Water Closets, Urinals, and Bidets
22 41 16 Residential Lavatories and Sinks
22 41 19 Residential Bathtubs
22 41 23 Residential Shower Receptors and Basins
22 41 26 Residential Disposers
22 41 36 Residential Laundry Trays

22 42 00 Commercial Plumbing Fixtures
22 42 13 Commercial Water Closets, Urinals, and Bidets
22 42 16 Commercial Lavatories and Sinks
22 42 19 Commercial Bathtubs
22 42 23 Commercial Shower Receptors and Basins
22 42 26 Commercial Disposers
22 42 29 Shampoo Bowls
22 42 33 Wash Fountains
22 42 36 Commercial Laundry Trays
22 42 39 Commercial Faucets, Supplies, and Trim
22 42 43 Flushometers

22 43 00 Healthcare Plumbing Fixtures
22 43 13 Healthcare Water Closets
22 43 16 Healthcare Sinks

22 43 19 Healthcare Bathtubs and Showers
22 43 23 Healthcare Shower Receptors and Basins
22 43 39 Healthcare Faucets
22 43 43 Healthcare Plumbing Fixture Flushometers

22 45 00 Emergency Plumbing Fixtures

SECTION 22 45 13
EMERGENCY SHOWERS

CONSULTANT DESIGN GUIDELINE

Emergency showers shall be combination units with drench shower and eyewash. Shower shall have plastic head and stay-open, chrome-plated brass ball valve activated by a stainless steel pull rod. Eyewash shall have plastic bowl, soft plastic heads, and chrome plated stay open brass ball valve with paddle handle. Eyewash shall be pressure compensated to provide steady flow under varying water pressure conditions. Eyewash heads shall have dust covers that automatically release when valve is actuated. Fixture manufacturer shall be Guardian, Haws, or Facilities Management approved equal.

END SECTION

22 45 16 Eyewash Equipment
22 45 19 Self-Contained Eyewash Equipment
22 45 23 Personal Eyewash Equipment
22 45 26 Eye/Face Wash Equipment
22 45 29 Hand-Held Emergency Drench Hoses
22 45 33 Combination Emergency Fixture Units
22 45 36 Emergency Fixture Water-Tempering Equipment

22 46 00 Security Plumbing Fixtures
22 46 13 Security Water Closets and Urinals
22 46 16 Security Lavatories and Sinks
22 46 39 Security Faucets, Supplies, and Trim
22 46 43 Security Plumbing Fixture Flushometers
22 46 53 Security Plumbing Fixture Supports

SECTION 22 47 00
DRINKING FOUNTAINS AND WATER COOLERS

CONSULTANT DESIGN GUIDELINE

Architect will select type of electric water cooler (surface mounted, partially recessed, etc.) for compatibility with the architecture. Stops shall be loose key angle type with brass control valve body, stem, and gland nut. Traps will be 1¼", 20 gauge cast brass P-trap with chrome plated finish. Fixtures will be Elkay, Halsey-Taylor, Haws, Oasis, or Facilities Management approved equal.

Water bottle filling capability should be considered in the selection of drinking fountains, especially at high student traffic areas. Please confer with Facilities Management.

END SECTION

22 47 13 Drinking Fountains
22 47 16 Pressure Water Coolers
22 47 19 Water Station Water Coolers
22 47 23 Remote Water Coolers

22 50 00 POOL AND FOUNTAIN PLUMBING SYSTEMS

CONSULTANT DESIGN GUIDELINE

Route drains to sanitary sewer.

22 51 00 Swimming Pool Plumbing Systems
22 51 13 Swimming Pool Piping
22 51 16 Swimming Pool Pumps
22 51 19 Swimming Pool Water Treatment Equipment
22 51 23 Swimming Pool Equipment Controls

22 52 00 Fountain Plumbing Systems
22 52 13 Fountain Piping
22 52 16 Fountain Pumps
22 52 19 Fountain Water Treatment Equipment
22 52 23 Fountain Equipment Controls

22 60 00 GAS VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES
22 61 00 Compressed-Air Systems for Laboratory and Healthcare Facilities

22 61 13 Compressed-Air Piping for Laboratory and Healthcare Facilities
22 61 13.53 Laboratory Compressed-Air Piping
22 61 13.70 Healthcare Compressed-Air Piping

22 61 13.74 Dental Compressed –Air Piping

22 61 19 Compressed-Air Equipment for Laboratory and Healthcare Facilities
22 61 19.53 Laboratory Compressed-Air Equipment
22 61 19.70 Healthcare Compressed-Air Equipment
22 61 19.74 Dental Compressed-Air Equipment

22 62 00 Vacuum Systems for Laboratory and Healthcare Facilities
22 62 13 Vacuum Piping for Laboratory and Healthcare Facilities
22 62 13.53 Laboratory Vacuum Piping
22 62 13.70 Healthcare, Surgical Vacuum Piping
22 62 13.74 Dental Vacuum Piping
22 62 19 Vacuum Equipment for Laboratory and Healthcare Facilities
22 62 19 .53 Laboratory Vacuum Equipment
22 62 19.70 Healthcare Vacuum Equipment
22 62 19.74 Dental Vacuum and Evacuation Equipment
22 62 23 Waste Anesthesia-Gas Piping

22 63 00 Gas Systems for Laboratory and Healthcare Facilities

CONSULTANT DESIGN GUIDELINE

EXECUTION
Install unions, shut off cocks, and dirt legs on all natural gas piping at all gas fired appliances and equipment. Where the gas pipe is manifold to serve a group of appliances, a single dirt leg installed at the bottom of the drop to the manifold is acceptable.

END OF SECTION

22 63 13 Gas Piping for Laboratory and Healthcare Facilities
22 63 13.53 Laboratory Gas Piping
22 63 13.70 Healthcare Gas Piping
22 63 19 Gas Storage Tanks for Laboratory and Healthcare Facilities
22 63 19.53 Laboratory Gas Storage Tanks
22.63 19.70 Healthcare Gas Storage Tanks

22 66 00 Chemical-Waste Systems for Laboratory and Healthcare Facilities

CONSULTANT DESIGN GUIDELINE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall piping.
2. Piping specialties.

INCLUDE IN CONSTRUCTION DOCUMENTS

1.3 PERFORMANCE REQUIREMENTS

A. Single-Wall Piping Pressure Rating: 10 feet head of water.

1.4 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SINGLE-WALL PIPE AND FITTINGS

A. CPVC Drainage Pipe and Fittings: ASTM D1784.

1. Material: Special drainage systems for corrosive chemical or acid waste shall be manufactured from CPVC Type IV, ASTM Cell Classification 23447 from Spears® Manufacturing Company, or Harvel Plastics, Inc.

2. Dimensions: All pipe shall be Schedule 40 CPVC manufactured to dimensional requirements of ASTM F441. All pipe markings shall be accompanied by a yellow stripe for identification of CPVC chemical waste system. All fittings shall be CPVC drainage patterns meeting the requirements of ASTM D3311 and specialty patterns according to the manufacturer's specifications. CPVC system shall be available in sizes 1-1/2 through 24-inch iron pipe size (IPS) dimensions.

3. Joining Method: Joining method for pipe and fittings shall be solvent cement welding. Solvent cement shall be a "one-step" primerless type CPVC cement designated by the system manufacturer, specially formulated for resistance to corrosive chemicals and manufactured in accordance with ASTM F493. Mechanical connections for special equipment connection or transition to other system materials shall be as specified by the CPVC system manufacturer.

4. Flame and Smoke Conformance Rating: All molded fittings shall be CAN/ULC S102.2. Listed for flame spread and smoke development and rating designated on the original package labeling. All pipe shall be CAN/ULC S102.2 listed for flame spread and smoke development with rating designated on the pipe marking.

5. Special Requirements and Approvals: All pipe, fittings, and cement shall be supplied together as a complete system certified by the NSF international for use in corrosive waste drainage systems as a Special Engineered (SE) Product. Installation shall be in accordance with the manufacturer's instructions and all applicable codes.

B. PP Drainage Pipe and Fittings: ASTM F 1412, pipe extruded and drainage-pattern fittings molded, with Schedule 40 dimensions, from PP resin with fire-retardant additive complying with ASTM D 4101; with fusion and mechanical joint ends.

1. Exception: Pipe and fittings made from PP resin without fire-retardant additive may be used for underground installation.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a.Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.

2.2 JOINING MATERIALS

A. Couplings: Assemblies with combination of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.

B. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.

C. Flanges: Assemblies of companion flanges and gaskets complying with ASME B16.21 and compatible with system liquid, and bolts and nuts.

2.3 PIPING SPECIALTIES

A. Plastic Dilution Traps:

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

a. Orion Fittings, Inc.; a division of Watts Water Technologies, Inc.
b. Spears Manufacturing Company

2. Material: Corrosion-resistant PP or CPVC with removable base.
3. End Connections: Mechanical joint or solvent cement welding.
4. Small Dilution Jars: 1-pint capacity, with clear base unless colored base is indicated; with NPS 1-1/2 top inlet and NPS 1-1/2 side outlet.
5. Large Dilution Jars: 1-quart capacity; with NPS 1-1/2 top inlet and NPS 1-1/2 side outlet.

B. Corrosion-Resistant Traps:

1. Type: P-trap or drum trap.
2. Size: NPS 1-1/2 or NPS 2, as required to match connected piping.
3. CPVC: ASTM D1784, with union connections.
4. PP: ASTM D 4101, with mechanical-joint pipe connections.

C. Cast-Iron Floor Drains:

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

a. MIFAB, Inc
b. Tyler Pipe; Wade Div.
c. Zurn Plumbing Products Group.

2. Standard: ASME A112.6.3.
3. Coating: Acid resistant epoxy.
4. Grate: Stainless steel

D. CPVC and PP Sink Outlets:

1. Description: NPS 1-1/2, with clamping device.

END OF SECTION 226600

SECTION 22 66 53
LABORATORY CHEMICAL WASTE AND VENT PIPING

22 66 70 Healthcare Chemical-Waste and Vent Piping
22 66 83 Chemical-Waste Tanks

22 67 00 Processed Water Systems for Laboratory and Healthcare Facilities
22 67 13 Processed Water Piping for Laboratory and Healthcare Facilities
22 67 13.13 Distilled-Water Piping
22 67 13.16 Reverse-Osmosis Water Piping
22 67 13.19 Deionized-Water Piping
22 67 19 Processed Water Equipment for Laboratory and Healthcare Facilities
22 67 19.13 Distilled-Water Equipment
22 67 19.16 Reverse-Osmosis Water Equipment
22 67 19.19 Deionized-Water Equipment

UNIVERSITY OF ARKANSAS

Facilities Management

5/11/2011

FACILITIES MANAGEMENT CROSS-CONNECTION PROGRAM INTERCONNECTIOINS AND RECOMMENDATIONS

POINT OF INTERCONNECTION	RECOMMENDATION OF DEVICES
Supply to building, 1/2" - 2"	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Supply to building, 2-1/2" - 6"	RPZ, Wilkins/Zurn 375, Standard # 1013 or equal
Fire line, 3/4" - 2"	DCVA, Wilkins/Zurn 950XL., Standard # 1015 or equal
Fire line, 2-1/2" - 3"	DCDA, Wilkins/Zurn 950DA, Standard # 1048 or equal
Fire line, 4" - 8"	DCDA, Wilkins/Zurn 350ADA, Standard # 1048 or equal
Make-up/cooling water/process water, 1/2" - 2"	PVB, Wilkins/Zurn 720A, Standard # 1020, or
	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Make-up/cooling water/process water, 2-1/2" - 6"	RPZ, Wilkins/Zurn 375, Standard # 1013 or equal
Irrigation systems, fountains, ponds, 3/4" - 2"	PVB, Wilkins/Zurn 720A, Standard # 1020, or
	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Irrigation systems, 2-1/2" - 6"	RPZ, Wilkins/Zurn 375, Standard # 1013 or equal
Building DI systems (water purification sytem), 3/4" -2"	PVB, Wilkins/Zurn 720A, Standard # 1020, or
	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Building DI systems (water purification sytem), 2-1/2" - 4"	RPZ, Wilkins/Zurn 375, Standard # 1013 or equal
Point of use DI systems (water purification systems), 1/4" - 1"	Dual check valve, Wilkins/Zurn 700, Standard # 1024 or equal
Sterilizer, 3/4" - 2"	PVB, Wilkins/Zurn 720A, Standard # 1020, or
	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Autoclave, 3/4" - 2"	PVB, Wilkins/Zurn 720A, Standard # 1020, or
	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Humidifier, 1/2" - 2"	PVB, Wilkins/Zurn 720A, Standard # 1020, or
	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Lab faucet, (on new goose neck)	AVB, Standard # 1001
DI lab faucet, (on new goose neck)	AVB, Standard # 1001
Lab faucet w/o AVB (thread on type), 3/8"	AVB, T&S Brass B-0970, Standard # 1035 or equal
DI Lab faucet w/o AVB (thread on type), 3/8" tin lined	AVB, T&S Brass B-0970, tin lined, Standard # 1035 or equal
Outside wall hydrant w/ AVB, 3/4" hose thread	Zurn Z1300, Standard # 1019 or equal
Outside wall hydrant w/o AVB 3/4" hose thread	HBVB, Watts 8FR, Standard # 1011 or equal
Inside hose bibb, 3/4" hose thread	HBVB, Wilkins/Zurn BFP-8, Standard # 1011 or equal
Ground hydrant	Zurn Z1396, Standard # 1019 and
	HBVB, Watts 8FR, Standard # 1011 and
	Dual check valve, Wilkins/Zurn 700, Standard # 1024 or equal
Yard hydrant	Zurn Z1361, Standard # 1019 and
	HBVB, Watts 8FR, Standard # 1011 and
	Dual check valve, Wilkins/Zurn 700, Standard # 1024 or equal
Hose bibbs on non-potable water lines; Chill water, heating..	Tag as non-potable water
Coffee/juice machine	Carbonated beverage backflow preventer, Wilkins/Zurn 740,Standard # 1022 or equal
Coke machine, carbonated beverage dispensing systems	Carbonated beverage backflow preventer, Wilkins/Zurn 740,Standard # 1022 or equal
Dishwasher drain line	Install air gap on top of counter or air gap at floor drain
Commerce dish machine water line	AVB, Wilkins/Zurn 35, Standard # 1001, or
	PVB, Wilkins/Zurn 720A, Standard # 1020, or
	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Garbage disposal	AVB, Wilkins/Zurn 35, Standard # 1001, or
	PVB, Wilkins/Zurn 720A, Standard # 1020, or
	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Soap pumping machines	PVB, Wilkins/Zurn 720A, Standard # 1020, or
	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Fire hydrant (irrigation, make-up, etc…), (portable unit)	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Quick fill lines for chill water, (portable unit)	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Hot box for outside enclosure	Standard # 1060
Trap seal primer	Standard # 1018 or # 1044
Water hammer arrestors	Standard # 1010
Swimming pool, whirlpools, saunas	PVB, Wilkins/Zurn 720A, Standard # 1020, or
	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Pressure washers, (stationary car or equipment washer)	PVB, Wilkins/Zurn 720A, Standard # 1020, or
	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal
Pressure washers, (portable unit)	HBVB, Watts 8FR, Standard # 1011 or
	HBVB, Wilkins/Zurn BFP-8, Standard # 1011 or equal
Temporary water service for contractors	PVB, Wilkins/Zurn 720A, Standard # 1020, or
	RPZ, Wilkins/Zurn 975XL, Standard # 1013 or equal

AVB	Atmospheric Vacuum Breaker
PVB	Pressure Vacuum Breaker
DCVA	Double Check Valve Assembly
DCDA	Double Check Detector Assembly
RPZ	Reduced Pressure Zone Assembly
HBVB	Hose Bibb Vacuum Breaker

AIR HANDLING UNIT (1 OF 2)		
DESIGNATION		AHU E-1
MANUFACTURER/MODEL		YORK CP-500
UNIT CONFIGURATION		HORIZONTAL DRAW THRU
CASING INSULATION		2 INCHES - 3 PCF DENSITY
ISOLATION TYPE		2" SPRING
MAXIMUM UNIT LENGTH		20' -2"
MAXIMUM UNIT WIDTH		10'-5"
MAXIMUM UNIT HEIGHT (INCLUDES BASE RAIL)		6'-9"
MAXIMUM OPERATING WEIGHT (LBS.)		10,050
BASE RAIL HEIGHT (INCHES)		18
MIXING BOX	CASING LINER	SOLID
	SECTION AIR PRESSURE DROP (INCHES W.G.)	0.25
	TOP DAMPER TYPE	PARALLEL BLADE
	BACK DAMPER TYPE	TRAQ
	DAMPER ACTUATOR	FURNISHED WITH AIRHANDLER
	ACCESS DOORS	NONE
	AIRFLOW LENGTH (INCHES)	48
ANGLE FILTER SECTION	AIR FLOW (CFM)	25,000
	FACE VELOCITY	310
	FILTER DEPTH (INCHES)	2
	FILTER TYPE	PLEATED
	EFFICIENCY (%)	30
	INITIAL AIR PRESSURE DROP (INCHES W.G.)	0.11
	FINAL AIR PRESSURE DROP (INCHES W.G.)	1.00
	CASING LINER	SOLID
	ACCESS DOORS	RIGHT SIDE
	AIRFLOW LENGTH (INCHES)	31
FLAT FILTER SECTION	AIR FLOW (CFM)	24,000
	FACE VELOCITY	464
	FILTER DEPTH (INCHES)	2
	FILTER TYPE	PLEATED
	EFFICIENCY (%)	30
	INITIAL AIR PRESSURE DROP (INCHES W.G.)	0.28
	FINAL AIR PRESSURE DROP (INCHES W.G.)	0.78
	CASING LINER	SOLID
	ACCESS DOORS	BOTH SIDES
	AIRFLOW LENGTH (INCHES)	13
AIR BLENDER	CASING LINER	SOLID
	SECTION AIR PRESSURE DROP (INCHES W.G.)	0.11
	FACE VELOCITY	1263
	ACCESS DOORS	NONE
	AIRFLOW LENGTH (INCHES)	48
ACCESS SECTION	CASING LINER	SOLID
	SECTION AIR PRESSURE DROP (INCHES W.G.)	0.00
	ACCESS DOORS	DRIVE SIDE ONLY
	ACCESSORIES	SERVICE LIGHT
	AIRFLOW LENGTH (INCHES)	12
INTERNAL FACE AND BYPASS SECTION	CASING LINER	SOLID
	SECTION AIR PRESSURE DROP (INCHES W.G.)	0.02
	DAMPER TYPE	OPPOSED BLADE
	DAMPER ACTUATOR	FURNISHED BY CONTROLS CONTRACTOR
	AIRFLOW LENGTH (INCHES)	12
STEAM PREHEAT COIL	AIR FLOW (CFM)	24,000
	COIL FACE VELOCITY (FPM)	642
	ROWS	1
	FIN SPACING (FINS PER FOOT)	12
	ENTERING AIR TEMPERATURE (DB DEG. F.)	24
	LEAVING AIR TEMPERATURE (DB DEG. F.)	63.2
	COIL AIR PRESSURE DROP (INCHES W.G.)	0.14
	ENTERING STEAM PRESSURE (PSIG)	2
	STEAM FLOW RATE (LBS/HR)	1051
	SENSIBLE HEAT TRANSFER (MBH)	1021.5
	CASING LINER	SOLID
	ACCESS DOORS	NONE
	AIRFLOW LENGTH (INCHES)	10
CHILLED WATER COIL	AIR FLOW (CFM)	24,000
	COIL FACE VELOCITY (FPM)	485
	ROWS	8
	FIN SPACING (FINS PER FOOT)	120
	ENTERING AIR TEMPERATURE (DB/WB DEG. F.)	82/75
	LEAVING AIR TEMPERATURE (DB/WB DEG. F.)	51.8/51.7
	COIL AIR PRESSURE DROP (INCHES W.G.)	1.08
	ENTERING CHILLED WATER TEMPERATURE (DEG. F.)	45.0
	LEAVING CHILLED WATER TEMPERATURE (DEG. F.)	55.0
	CHILLED WATER FLOW (GPM)	371.5
	COIL WATER PRESSURE DROP (FEET W.G.)	14.4
	TOTAL HEAT TRANSFER (MBH)	1856.3
	SENSIBLE HEAT TRANSFER (MBH)	1058.9
	CASING LINER	SOLID
	ACCESS DOORS	NONE
	DRAIN PAN	STAINLESS STEEL SLOPED IAG
	AIRFLOW LENGTH (INCHES)	36
DIRECT EXPANSION COIL	AIR FLOW (CFM)	25,000
	NUMBER OF COILS / AIRFLOW PER COIL (CFM)	2 / 12500
	COIL FACE VELOCITY (FPM)	506
	ROWS	6
	FIN SPACING (FINS PER FOOT)	123
	ENTERING AIR TEMPERATURE (DB/WB)	80.2 / 63.5
	LEAVING AIR TEMPERATURE (DB/WB)	51.0 / 50.5
	COIL AIR PRESSURE DROP (INCHES W.G.)	0.70
	SATURATION SUCTION TEMPERATURE (DEG. F.)	34.5
	TOTAL HEAT TRANSFER (MBH)	926.1
	SENSIBLE HEAT TRANSFER (MBH)	1059.9
	CASING LINER	SOLID
	ACCESS DOORS	NONE
	DRAIN PAN	STAINLESS STEEL SLOPED IAG
	AIRFLOW LENGTH (INCHES)	19

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AIR HANDLING UNIT (2 OF 2)

FAN SECTION	FAN TYPE	PLENUM AIRFOIL / CLASS II
	AIR FLOW (CFM)	24,000
	TOTAL STATIC PRESSURE (INCHES W.G.)	5.8
	EXTERNAL STATIC PRESSURE (INCHES W.G.)	3.0
	FAN RPM	1302
	FAN BHP	37.6
	MOTOR HP	40
	MOTOR EFFICIENCY (%)	94.1
	MOTOR VOLTAGE / PHASE	460 / 3
	CASING LINER	SOLID
	ACCESS DOORS	DRIVE SIDE ONLY
	SECTION ACCESSORIES	FAN KILL SWITCH, LIGHTS
	FAN ACCESSORIES	THRUST RESTRAINTS
	AIRFLOW LENGTH (INCHES)	60
	DISCHARGE CONFIGURATION	REFER TO PLANS
DIFFUSER SECTION	CASING LINER	SOLID
	SECTION AIR PRESSURE DROP (INCHES W.G.)	0.16
	ACCESS DOORS	NONE
	ACCESSORIES	NONE
	AIRFLOW LENGTH (INCHES)	34
ACCESS SECTION	CASING LINER	SOLID
	SECTION AIR PRESSURE DROP (INCHES W.G.)	0.00
	ACCESS DOORS	DRIVE SIDE ONLY
	ACCESSORIES	NONE
	AIRFLOW LENGTH (INCHES)	18
FINAL FILTER SECTION	FACE VELOCITY	
	FILTER DEPTH (INCHES)	12
	FILTER EFFICIENCY (%)	90
	FILTER INITIAL AIR PRESSURE DROP (INCHES W.G.)	0.75
	FILTER FINAL AIR PRESSURE DROP (INCHES W.G.)	1.25
	CASING LINER	SOLID
	ACCESS DOORS	DRIVE SIDE ONLY
	ACCESSORIES	NONE
	AIRFLOW LENGTH (INCHES)	21
DISCHARGE PLENUM SECTION	CASING LINER	SOLID
	SECTION AIR PRESSURE DROP (INCHES W.G.)	0.32
	ACCESS DOORS	DRIVE SIDE ONLY
	ACCESSORIES	HUMIDIFIER H-X
	AIRFLOW LENGTH (INCHES)	38
	DRAIN PAN	STAINLESS STEEL SLOPED IAQ
HUMIDIFIER H-X	MANUFACTURER / MODEL	DRI-STEEM ULTRA-SORB LV
	STEAM FLOW RATE (LBS. / HR.)	445
	STEAM PRESSURE (PSIG)	5
	ENTERING AIR DRY BULB / RELATIVE HUMIDITY	55 / 4
	LEAVING AIR DRY BULB / RELATIVE HUMIDITY	55 / 57
	DISPERSION TUBE LENGTH (INCHES)	108
	DISPERSION TUBE HEIGHT (INCHES)	48
	TUBE CENTERS (INCHES)	3
	ABSORPTION DISTANCE (INCHES)	9
SOUND POWER LEVELS (CASING INLET AND OUTLET)	63 (DB re 10^{-12} WATTS)	86 / 88
	125 (DB re 10^{-12} WATTS)	95 / 96
	250 (DB re 10^{-12} WATTS)	92 / 93
	500 (DB re 10^{-12} WATTS)	88 / 89
	1000 (DB re 10^{-12} WATTS)	81 / 81
	2000 (DB re 10^{-12} WATTS)	74 / 69
	4000 (DB re 10^{-12} WATTS)	62 / 52
	8000 (DB re 10^{-12} WATTS)	58 / 41
REMARKS:		
	SPECIFIED IN SECTION 15600	

ENERGY RECOVERY UNIT SCHEDULE

DESIGNATION		ERU-1
MANUFACTURER/MODEL		DESCHAMPS LAB / ECH 1206
CASING INSULATION		2 INCHES - 3 PCF DENSITY
MAXIMUM UNIT LENGTH (INCHES)		20'-2"
MAXIMUM UNIT WIDTH (INCHES)		10'-5"
MAXIMUM UNIT HEIGHT (INCHES, INCLUDES BASE RAIL)		6'-9"
MAXIMUM OPERATING WEIGHT (LBS.)		10,050
SERVES		AHU-1 VENTILATION
SHIPPING SPLITS		NONE
TOTAL OSA FLOW (SCFM)		32,323
SPACE VENTILATION AIR FLOW (SCFM)		31,000
PURGE AIR FLOW (SCFM)		1,323
SPACE EXHAUST AIR FLOW (SCFM)		27,000
TOTAL EXHAUST AIR FLOW (SCFM)		28,323
ENERGY WHEEL	AIR PRESSURE DROP - SUPPLY (INCHES WG.)	1.36
	AIR PRESSURE DROP - EXHAUST (INCHES WG.)	1.19
	FACE VELOCITY - SUPPLY (FPM)	831
	FACE VELOCITY - EXHAUST (FPM)	728
	DIAMETER (INCHES)	128
	DEPTH (INCHES)	12
SUMMER CONDITIONS	OUTSIDE AIR EDB / EWB (DEG. F.)	99/76
	VENTILATION AIR LDB / LWB (DEG. F.)	82.1/67.4
	SPACE EXHAUST AIR EDB / EWB (DEG. F.)	75/62.6
	EXHAUST AIR LDB / LWB (DEG. F.)	94.6/73.4
	SENSIBLE HEAT (MBH)	516.0
	TOTAL HEAT (MBH)	1,050.6
	PERCENT EFFECTIVENESS (%)	78.2
WINTER CONDITIONS	OUTSIDE AIR EDB / EWB (DEG. F.)	99/76
	VENTILATION AIR LDB / LWB (DEG. F.)	82.1/67.4
	SPACE EXHAUST AIR EDB / EWB (DEG. F.)	75/62.6
	EXHAUST AIR LDB / LWB (DEG. F.)	94.6/73.4
	SENSIBLE HEAT (MBH)	516.0
	TOTAL HEAT (MBH)	1,050.6
	PERCENT EFFECTIVENESS (%)	78.2
VENTILATION FAN	AIR FLOW (CFM)	32,328
	QUANTITY	1
	FAN SIZE / CLASS	-/1
	FAN TYPE	SWSI PLENUM
	TOTAL STATIC PRESSURE (INCHES WG.)	3.5
	EXTERNAL STATIC PRESSURE (INCHES WG.)	1.5
	FAN RPM	749
	FAN BHP	26.9
	MOTOR HP	30
	MOTOR VOLTAGE / PHASE	460 / 3Φ
	ACCESS DOORS	DRIVE SIDE
	VIBRATION ISOLATION TYPE / DEFLECTION	SPRING / 2"
EXHAUST FAN	AIR FLOW (CFM)	28,328
	QUANTITY	1
	FAN SIZE / CLASS	33/11
	FAN TYPE	DWDI AIRFOIL
	TOTAL STATIC PRESSURE (INCHES WG.)	4.5
	EXTERNAL STATIC PRESSURE (INCHES WG.)	.25
	FAN RPM	1,212
	FAN BHP	32.9
	MOTOR HP	40
	MOTOR VOLTAGE / PHASE	460 / 3Φ
	ACCESS DOORS	DRIVE SIDE
	VIBRATION ISOLATION TYPE / DEFLECTION	SPRING / 2"
VENTILATION AIR FILTERS	AIR FLOW (CFM)	32,323
	FACE VELOCITY (FPM)	461
	FILTER DEPTH (INCHES)	4
	FILTER TYPE	PLEATED
	EFFICIENCY (%)	30
	INITIAL AIR PRESSURE DROP (INCHES WG.)	0.26
	FINAL AIR PRESSURE DROP (INCHES WG.)	0.76
	ACCESS DOORS	FRONT LOAD DOOR
EXHAUST AIR FILTERS	AIR FLOW (CFM)	27,000
	FACE VELOCITY (FPM)	540
	FILTER DEPTH (INCHES)	4
	FILTER TYPE	PLEATED
	EFFICIENCY (%)	30
	INITIAL AIR PRESSURE DROP (INCHES WG.)	0.31
	FINAL AIR PRESSURE DROP (INCHES WG.)	0.81
	ACCESS DOORS	FRONT LOAD DOOR
SOUND POWER LEVELS (SUPPLY FAN DISCHARGE / EXHAUST FAN DISCHARGE)	63 (DB re 10^{-12} WATTS)	94 / 93
	125 (DB re 10^{-12} WATTS)	92 / 92
	250 (DB re 10^{-12} WATTS)	92 / 92
	500 (DB re 10^{-12} WATTS)	87 / 86
	1000 (DB re 10^{-12} WATTS)	82 / 81
	2000 (DB re 10^{-12} WATTS)	81 / 81
	4000 (DB re 10^{-12} WATTS)	79 / 78
	8000 (DB re 10^{-12} WATTS)	71 / 70
ACCESSORIES	FURNISH LIGHTS AT FILTERS, ENERGY WHEEL AND FAN SECTION. FURNISH CONTROL PANELS FOR VFD'S AND MAIN DISCONNECT. PROVIDE SINGLE POINT POWER CONNECTION.	
REMARKS	FURNISH SPACE FOR FIELD MOUNTED DDC AND FEP PANELS. CONTROL PANELS FOR VFD'S AND MAIN DISCONNECT.	
	SPECIFIED IN SECTION 15600	

EXHAUST AIR TERMINALS

SPECIFIED IN SECTION 15800

DESIGNATION	SERVES	AIR TERMINAL CONTROL DIAGRAM	ASSOCIATED SUPPLY AIR TERMINAL	REFERENCE PRODUCT	INLET SIZE (INCHES)	OCCUPIED MAX. AIRFLOW (CFM)	OCCUPIED MIN. AIRFLOW (CFM)	UNOCCUPIED MAX. AIRFLOW (CFM)	UNOCCUPIED MIN. AIRFLOW (CFM)	PRESSURE[1] DROP (INCHES w.g.)	REMARKS
ET-104	INDEPENDENT STUDY LAB R015	4	ST-104	ANEMOSTAT AFT	6"Φ	100	100	100	100	0.04	SERVES MISC. VENTS (STANDARD RANGE)
ET-302B	INDEPENDENT RESEARCH LAB R212	7	ST-302	ANEMOSTAT AFT	6"Φ	200	200	200	200	0.11	SERVES ONE SNORKEL (STANDARD RANGE)
ET-619	BIOCHEMISTRY PREP 217A	2	ST-619	ANEMOSTAT AFT	6"Φ	300	300	300	300	0.03	SERVES EXHAUST GRILLE
ET-612B	LASER ONE 208	6	ST-612	ANEMOSTAT AFT	6"Φ	350	350	150	150	0.05	SERVES EXHAUST GRILLE
ET-608A	CHARACTERIZATION LAB 219	3	ST-608	ANEMOSTAT AFT	6"Φ	400	100	200	200	0.06	SERVES TWO SNORKELS
ET-615	PREP 210A	2	ST-615	ANEMOSTAT AFT	6"Φ	400	400	200	200	0.06	SERVES EXHAUST GRILLE
ET-302A	INDEPENDENT RESEARCH LAB R212	7	ST-302	ANEMOSTAT AFT	8"Φ	500	150	200	200	0.03	SERVES 4' CHEMICAL FUME HOOD
ET-302C	INDEPENDENT RESEARCH LAB R212	7	ST-302	ANEMOSTAT AFT	8"Φ	550	100	100	100	0.04	SERVES EXHAUST GRILLE
ET-303B	INDEPENDENT RESEARCH LAB R214	6	ST-303	ANEMOSTAT AFT	8"Φ	600	100	100	100	0.04	SERVES EXHAUST GRILLE
ET-607E	SYNTHESIS LAB 218	5	ST-607	ANEMOSTAT AFT	8"Φ	600	200	200	200	0.04	SERVES 6' ADA CHEMICAL FUME HOOD
ET-505A	NUCLEAR PHYSICS LAB 116	6	ST-505	ANEMOSTAT AFT	8"Φ	600	200	600	200	0.04	SERVES 4' RADIOISOTOPE FUME HOOD
ET-310A	INDEPENDENT RESEARCH LAB R219	8	ST-310	ANEMOSTAT AFT	8"Φ	600	600	600	200	0.04	SERVES 6' ADA CHEMICAL FUME HOOD
ET-604	STOCKROOM 214	2	ST-604	ANEMOSTAT AFT	8"Φ	600	600	600	600	0.04	SERVES EXHAUST GRILLE
ET-625A	ORGANIC CHEMISTRY LAB 209	5	ST-625	ANEMOSTAT AFT	8"Φ	600	600	200	200	0.06	SERVES 6' ADA CHEMICAL FUME HOOD
ET-516	HOLOGRAPHY III	2	ST-516	ANEMOSTAT AFT	8"Φ	650	650	250	250	0.05	SERVES SLOTTED INTAKE
ET-618B	BIOCHEMISTRY RESEARCH 219	6	ST-618	ANEMOSTAT AFT	8"Φ	700	100	100	100	0.06	SERVES EXHAUST GRILLE
ET-518A	SOLID STATE LAB 121	6	ST-518	ANEMOSTAT AFT	8"Φ	700	200	200	200	0.06	SERVES 5' CHEMICAL FUME HOOD
ET-618A	BIOCHEMISTRY RESEARCH 219	6	ST-618	ANEMOSTAT AFT	8"Φ	800	200	200	200	0.07	SERVES 6' CHEMICAL FUME HOOD
ET-622D	BIOCHEMISTRY LAB 217	5	ST-622	ANEMOSTAT AFT	8"Φ	800	200	200	200	0.07	SERVES 6' CHEMICAL FUME HOOD
ET-506B	BIOPHYSICS LAB 118	6	ST-506	ANEMOSTAT AFT	10"Φ	950	450	200	200	0.05	SERVES EXHAUST GRILLE
ET-623D	CHEM. IND. RESEARCH LAB 215	5	ST-623	ANEMOSTAT AFT	10"Φ	1100	200	200	200	0.05	SERVES 6' CHEMICAL FUME HOOD
ET-505B	NUCLEAR PHYSICS LAB 116	6	ST-505	ANEMOSTAT AFT	10"Φ	1150	750	1150	750	0.06	SERVES EXHAUST GRILLE
ET-520	OPTICS LAB 117	2	ST-520	ANEMOSTAT AFT	10"Φ	1150	1150	400	400	0.05	SERVES EXHAUST GRILLE
ET-608B	CHARACTERIZATION LAB 219	3	ST-608	ANEMOSTAT AFT	10"Φ	1250	1250	300	300	0.07	SERVES EXHAUST GRILLE
ET-310C	INDEPENDENT RESEARCH LAB R219	8	ST-310	ANEMOSTAT AFT	12"Φ	1400	1400	200	200	0.05	SERVES 6' WALK IN FUME HOOD
ET-518B	SOLID STATE LAB 121	6	ST-518	ANEMOSTAT AFT	12"Φ	1450	950	350	350	0.05	SERVES EXHAUST GRILLE
ET-606	DISPENSING 216	4	ST-606	ANEMOSTAT AFT	12"Φ	1800	1800	1800	1800	0.07	SERVES 8' COMBINATION HOOD

1 DIFFERENCE IN STATIC PRESSURE FROM INLET TO DISCHARGE AT MAXIMUM EXHAUST AIRFLOW

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DUAL DUCT SUPPLY AIR TERMINALS

SPECIFIED IN SECTION 15800

DESIGNATION	SERVES	REFERENCE PRODUCT	INLET SIZE (INCHES)	OCCUPIED MAX. AIRFLOW (CFM)	OCCUPIED MIN. AIRFLOW (CFM)	UNOCCUPIED AIRFLOW (CFM)	MAXIMUM UNIT AIRFLOW (CFM)	TERMINAL [1] PRESSURE DROP (INCHES w.g.)	REMARKS
ST-101	X	TUTTLE & BAILEY DDV	6"Φ	100	100	100	350	0.28	MAXIMUM NC: 35 AT 0.75" INLET STATIC PRESSURE
ST-102	X	TUTTLE & BAILEY DDV	8"Φ	100	100	100	625	0.22	MAXIMUM NC: 35 AT 0.75" INLET STATIC PRESSURE
ST-103	X	TUTTLE & BAILEY DDV	10"Φ	100	100	100	800	0.16	MAXIMUM NC: 35 AT 0.75" INLET STATIC PRESSURE
ST-104	X	TUTTLE & BAILEY DDV	12"Φ	100	100	100	1200	0.20	MAXIMUM NC: 37 AT 0.75" INLET STATIC PRESSURE
ST-105	X	TUTTLE & BAILEY DDV	14"Φ	100	100	100	1600	0.16	MAXIMUM NC: 37 AT 0.75" INLET STATIC PRESSURE
ST-106	X	TUTTLE & BAILEY DDV	16"Φ	100	100	100	2100	0.17	MAXIMUM NC: 40 AT 0.75" INLET STATIC PRESSURE

1 TOTAL AIR PRESSURE LOSS THRU UNIT AT MAXIMUM UNIT AIR FLOW

TERMINAL AIR BOXES

HEATING COIL

SPECIFIED IN SECTION 15000

DESIGNATION	REFERENCE PRODUCT	TYPE	INLET SIZE (IN.)	MAX. COOLING AIR FLOW (CFM)	MIN. COOLING AIR FLOW (CFM)	MAX. HEATING AIR FLOW (CFM)	MIN. HEATING AIR FLOW (CFM)	MINIMUM INLET S.P. (IN. WATER)	AIR PRESSURE DROP (IN. WATER)	CAPACITY (MBH)	EDB / LDB (°F)	AIR PRESSURE DROP (IN. WATER)	WATER FLOW RATE (GPM)	EWT / LWT (°F)	WATER PRESSURE DROP (FT. WATER)	MIN. # ROWS	REMARKS
A	TUTTLE & BAILEY SDVD W/ REHEAT COIL	VARIABLE VOLUME SUPPLY	6" RD	350	350	350	350	0.29	0.13	17	55 / 100	0.16	2.0	160 / 142	0.43	2	MAXIMUM NC: 35 AT 0.6" INLET STATIC PRESSURE
B			8"RD	650	650	650	650	0.44	0.06	25	55 / 90	0.38	2.0	160 / 125	0.48		
C			10" RD	1350	1350	1350	1350	0.10	0.10	45	55 / 86	0.60	3.0	160 / 130	1.34		
D			12"RD	1900	1900	1900	1900	0.14	0.06	56	55 / 82	0.68	3.0	160 / 122	0.56		
E			14" RD	2500	2500	2500	2500	0.65	0.02	76	55 / 83	0.63	4.0	160 / 122	0.52		
F			16"RD	2450	2450	2450	2450	0.43	0.03	84	55 / 87	0.40	4.0	160 / 118	0.84		
G	TUTTLE & BAILEY FPV 260	VAV W/FAN POWERED HEATING	6" RD	350	350	240	240	0.13	0.13	15	65 / 123	0.03	2.0	160 / 145	0.65		MAXIMUM NC: 35 AT 0.6" INLET STATIC PRESSURE BLOWER MOTOR: 1/6 HP, 120 V / 1 PH (0.60" SP)
H	380		8"RD	650	650	625	625	0.06	0.06	30	65 / 109	0.09	2.0	160 / 130	0.79		BLOWER MOTOR: 1/4 HP, 120 V / 1 PH (0.60" SP)
I	410		10" RD	1350	1350	650	650	0.10	0.10	31	65 / 109	0.09	2.0	160 / 129	0.30		BLOWER MOTOR: 1/3 HP, 120 V / 1 PH (0.60" SP)
J	512		12"RD	1900	1900	940	940	0.06	0.06	41	65 / 105	0.12	3.0	160 / 133	0.62		BLOWER MOTOR: 1/2 HP, 120 V / 1 PH (0.60" SP)
K	614		14"RD	2500	2500	1530	1530	0.02	0.02	54	65 / 91	0.16	3.0	160 / 121	0.38		BLOWER MOTOR: 3/4 HP, 277 V / 1 PH (0.60" SP)
L	616		16" RD	2450	2450	1530	1530	0.03	0.03	62	65 / 102	0.16	4.0	160 / 129	0.83		BLOWER MOTOR: 3/4 HP, 277 V / 1 PH (0.60" SP)

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TERMINAL AIR BOXES

HEATING COIL — SPECIFIED IN SECTION 15800

DESIGNATION	REFERENCE PRODUCT	TYPE	INLET SIZE (IN.)	MAX. COOLING AIR FLOW (CFM)	MIN. COOLING AIR FLOW (CFM)	MAX. HEATING AIR FLOW (CFM)	MIN. HEATING AIR FLOW (CFM)	MINIMUM INLET S.P. (IN. WATER)	AIR PRESSURE DROP (IN. WATER)	CAPACITY (MBH)	EDB / LDB (°F)	AIR PRESSURE DROP (IN. WATER)	WATER FLOW RATE (GPM)	EWT / LWT (°F)	WATER PRESSURE DROP (FT. WATER)	MIN. # ROWS	REMARKS
A	TUTTLE & BAILEY SDVD W/ REHEAT COIL	VARIABLE VOLUME SUPPLY	6" RD	350	350	350	350	0.29	0.13	17	55 / 100	0.16	2.0	160 / 142	0.43	2	MAXIMUM NC: 35 AT 0.6" INLET STATIC PRESSURE
B			8" RD	650	650	650	650	0.44	0.06	25	55 / 90	0.38	2.0	160 / 125	0.48		
C			10" RD	1350	1350	1350	1350	0.70	0.10	45	55 / 86	0.60	3.0	160 / 130	1.34		
D			12" RD	1900	1900	1900	1900	0.74	0.06	56	55 / 82	0.68	3.0	160 / 122	0.56		
E			14" RD	2500	2500	2500	2500	0.65	0.02	76	55 / 83	0.63	4.0	160 / 122	0.52		
F			16" RD	2450	2450	2450	2450	0.43	0.03	84	55 / 87	0.40	4.0	160 / 118	0.64		
G	TUTTLE & BAILEY FPV 260	VAV W/FAN POWERED HEATING	6" RD	350	350	240	240	0.13	0.13	15	65 / 123	0.03	2.0	160 / 145	0.65		MAXIMUM NC: 35 AT 0.6" INLET STATIC PRESSURE BLOWER MOTOR: 1/6 HP, 120 V / 1 PH (0.60" SP)
H	380		8" RD	650	650	625	625	0.06	0.06	30	65 / 109	0.09	2.0	160 / 130	0.79		BLOWER MOTOR: 1/4 HP, 120 V / 1 PH (0.60" SP)
I	410		10" RD	1350	1350	650	650	0.10	0.10	31	65 / 109	0.09	2.0	160 / 129	0.30		BLOWER MOTOR: 1/3 HP, 120 V / 1 PH (0.60" SP)
J	512		12" RD	1900	1900	940	940	0.06	0.06	41	65 / 105	0.12	3.0	160 / 133	0.62		BLOWER MOTOR: 1/2 HP, 120 V / 1 PH (0.60" SP)
K	614		14" RD	2500	2500	1530	1530	0.02	0.02	54	65 / 91	0.16	3.0	160 / 121	0.38		BLOWER MOTOR: 3/4 HP, 277 V / 1 PH (0.60" SP)
L	616		16" RD	2450	2450	1530	1530	0.03	0.03	62	65 / 102	0.16	4.0	160 / 129	0.63		BLOWER MOTOR: 3/4 HP, 277 V / 1 PH (0.60" SP)

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AIR DISTRIBUTION DEVICES

DESIGNATION SUPPLY — THROW CFM — RETURN OR EXHAUST — DESIGNATION CFM

SPECIFIED IN SECTION 15800

DESIGNATION	REFERENCE PRODUCT	TYPE	MAXIMUM AIR FLOW (CFM)	TOTAL PRESSURE (IN. WATER)	NECK SIZE (IN.)	PANEL SIZE (IN x IN)	MAX N.C.	FINISH	REMARKS
A	TUTTLE & BAILEY SN	SUPPLY LAY-IN MOUNT	100	0.02	6"Φ	24"x24"	30	OFF-WHITE	FURNISH W/OBD
B			220	0.06	8"Φ				
C			400	0.08	10"Φ				
D			550	0.08	12"Φ				
E	T50		100	0.02	6"x6"	24"x12"			FURNISH OBD AND 6"Φ ADAPTER
F	T50		220	0.08	8"x8"	24"x12"			FURNISH OBD AND 8"Φ ADAPTER
G	SN	SUPPLY SURFACE MOUNT	100	0.02	6"Φ	24"x24"			FURNISH W/OBD
H			220	0.06	8"Φ	24"x24"			
I			400	0.08	10"Φ	24"x24"			
J			550	0.08	12"Φ	24"x24"			
K	T50		125	0.08	6"x6"	12"x24"			FURNISH OBD, CEILING GASKET AND 6"Φ ADAPTER
L	T50		220	0.08	8"x8"	12"x24"			FURNISH OBD, CEILING GASKET AND 8"Φ ADAPTER
M	RC40	SUPPLY LAY-IN	1125	0.10	18"x18"	24"x24"			FURNISH W/OBD, 18"Φ ADAPTER AND CEILING GASKET
N	VF-57	SUPPLY SIDEWALL	275	0.12	12"x6"	14"x8"			FURNISH W/OBD
O	VF-57		700	0.12	18"x6"	20"x8"			FURNISH W/OBD
P	VF-57		1050	0.12	22"x8"	24"x10"			FURNISH W/OBD
Q	TBAV	SUPPLY LINEAR BAR	800	0.05	4"x96"	-			FURNISH W/FLANGED FRAME. ADD CORNER DIMENSION.
R	TBAV		450	0.05	4"x54"	-			FURNISH W/FLANGED FRAME. ADD CORNER DIMENSION.
1	TUTTLE & BAILEY T70	RET/EXH LAY-IN MOUNT	100	0.04	6"x6"	24"x24"	30	OFF-WHITE	FURNISH OBD AND 6"Φ ADAPTER
2			200	0.04	8"x8"				FURNISH OBD AND 8"Φ ADAPTER
3			350	0.05	10"x10"				FURNISH OBD AND 10"Φ ADAPTER
4			700	0.08	12"x12"				FURNISH OBD AND 12"Φ ADAPTER
5			1000	0.09	14"x14"				FURNISH OBD AND 14"Φ ADAPTER
6			1400	0.03	22"x22"				FURNISH W/OBD
7			100	0.02	6"x6"	24"x12"			FURNISH OBD AND 6"Φ ADAPTER
8			200	0.03	8"x8"	24"x12"			FURNISH OBD AND 8"Φ ADAPTER
9			750	0.03	22"x10"	24"x12"			FURNISH W/OBD
10	CRE500		3250	0.03	22"x22"	24"x24"			FURNISH W/OBD
11	T70	RET/EXH SURFACE MOUNT	100	0.04	6"x6"	24"x24"			FURNISH OBD, CEILING GASKET, AND 6"Φ ADAPTER
12			200	0.04	8"x8"	24"x24"			FURNISH OBD, CEILING GASKET, AND 8"Φ ADAPTER
13			350	0.05	10"x10"	24"x24"			FURNISH OBD, CEILING GASKET, AND 10"Φ ADAPTER
14			700	0.08	12"x12"	24"x24"			FURNISH OBD, CEILING GASKET, AND 12"Φ ADAPTER
15			1000	0.09	14"x14"				FURNISH OBD, CEILING GASKET, AND 14"Φ ADAPTER
16			1400	0.03	22"x22"				FURNISH W/OBD AND CEILING GASKET
17			100	0.02	6"x6"	24"x12"			FURNISH OBD, CEILING GASKET, AND 6"Φ ADAPTER
18			200	0.03	8"x8"	24"x12"			FURNISH OBD, CEILING GASKET, AND 8"Φ ADAPTER
19			750	0.03	22"x10"	24"x12"			FURNISH W/OBD AND CEILING GASKET
20	CRE500		3250	0.03	22"x22"	24"x24"			FURNISH W/OBD AND CEILING GASKET
21	VF-57	RET/EXH SIDEWALL	325	0.10	12"x6"	14"x8"			FURNISH W/OBD 42 ° HORIZONTAL DEFLECTION
22	VF-57		425	0.10	18"x6"	20"x8"			
23	VF-57		800	0.10	22"x8"	24"x10"			
24	TBAV	RET/EXH LINEAR BAR	400	0.05	4"x48"	4"x48"			FURNISH W/FLANGED FRAME. ADD CORNER DIMENSION.
25	TBAV	RET/EXH LINEAR BAR	800	0.05	4"x96"	4"x96"			FURNISH W/OBD
	N/A	SUPPLY RET/EXH	N/A	N/A	N/A	N/A	N/A	N/A	EXISTING GRILLE

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SILENCERS

SPECIFIED IN SECTION 15800

DESIGNATION	REFERENCE PRODUCT	SERVES	UNIT SIZE (IN. x IN. x FT.)	QUANTITY	OVERALL DIMENSION (IN. x IN. x FT.)	MAXIMUM UNIT AIR FLOW (CFM)	MAXIMUM VELOCITY (FPM)	AIR PRESSURE DROP (IN. WATER)	DYNAMIC INSERTION LOSS (db) OCTAVE BAND								REMARKS
									1	2	3	4	5	6	7	8	
SIL-1A	SEMCO M36-TJ	AHU-1	36"x36"x7'	2	72"x36"x7'	26000	500	0.05	12	16	23	35	42	29	15	10	DYNAMIC INSERTION LOSS RATINGS FOR 0 FPM PRESSURE DROP LOSS RATING FOR 500 FPM
SIL-1B	SEMCO 61-DR	AHU-1	36"Ø x 72"	1	36"⅜x72"	26000	500	0.02	8	9	21	34	43	38	27	20	DYNAMIC INSERTION LOSS RATINGS FOR 0 FPM PRESSURE DROP LOSS RATING FOR 500 FPM (DOUBLE WALL)

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AIR SEPARATORS							SPECIFIED IN SECTION 15100
DESIGNATION	REFERENCE PRODUCT	SERVES	TYPE	PIPE DIAMETER (IN.)	WATER FLOW RATE (GPM)	WATER PRESSURE DROP (FT OF HEAD)	REMARKS

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LOUVERS

SPECIFIED IN SECTION 15800

DESIGNATION	REFERENCE PRODUCT	TYPE	WIDTH (IN.)	HEIGHT (IN.)	DEPTH (IN.)	MAXIMUM AIR FLOW (CFM)	PRESSURE DROP (IN. WATER)	FINISH	REMARKS
L-1	AMERICAN WARMING & VENTILATING LE-31	DRAINABLE BLADE	60	96	6	10,000	0.02	DARK BRONZE	FURNISH WITH BIRD SCREEN
L-2	↓	↓	60	96	6	10,000	0.02	↓	FURNISH W/ BIRD SCREEN, STANDARD KYNAR FINISH TO BE SELECTED BY ARCHITECT
L-3	↓	↓	60	96	6	10,000	0.02	↓	FURNISH W/ BIRD SCREEN AND SHOP PRIMED FINISH. LOUVER TO BE FIELD PAINTED BY GENERAL CONTRACTOR
								SEE REMARKS	

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EXHAUST FANS

SPECIFIED IN SECTION 15600

DESIGNATION	REFERENCE PRODUCT	TYPE	SERVES	AIR FLOW RATE (CFM)	TOTAL STATIC PRESSURE (IN. WATER)	ROTATION (RPM)	DRIVE	BHP (NO FEET)	MOTOR SIZE BHP	MOTOR SIZE HP	ELECTRICAL VOLTS	ELECTRICAL PHASE	REMARKS
LEF-1	STROBIC TSSL150C9	UP-BLAST CENTRIFUGAL	LABORATORY EXHAUST	30,000	4.0	870	DIRECT	9.2	7.3	7.5	480	3	
LEF-2	STROBIC TSSL150C9	UP-BLAST CENTRIFUGAL	LABORATORY EXHAUST	30,000	4.0	870	DIRECT	9.2	7.3	7.5	480	3	
LEF-3	STROBIC TSSL150C9	UP-BLAST CENTRIFUGAL	LABORATORY EXHAUST	30,000	4.0	870	DIRECT	9.2	7.3	7.5	480	3	
LEF-4	STROBIC TSSL150C9	UP-BLAST CENTRIFUGAL	LABORATORY EXHAUST	30,000	4.0	870	DIRECT	9.2	7.3	7.5	480	3	

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EXHAUST FANS

SPECIFIED IN SECTION 15600

DESIGNATION	REFERENCE PRODUCT	TYPE	SERVES	AIR FLOW RATE (CFM)	TOTAL STATIC PRESSURE (IN. WATER)	ROTATION (RPM)	DRIVE	SONES	MOTOR SIZE		ELECTRICAL		REMARKS
									BHP	MHP	VOLTS	PHASE	
EF-1	ACME PRN 126E	DOWN-BLAST	MEN, WOMEN TOILETS	1100	0.5	1500	DIRECT	10	-	1/4	120	1	FURNISH WITH SPEED CONTROLLER, MOTORIZED BACKDRAFT DAMPER, ROOF CURB AND BIRD SCREEN

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FAN COIL UNITS - FOUR PIPE

						COOLING					HEATING					ELECTRICAL		SPECIFIED IN SECTION 15000
DESIGNATION	REFERENCE PRODUCT	TYPE	AIR FLOW RATE (CFM)	EXTERNAL PRESSURE (IN. WATER)	FILTER TYPE	SENSIBLE/TOTAL CAPACITY (MBH)	AIR EDB / EWB (°F)	WATER FLOW RATE (GPM)	WATER EWT / LWT (°F)	WATER PRESSURE DROP (FT. WATER)	TOTAL CAPACITY (MBH)	AIR EDB (°F)	WATER FLOW RATE (GPM)	WATER EWT / LWT (°F)	WATER PRESSURE DROP (FT. WATER)	VOLTS / PHASE	WATTS / AMPS	REMARKS
FCU-1	TRANE FCBB 030	VERTICAL CABINET	300	N/A	1" PLEATED THROW-AWAY	6.1 / 6.5	75 / 63	1.3	45/55	2.6	13.3	70	1.5	180/162	4.4	120 / 1	135 / 1.2	FURNISH WITH VALVE PACKAGE AND PSC MOTOR
FCU-2	040		400			7.9 / 9.0		1.8		5.4	17.2		2.0	180/162	8.7		150 / 1.3	
FCU-3	060		600			12.1 / 12.6		2.5		2.5	26.0		2.0	180/153	11.6		235 / 2.0	
FCU-4	080		800			14.8 / 16.6		3.3		4.7	30.4		2.0	180/149	14.0		360 / 3.1	
FCU-5	100		1000			19.9 / 23.3		4.6		9.9	37.7		2.0	180/142	17.2		385 / 3.4	
FCU-6	TRANE FCCB 030	HORIZONTAL CONCEALED	300	0.5		6.1 / 6.5		1.3		2.6	13.3		1.5	180/162	4.4		130 / 1.1	FURNISH WITH VALVE PACKAGE AND HIGH STATIC PSC MOTOR
FCU-7	040		400			7.9 / 9.0		1.8		5.4	17.2		2.0	180/162	8.7		185 / 1.6	
FCU-8	060		600			12.1 / 12.6		2.5		2.5	26.0		2.0	180/153	11.6		260 / 2.3	
FCU-9	080		800			14.8 / 16.6		3.3		4.7	30.4		2.0	180/149	14.0		290 / 2.5	
FCU-10	100		1000			19.9 / 23.3		4.6		5.3	37.7		2.0	180/142	17.2		445 / 3.9	

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FAN COIL UNITS (HEATING ONLY)						HEATING					ELECTRICAL		SPECIFIED IN SECTION 15600
DESIGNATION	REFERENCE PRODUCT	TYPE	AIR FLOW RATE (CFM)	EXTERNAL PRESSURE (IN. WATER)	FILTER TYPE	TOTAL CAPACITY (MBH)	AIR EDB (°F)	WATER FLOW RATE (GPM)	WATER ENT. / LVT (°F)	WATER PRESSURE DROP (FT. WATER)	VOLTS / PHASE	WATTS / AMPS	REMARKS
FCU-1	TRANE FCDB 030	HORIZONTAL CABINET	300	N/A	1" PLEATED THROW-AWAY	13.3	70	1.5	180/162	4.4	120 / 1	135 / 1.2	FURNISH WITH VALVE PACKAGE AND PSC MOTOR
FCU-2	040	↓	400	↓	↓	17.2	↓	2.0	180/162	8.7	↓	150 / 1.3	↓
FCU-3	060		600			26.0		2.0	180/153	11.6		235 / 2.0	
FCU-4	080		800			30.4		2.0	180/149	14.0		360 / 3.1	
FCU-5	100		1000			37.7		2.0	180/142	17.2		385 / 3.4	

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FAN COIL UNITS						HYDRONIC COOLING					ELECTRIC HEATING					ELECTRICAL			SPECIFIED IN SECTION 15600
DESIGNATION	REFERENCE PRODUCT	TYPE	AIR FLOW RATE (CFM)	EXTERNAL PRESSURE (IN. WATER)	FILTER TYPE	SENSIBLE/TOTAL CAPACITY (MBH)	AIR EDB / EWB (°F)	WATER FLOW RATE (GPM)	WATER EWT / LWT (°F)	WATER PRESSURE DROP (FT. WATER)	TOTAL CAPACITY (MBH)	ELECTRICAL INPUT (KW)	NUMBER OF STAGES	AIR EDB / LDB (°F)	AIR PRESSURE DROP (IN. WATER)	VOLTS / PHASE	WATTS / AMPS	REMARKS	
FCU-1	TRANE FCBB 030	VERTICAL CABINET	300	N/A	1" PLEATED THROW-AWAY	6.1 / 6.5	75 / 63	1.3	45/55	.26	15.2	1.5	1.5	56 / 96	0.44	120 / 1	135 / 1.2	FURNISH WITH VALVE PACKAGE AND PSC MOTOR	
FCU-2	040		400			7.9 / 9.0		1.8		.54							150 / 1.3		
FCU-3	060		600			12.1 / 12.6		.25		.25							.235 / 2.0		
FCU-4	080		800			14.8 / 16.6		3.3		4.7							360 / 3.1		
FCU-5	100		1000			19.9 / 23.3		4.6		9.9							385 / 3.4		
FCU-6	TRANE FCCB 030	HORIZONTAL CONCEALED	300	0.5		6.1 / 6.5		1.3		.26							130 / 1.1	FURNISH WITH VALVE PACKAGE AND HIGH STATIC PSC MOTOR	
FCU-7	040		400			7.9 / 9.0		1.8		.54							185 / 1.6		
FCU-8	060		600			12.1 / 12.6		.25		.25							.260 / 2.3		
FCU-9	080		800			14.8 / 16.6		3.3		4.7							.290 / 2.5		
FCU-10	100		1000			19.9 / 23.3		4.6		5.3							445 / 3.9		

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CONDENSATE RETURN PUMPS								ELECTRICAL			SPECIFIED IN SECTION 15600
DESIGNATION	REFERENCE PRODUCT	LOCATION	SERVES	TYPE	CONDENSATE FLOWRATE (GPM)	DISCHARGE PRESSURE (PSIG)	ROTATION (RPM)	NO. of PUMPS	PUMP MOTOR (HP)	VOLTS/PHASE	REMARKS
P-1	PACO GRD 1070-5	BASEMENT	BOILER B-1	DUPLEX PACKAGE	34	25	-	2	1/2 EA	460/3	FURNISH W/ 15 GAL. CAST IRON RECEIVER, MECHANICAL ALTERNATOR, INLET STRAINER, WATER GAUGE GLASS, WATER THERMOMETER, INLET STAINER, PUMP DISCHARGE VALVES, CONTROL PANEL WITH CIRCUIT BREAKERS, MOTOR STARTERS AND HOA SWITCHES.

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GAS FIRED DOMESTIC WATER HEATERS

SPECIFIED IN SECTION 15600

DESIGNATION	REFERENCE PRODUCT	LOCATION	TYPE	FUEL	OPERATING WEIGHT (LBS)	NAT. GAS INPUT (MBH)	HEATING OUTPUT (MBH)	EWT / LWT (°F)	RECOVERY RATE (GPH)	FLUE DIAMETER (IN.)	RATED PRESSURE (PSIG)	ELECTRICAL VOLTS/PHASE/AMPS	REMARKS
WH-1	A.O. SMITH FSD-50	MECHANICAL CLOSET	POWER DIRECT VENT	NAT. GAS	600	42	40	40/120	40.4	3	125	120 / 1 / 2	REFER TO SPECIFICATIONS FOR WARRANTY

NOTE: RECOVERY RATE BASED ON 90 DEGREE RISE

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ELECTRIC DOMESTIC WATER HEATERS

SPECIFIED IN SECTION 15400

DESIGNATION	*REFERENCE PRODUCT	LOCATION	TYPE	OPERATING WEIGHT (LBS)	ELEMENT SIZE (WATTS)	HEATING OUTPUT (BTUH)	ENT / LNT (°F)	*RECOVERY RATE (GPH)	*RATED PRESSURE (PSIG)	ELECTRICAL VOLTS/PHASE/AMPS	REMARKS
WH-1	AO SMITH ELSF-15	JANITORS CLOSET	ELECTRIC TANK TYPE	191	1500	5100	40/120	7.65	125	120 / 1 / 8	REFER TO SPECIFICATIONS FOR WARRANTY

NOTE: RECOVERY RATE BASED ON 90 DEGREE RISE

STEAM FIRED DOMESTIC WATER HEATERS — SPECIFIED IN SECTION 15400

DESIGNATION	REFERENCE PRODUCT	LOCATION	SERVES	OPERATING WEIGHT (LBS)	STEAM FLOW RATE (LBS/HR)	STEAM PRESSURE (PSIG)	HEATING CAPACITY (MBH)	ENT / LVT (°F)	RECOVERY RATE (GPH)	RATED PRESSURE (PSIG)	ELECTRICAL VOLTS/PHASE/AMPS	REMARKS
WH-1	AERCO WATER WIZARD B03/1	BASEMENT	KITCHEN	832	940	15	850	40/120	100	125	120 / 1 / 8	FURNISH W/ PNEUMATIC TEMPERATURE CONTROLLER, PRESSURE & TEMPERATURE RELIEF VALVE, SOLENOID TEMPERATURE LIMIT SYSTEM, CONDENSATE CHECK VALVE, DRAIN VALVE, CONTROL PANEL AND ORIFICE STEAM TRAP

NOTE: RECOVERY RATE BASED ON 90 DEGREE RISE

CABINET HEATERS - HOT WATER

SPECIFIED IN SECTION 15600

DESIGNATION	REFERENCE PRODUCT	SERVES	HEATING CAPACITY (MBH)	AIR FLOW RATE (CFM)	AIR EDB / LDB (°F)	WATER FLOW RATE (GPM)	WATER PRESSURE DROP (FT. WATER)	EWT / LWT (°F)	ROTATION (RPM)	MOTOR SIZE (HHP)	ELECTRICAL VOLTS/PHASE	REMARKS
UH-1	TRANE 42-P	VESTIBULE 201	6.8	595	60 / 87	1.8	0.1	160/146	1550	1/25	120 / 1	FURNISH WITH THERMOSTAT

UNIT HEATERS - HOT WATER — SPECIFIED IN SECTION 15600

DESIGNATION	REFERENCE PRODUCT	SERVES	HEATING CAPACITY (MBH)	AIR FLOW RATE (CFM)	AIR EDB / LDB (°F)	WATER FLOW RATE (GPM)	WATER PRESSURE DROP (FT. WATER)	EWT / LWT (°F)	ROTATION (RPM)	MOTOR SIZE (MHP)	ELECTRICAL VOLTS/PHASE	REMARKS
UH-1	TRANE 42-P	VESTIBULE 201	6.8	595	60 / 87	1.8	0.1	160/146	1550	1/25	120 / 1	FURNISH WITH THERMOSTAT

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PUMPS

SPECIFIED IN SECTION 15600

DESIGNATION	REFERENCE PRODUCT	LOCATION	SERVES	TYPE	WATER FLOW-RATE (GPM)	TOTAL HEAD (FT. WATER)	ROTATION (RPM)	EFFICIENCY (%)	MOTOR SIZE		ELECTRICAL		REMARKS
									BHP	HHP	VOLTS	PHASE	
P-1	PACO PIP 702A	BASEMENT	WET PIT	SUMP	34	25	-	-	-	1/2	120	1	FURNISH WITH OSHA GUARD AND SPARE SEAL
													FURNISH WITH INTEGRAL FLOAT AND POWER CORD

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AIR SEPARATORS

SPECIFIED IN SECTION 15100

DESIGNATION	REFERENCE PRODUCT	SERVES	TYPE	PIPE DIAMETER (IN.)	WATER FLOW RATE (GPM)	WATER PRESSURE DROP (FT OF HEAD)	REMARKS

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PRESSURE RELIEF VALVES

SPECIFIED IN SECTION 15100

DESIGNATION	REFERENCE PRODUCT	SERVES	CAPACITY (LBS/HR)	CAPACITY (MBH)	ORIFICE AREA (SQ. IN.)	PRESSURE RELIEF SETTING (PSIG)	VALVE SIZE (IN.)	REMARKS
RV-1	KUNKLE 137	HWS SYSTEM	-	3154	-	125	1	

EXPANSION TANKS

SPECIFIED IN SECTION 15100

DESIGNATION	REFERENCE PRODUCT	SERVES	TYPE	SYSTEM VOLUME (GAL)	MINIMUM TEMPERATURE (°F)	MAXIMUM TEMPERATURE (°F)	INITIAL TANK AIR PRESSURE (PSIG)	MAXIMUM PRESSURE (PSIG)	MINIMUM TANK SIZE (GAL)	MINIMUM ACCEPTANCE (GAL)	TANK DIAMETER (IN.)	TANK LENGTH (IN.)	REMARKS
ET-1	WHEATLEY WFA-450	HTG WATER LOOP	EXPANSION (DIAPHRAGM)	2000	40	180	24	65	120	120	24	79	FULL ACCEPTANCE
ET-2	WHEATLEY WFA-140	CHILLED WATER LOOP	EXPANSION (DIAPHRAGM)	1000	40	60	24	60	37	37	20	40	FULL ACCEPTANCE
ST-1	WHEATLEY WPS-400	CHILLED WATER LOOP	STORAGE	-	-	-	-	125	400	-	36	94	(2) 6" CONNECTIONS

CONVERTORS					TUBE SIDE						SHELL SIDE				SPECIFIED IN SECTION 15600
DESIGNATION	REFERENCE PRODUCT	LOCATION	SERVES	HEATING CAPACITY (MBH)	WATER FLOW RATE (GPM)	ENT / LVT (°F)	WATER PRESSURE DROP (FT. WATER)	FOULING FACTOR	VELOCITY (FT./SEC.)	No. OF PASSES	STEAM FLOW RATE (LBS/HR)	STEAM PRESSURE (PSIG)	MINIMUM DIAMETER (IN.)	MINIMUM LENGTH (IN.)	-REMARKS
HC-1	WHEATLEY W5120602A	BASEMENT	AHU-1	723	250	45/55	2.0	0.0005	4.25	2	183.2	183.2	12	12	

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WATER SOURCE HEAT PUMP UNITS

SPECIFIED IN SECTION 15659

								COOLING					HEATING					ELECTRICAL				PHYSICAL SIZE		
DESIGNATION	PERFORMANCE PREFIX	TYPE	AIR FLOW RATE (CFM)	EXTERNAL PRESSURE (IN. WATER)	FILTER TYPE	WATER FLOW RATE (GPM)	WATER PRESSURE DROP (FT. H2O)	SENSIBLE CAPACITY (MBH)	TOTAL HEAT REJECTION (MBH)	WATER TEMP. IN / OUT (°F)	AIR TEMP. IN / OUT (°F)	POWER CONSUMPTION (KW)	SENSIBLE CAPACITY (MBH)	TOTAL HEAT ABSORPTION (MBH)	WATER TEMP. IN / OUT (°F)	AIR TEMP. IN / OUT (°F)	POWER CONSUMPTION (KW)	VOLTS / PHASE	COMPRESSOR AMPS	FAN MOTOR (HP)	MINIMUM CIRCUIT AMPS	MAXIMUM FUSE SIZE	LENGTH x WIDTH x HEIGHT	WEIGHT (LBS.)	REMARKS
WSHP-1	MAMMOTH - D-018-H-H-S	HORIZONTAL STANDARD	750	0.5	1" PLEATED THROW-AWAY	4.0	1.0	13.9 / 11.3	23.2	40 / 105.8	80 / 61	1.73	26.4	19.4	70 / 60.3	70 / 102.9	2.09	208 / 1	1.2	1.5	10.3	15	21 x 21 x 32	205	FURNISH WITH AUTOMATIC VALVE, 3/4" THREE FOOT HOSE KIT
WSHP-2	D-024-H-H-S		875	0.5		5.0	10.4	17.8 / 23.2	30.8	40 / 102.3		2.24	30.4	22.6	70 / 60.9	70 / 102.1	2.45	208 / 1	1.8	1.5	13.1	20	24 x 24 x 31	215	FURNISH WITH AUTOMATIC VALVE, 1" THREE FOOT HOSE KIT
WSHP-3	D-036-H-H-S		1200	0.5		7.5	15.1	27.1 / 34.8	46.3	40 / 102.3		3.4	45.8	33.8	70 / 61.0	70 / 98.3	3.30	208 / 1	1.9.1	1.2	22.3	35	24 x 24 x 31	245	
WSHP-4	D-052-H-H-S		1500	0.5		10.0	10.1	39.1 / 50.8	68.0	40 / 105.0		5.01	66.2	50.6	70 / 54.8	70 / 109.2	5.11	208 / 1	20.5	3.4	30.8	50	28 x 28 x 44	335	
WSHP-5	D-018-V-H-E	VERTICAL STANDARD EFF.	875	0.5		5.0	4.1	10.8 / 14.9	17.8	40 / 105.1		1.33	22.4	17.4	70 / 58.4	70 / 100.1	1.69	208 / 1	8.4	1.9	9.3	15	21 x 21 x 32	210	FURNISH WITH AUTOMATIC VALVE, 3/4" THREE FOOT HOSE KIT
WSHP-6	D-018-V-H-E		750	0.5		4.0	1.0	13.9 / 11.3	23.2	40 / 101.8		1.73	26.4	19.4	70 / 60.3	70 / 102.9	2.09	208 / 1	1.2	1.5	10.3	15	21 x 21 x 32	205	
WSHP-7	D-024-V-H-E		875	0.5		5.0	10.4	17.8 / 23.2	30.8	40 / 102.3		2.24	30.4	22.6	70 / 60.9	70 / 102.1	2.45	208 / 1	1.8	1.5	13.1	20	24 x 24 x 31	215	
WSHP-8	D-030-V-H-E		1200	0.5		8.0	14.1	22.1 / 29.3	39.0	40 / 103.0		2.84	37.3	27.5	70 / 60.8	70 / 98.4	2.90	208 / 1	13.3	1.9	17.8	25	24 x 24 x 31	230	FURNISH WITH AUTOMATIC VALVE, 1" THREE FOOT HOSE KIT
WSHP-9	D-036-V-H-E		1500	0.5		7.5	15.1	27.1 / 34.8	46.3	40 / 102.3		3.4	45.8	33.8	70 / 61.0	70 / 98.3	3.30	208 / 1	19.1	1.2	22.3	35	24 x 24 x 31	245	
WSHP-10	D-048-V-H-E		1500	0.5		9.0	15.1	30.4 / 39.5	52.4	40 / 104.8		3.76	51.3	39.1	70 / 61.3	70 / 102.8	4.15	208 / 1	19.1	1.2	24.2	35	24 x 24 x 31	260	
WSHP-11	D-052-V-H-E		1900	0.5		10.0	10.1	39.1 / 50.8	68.0	40 / 105.0		5.01	66.2	50.6	70 / 54.8	70 / 109.2	5.11	208 / 1	20.5	3.4	30.8	50	28 x 28 x 44	335	
WSHP-12	D-060-V-H-E		2100	0.5		12.0	7.8	44.7 / 58.0	77.6	40 / 105.2		5.7	82.7	60.8	70 / 54.8	70 / 108.5	6.40	208 / 1	24.8	3.4	39.3	60	28 x 28 x 44	345	
WSHP-13	D-018-V-H-E		750	0.5		4.0	1.0	13.9 / 11.3	23.2	40 / 101.8		1.73	26.4	19.4	70 / 60.3	70 / 102.9	2.09	208 / 1	1.2	1.5	10.3	15	21 x 21 x 32	205	FURNISH WITH AUTOMATIC VALVE, 3/4" THREE FOOT HOSE KIT, EXTENDED-RANGE PACKAGE, 4 HOT GAS-REHEAT
WSHP-14	D-030-V-H-E		1200	0.5		8.0	14.1	22.1 / 29.3	39.0	40 / 103.0		2.84	37.3	27.5	70 / 60.8	70 / 98.4	2.90	208 / 1	13.3	1.9	17.8	25	24 x 24 x 31	230	FURNISH WITH AUTOMATIC VALVE, 1" THREE FOOT HOSE KIT, EXTENDED-RANGE PACKAGE, 6 HOT GAS-REHEAT
WSHP-15	D-052-V-H-E		1900	0.5		10.0	10.1	39.1 / 50.8	68.0	40 / 105.0		5.01	66.2	50.6	70 / 54.8	70 / 109.2	5.11	208 / 1	20.5	3.4	30.8	50	28 x 28 x 44	335	FURNISH WITH AUTOMATIC VALVE, 1" THREE FOOT HOSE KIT, EXTENDED-RANGE PACKAGE, 6 HOT GAS-REHEAT

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CONDENSATE RETURN PUMPS								ELECTRICAL			SPECIFIED IN SECTION 15600
DESIGNATION	REFERENCE PRODUCT	LOCATION	SERVES	TYPE	CONDENSATE FLOW RATE (GPM)	DISCHARGE PRESSURE (PSIG)	ROTATION (RPM)	NO. OF PUMPS	PUMP MOTOR (HP)	VOLTS/PHASE	REMARKS
P-1	PACO GRD 1070-5	BASEMENT	BOILER B-1	DUPLEX PACKAGE	34	25	-	2	1/2 EA	460/3	FURNISH W/ 15 GAL. CAST IRON RECEIVER, MECHANICAL ALTERNATOR, INLET STRAINER, WATER GAUGE GLASS, WATER THERMOMETER, INLET STAINER, PUMP DISCHARGE VALVES, CONTROL PANEL WITH CIRCUIT BREAKERS, MOTOR STARTERS AND HOA SWITCHES.

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FLASH TANKS — SPECIFIED IN SECTION 15600

DESIGNATION	REFERENCE PRODUCT	LOCATION	TANK SIZE (GAL.)	TANK DIAMETER (IN.)	LENGTH (IN)	DRAIN SIZE (IN.)	INLET SIZE (IN.)	OUTLET SIZE (IN.)	VENT SIZE (IN.)	SPRAY PIPE DIAMETER (IN.)	SPRAY PIPE LENGTH (IN.)	DRIP LEG SIZE (IN.)	DRIP LEG LENGTH (IN.)	HAND HOLE SIZE (IN. x IN.)	OPERATING WEIGHT (LBS)	REMARKS
FT-1	KEWANEE M-255 K	CENTRAL PLANT	5	5	24	3/4	3/4	3/4	1	3/4	12	1	12	12 x 12	345	REFER TO DETAIL FOR PIPING CONNECTIONS

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FLASH TANKS — SPECIFIED IN SECTION 15600

DESIGNATION	REFERENCE PRODUCT	LOCATION	TANK SIZE (GAL.)	TANK DIAMETER (IN.)	LENGTH (IN)	DRAIN SIZE (IN.)	INLET SIZE (IN.)	OUTLET SIZE (IN.)	VENT SIZE (IN.)	SPRAY PIPE DIAMETER (IN.)	SPRAY PIPE LENGTH (IN.)	DRIP LEG SIZE (IN.)	DRIP LEG LENGTH (IN.)	HAND HOLE SIZE (IN. x IN.)	OPERATING WEIGHT (LBS)	REMARKS
FT-1	KEWANEE M-255 K	CENTRAL PLANT	5	5	24	3/4	3/4	3/4	1	3/4	12	1	12	12 x 12	345	REFER TO DETAIL FOR PIPING CONNECTIONS

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PRESSURE REDUCING STATIONS

SPECIFIED IN SECTION 15100

DESIGNATION	REFERENCE PRODUCT	LOCATION	CAPACITY (LBS/HR)	INLET STEAM PRESSURE (PSIG)	OUTLET STEAM PRESSURE (PSIG)	VALVE SIZE (IN.)	REMARKS
PRV-1	LESLIE GPKP SERIES	BASEMENT	3035	60	12	1	

PRESSURE REDUCING STATIONS

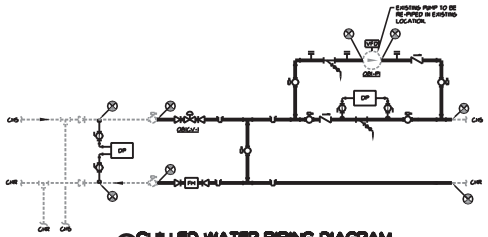
SPECIFIED IN SECTION 15100

DESIGNATION	REFERENCE PRODUCT	LOCATION	CAPACITY (LBS/HR)	INLET STEAM PRESSURE (PSIG)	OUTLET STEAM PRESSURE (PSIG)	VALVE SIZE (IN.)	REMARKS
PRV-1	LESLIE GPKP SERIES	BASEMENT	3035	60	12	1	

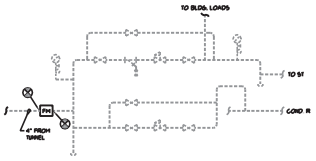
PRESSURE RELIEF VALVES

SPECIFIED IN SECTION 15100

DESIGNATION	REFERENCE PRODUCT	SERVES	CAPACITY (LBS/HR)	CAPACITY (MBH)	ORIFICE AREA (SQ. IN.)	PRESSURE RELIEF SETTING (PSIG)	VALVE SIZE (IN.)	REMARKS
RV-1	KUNKLE 137	HWS SYSTEM	-	3154	-	125	1	



② CHILLED WATER PIPING DIAGRAM
NOT TO SCALE



③ STEAM PIPING DIAGRAM
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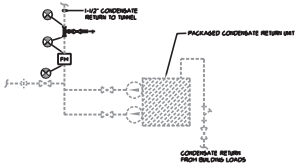

④ CONDENSATE RETURN PIPING DIAGRAM
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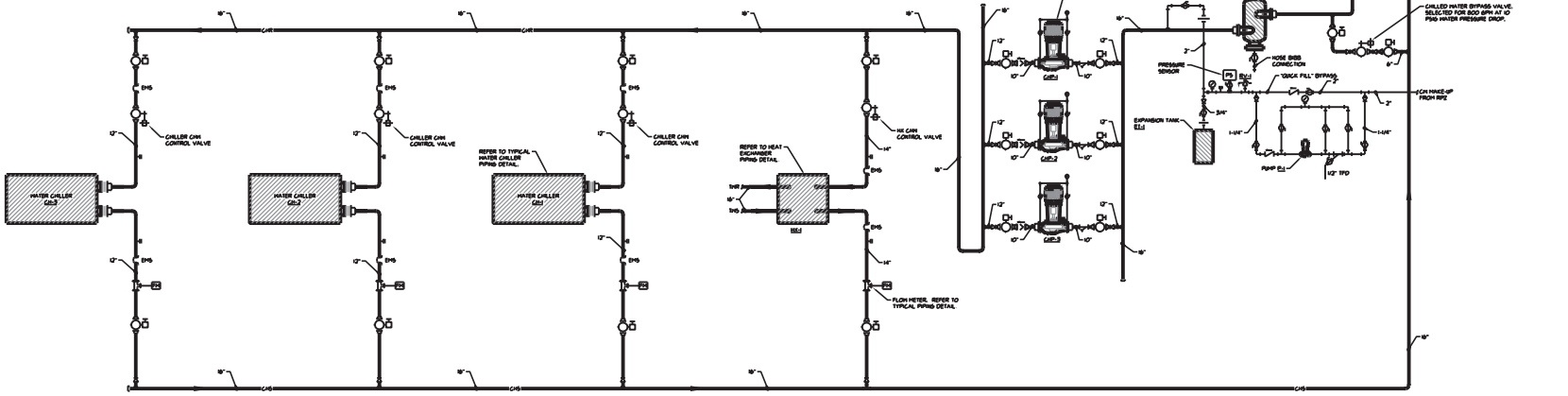

① CHILLED WATER PIPING DIAGRAM
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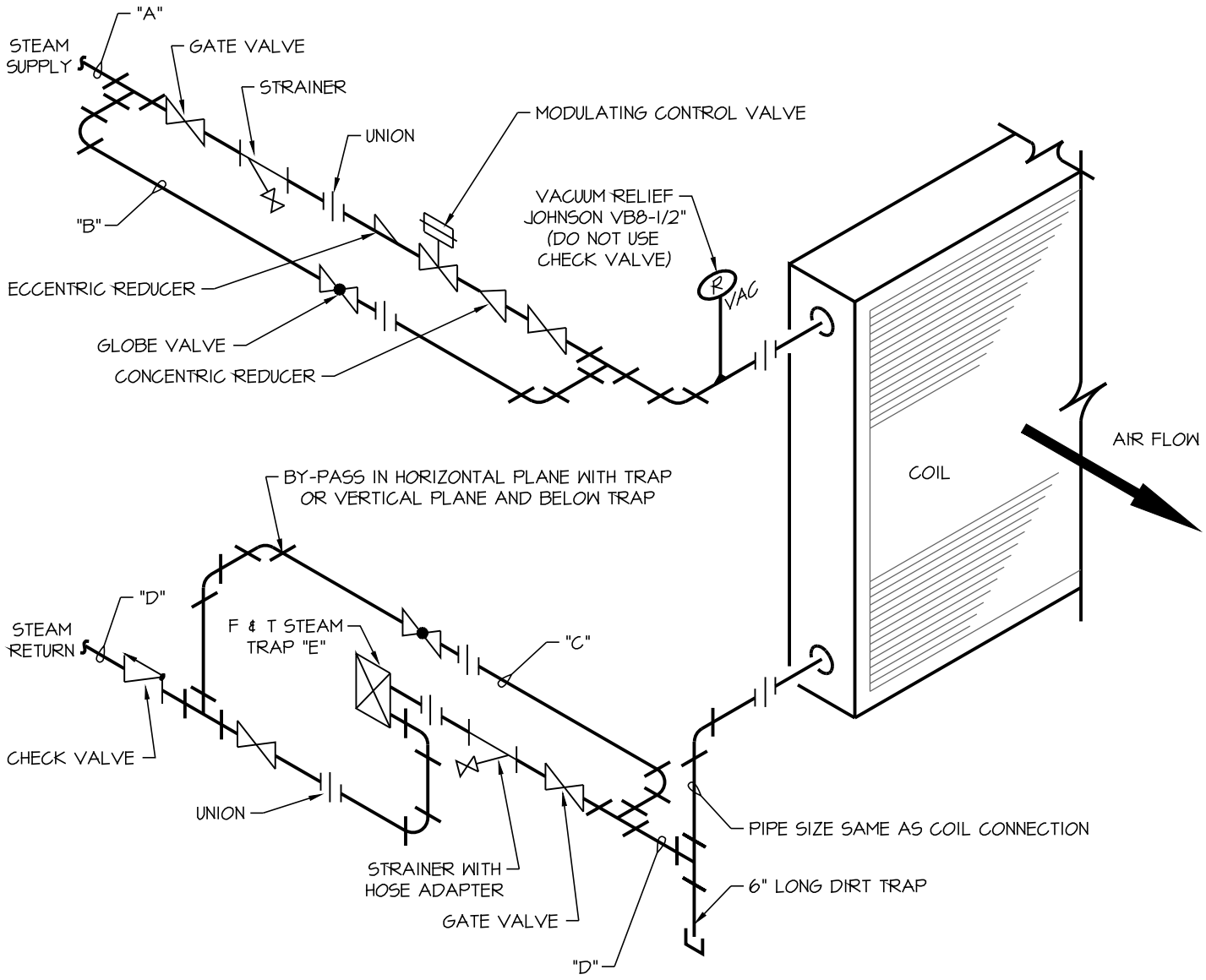

COIL DESIGNATION	A	B	C	D	E
HEATING COIL (HC-1)	1-1/2"	1-1/4"	1-1/4"	1-1/2"	ST-2

1 STEAM PREHEAT COIL PIPING DETAIL

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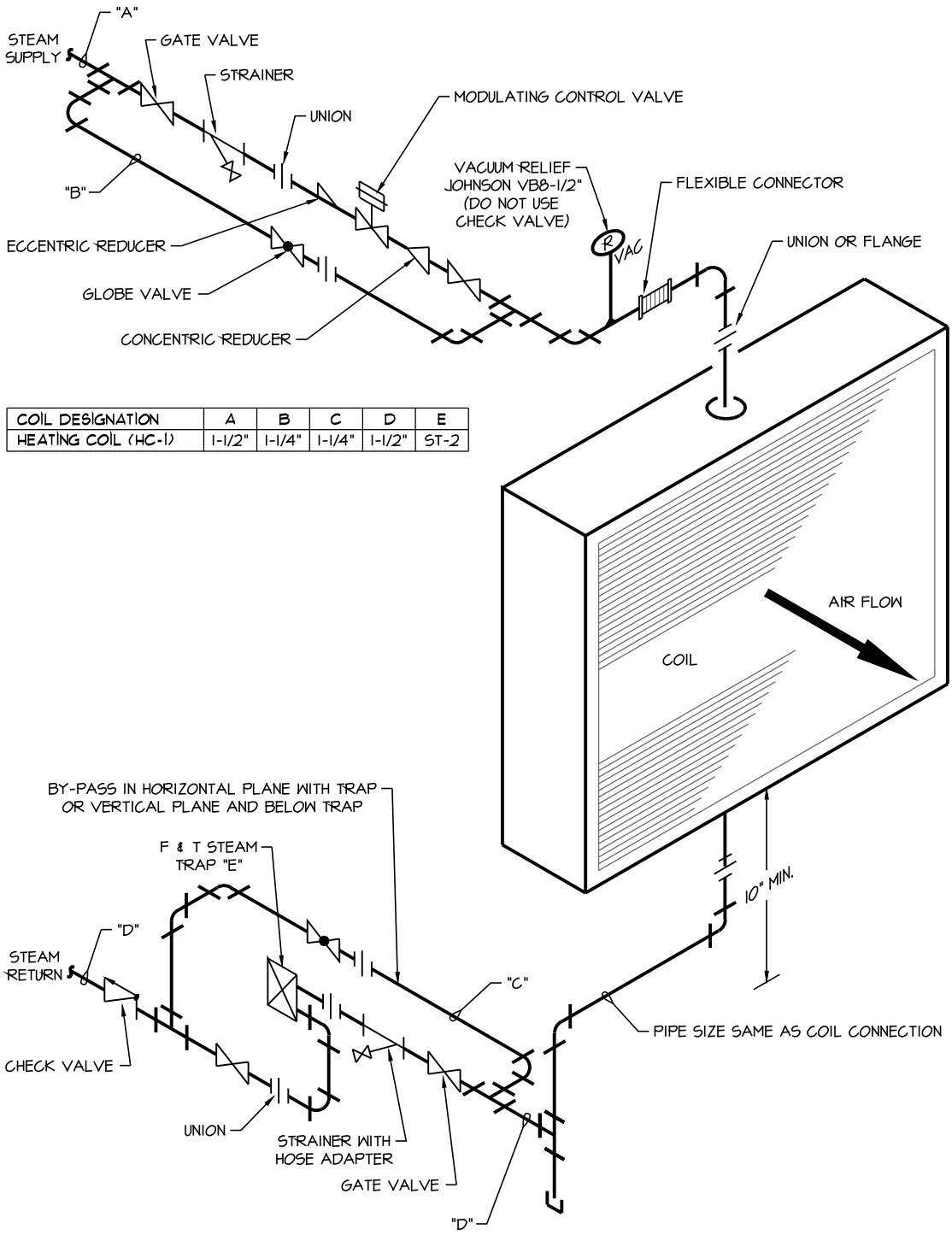

COIL DESIGNATION	A	B	C	D	E
HEATING COIL (HC-1)	1-1/2"	1-1/4"	1-1/4"	1-1/2"	ST-2

2 STEAM PREHEAT COIL PIPING DETAIL

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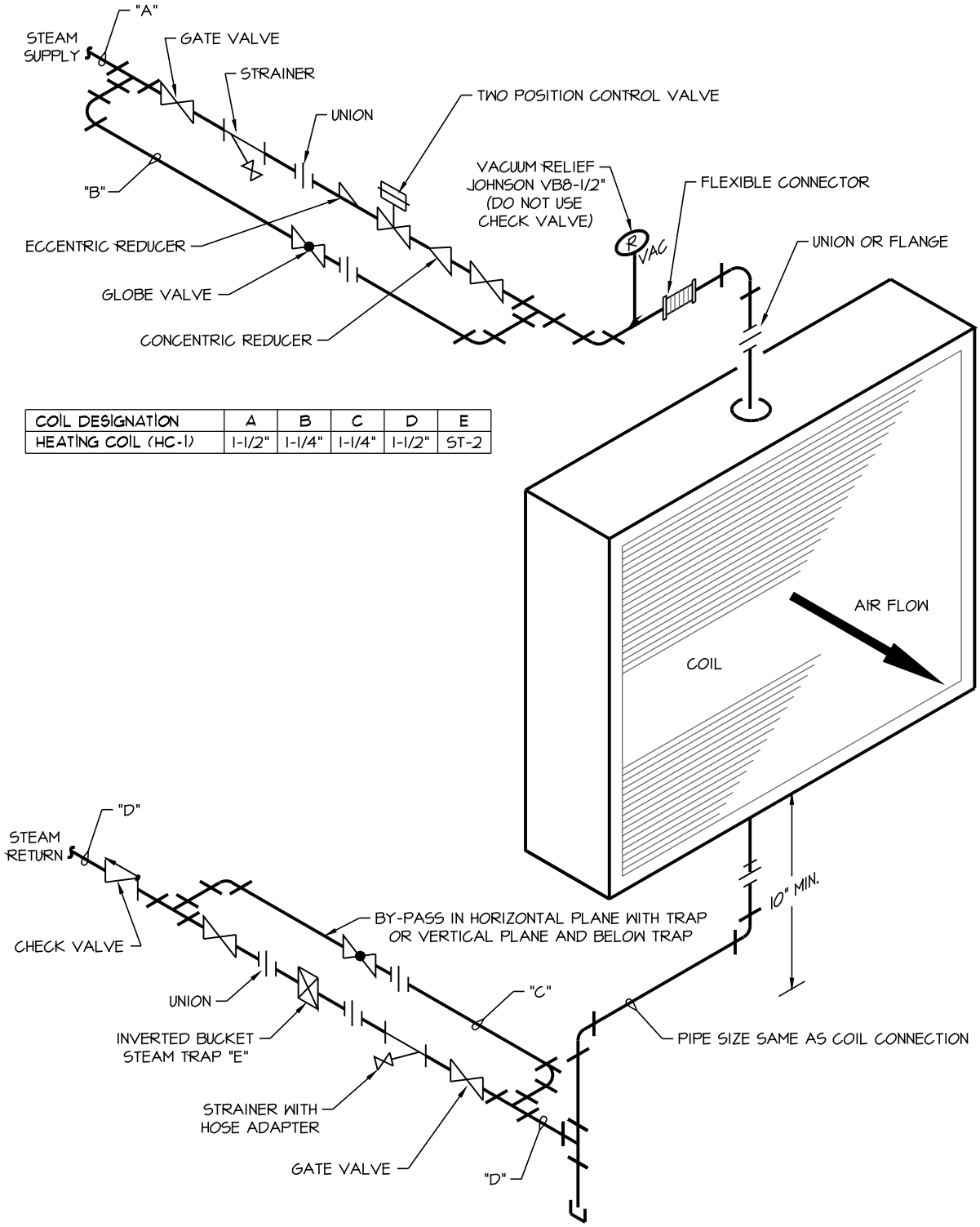

COIL DESIGNATION	A	B	C	D	E
HEATING COIL (HC-1)	1-1/2"	1-1/4"	1-1/4"	1-1/2"	ST-2

3 STEAM PREHEAT COIL PIPING DETAIL

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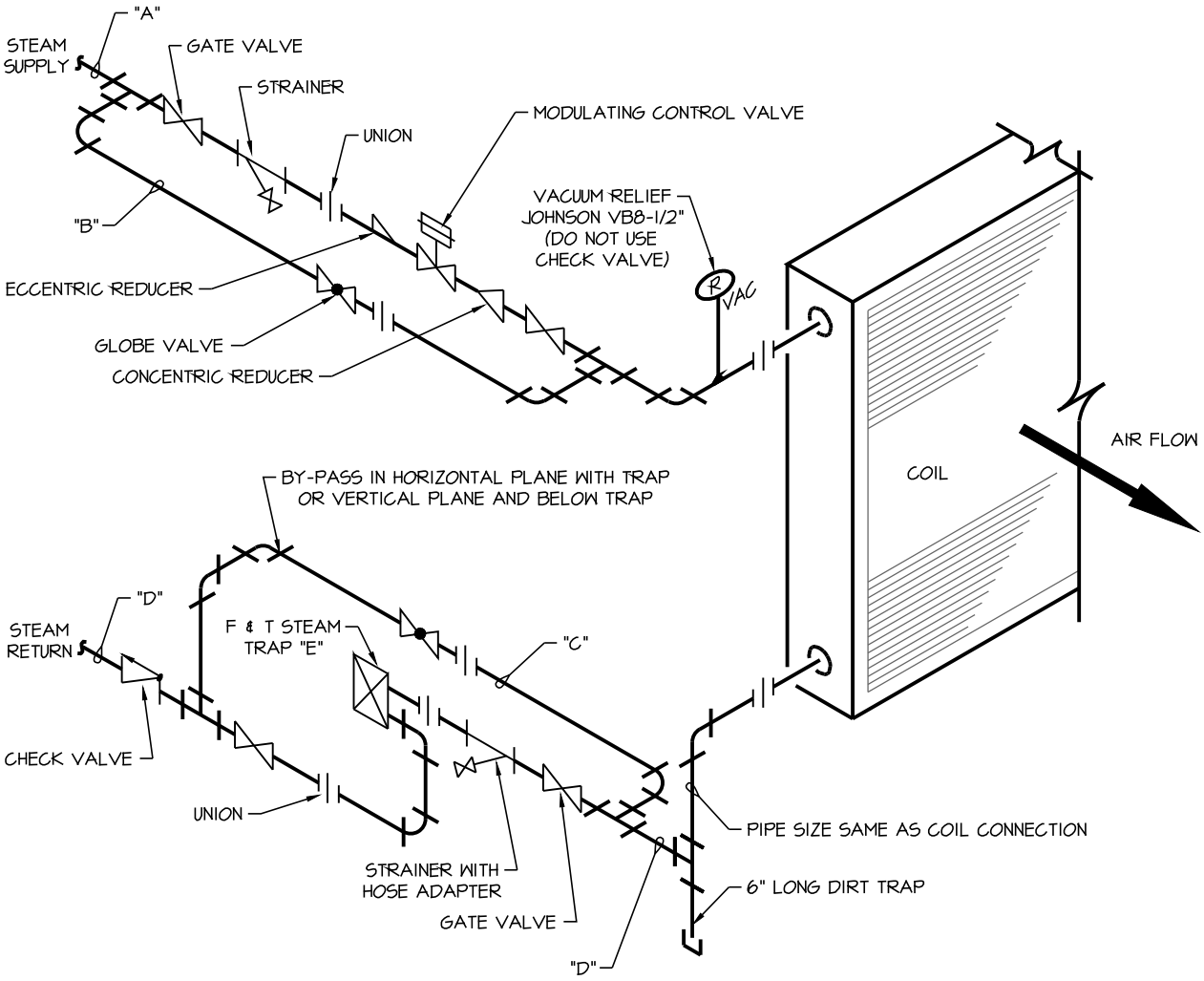

COIL DESIGNATION	A	B	C	D	E
HEATING COIL (HC-1)	1-1/2"	1-1/4"	1-1/4"	1-1/2"	ST-2

4 STEAM REHEAT COIL PIPING DETAIL

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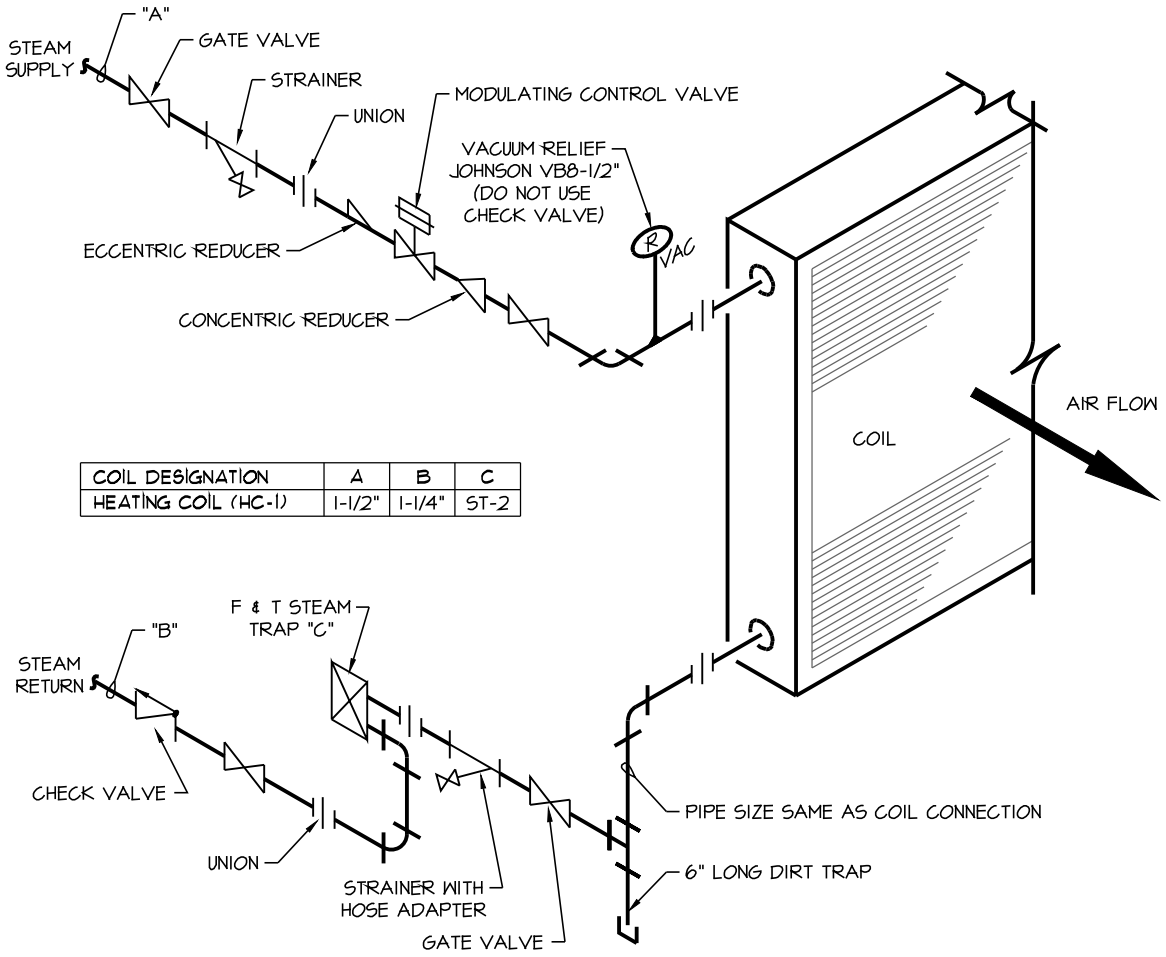

COIL DESIGNATION	A	B	C
HEATING COIL (HC-1)	1-1/2"	1-1/4"	ST-2

5 STEAM PREHEAT COIL PIPING DETAIL

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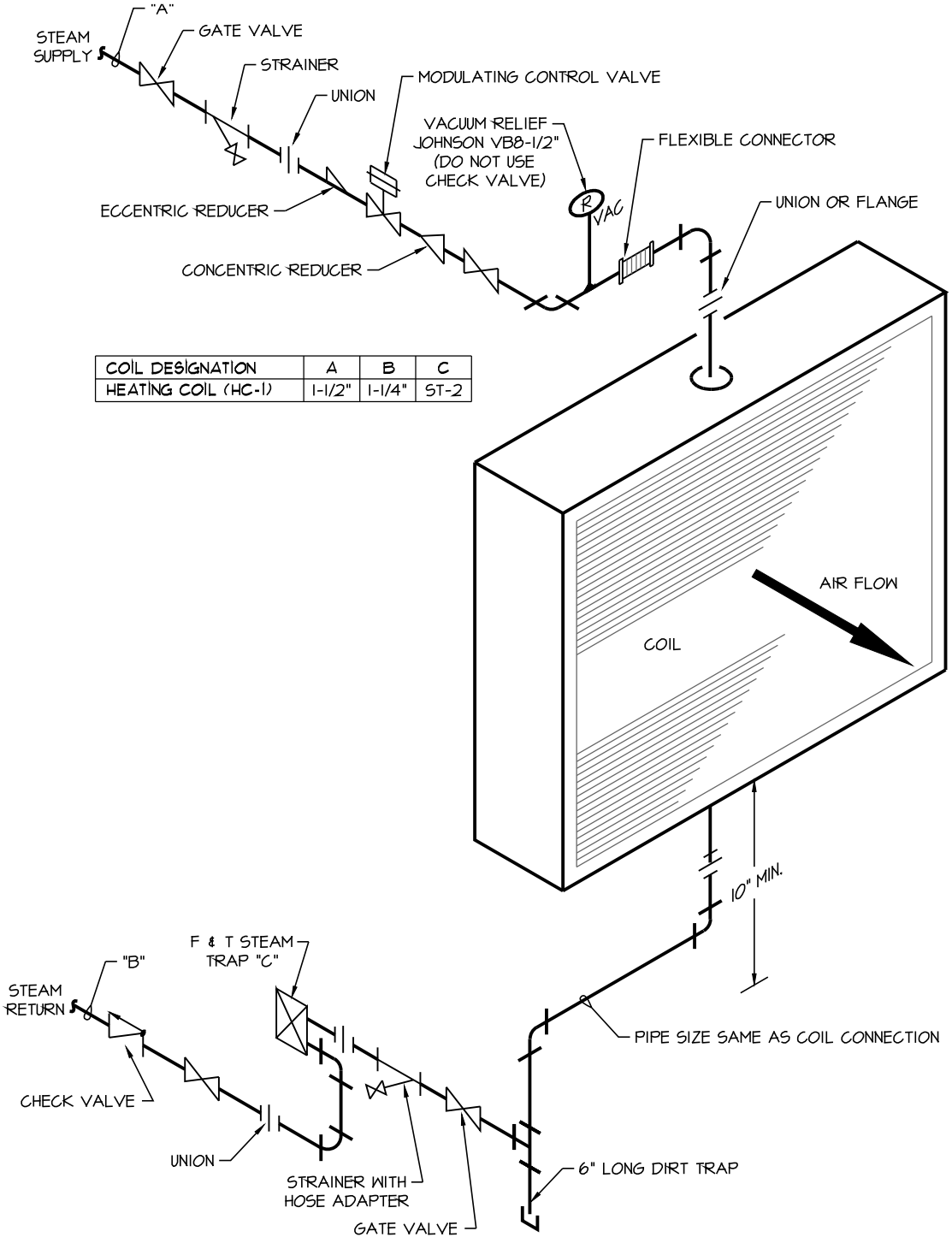

COIL DESIGNATION	A	B	C
HEATING COIL (HC-1)	1-1/2"	1-1/4"	ST-2

6 STEAM PREHEAT COIL PIPING DETAIL

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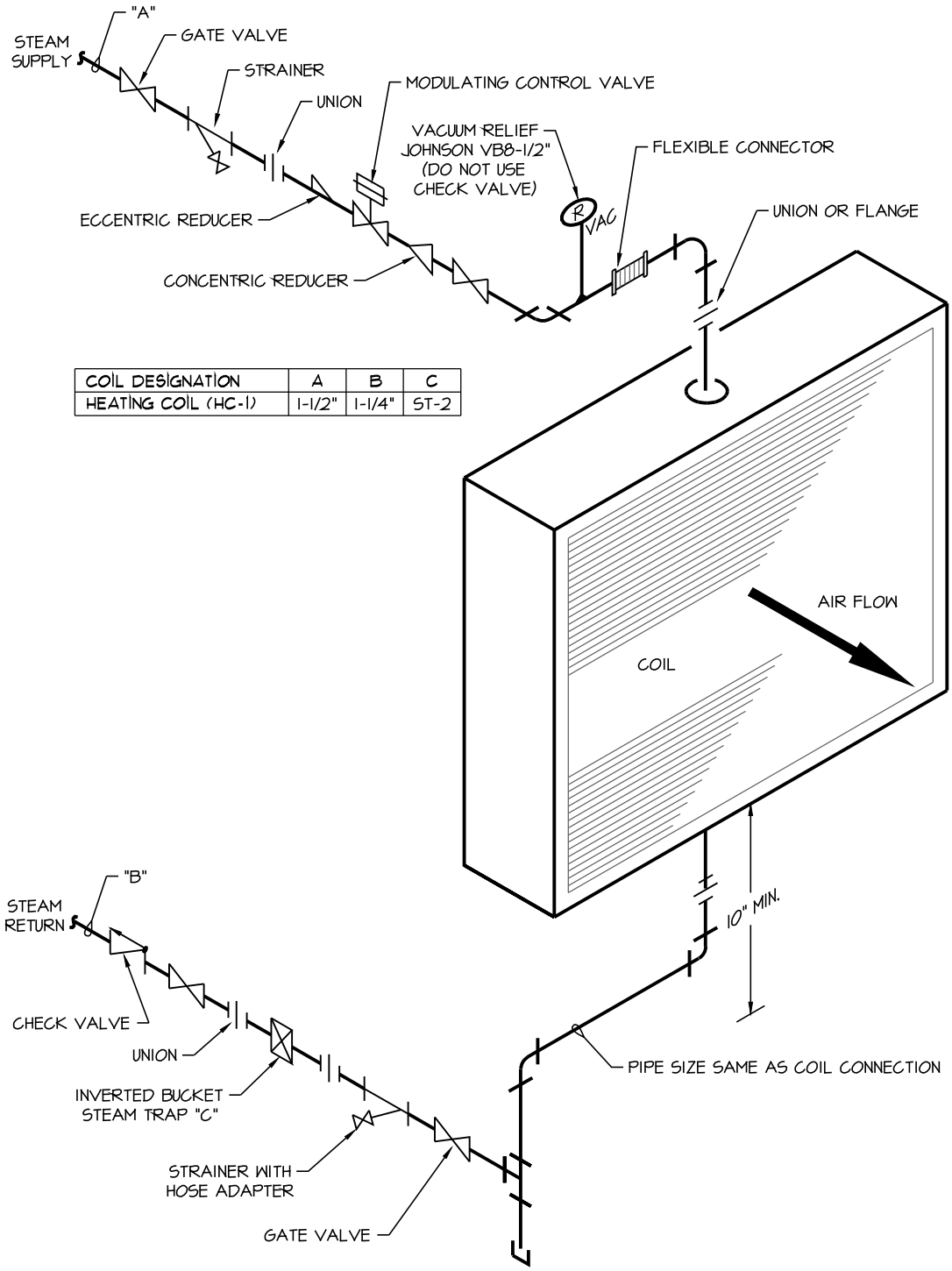

COIL DESIGNATION	A	B	C
HEATING COIL (HC-1)	1-1/2"	1-1/4"	ST-2

7 STEAM PREHEAT COIL PIPING DETAIL

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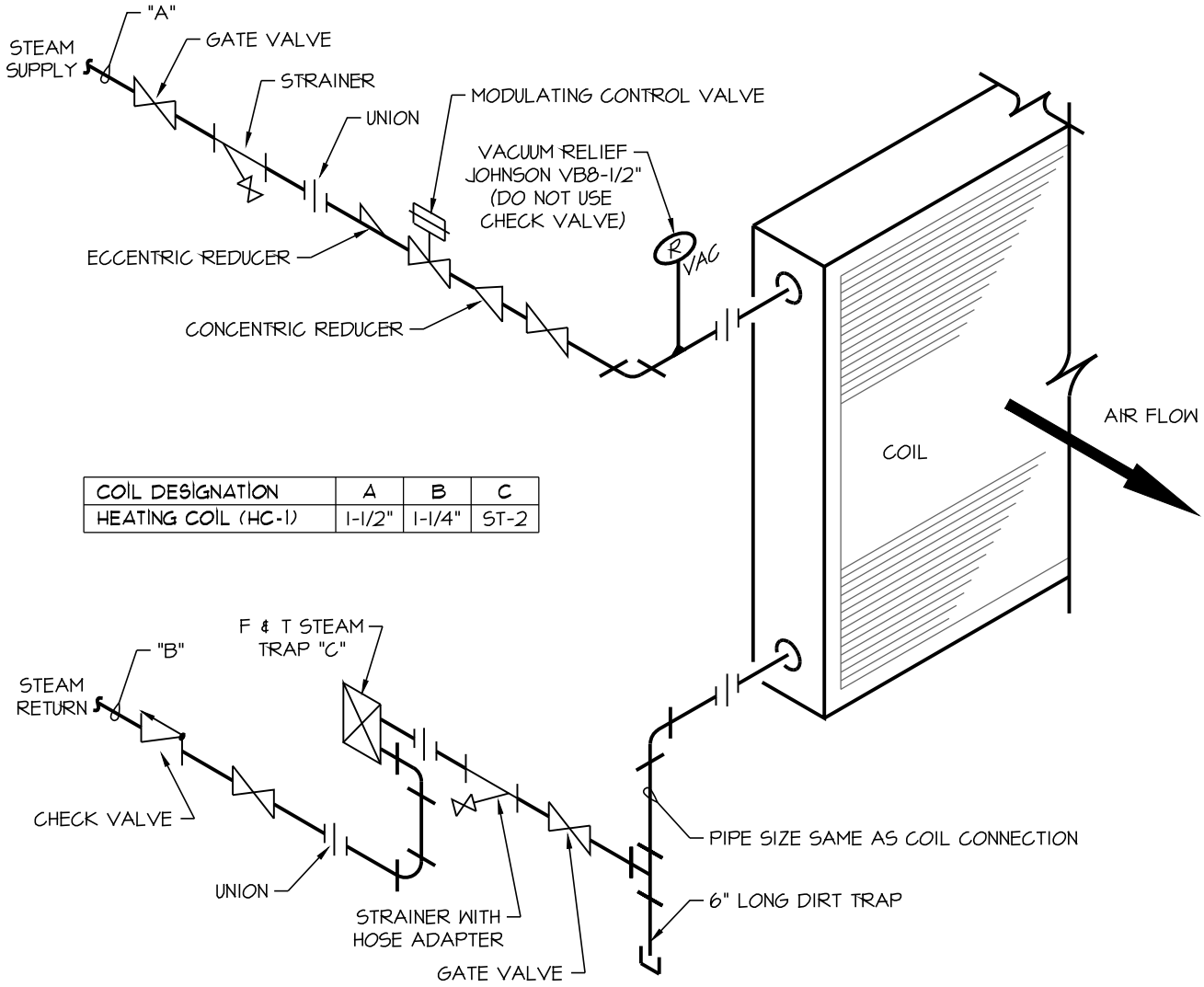

COIL DESIGNATION	A	B	C
HEATING COIL (HC-1)	1-1/2"	1-1/4"	ST-2

8 STEAM REHEAT COIL PIPING DETAIL

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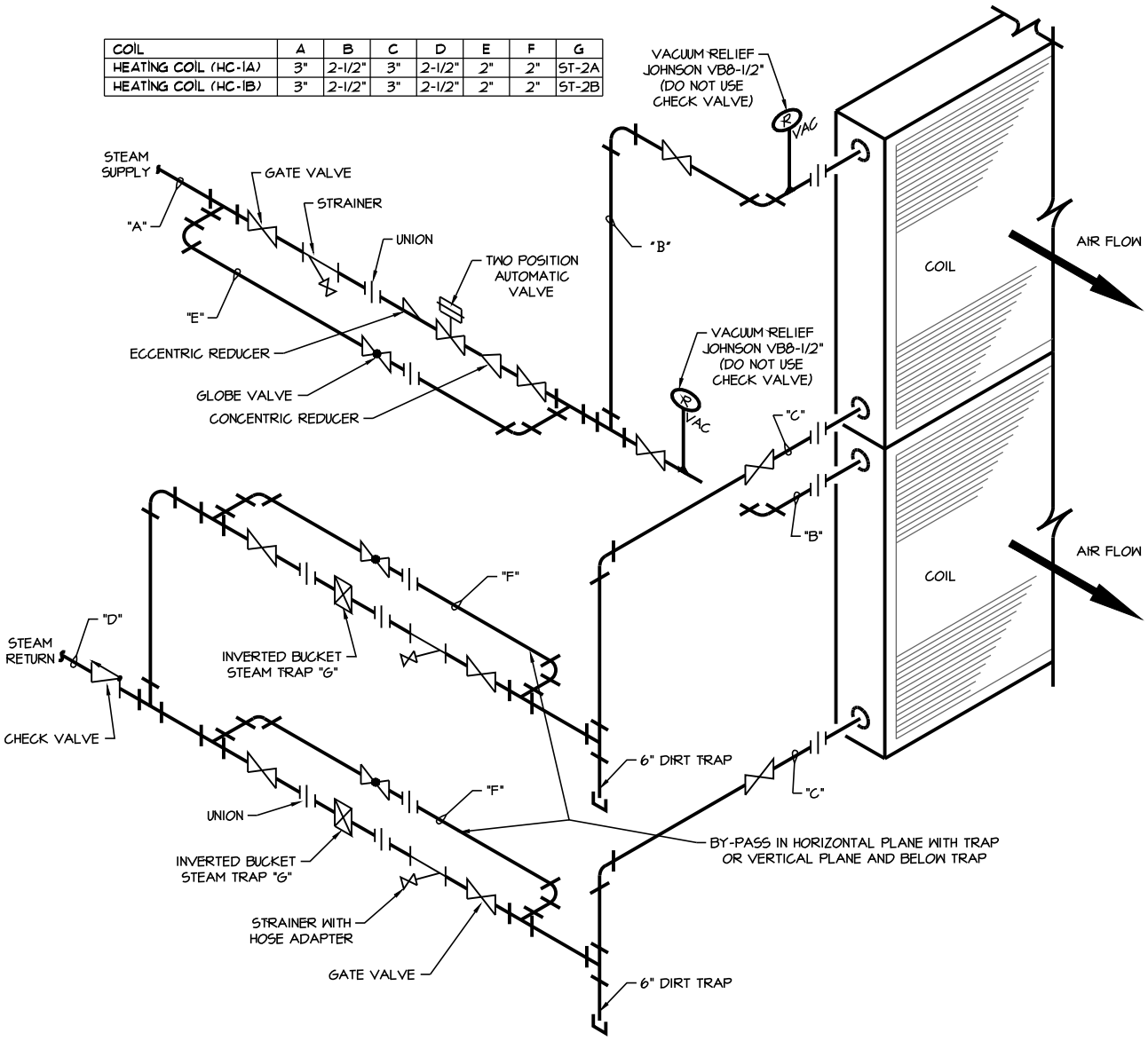
COIL	A	B	C	D	E	F	G
HEATING COIL (HC-1A)	3"	2-1/2"	3"	2-1/2"	2"	2"	ST-2A
HEATING COIL (HC-1B)	3"	2-1/2"	3"	2-1/2"	2"	2"	ST-2B



9 STEAM PREHEAT COIL PIPING DETAIL

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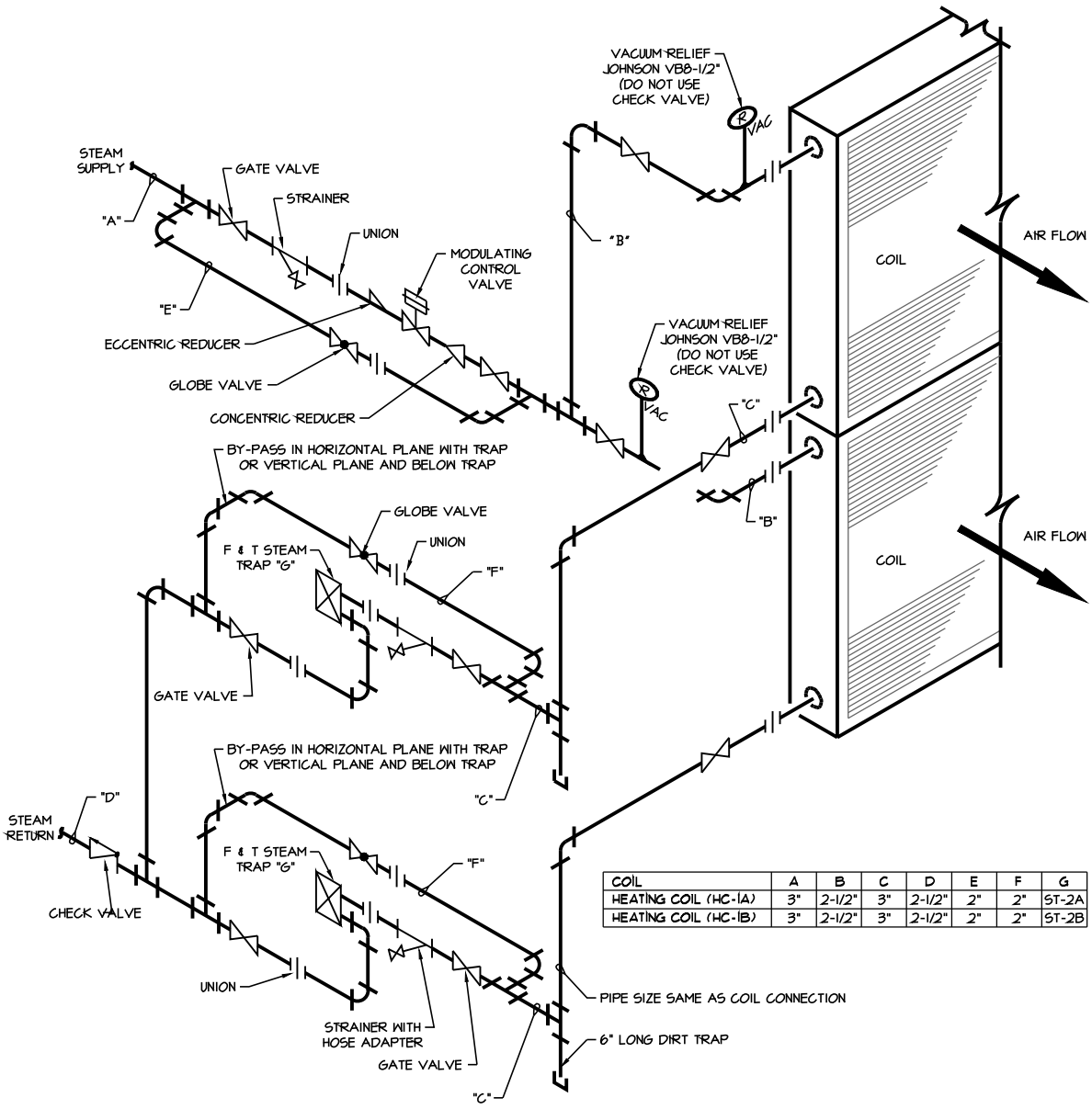

COIL	A	B	C	D	E	F	G
HEATING COIL (HC-1A)	3"	2-1/2"	3"	2-1/2"	2"	2"	ST-2A
HEATING COIL (HC-1B)	3"	2-1/2"	3"	2-1/2"	2"	2"	ST-2B

10 STEAM PREHEAT COIL PIPING DETAIL

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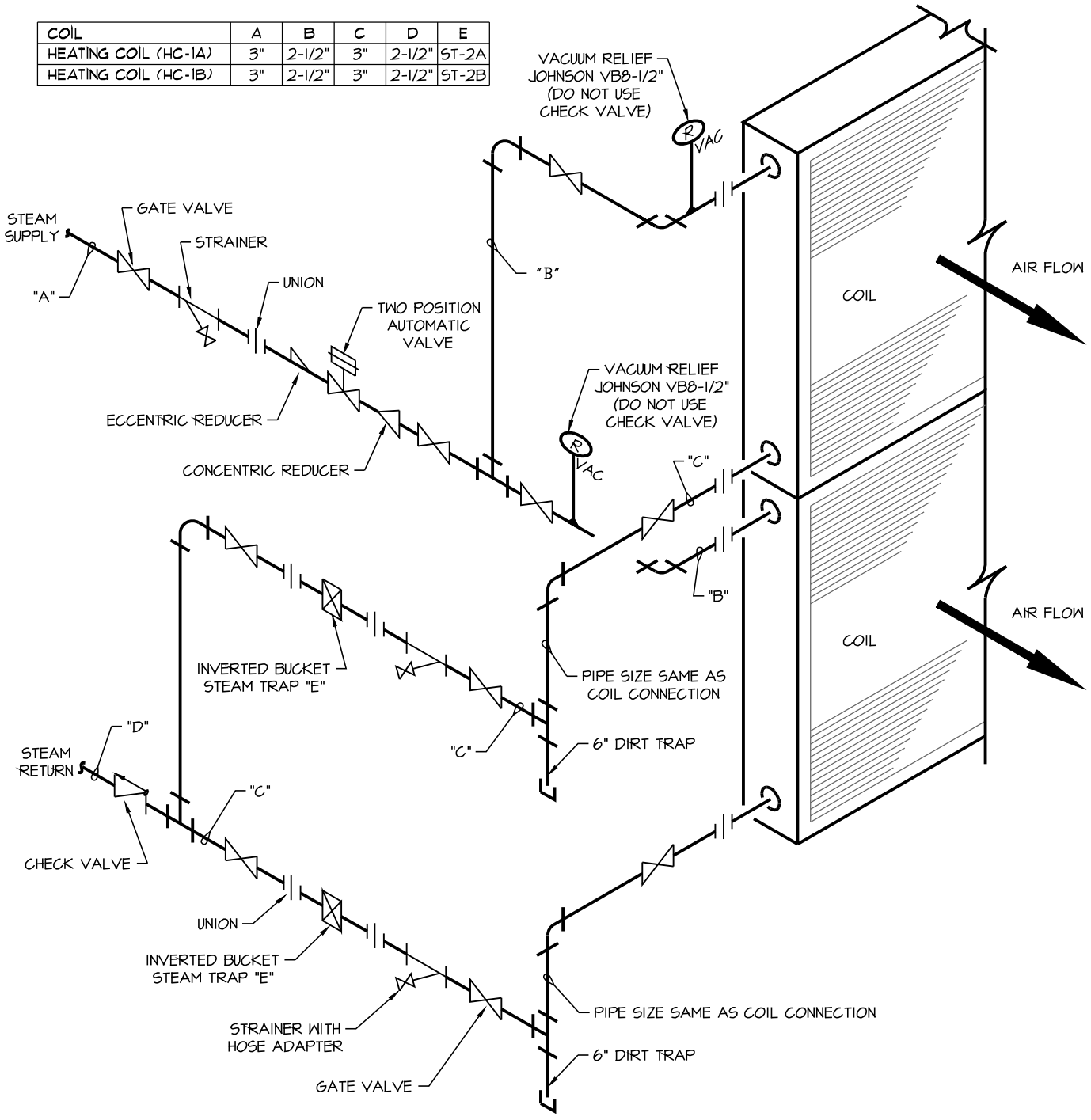
COIL	A	B	C	D	E
HEATING COIL (HC-1A)	3"	2-1/2"	3"	2-1/2"	ST-2A
HEATING COIL (HC-1B)	3"	2-1/2"	3"	2-1/2"	ST-2B



11 STEAM PREHEAT COIL PIPING DETAIL

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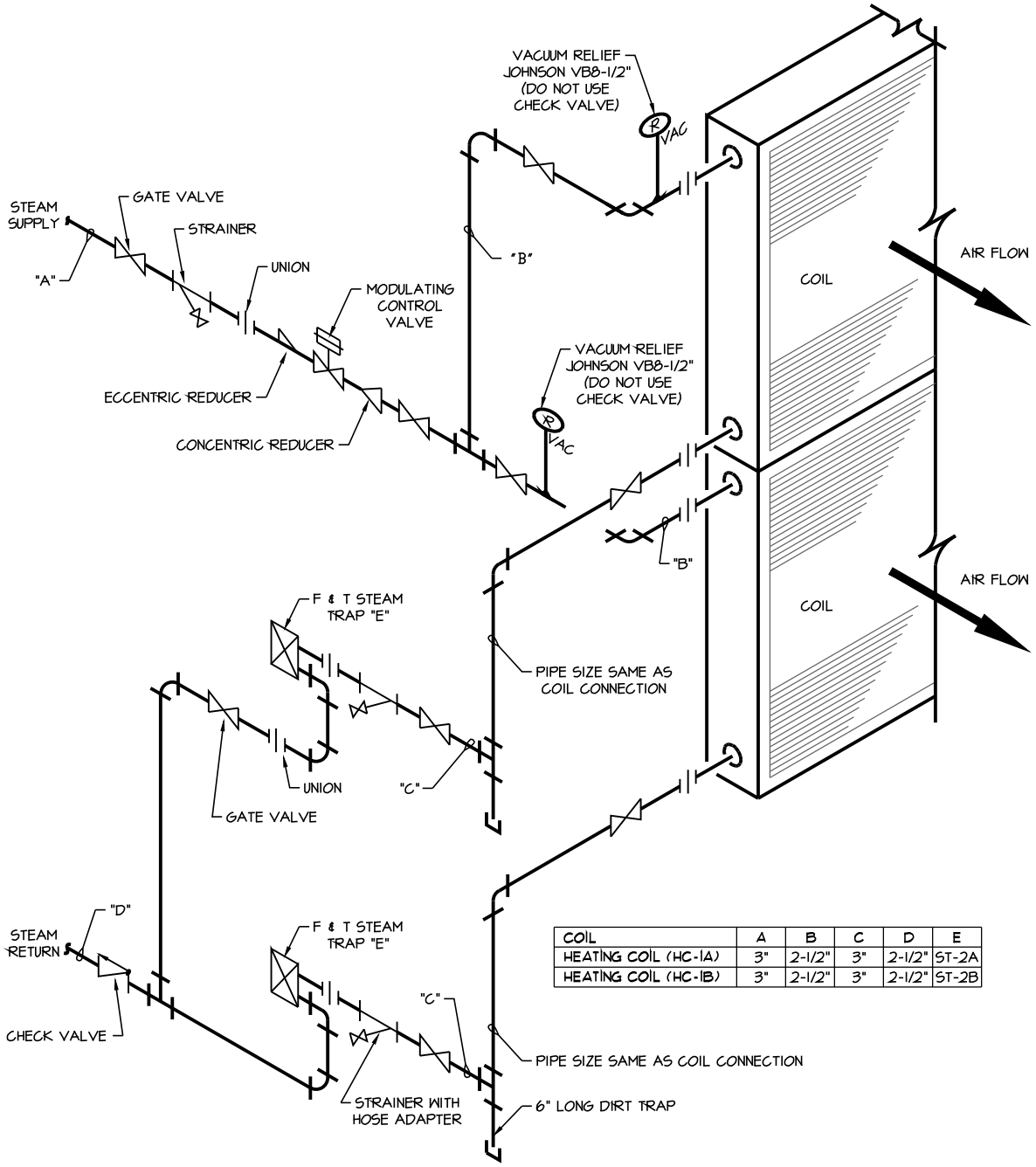

COIL	A	B	C	D	E
HEATING COIL (HC-1A)	3"	2-1/2"	3"	2-1/2"	ST-2A
HEATING COIL (HC-1B)	3"	2-1/2"	3"	2-1/2"	ST-2B

12 STEAM PREHEAT COIL PIPING DETAIL

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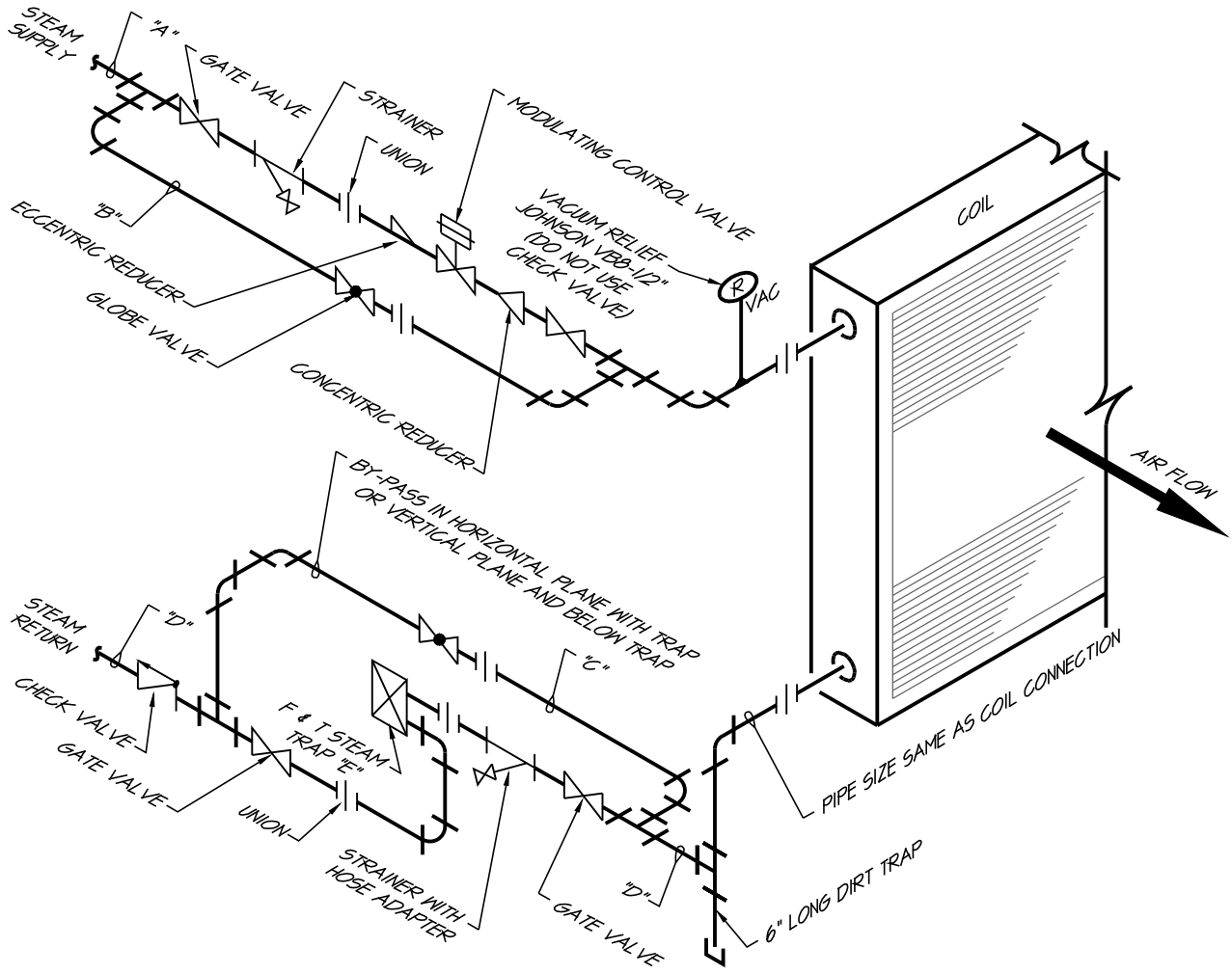

COIL DESIGNATION	A	B	C	D	E
HEATING COIL (HC-1)	1-1/2"	1-1/4"	1-1/4"	1-1/2"	ST-2

13 STEAM PREHEAT COIL PIPING DETAIL

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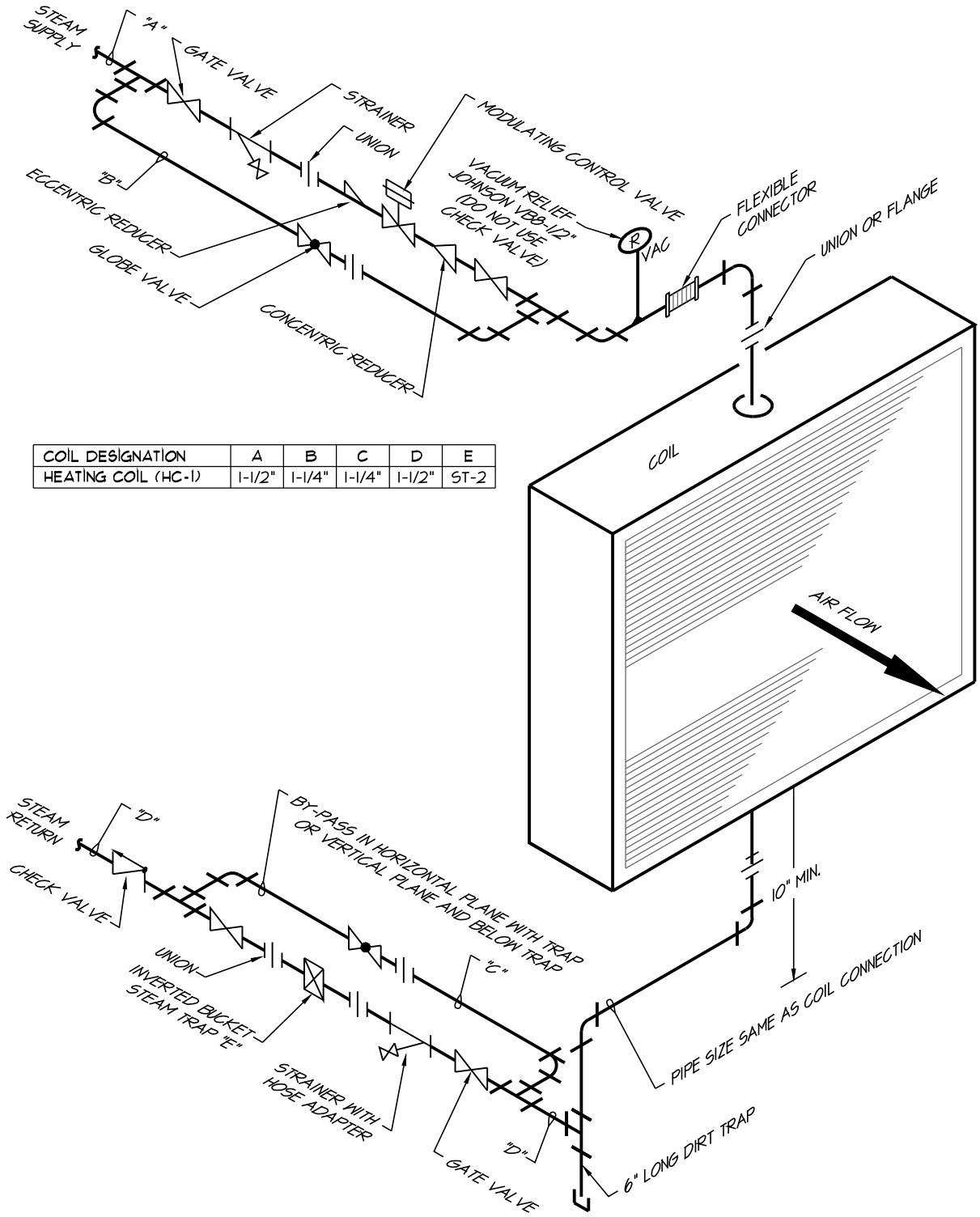

COIL DESIGNATION	A	B	C	D	E
HEATING COIL (HC-1)	1-1/2"	1-1/4"	1-1/4"	1-1/2"	ST-2

15 STEAM PREHEAT COIL PIPING DETAIL

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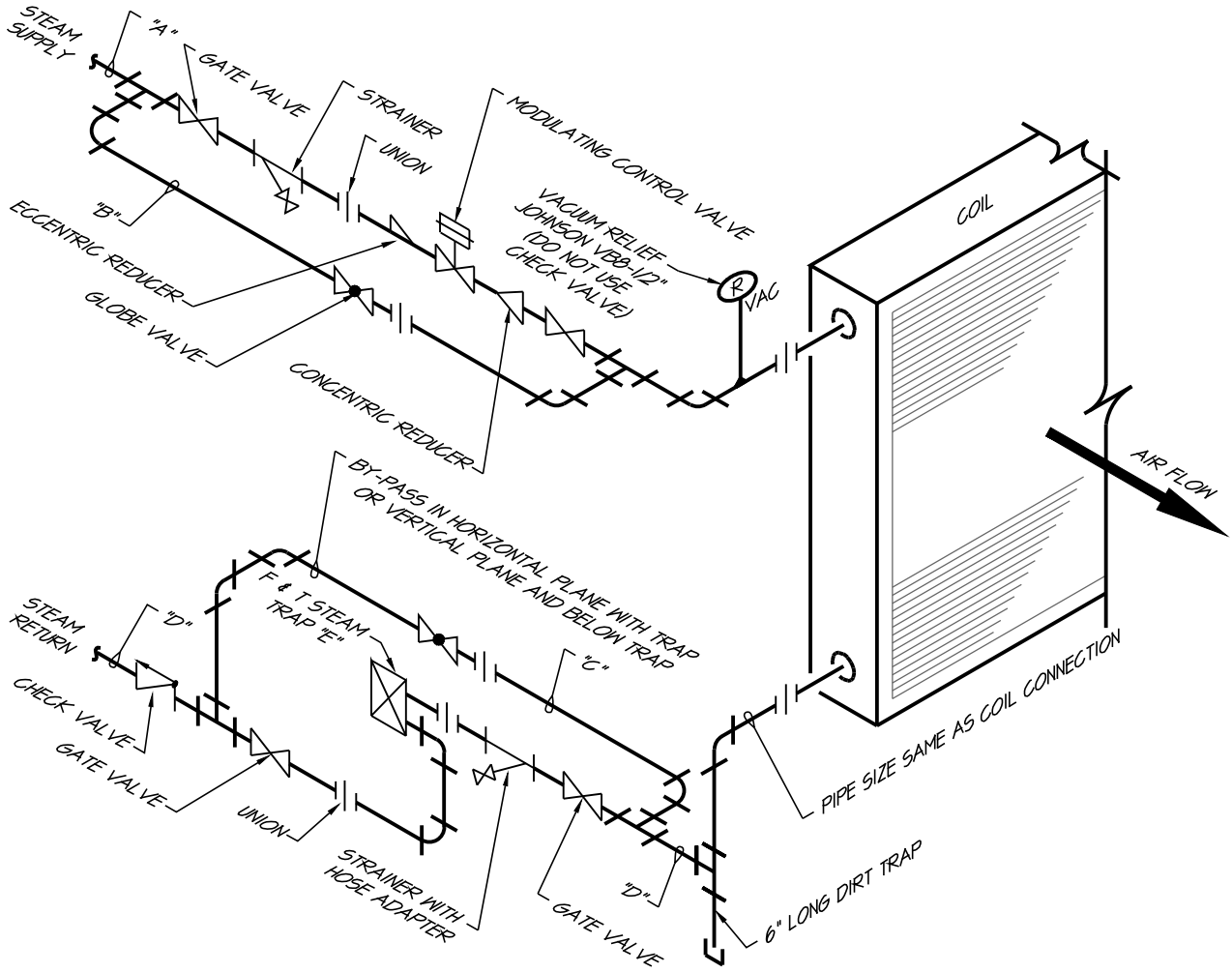
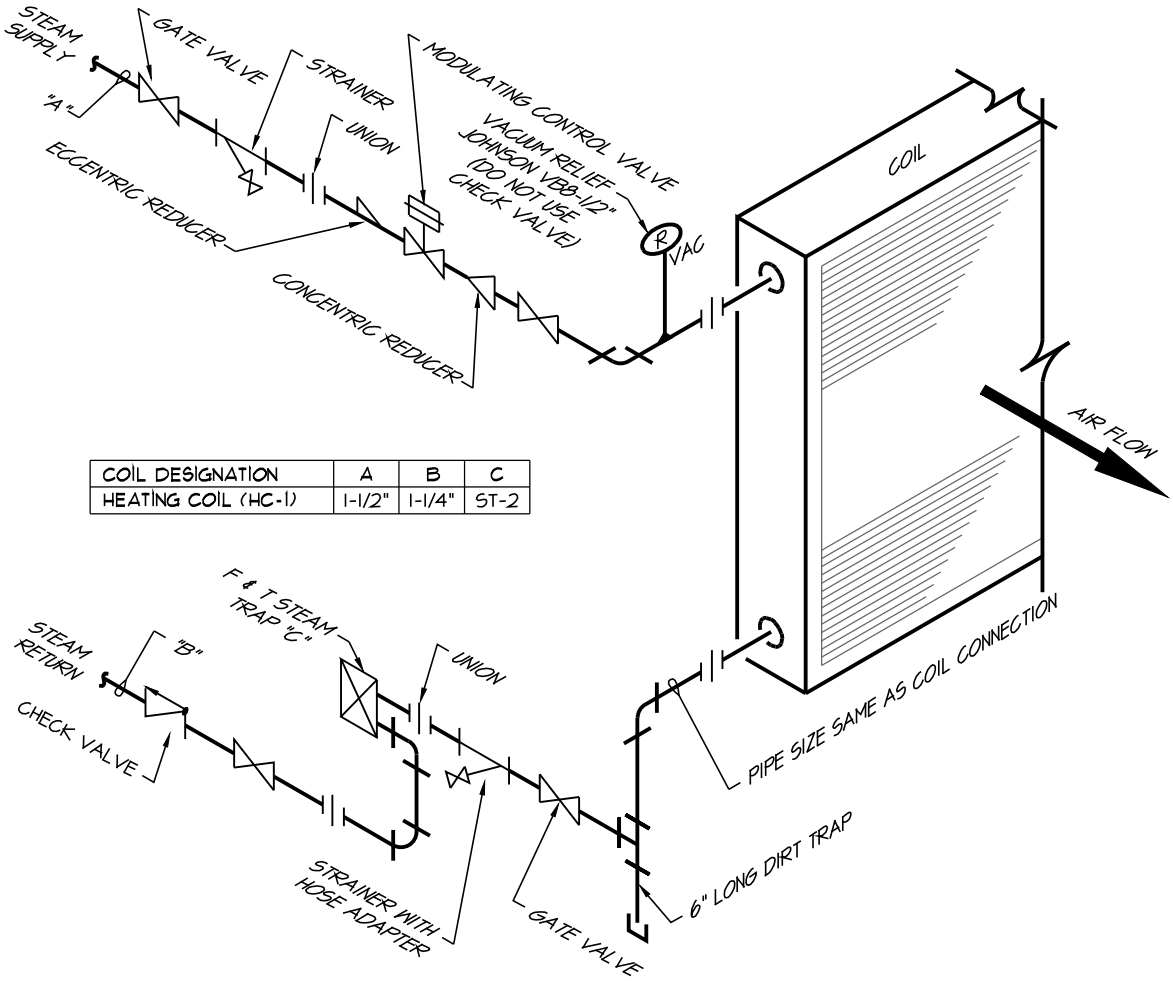


COIL DESIGNATION	A	B	C	D	E
HEATING COIL (HC-1)	1-1/2"	1-1/4"	1-1/4"	1-1/2"	ST-2

16 STEAM REHEAT COIL PIPING DETAIL

NOT TO SCALE



COIL DESIGNATION	A	B	C
HEATING COIL (HC-1)	1-1/2"	1-1/4"	ST-2

17 STEAM PREHEAT COIL PIPING DETAIL

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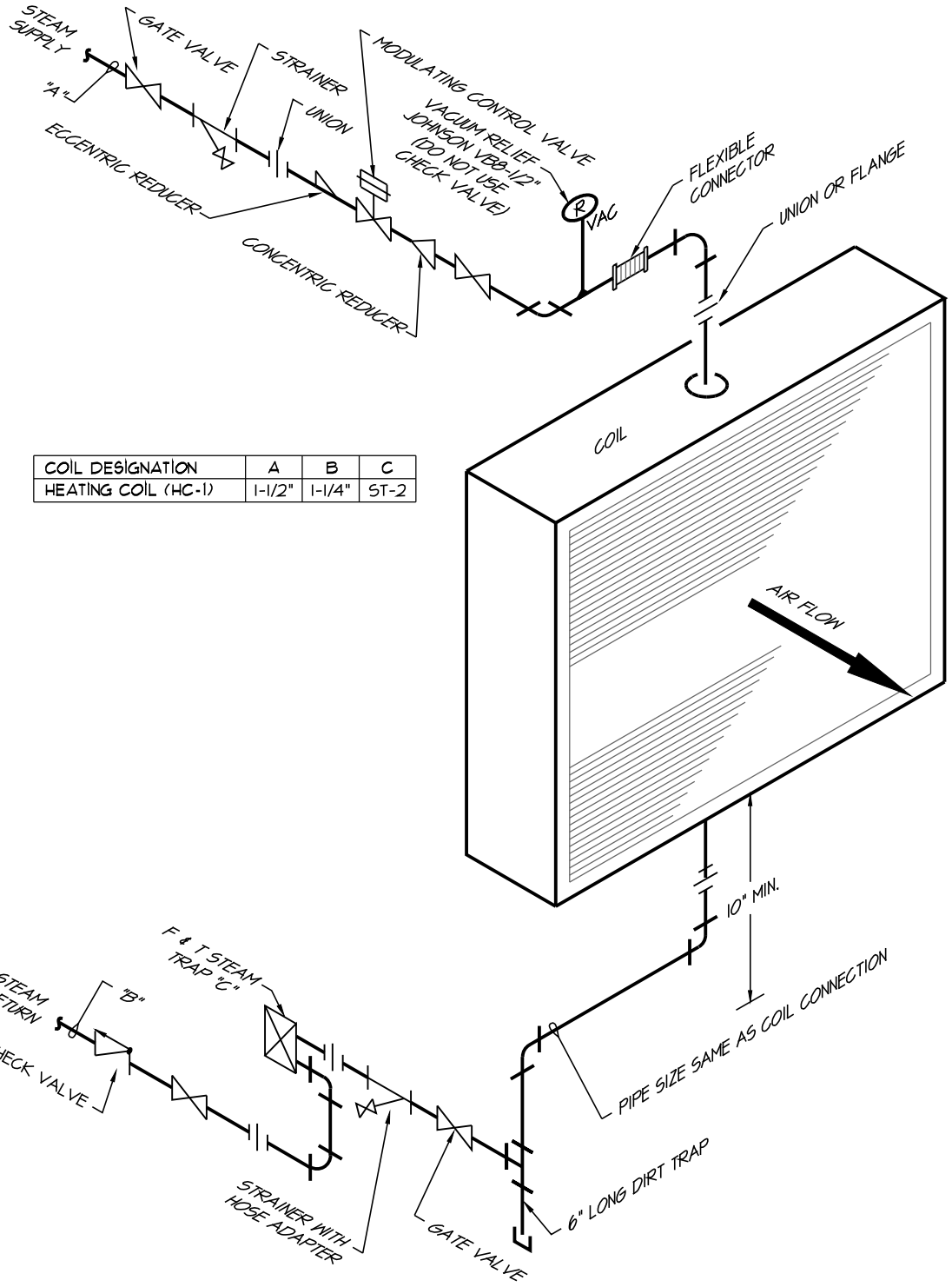

COIL DESIGNATION	A	B	C
HEATING COIL (HC-1)	1-1/2"	1-1/4"	ST-2

18 STEAM PREHEAT COIL PIPING DETAIL

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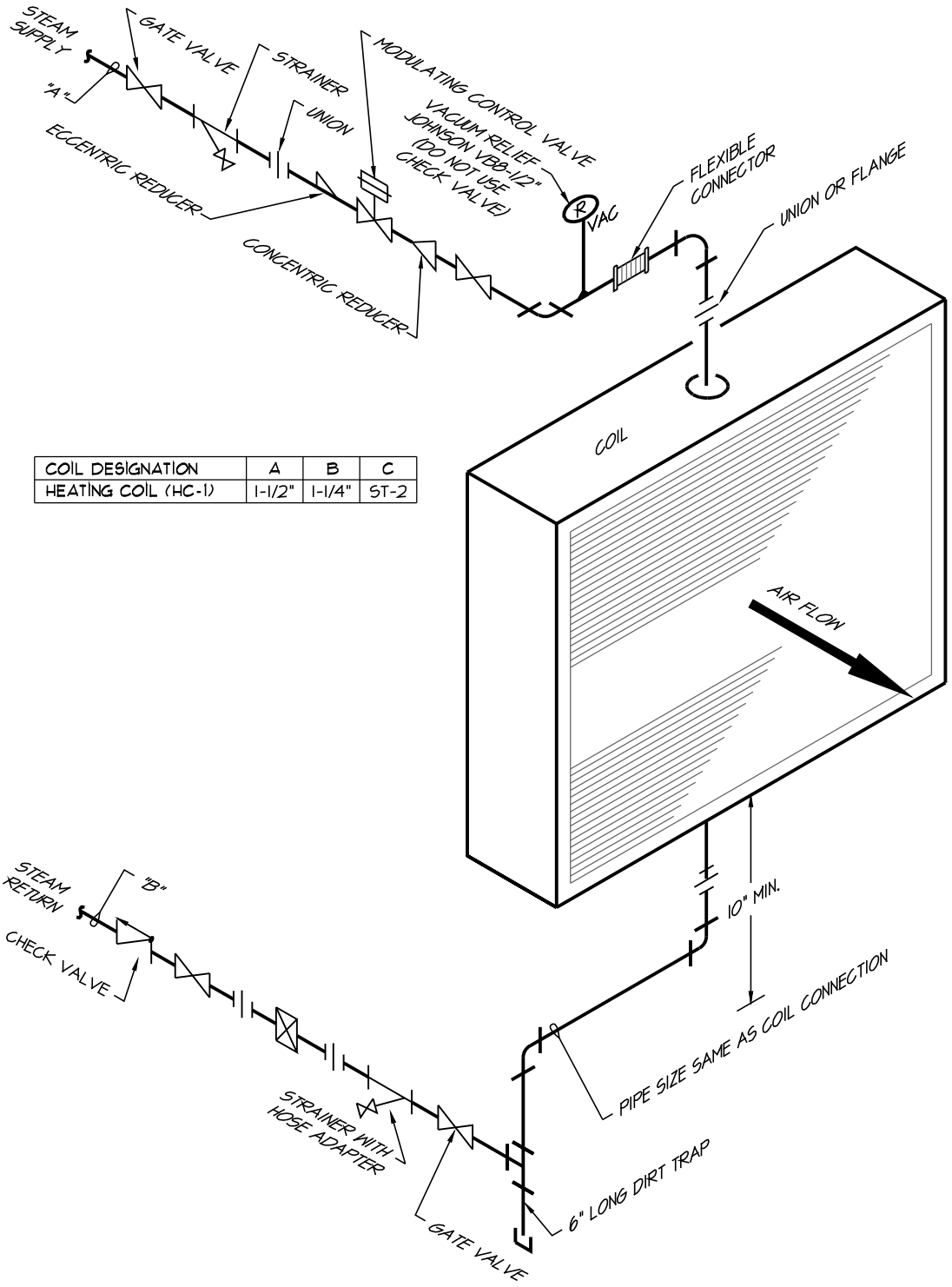

COIL DESIGNATION	A	B	C
HEATING COIL (HC-1)	1-1/2"	1-1/4"	ST-2

19 STEAM PREHEAT COIL PIPING DETAIL

NOT TO SCALE

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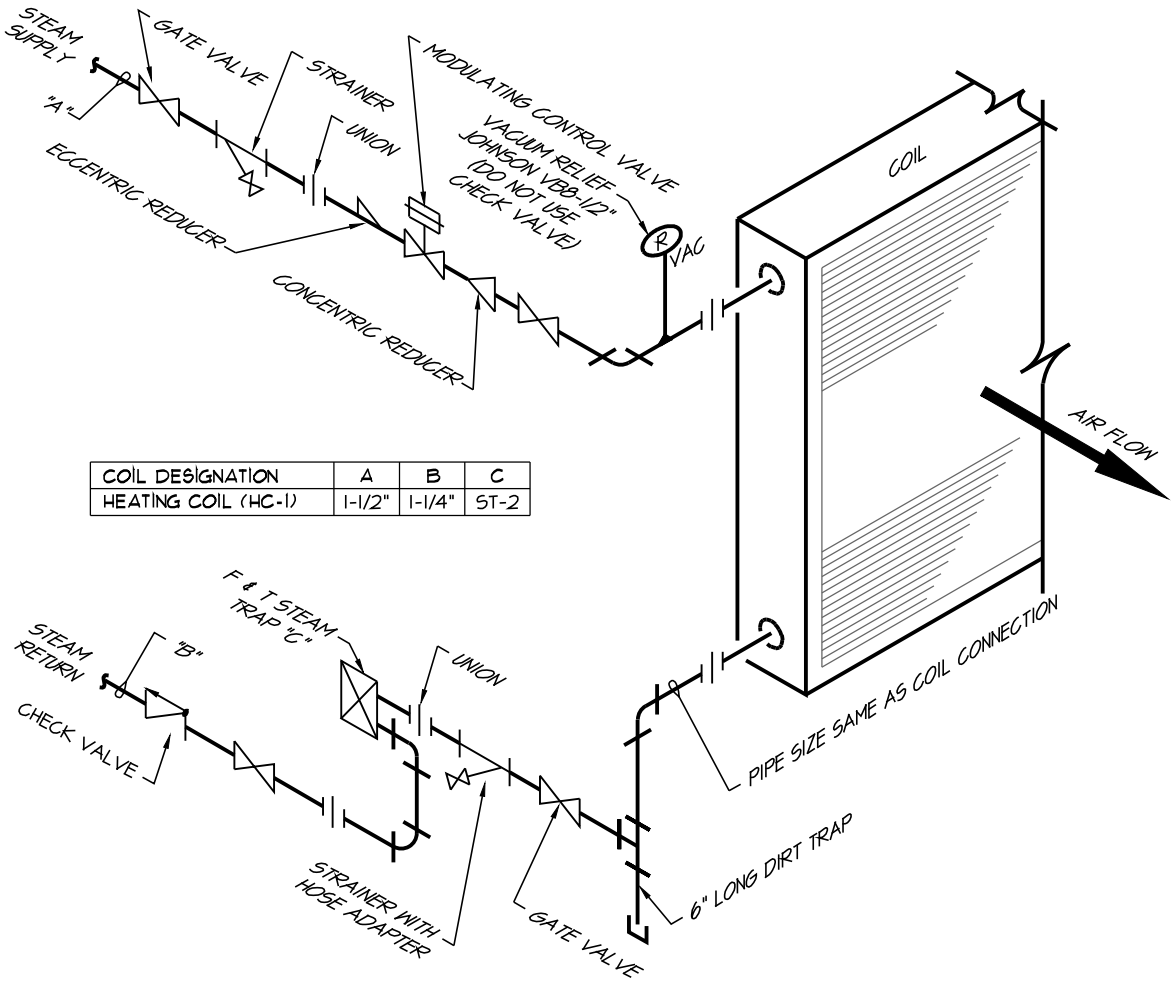

COIL DESIGNATION	A	B	C
HEATING COIL (HC-1)	1-1/2"	1-1/4"	ST-2

20 STEAM REHEAT COIL PIPING DETAIL

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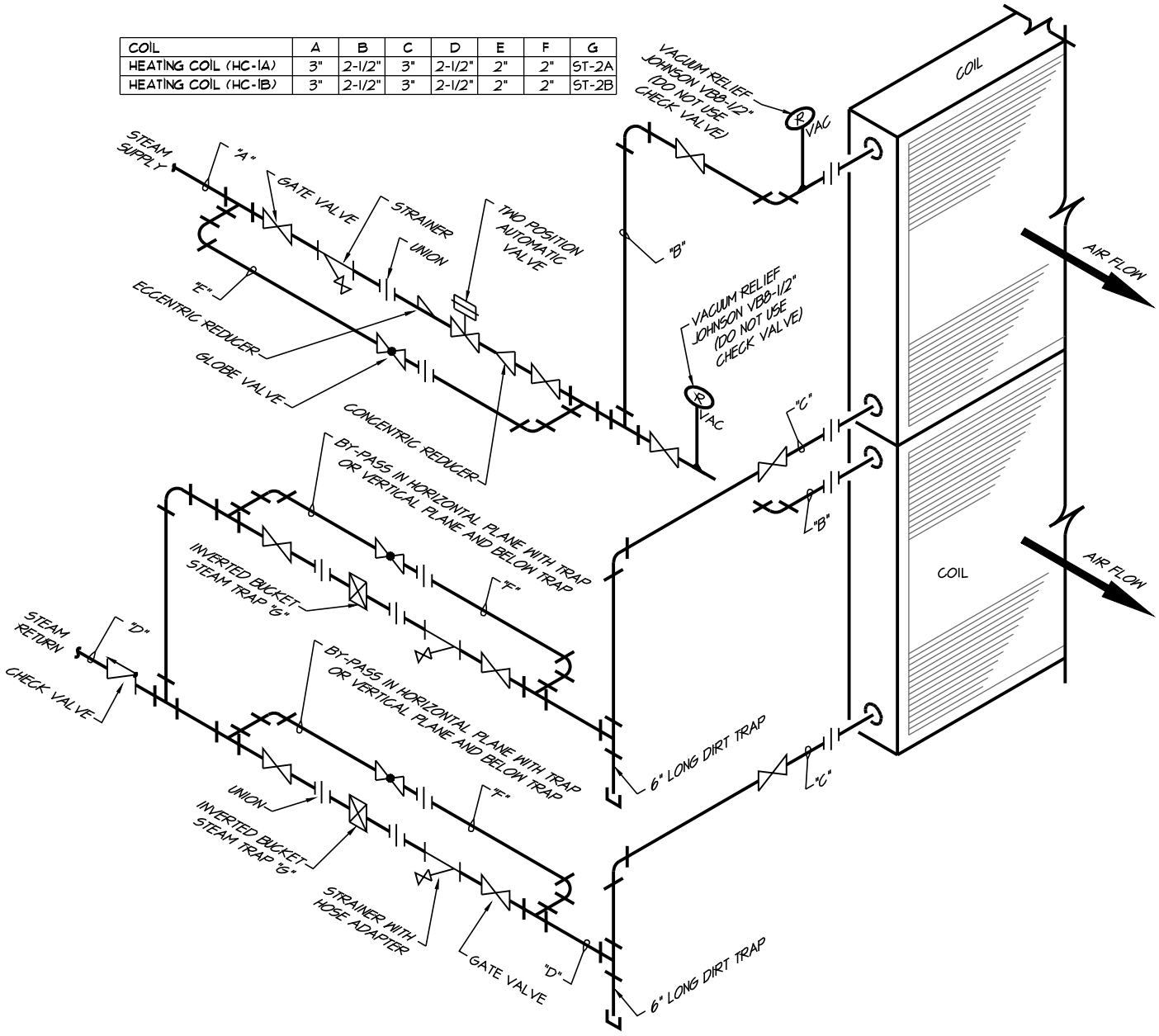
COIL	A	B	C	D	E	F	G
HEATING COIL (HC-1A)	3"	2-1/2"	3"	2-1/2"	2"	2"	ST-2A
HEATING COIL (HC-1B)	3"	2-1/2"	3"	2-1/2"	2"	2"	ST-2B



21 STEAM PREHEAT COIL PIPING DETAIL

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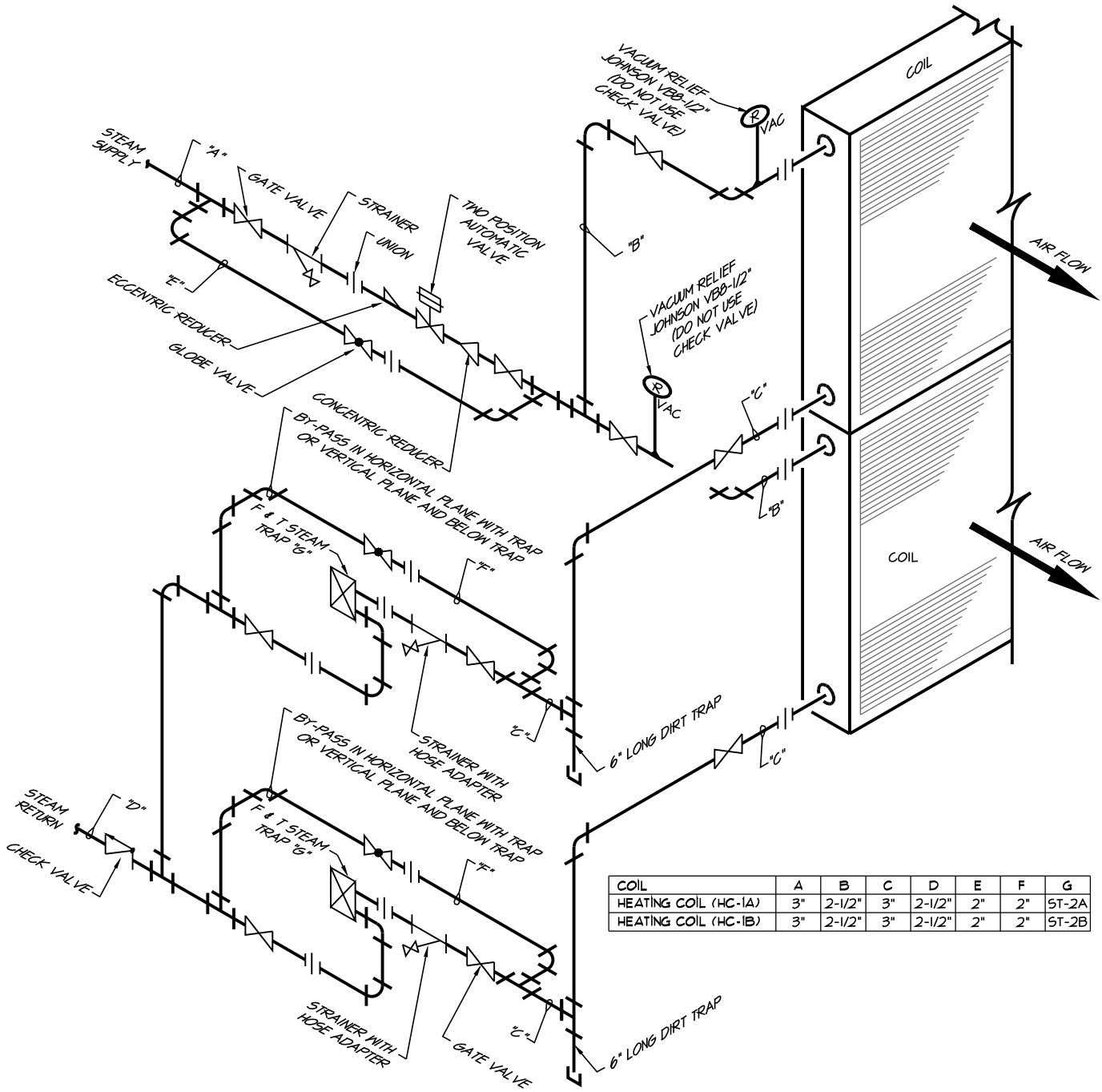

COIL	A	B	C	D	E	F	G
HEATING COIL (HC-1A)	3"	2-1/2"	3"	2-1/2"	2"	2"	ST-2A
HEATING COIL (HC-1B)	3"	2-1/2"	3"	2-1/2"	2"	2"	ST-2B

22 STEAM PREHEAT COIL PIPING DETAIL

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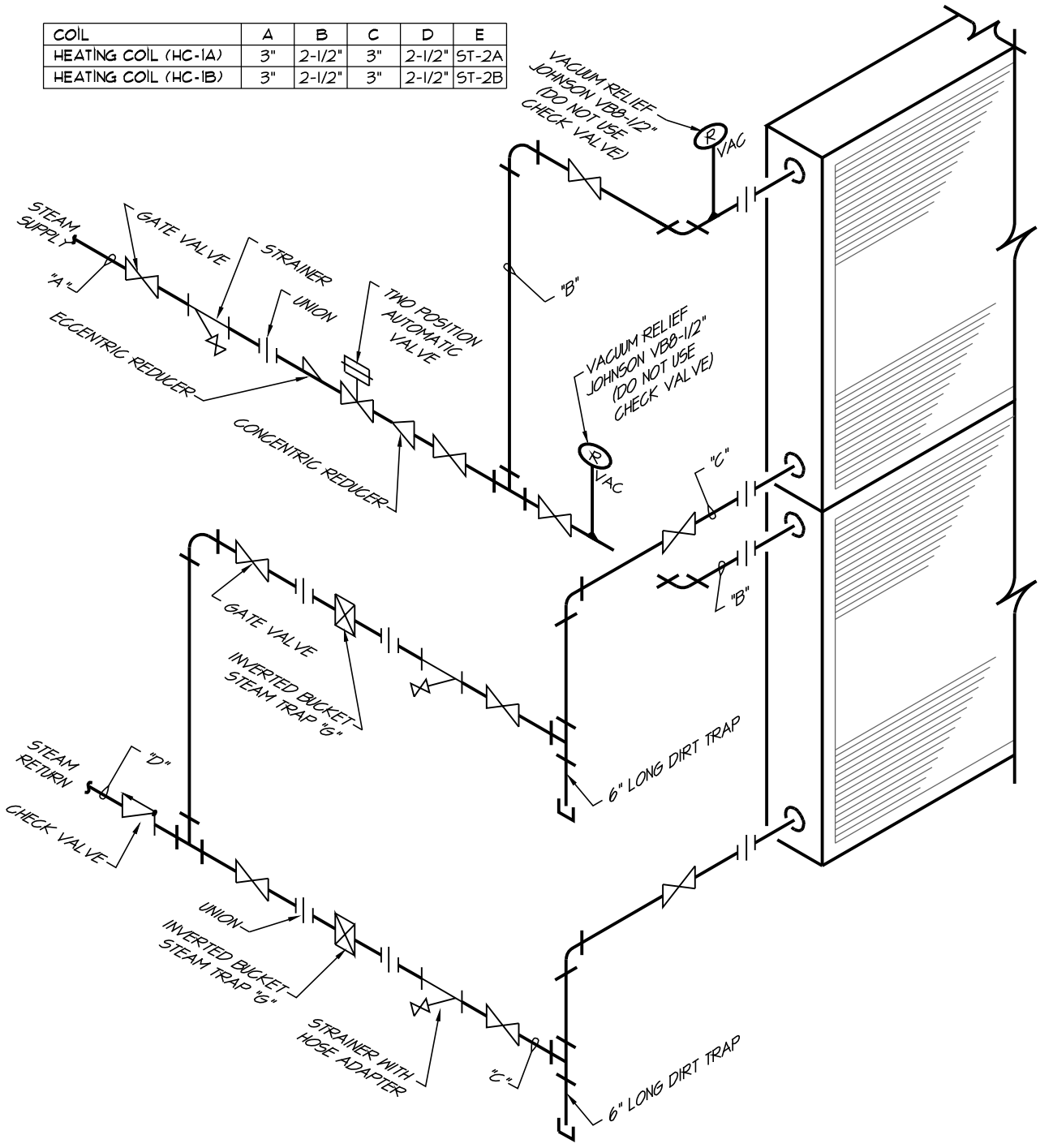
COIL	A	B	C	D	E
HEATING COIL (HC-1A)	3"	2-1/2"	3"	2-1/2"	ST-2A
HEATING COIL (HC-1B)	3"	2-1/2"	3"	2-1/2"	ST-2B



23 STEAM PREHEAT COIL PIPING DETAIL

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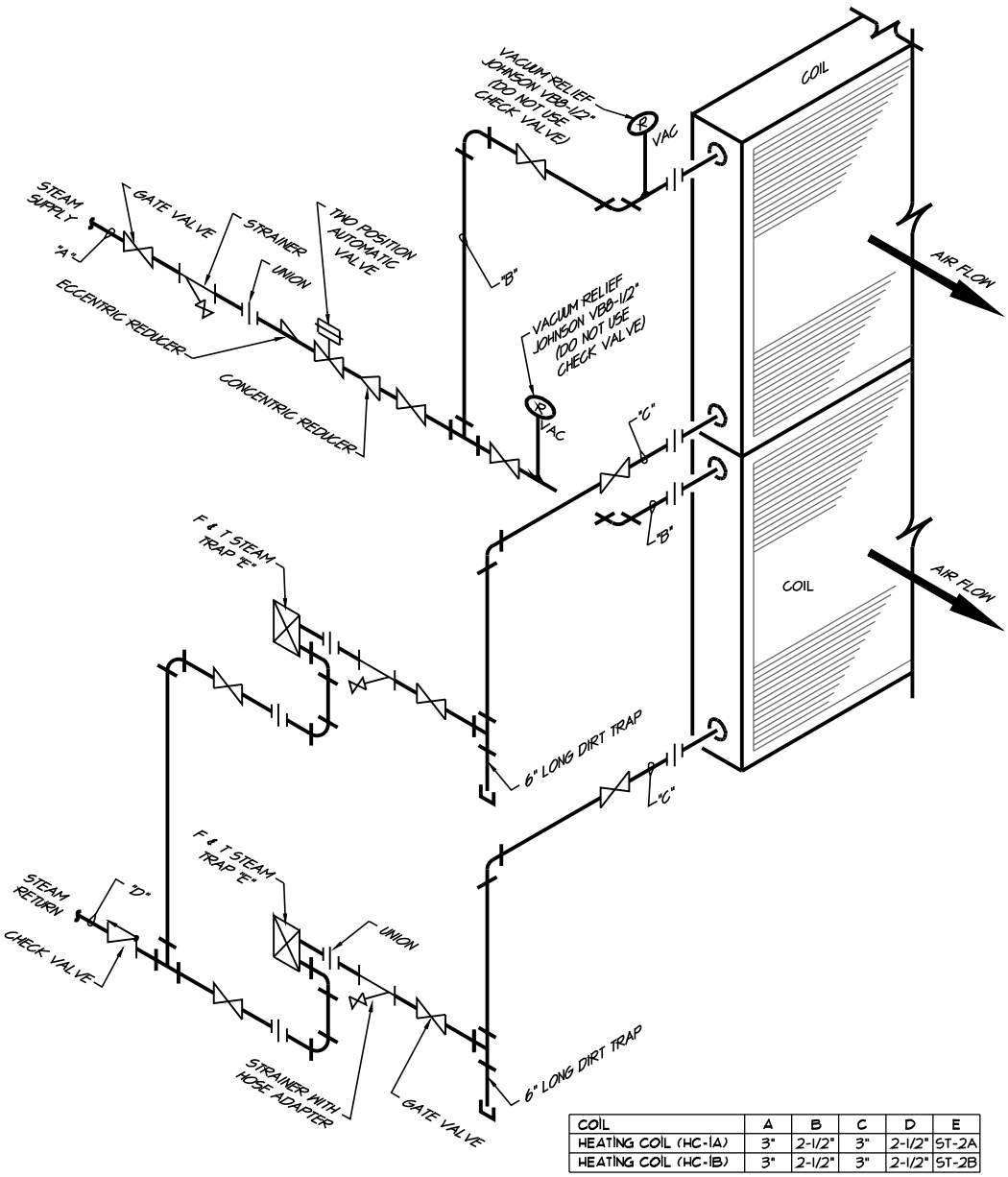

COIL	A	B	C	D	E
HEATING COIL (HC-1A)	3"	2-1/2"	3"	2-1/2"	ST-2A
HEATING COIL (HC-1B)	3"	2-1/2"	3"	2-1/2"	ST-2B

24 STEAM PREHEAT COIL PIPING DETAIL

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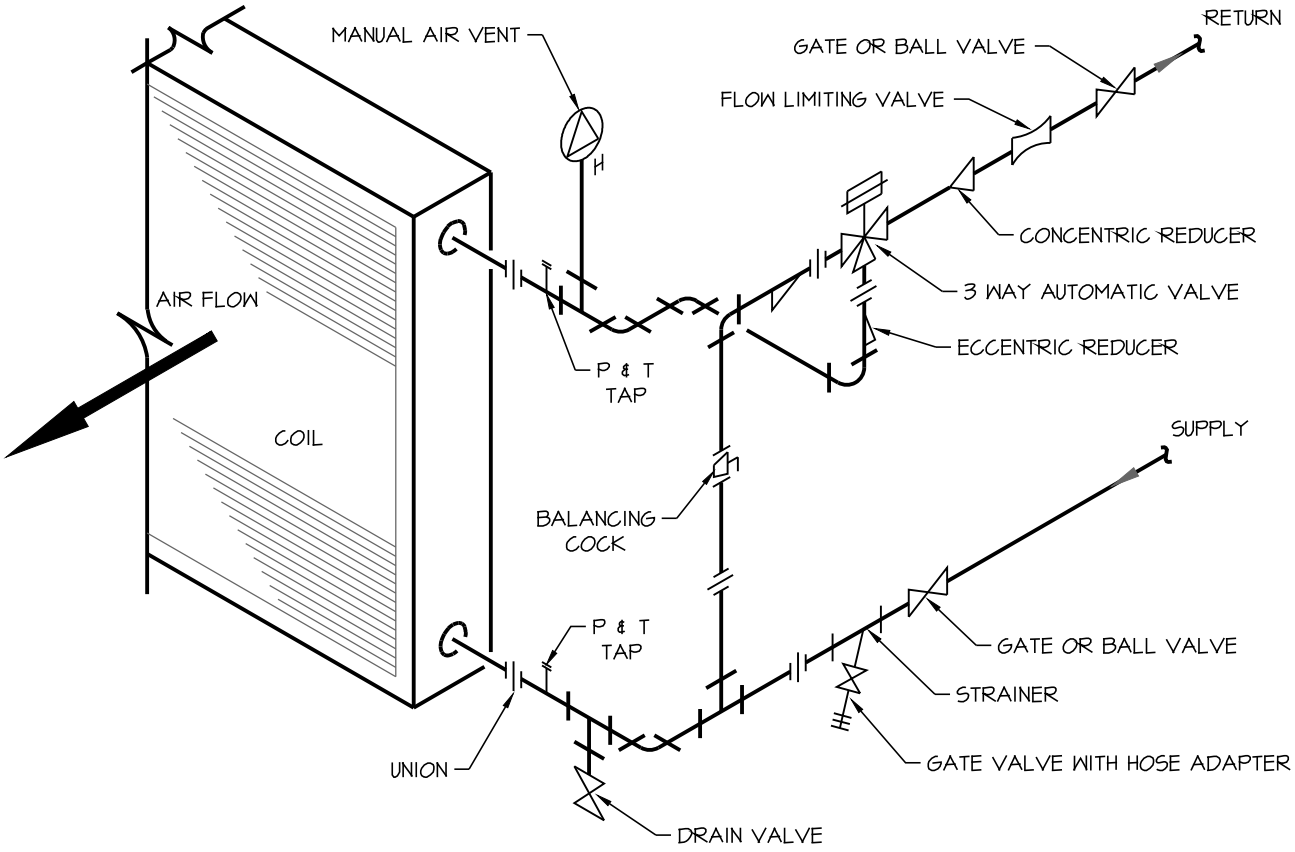

25 CHILLED WATER COIL PIPING DETAIL

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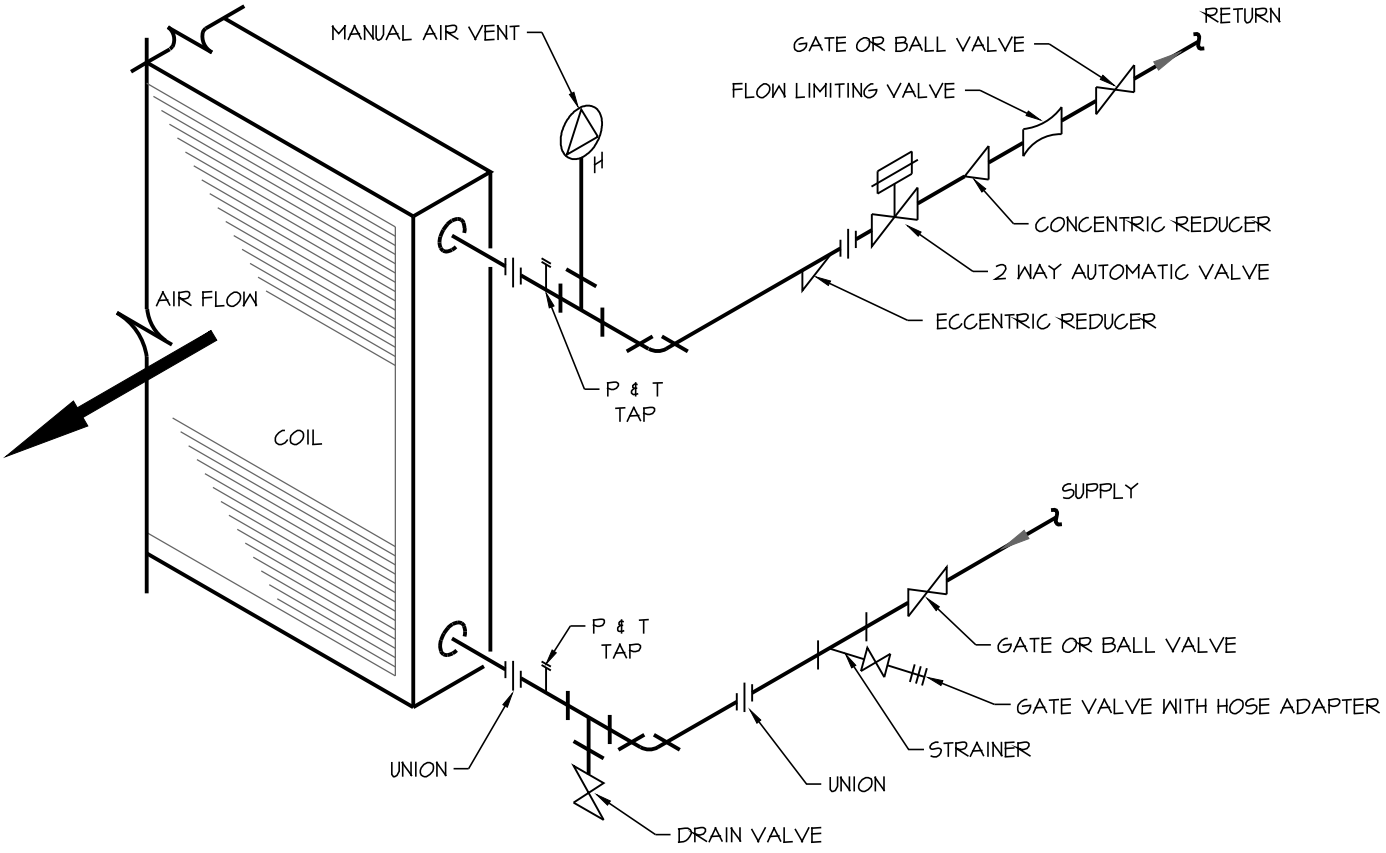

26 CHILLED WATER COIL PIPING DETAIL

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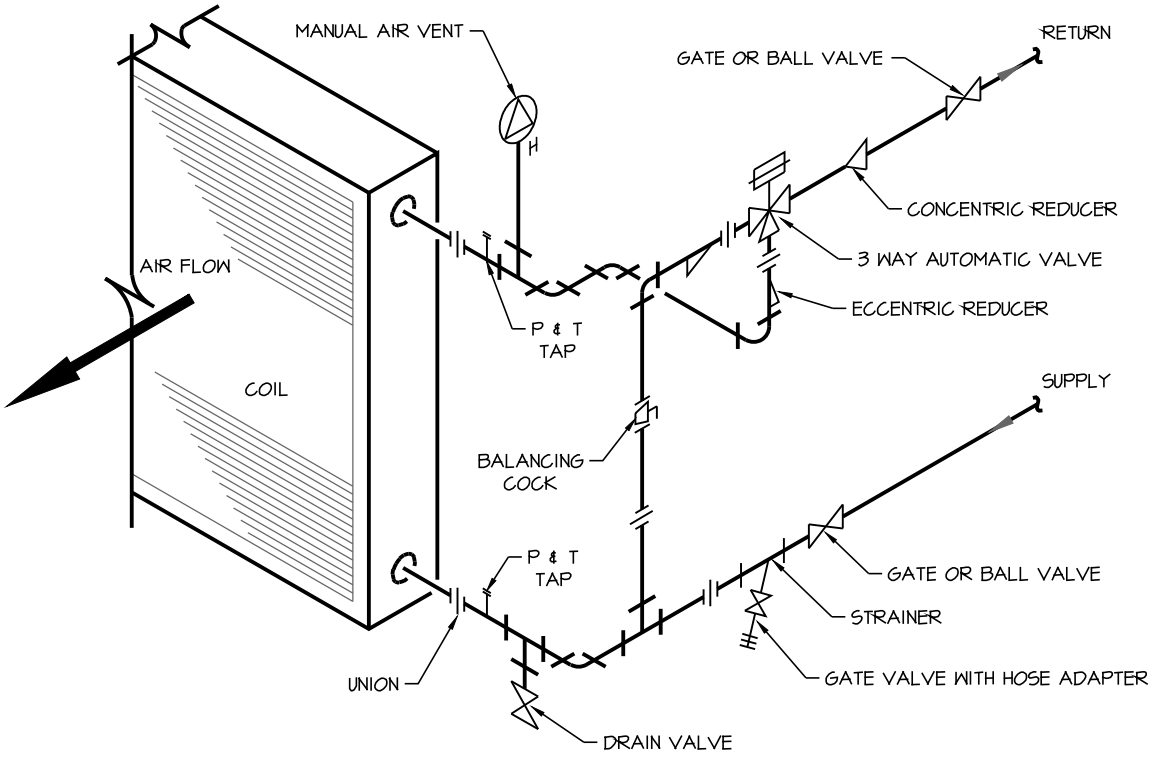
PUMP WITH VFD



27 CHILLED WATER COIL PIPING DETAIL

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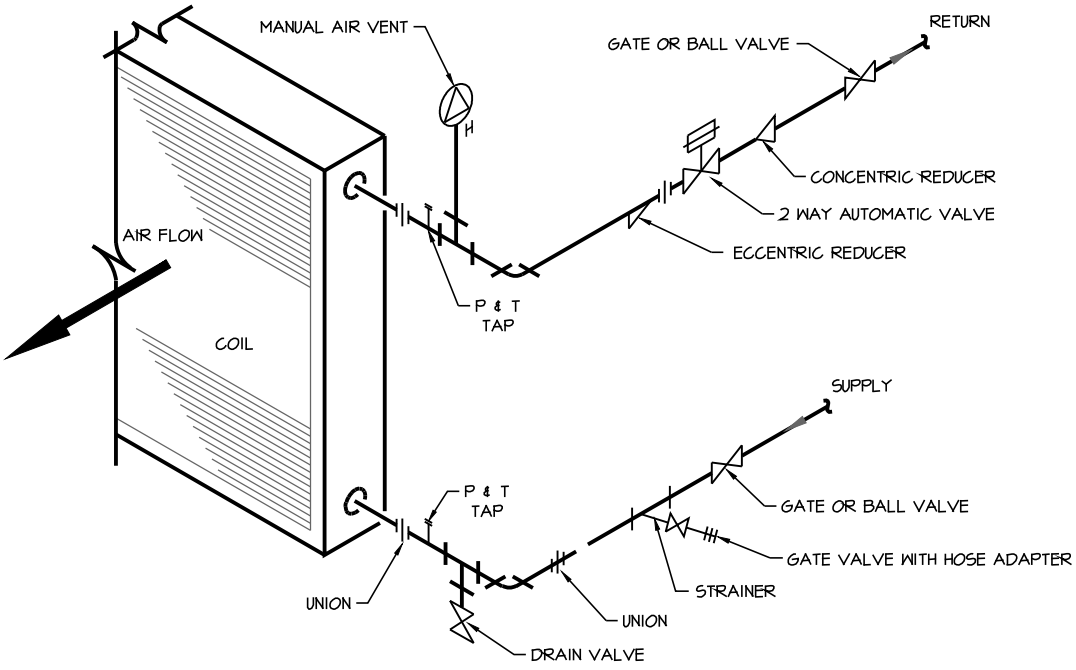
PUMP WITH VFD



28 CHILLED WATER COIL PIPING DETAIL

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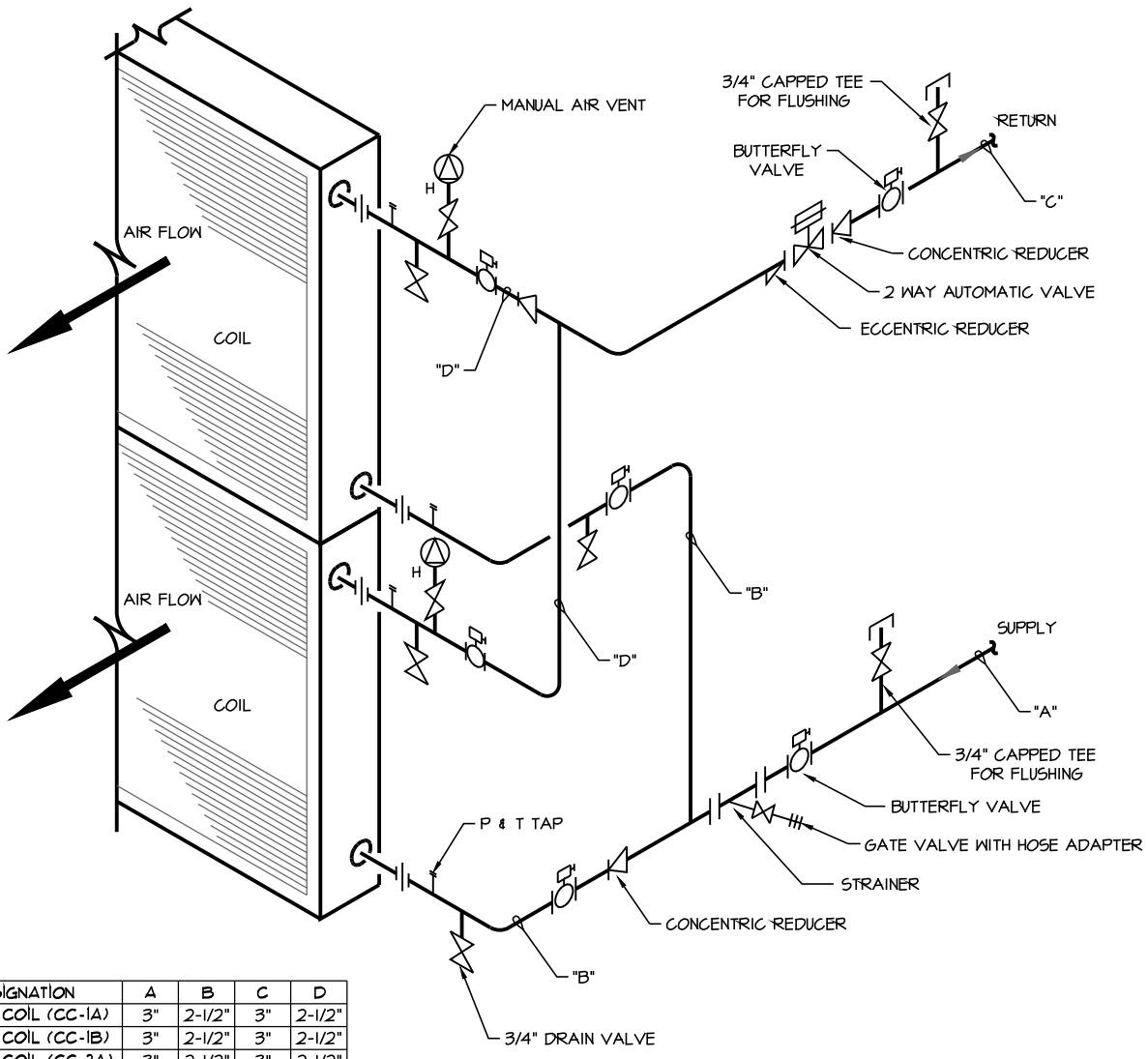

COIL DESIGNATION	A	B	C	D
COOLING COIL (CC-1A)	3"	2-1/2"	3"	2-1/2"
COOLING COIL (CC-1B)	3"	2-1/2"	3"	2-1/2"
COOLING COIL (CC-2A)	3"	2-1/2"	3"	2-1/2"
COOLING COIL (CC-2B)	3"	2-1/2"	3"	2-1/2"

29 CHILLED WATER COIL PIPING DETAIL

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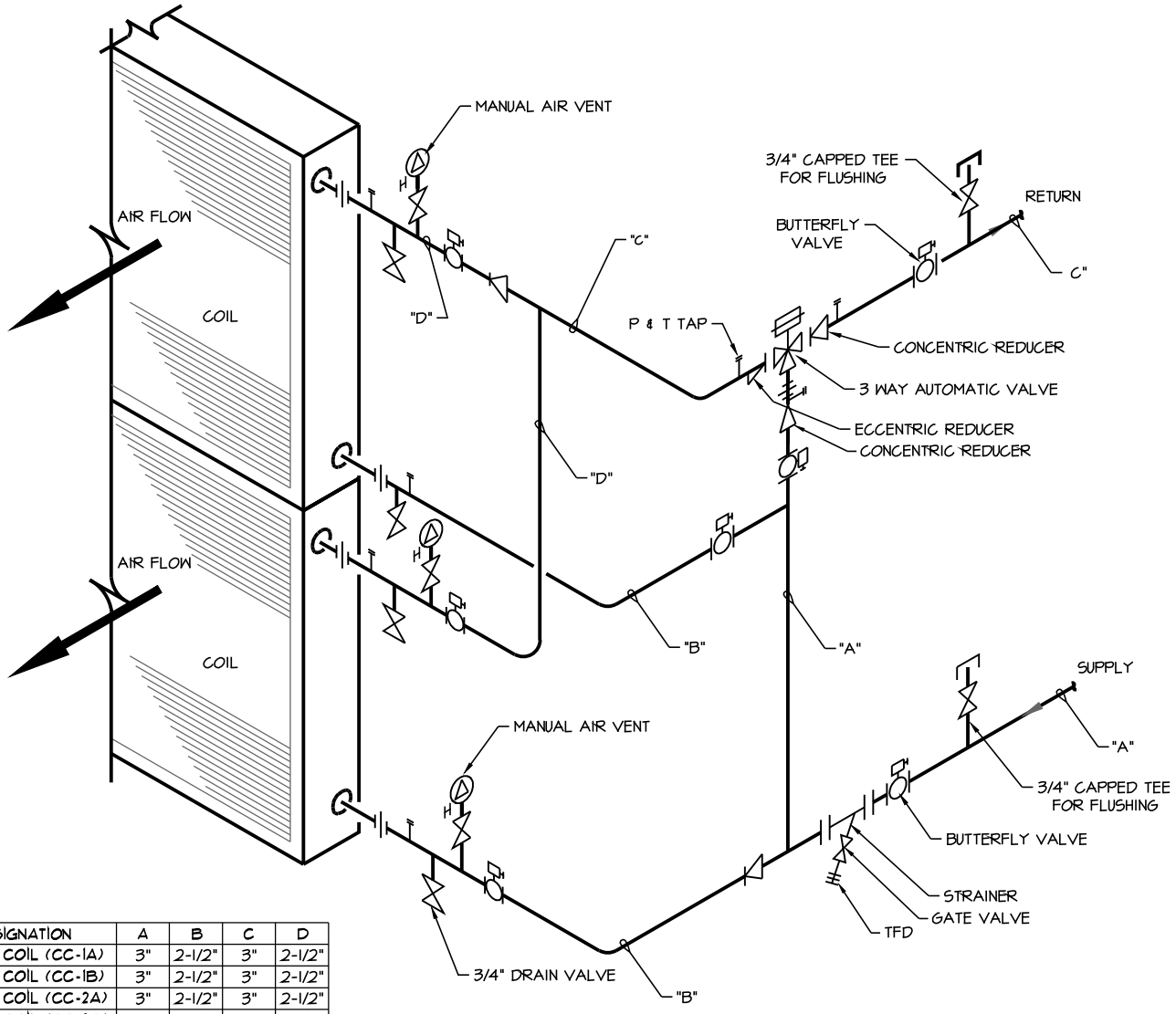
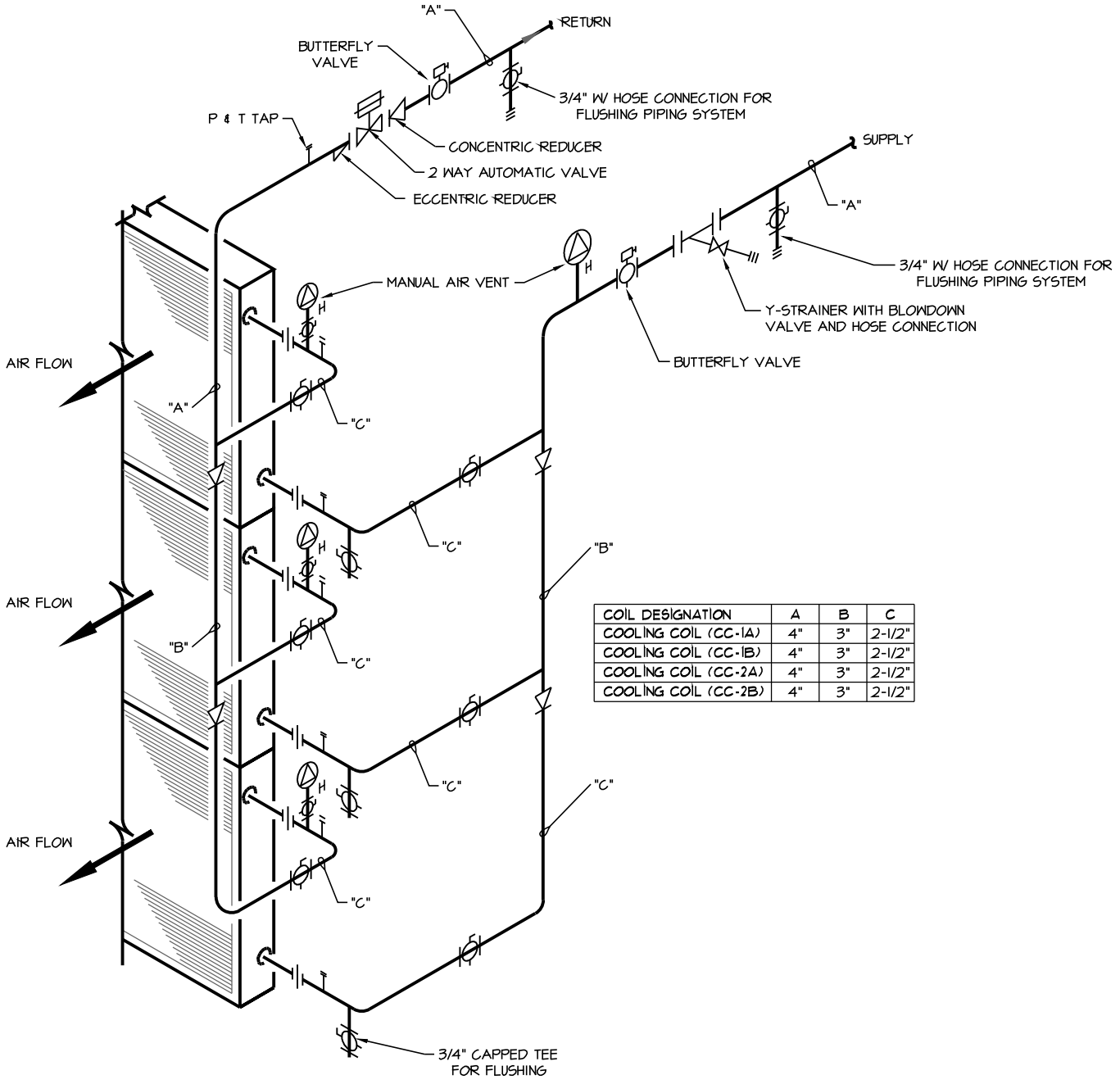


COIL DESIGNATION	A	B	C	D
COOLING COIL (CC-1A)	3"	2-1/2"	3"	2-1/2"
COOLING COIL (CC-1B)	3"	2-1/2"	3"	2-1/2"
COOLING COIL (CC-2A)	3"	2-1/2"	3"	2-1/2"
COOLING COIL (CC-2B)	3"	2-1/2"	3"	2-1/2"

30 CHILLED WATER COIL PIPING DETAIL

NOT TO SCALE



COIL DESIGNATION	A	B	C
COOLING COIL (CC-1A)	4"	3"	2-1/2"
COOLING COIL (CC-1B)	4"	3"	2-1/2"
COOLING COIL (CC-2A)	4"	3"	2-1/2"
COOLING COIL (CC-2B)	4"	3"	2-1/2"

31 CHILLED WATER COIL PIPING DETAIL

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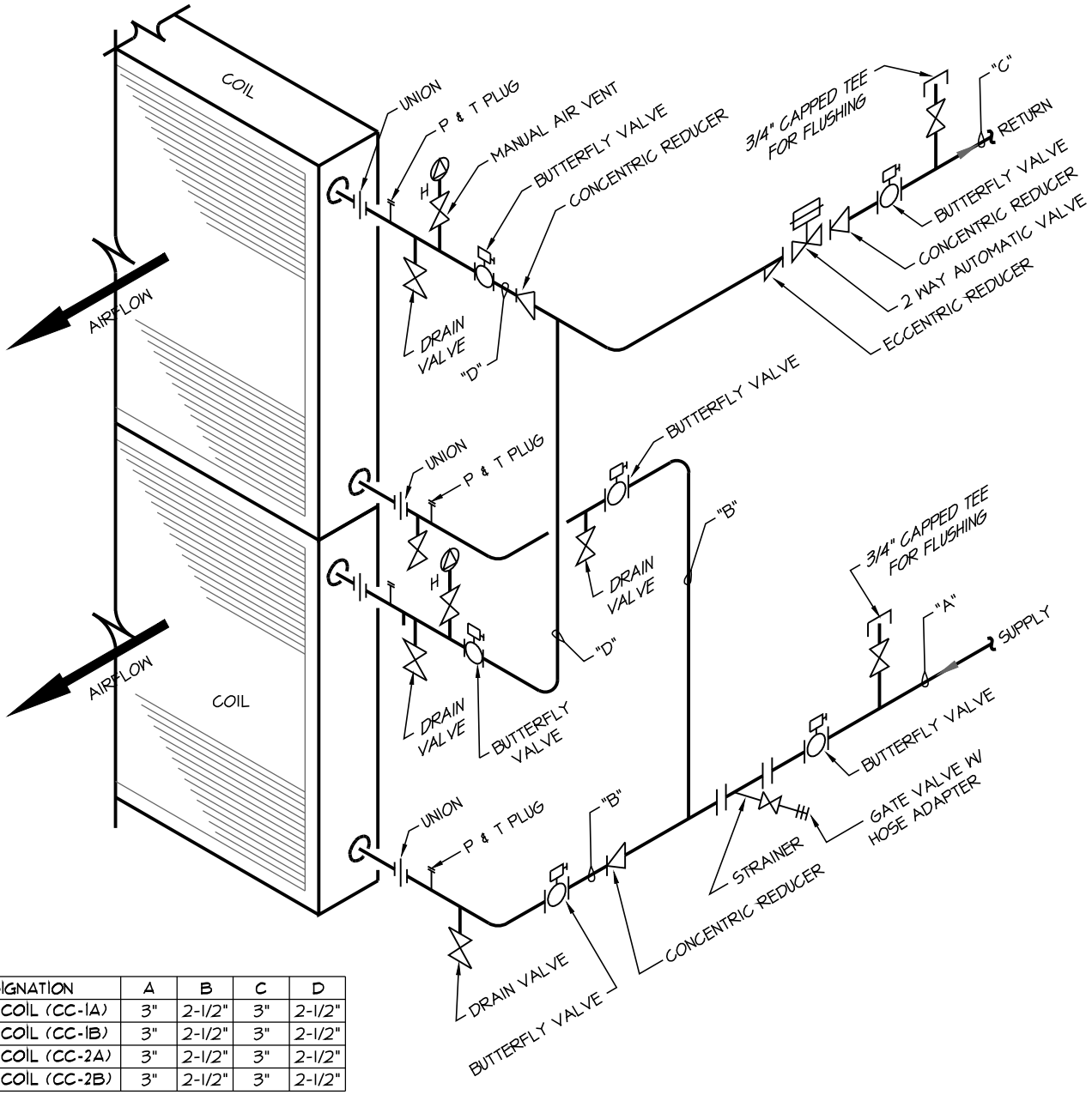

COIL DESIGNATION	A	B	C	D
COOLING COIL (CC-1A)	3"	2-1/2"	3"	2-1/2"
COOLING COIL (CC-1B)	3"	2-1/2"	3"	2-1/2"
COOLING COIL (CC-2A)	3"	2-1/2"	3"	2-1/2"
COOLING COIL (CC-2B)	3"	2-1/2"	3"	2-1/2"

32 CHILLED WATER COIL PIPING DETAIL

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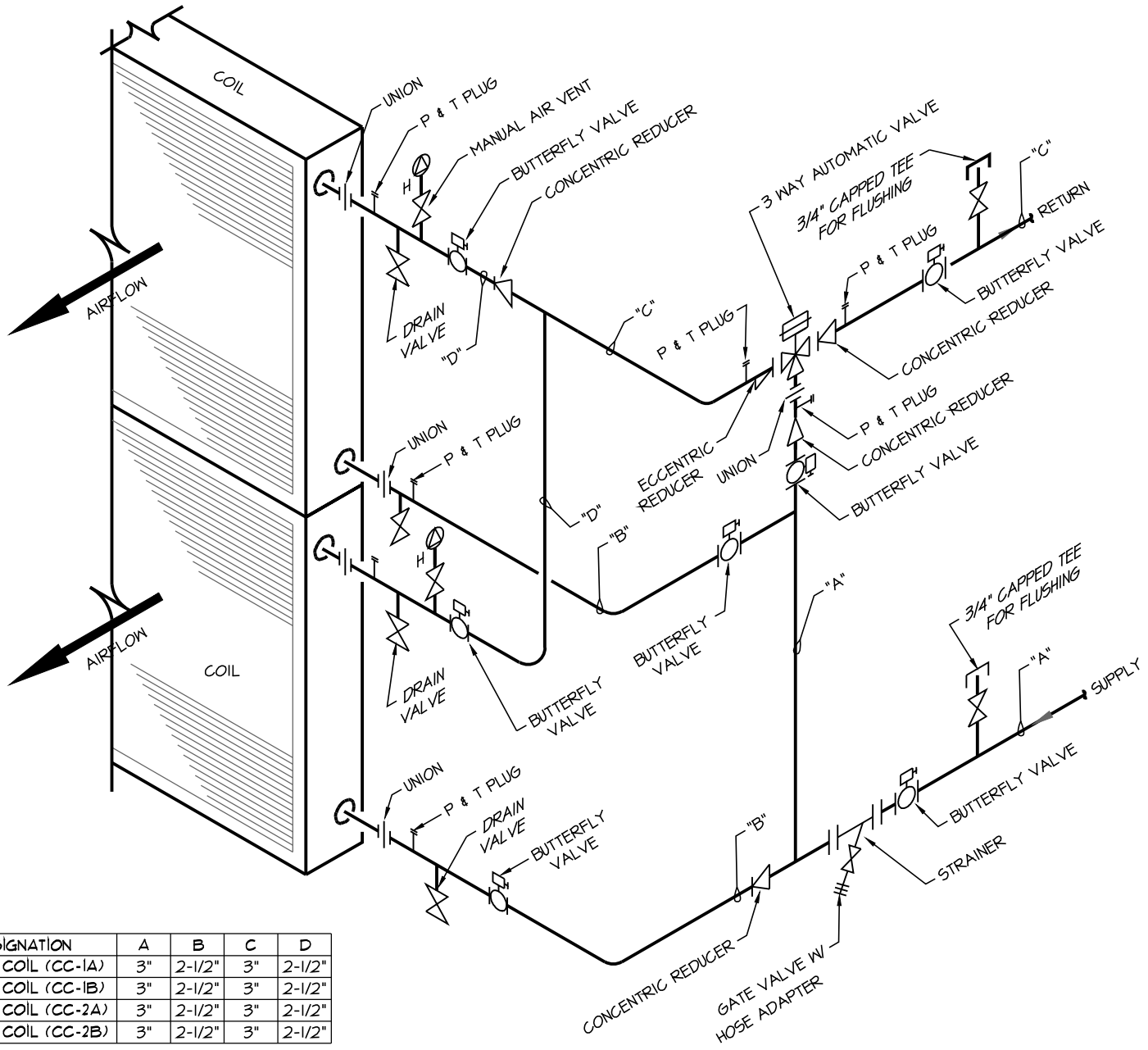

COIL DESIGNATION	A	B	C	D
COOLING COIL (CC-1A)	3"	2-1/2"	3"	2-1/2"
COOLING COIL (CC-1B)	3"	2-1/2"	3"	2-1/2"
COOLING COIL (CC-2A)	3"	2-1/2"	3"	2-1/2"
COOLING COIL (CC-2B)	3"	2-1/2"	3"	2-1/2"

33 CHILLED WATER COIL PIPING DETAIL

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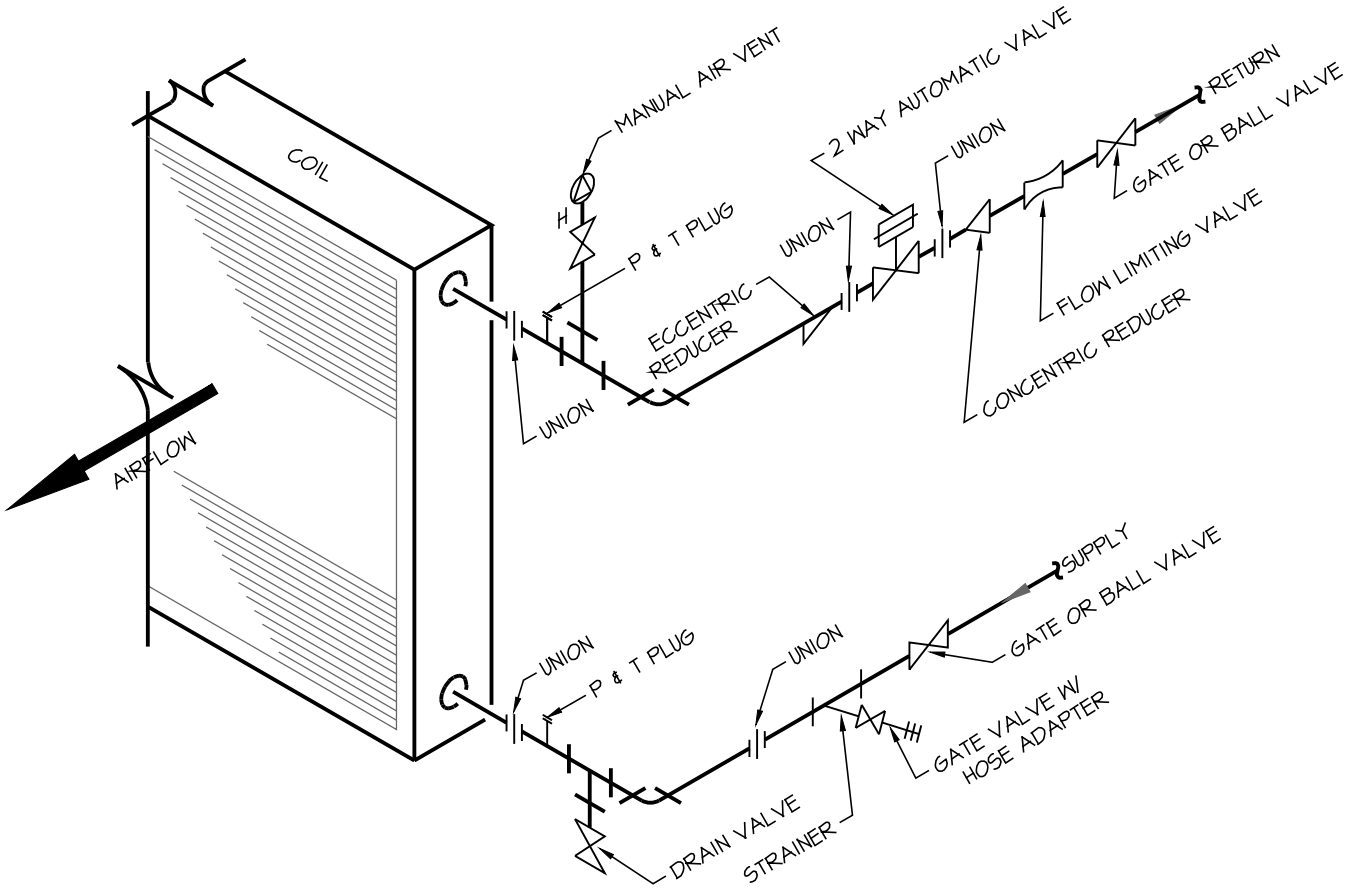

34 CHILLED WATER COIL PIPING DETAIL

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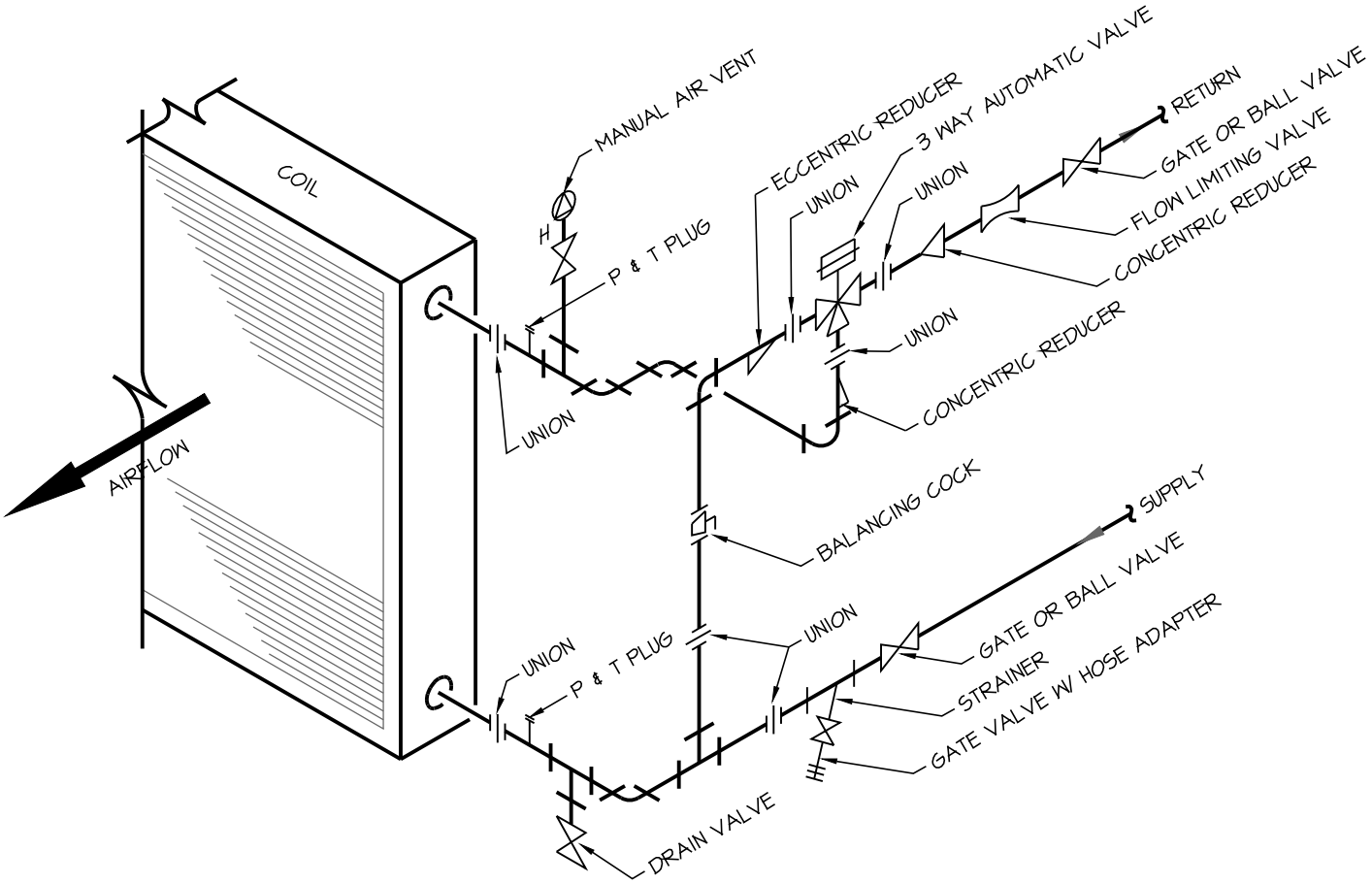

35 CHILLED WATER COIL PIPING DETAIL

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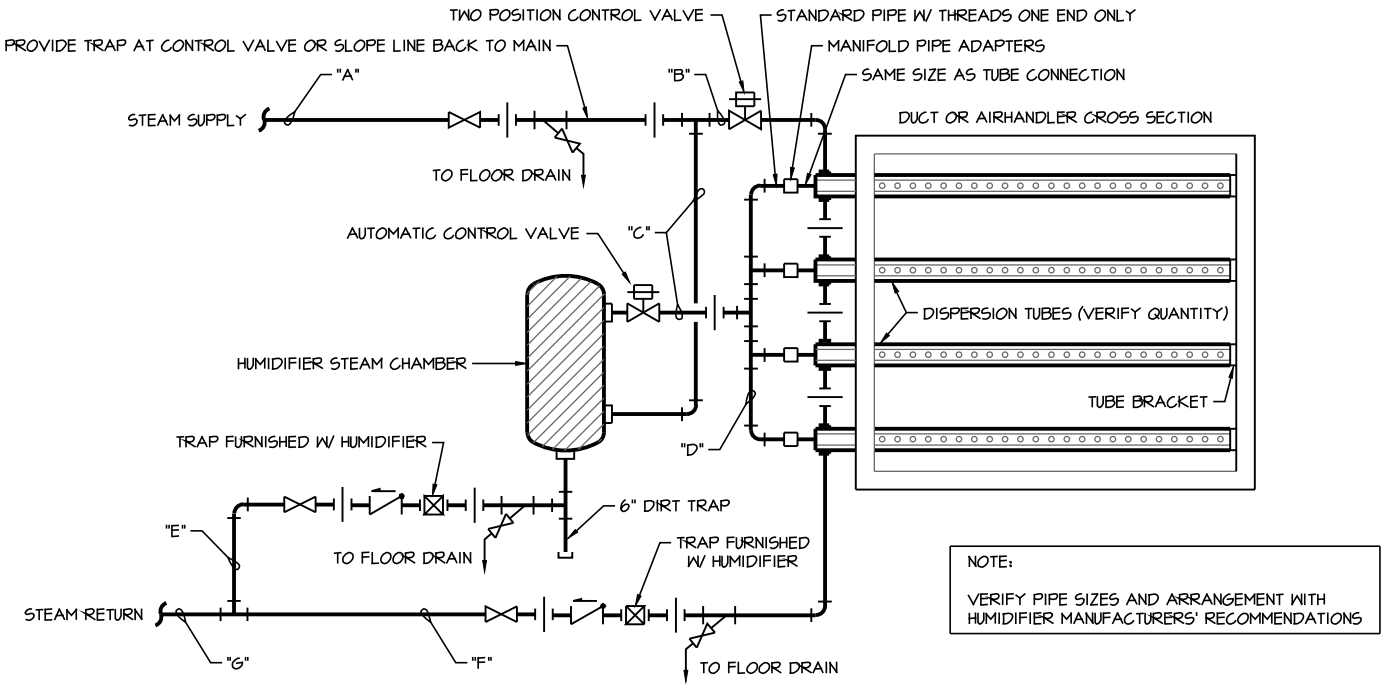
HUMIDIFIER	A	B	C	D	E	F	G
HUMIDIFIER (H-1)	2"	3/4"	2"	1-1/4"	3/4"	3/4"	3/4"



36 STEAM HUMIDIFIER PIPING DETAIL

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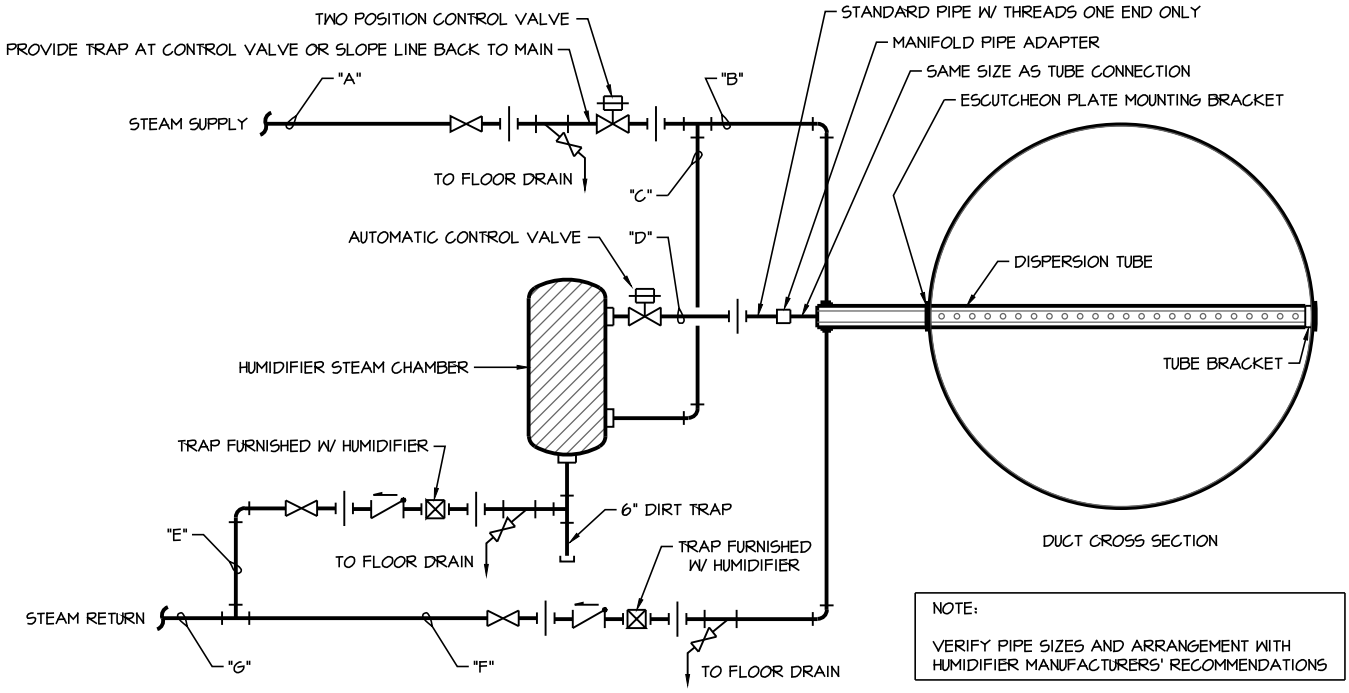
HUMIDIFIER	A	B	C	D	E	F	G
HUMIDIFIER (H-1)	2"	3/4"	2"	1-1/4"	3/4"	3/4"	3/4"



37 STEAM HUMIDIFIER PIPING DETAIL

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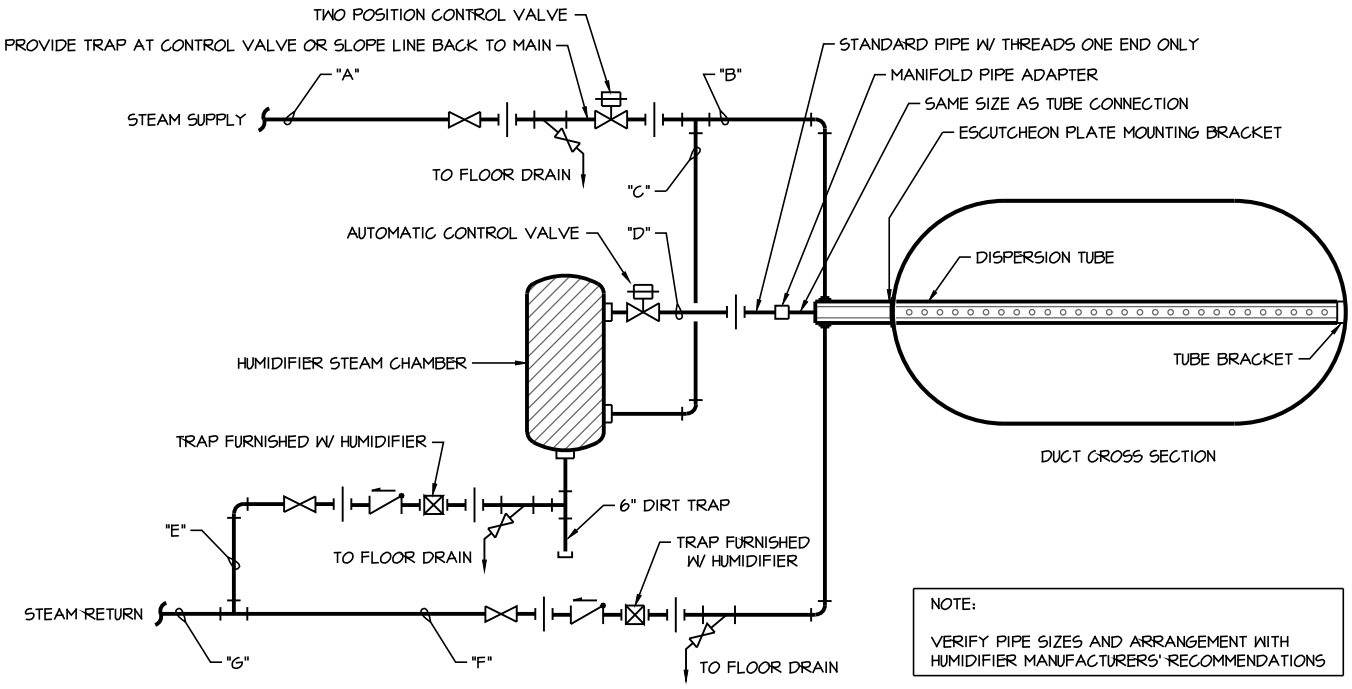
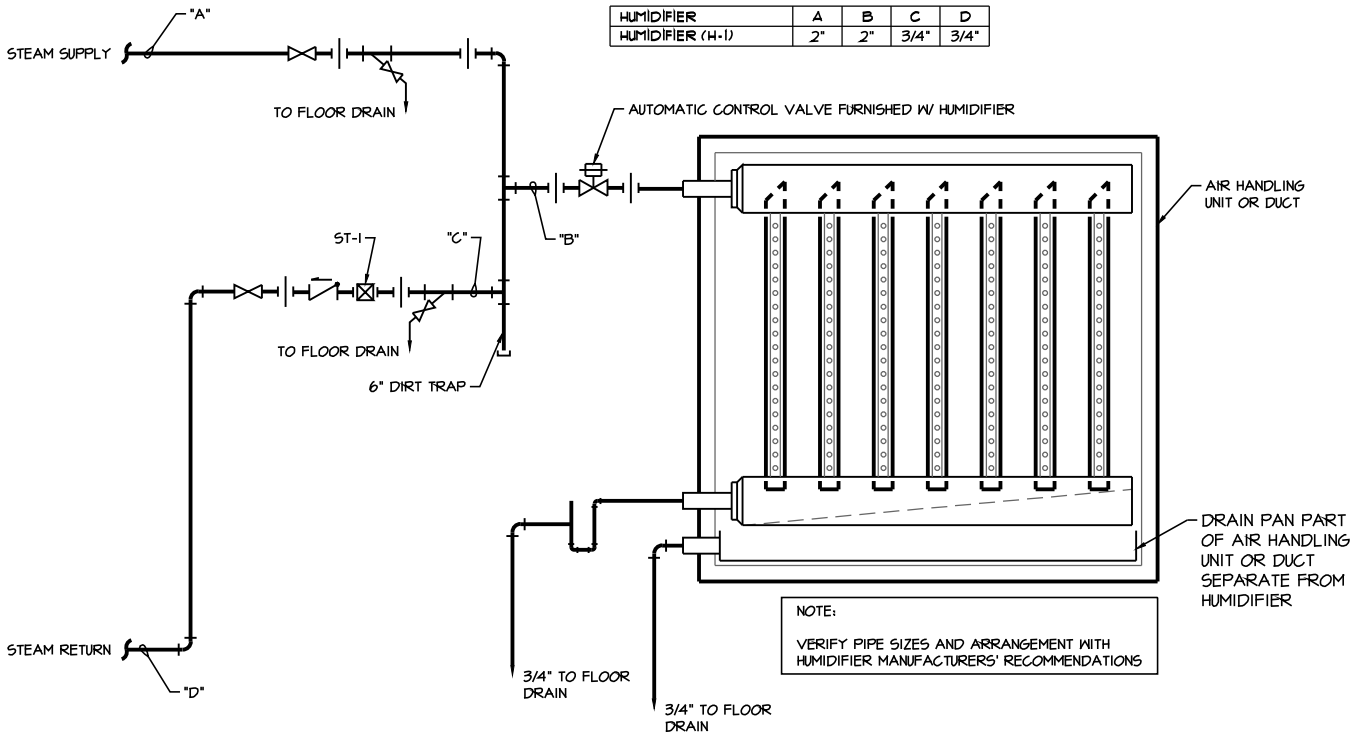
HUMIDIFIER	A	B	C	D	E	F	G
HUMIDIFIER (H-1)	2"	3/4"	2"	1-1/4"	3/4"	3/4"	3/4"



38 STEAM HUMIDIFIER PIPING DETAIL

NOT TO SCALE



HUMIDIFIER	A	B	C	D
HUMIDIFIER (H-1)	2"	2"	3/4"	3/4"

39 STEAM HUMIDIFIER PIPING DETAIL

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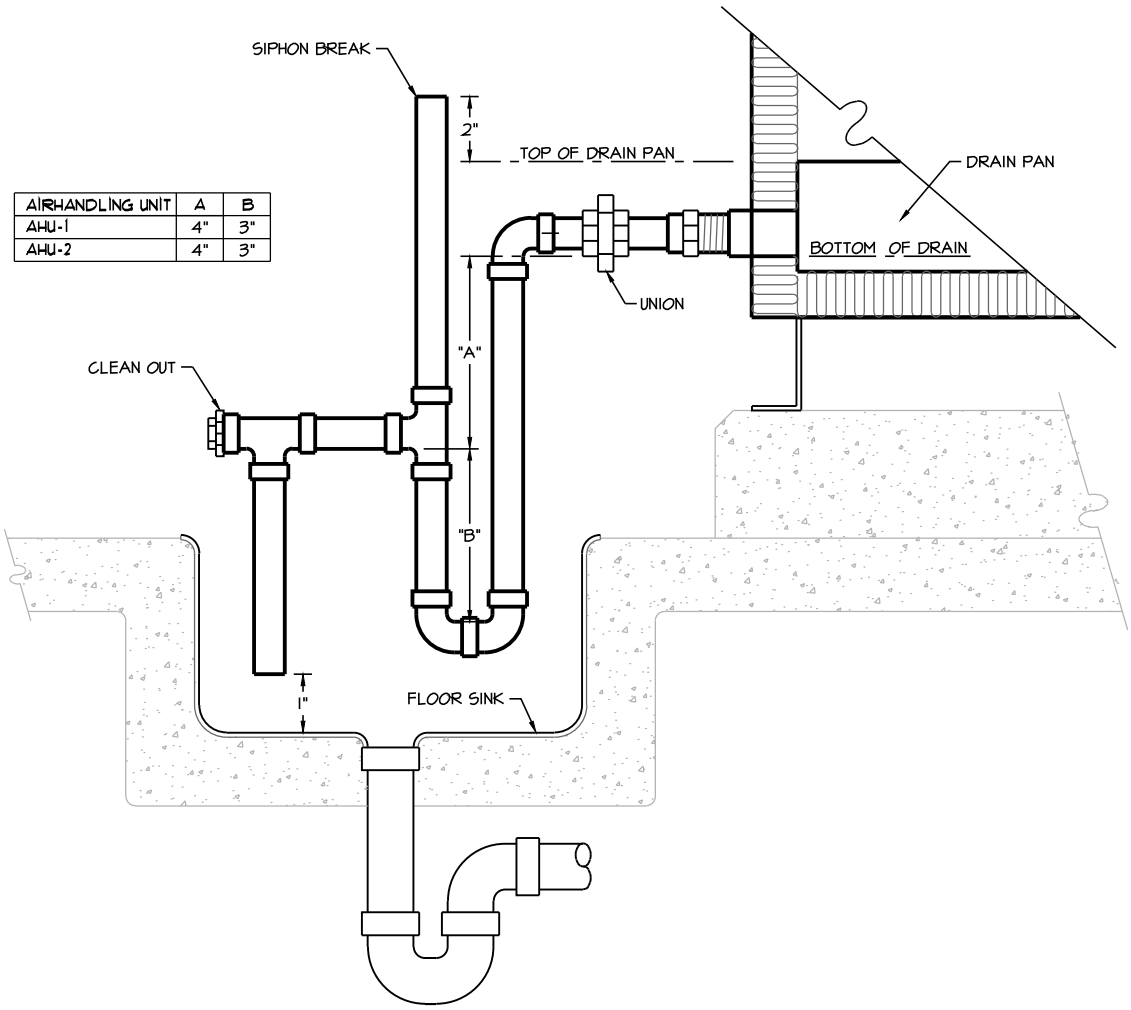
AIRHANDLING UNIT	A	B
AHU-1	4"	3"
AHU-2	4"	3"



40 CONDENSATE DRAIN PIPING DETAIL

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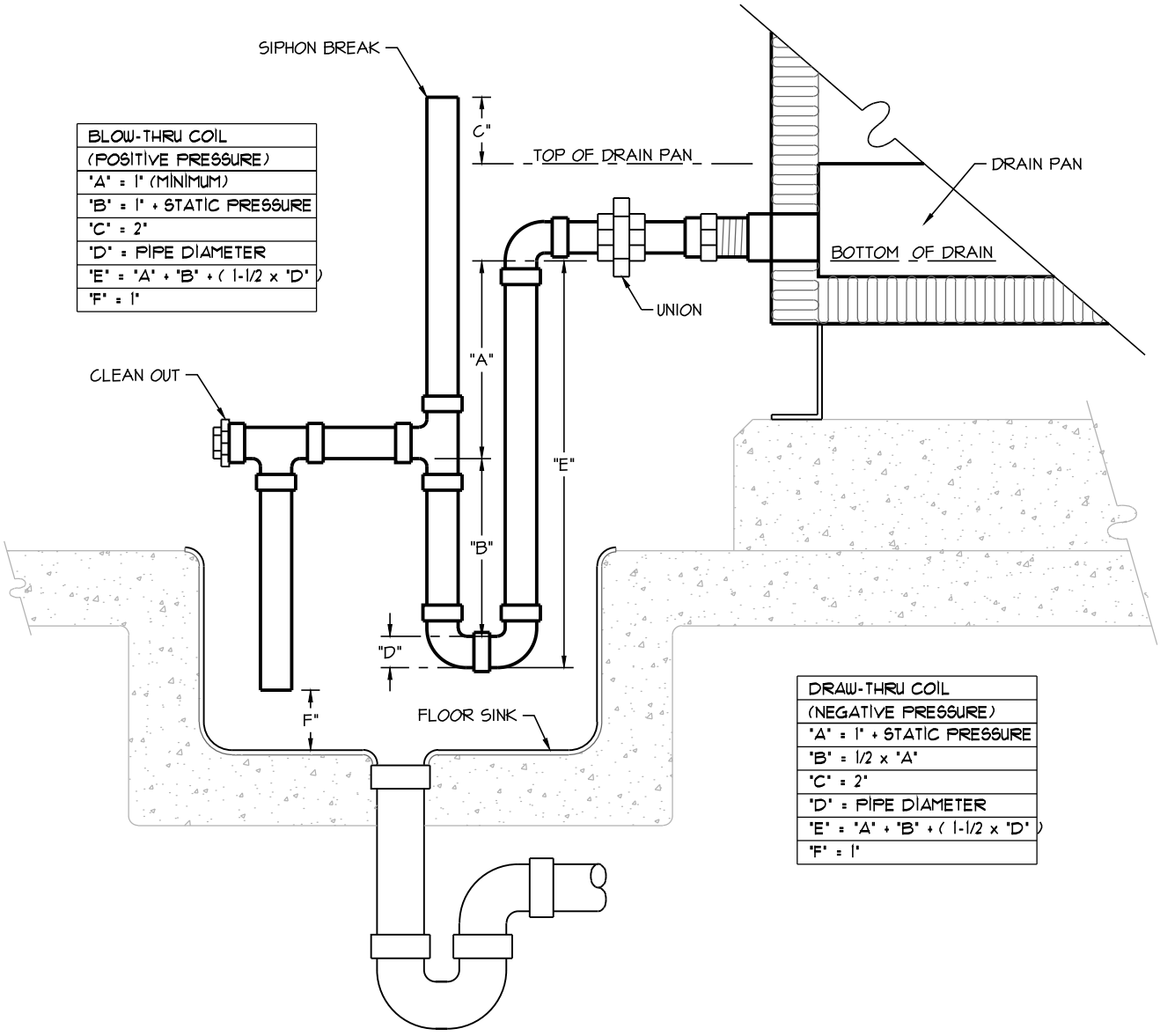

BLOW-THRU COIL
(POSITIVE PRESSURE)
"A" = 1" (MINIMUM)
"B" = 1" + STATIC PRESSURE
"C" = 2"
"D" = PIPE DIAMETER
"E" = "A" + "B" + (1-1/2 x "D")
"F" = 1"

DRAW-THRU COIL
(NEGATIVE PRESSURE)
"A" = 1" + STATIC PRESSURE
"B" = 1/2 x "A"
"C" = 2"
"D" = PIPE DIAMETER
"E" = "A" + "B" + (1-1/2 x "D")
"F" = 1"

41 CONDENSATE DRAIN PIPING DETAIL

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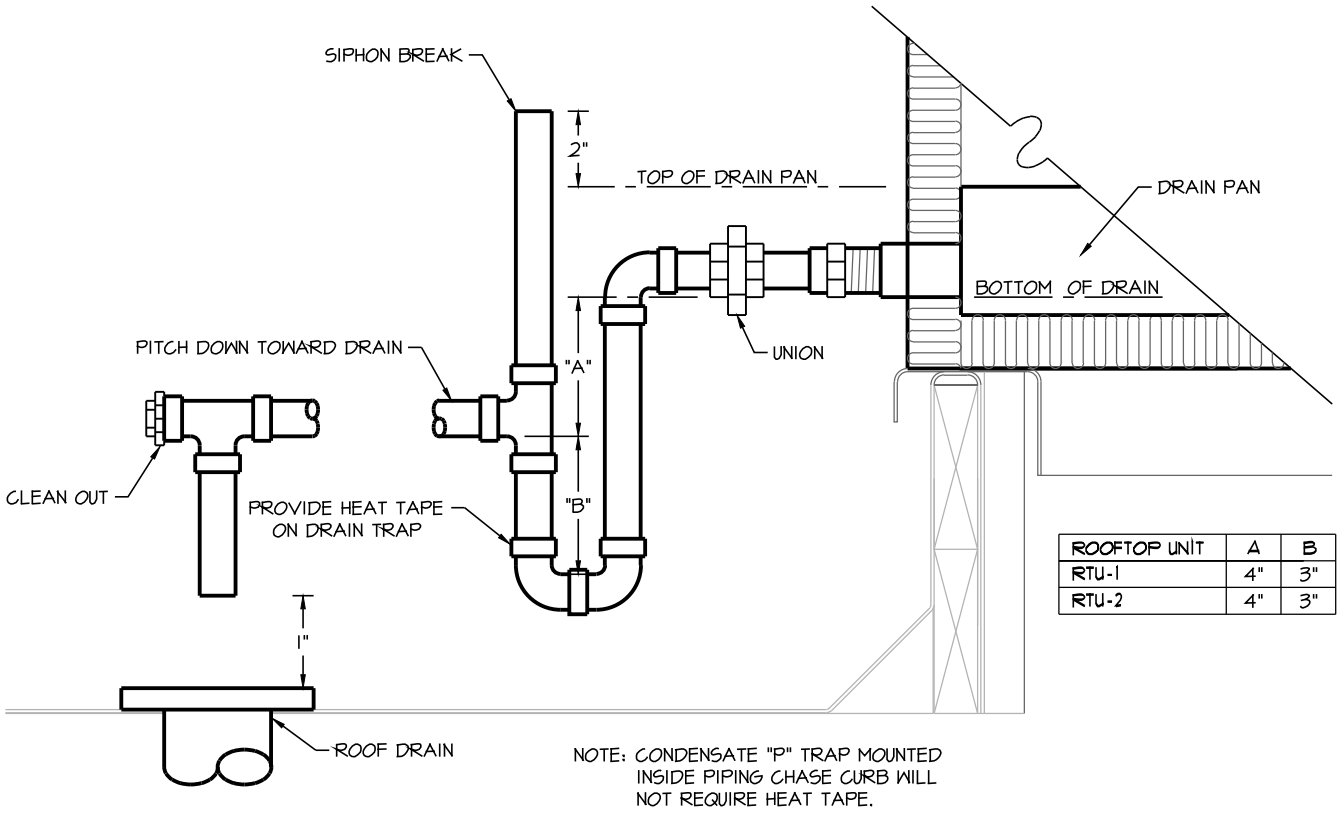

ROOFTOP UNIT	A	B
RTU-1	4"	3"
RTU-2	4"	3"

NOTE: CONDENSATE "P" TRAP MOUNTED INSIDE PIPING CHASE CURB WILL NOT REQUIRE HEAT TAPE.

42 CONDENSATE DRAIN PIPING DETAIL

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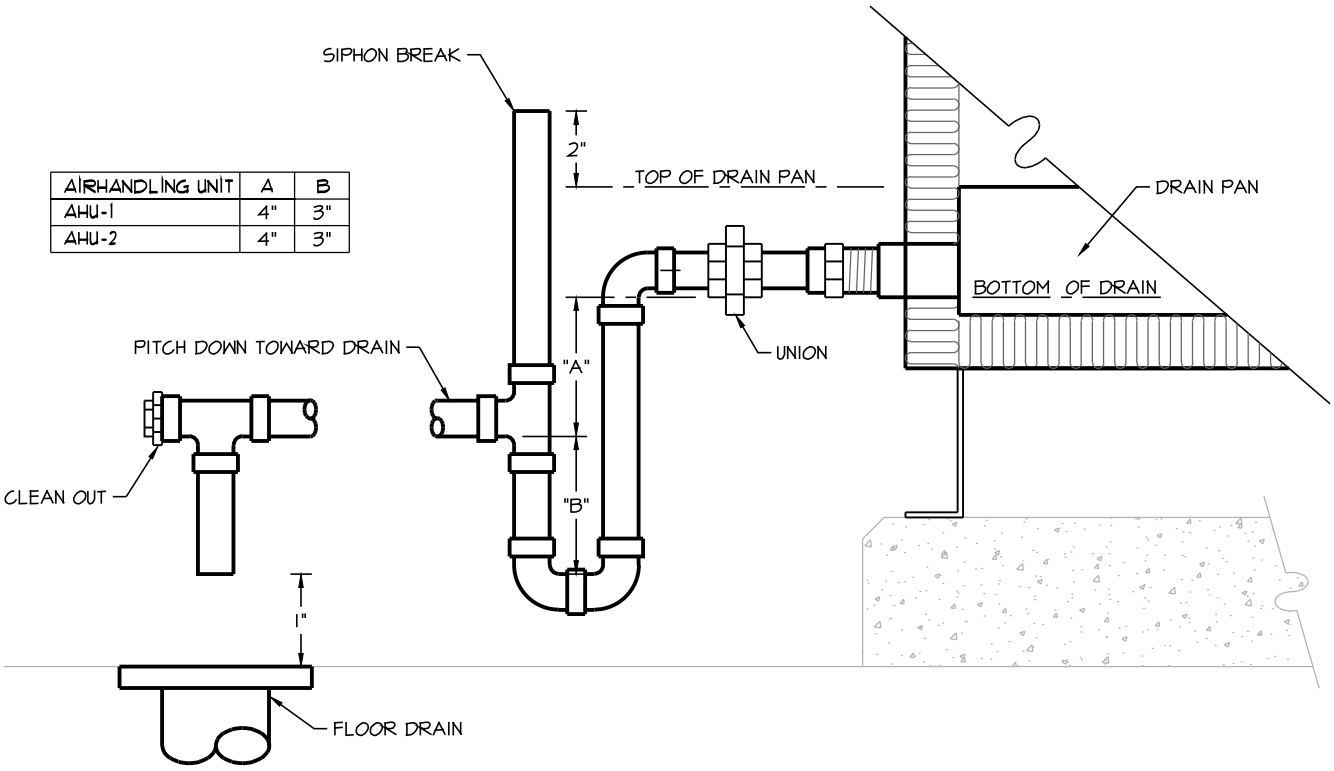
AIRHANDLING UNIT	A	B
AHU-1	4"	3"
AHU-2	4"	3"



43 CONDENSATE DRAIN PIPING DETAIL

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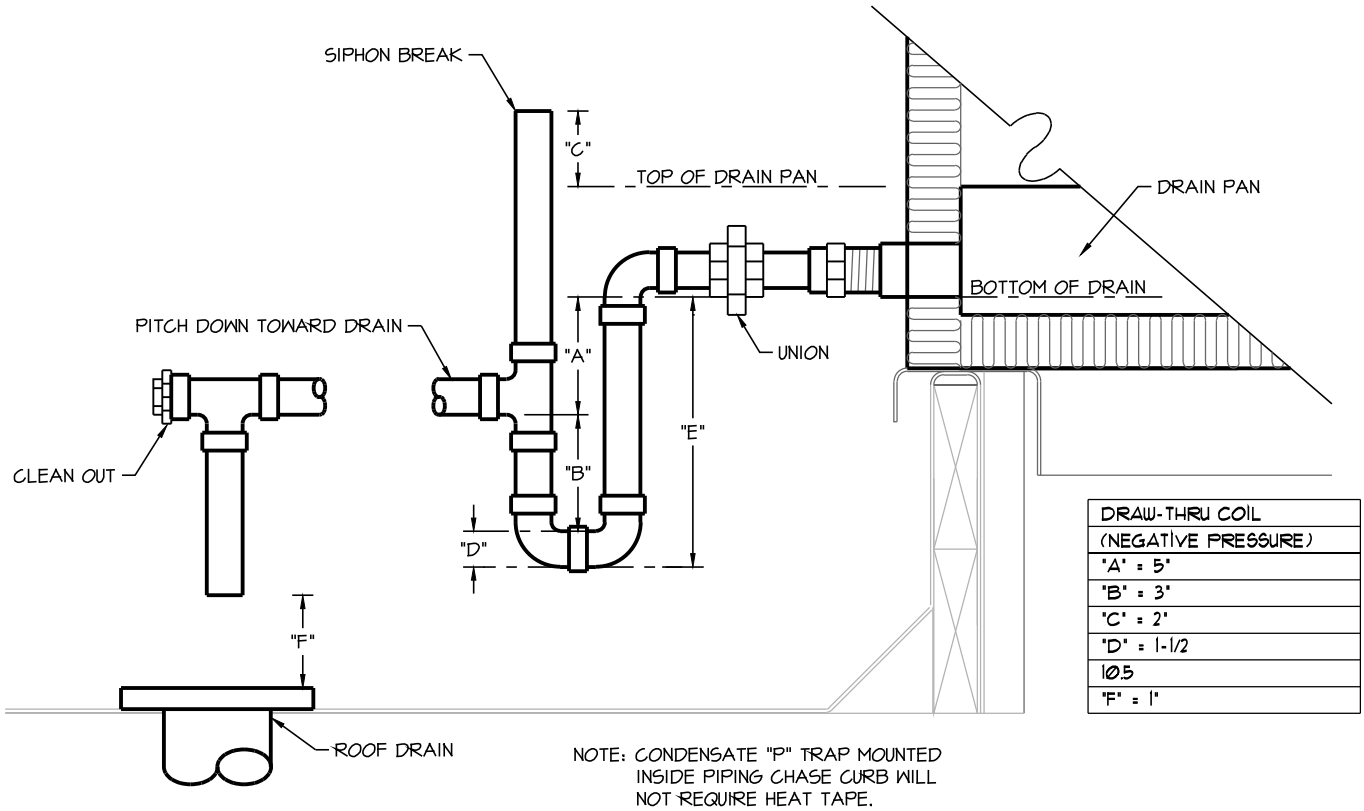

DRAW-THRU COIL
(NEGATIVE PRESSURE)
"A" = 5"
"B" = 3"
"C" = 2"
"D" = 1-1/2
10.5
"F" = 1"

44 CONDENSATE DRAIN PIPING DETAIL

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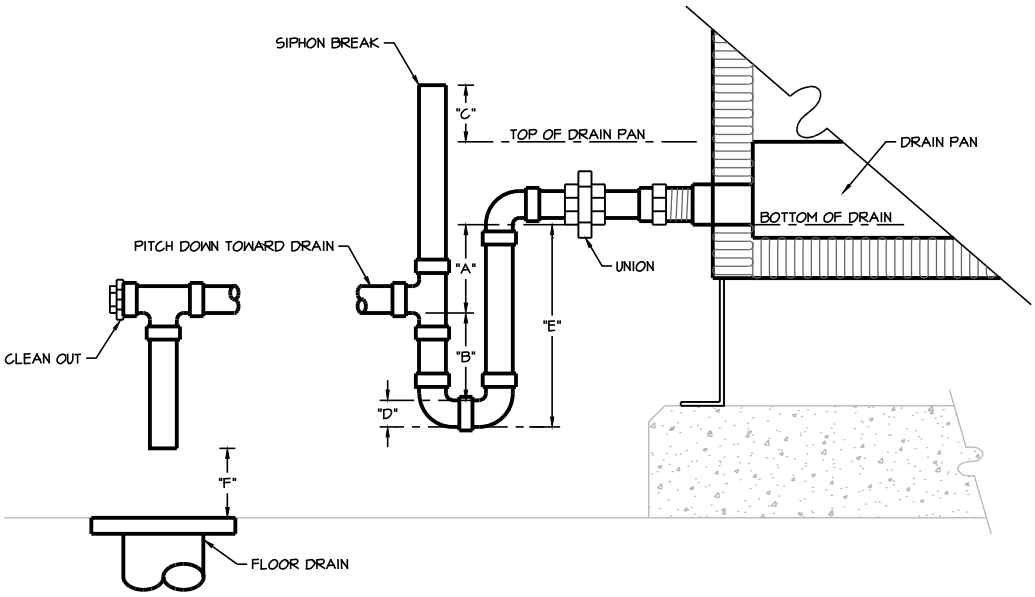

DRAW-THRU COIL
(NEGATIVE PRESSURE)
"A" = 1" + STATIC PRESSURE
"B" = 1/2 x "A"
"C" = 2"
"D" = PIPE DIAMETER
"E" = "A" + "B" + (1-1/2 x "D")
"F" = 1"

BLOW-THRU COIL
(POSITIVE PRESSURE)
"A" = 1" (MINIMUM)
"B" = 1" + STATIC PRESSURE
"C" = 2"
"D" = PIPE DIAMETER
"E" = "A" + "B" + (1-1/2 x "D")
"F" = 1"

45 CONDENSATE DRAIN PIPING DETAIL

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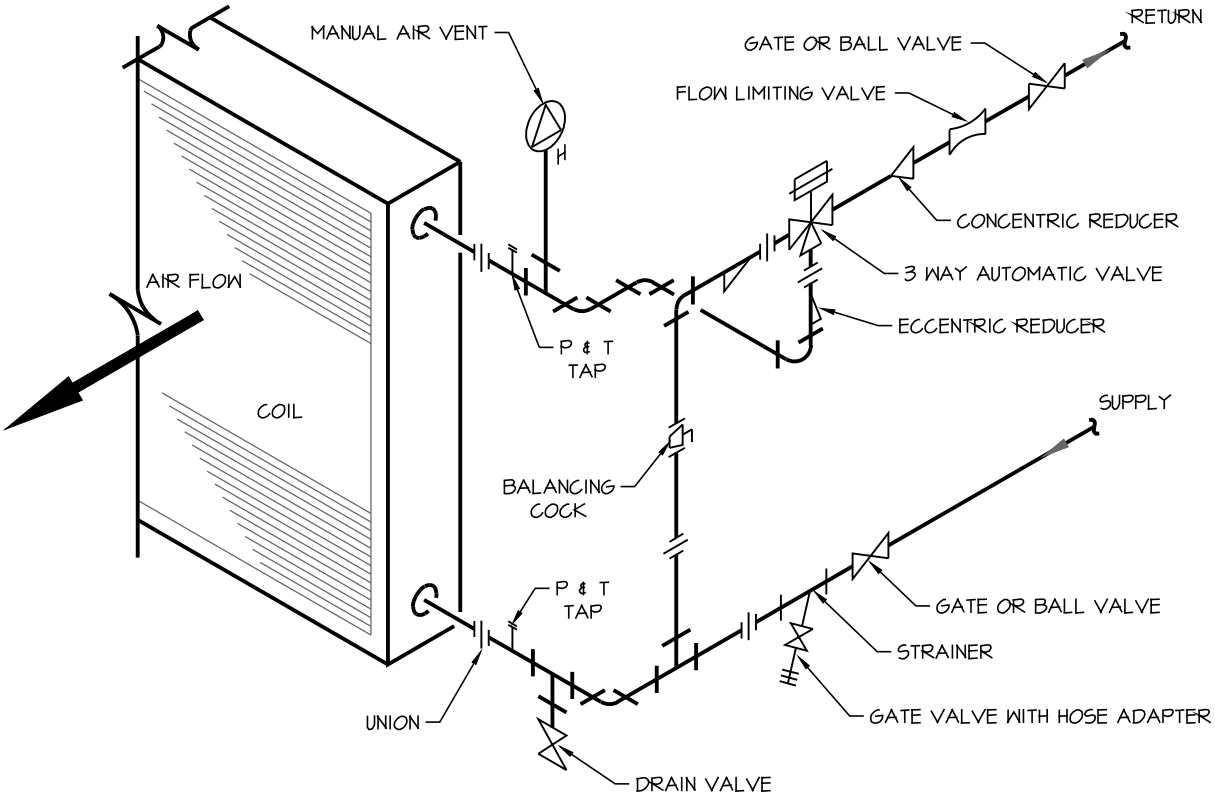

46 TYPICAL HOT WATER COIL PIPING DETAIL

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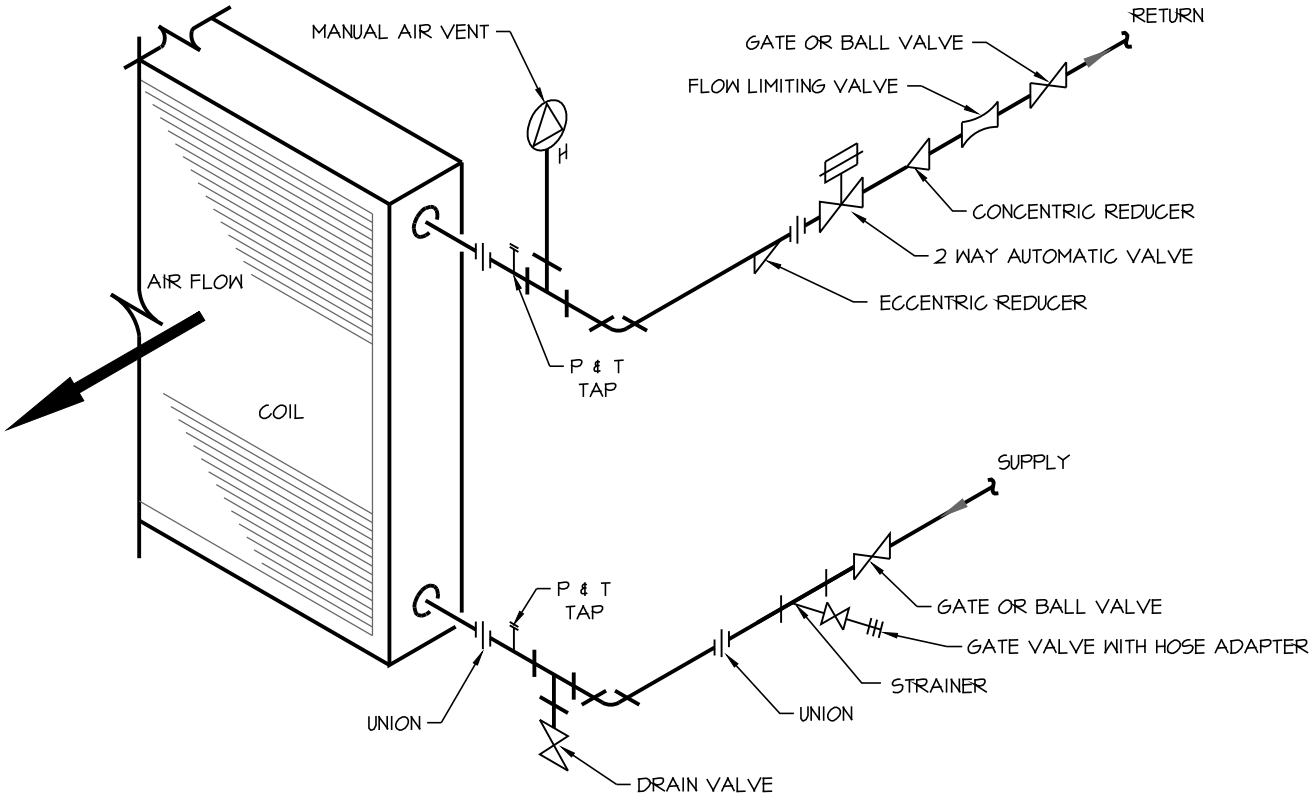
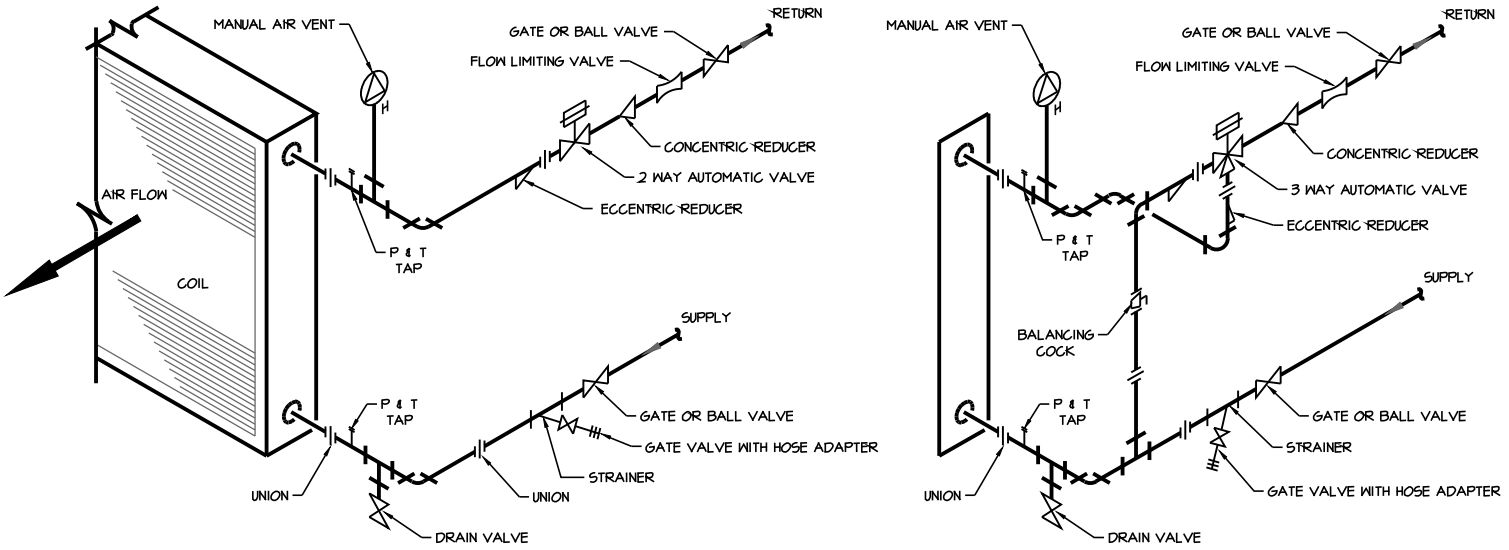


47 TYPICAL HOT WATER COIL PIPING DETAIL

NOT TO SCALE

NOTE:
USE 2-WAY CONTROL VALVES UNLESS SPECIFICALLY INDICATED
TO USE A 3-WAY CONTROL AT CERTAIN AIR TERMINALS.



48 TYPICAL HOT WATER COIL PIPING DETAIL

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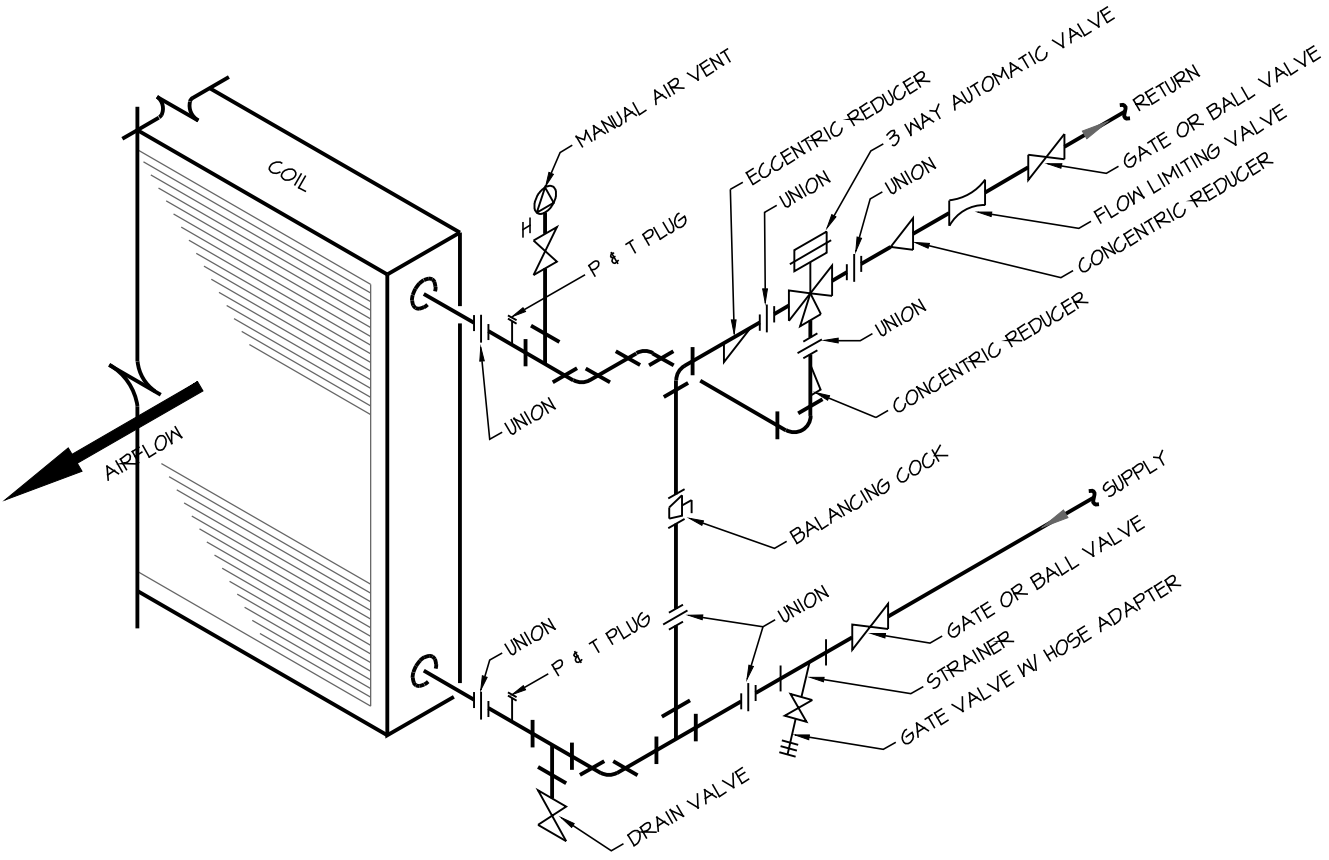

49 TYPICAL HOT WATER COIL PIPING DETAIL

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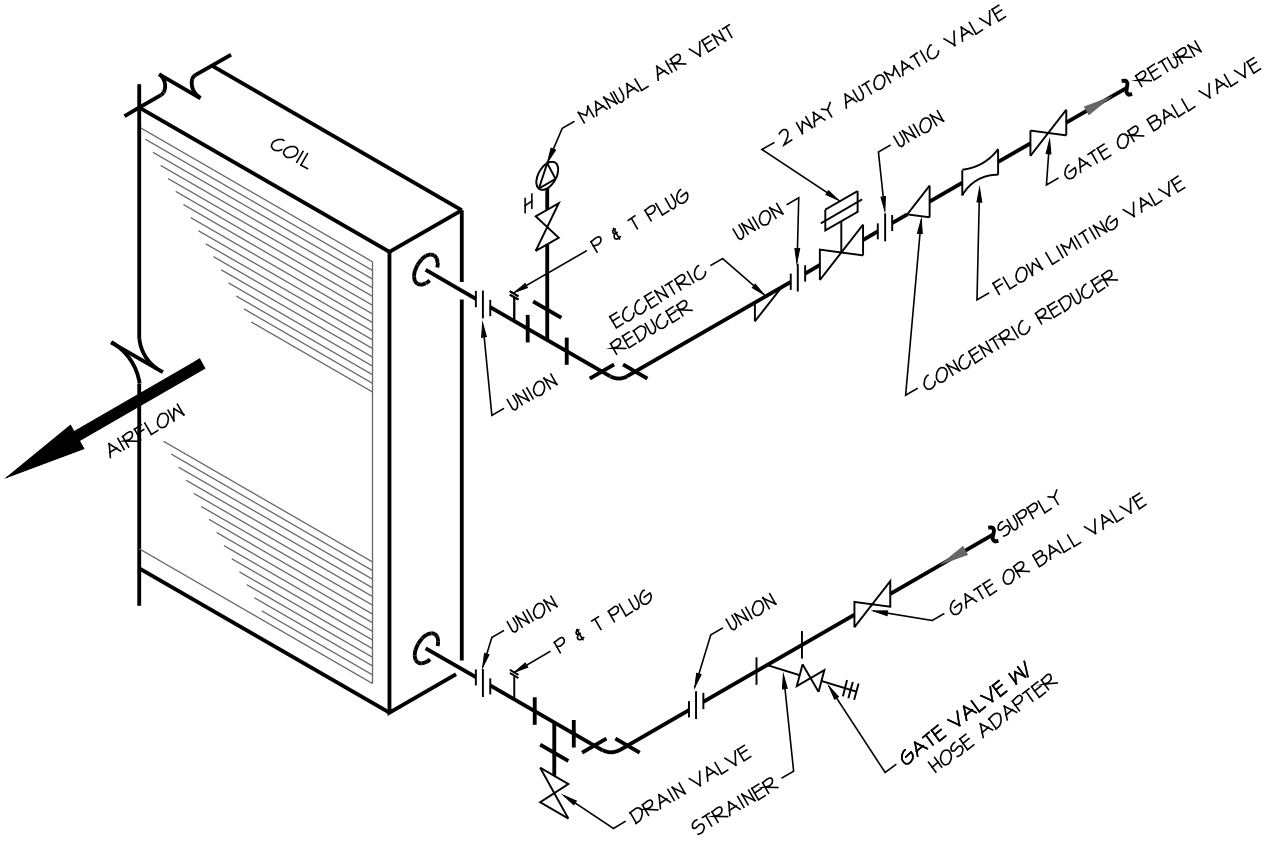
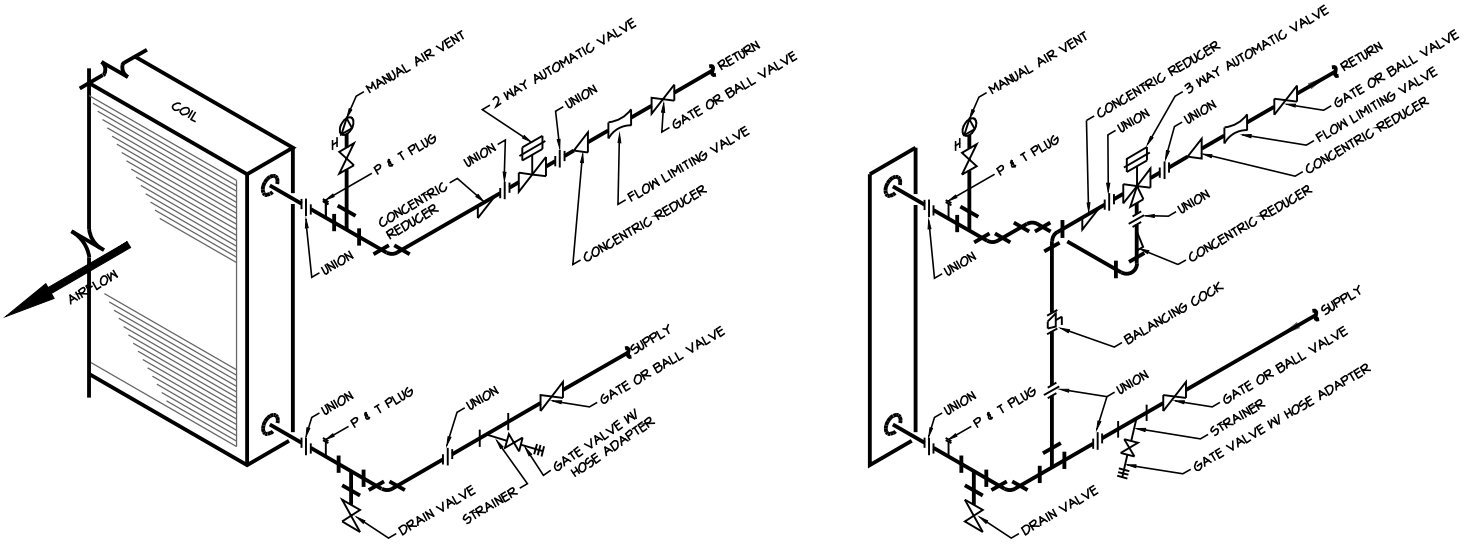


50 TYPICAL HOT WATER COIL PIPING DETAIL

NOT TO SCALE



NOTE:
USE 2-WAY CONTROL VALVES UNLESS SPECIFICALLY INDICATED TO USE A 3-WAY CONTROL AT CERTAIN VAV TERMINALS.

51 TYPICAL HOT WATER COIL PIPING DETAIL

NOT TO SCALE

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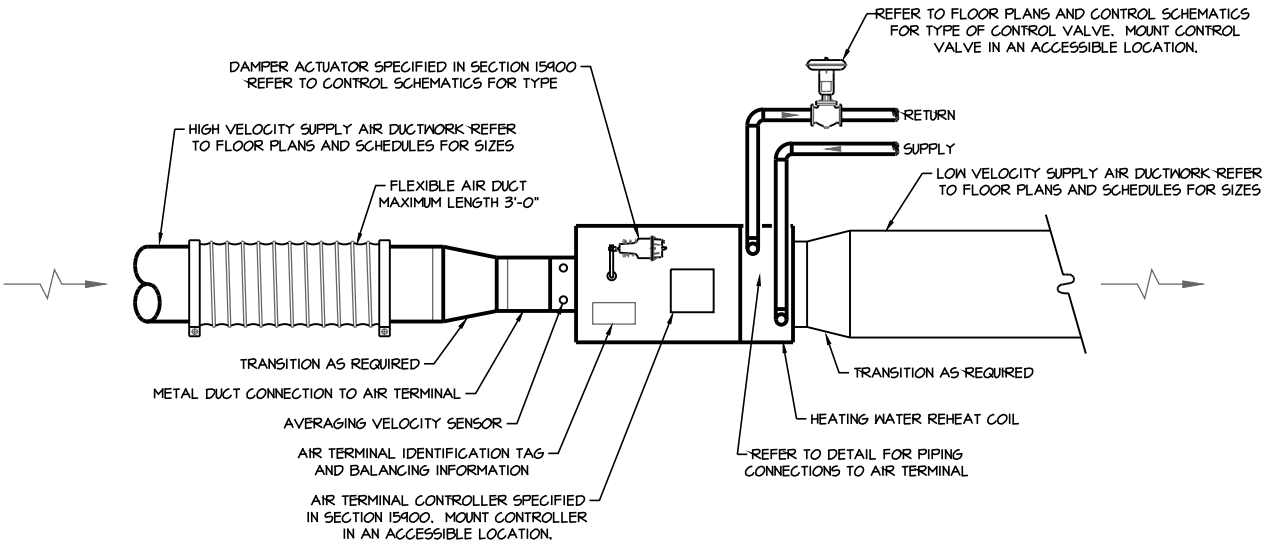
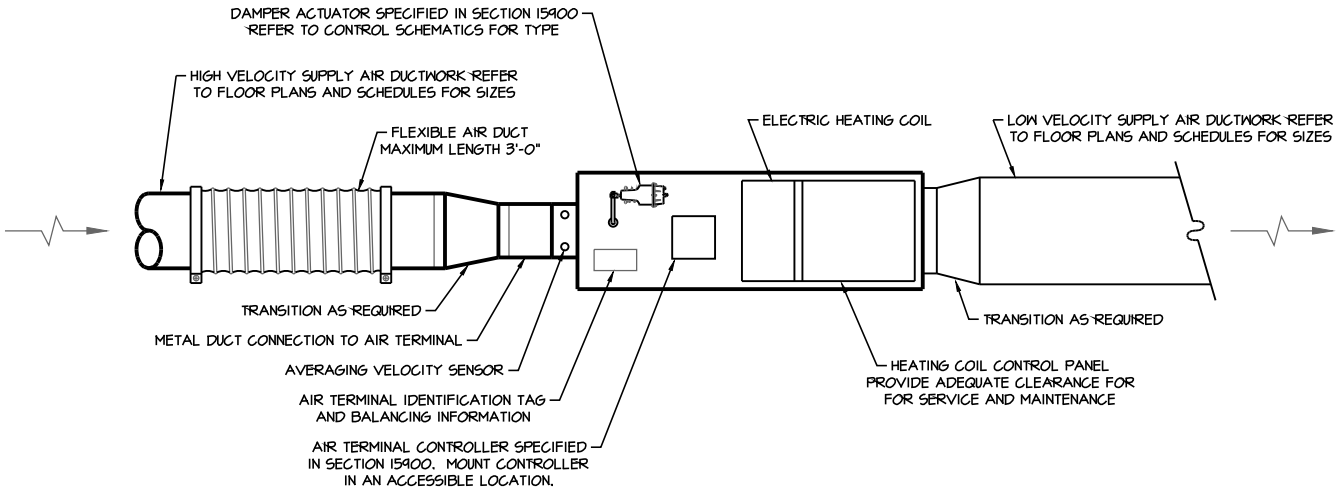
FOR ALL NON-SBS JOBS



52 TYPICAL AIR TERMINAL DETAIL

NOT TO SCALE

FOR ALL NON-SBS JOBS



53 TYPICAL AIR TERMINAL DETAIL

NOT TO SCALE

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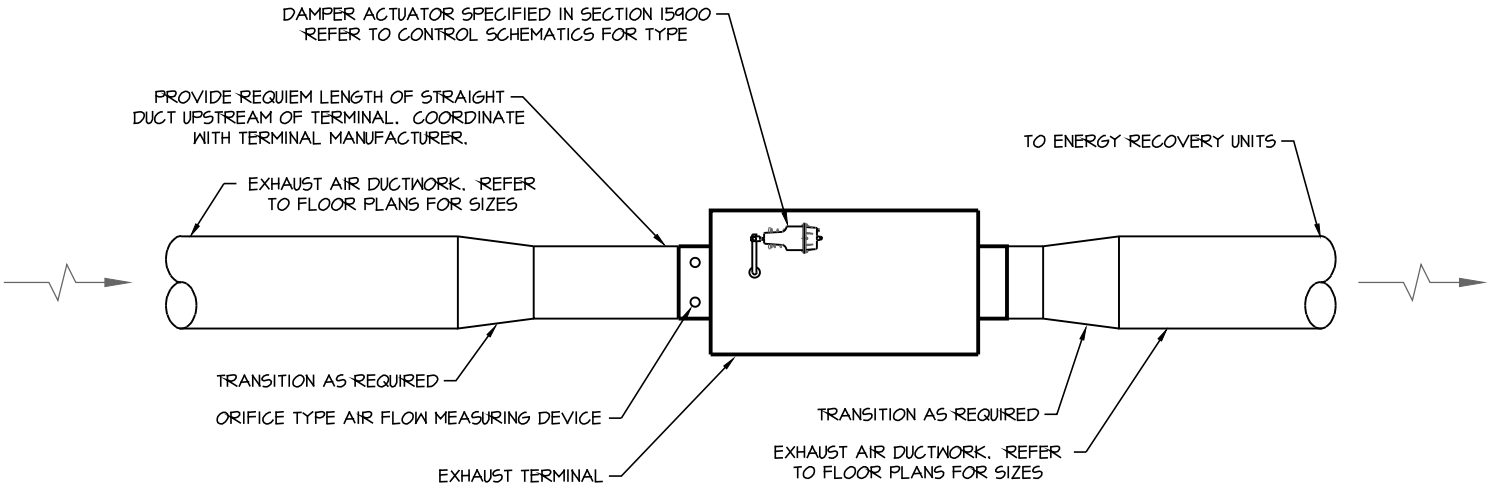

54 TYPICAL EXHAUST TERMINAL DETAIL

NOT TO SCALE

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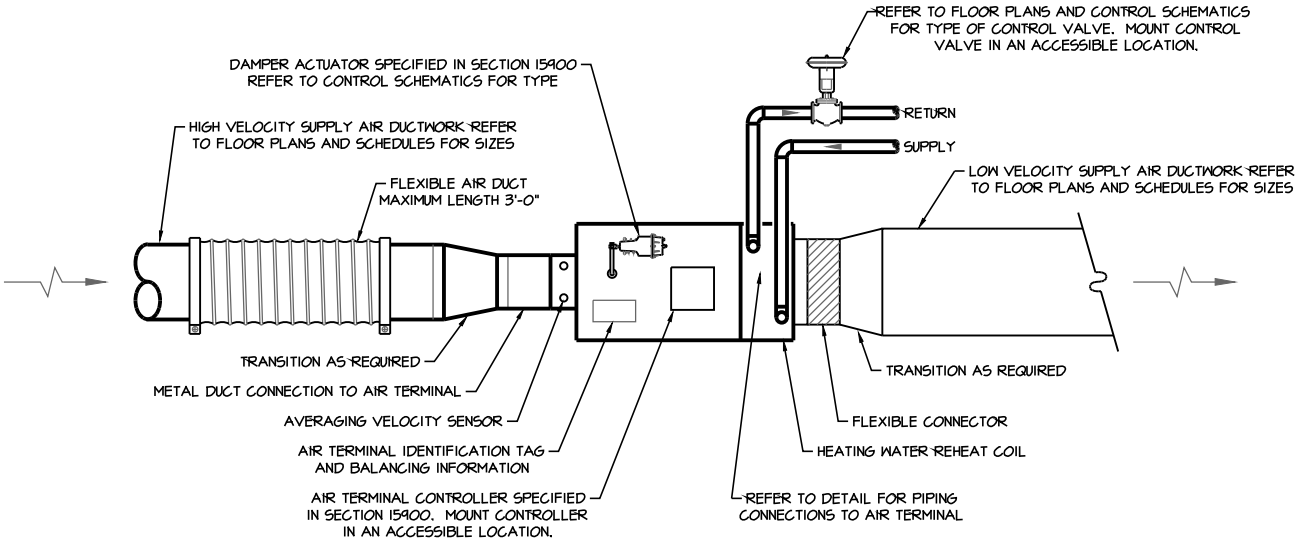
FOR SBS JOBS ONLY



55 TYPICAL AIR TERMINAL DETAIL

NOT TO SCALE

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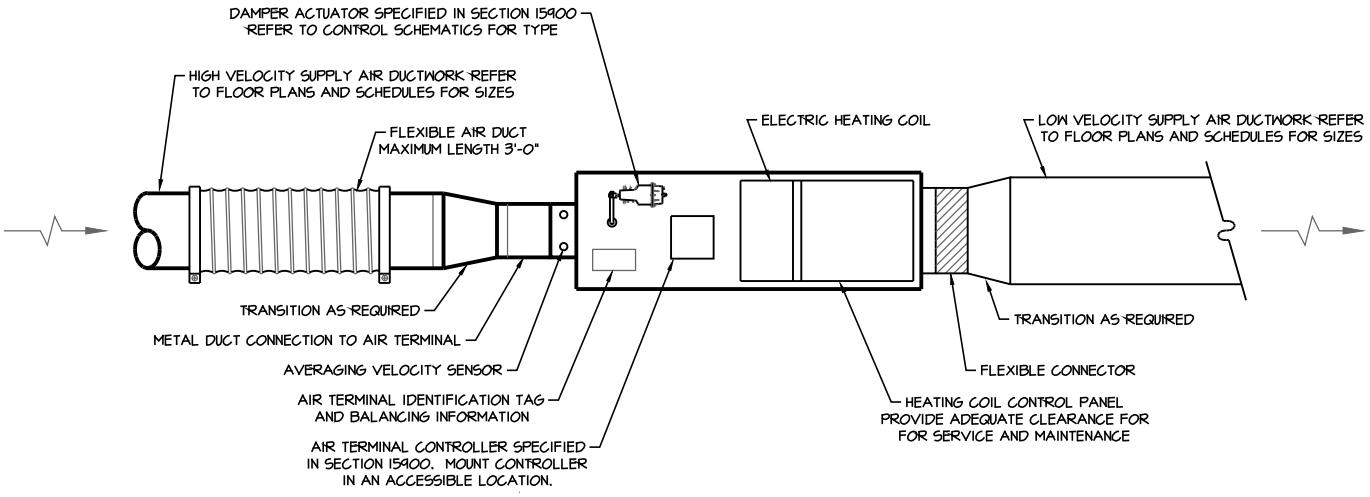
FOR SBS JOBS ONLY



56 TYPICAL AIR TERMINAL DETAIL

NOT TO SCALE

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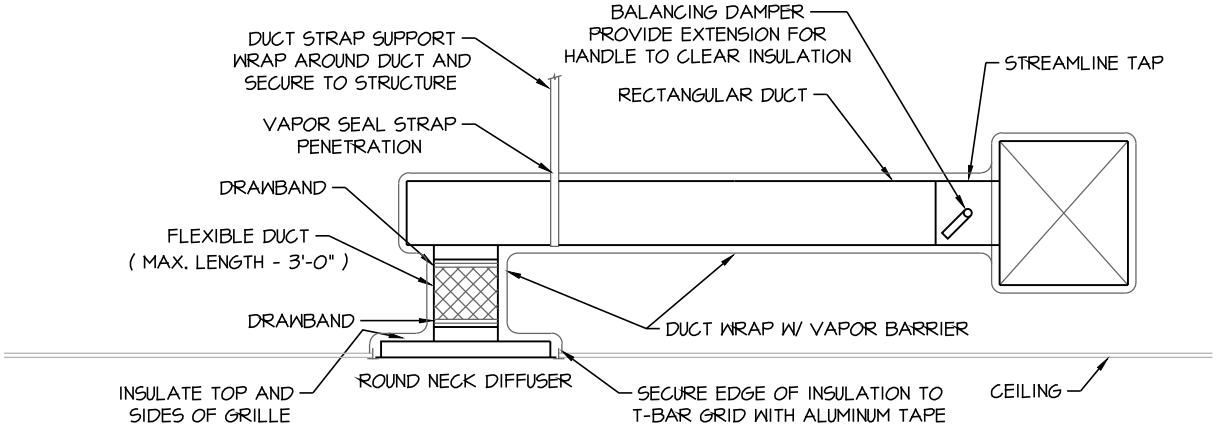
NOTE:
FLEXIBLE DUCT CONNECTIONS SHALL BE INSTALLED TO ADC STANDARDS AND SEALED TO UL STANDARDS PER AMC 603 AND 604.2.1. AS A MINIMUM, THE CONTRACTOR SHALL SECURE THE FLEXIBLE DUCT TO GRILLE AND METAL DUCT WITH DRAWBANDS, AND WRAP 3" WIDE ALUMINUM TAPE EQUAL TO HARDCAST "FOIL GRIP" AROUND DRAWBAND AND EXPOSED END OF FLEXIBLE DUCT INSULATION.



57 DIFFUSER CONNECTION TO RECTANGULAR DUCT

NOT TO SCALE

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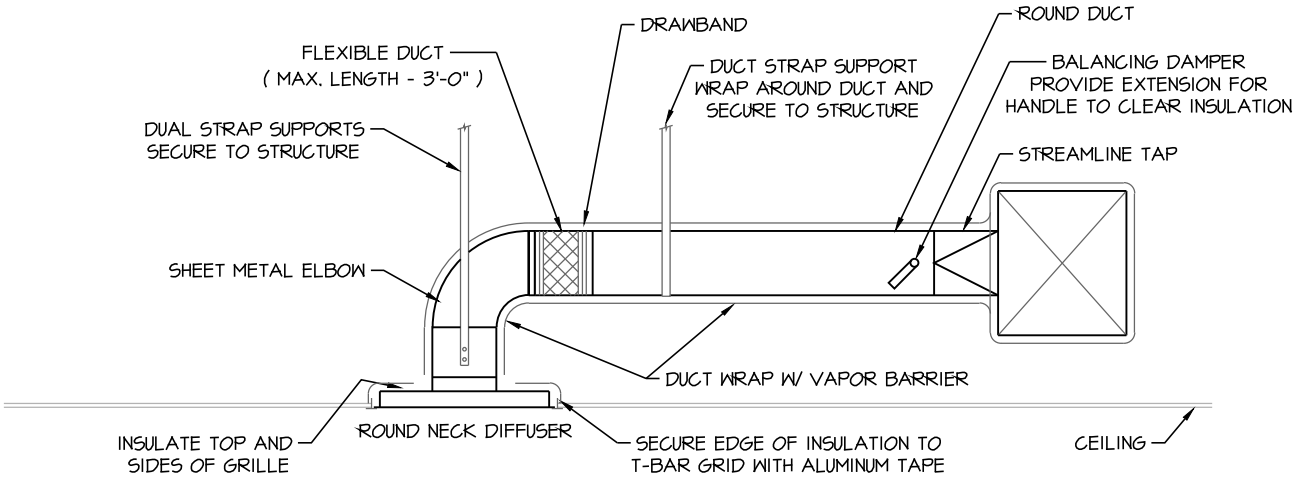
FOR SBS JOBS ONLY

NOTE:
FLEXIBLE DUCT CONNECTIONS SHALL BE INSTALLED TO ADC STANDARDS AND SEALED TO UL STANDARDS PER AMC 603 AND 604.2.1. AS A MINIMUM, THE CONTRACTOR SHALL SECURE THE FLEXIBLE DUCT TO ENDS OF METAL DUCT WITH DRAWBANDS, AND WRAP 3" WIDE ALUMINUM TAPE EQUAL TO HARDCAST "FOIL GRIP" AROUND DRAWBAND AND EXPOSED END OF FLEXIBLE DUCT INSULATION.



58 DIFFUSER CONNECTION TO ROUND DUCT

NOT TO SCALE

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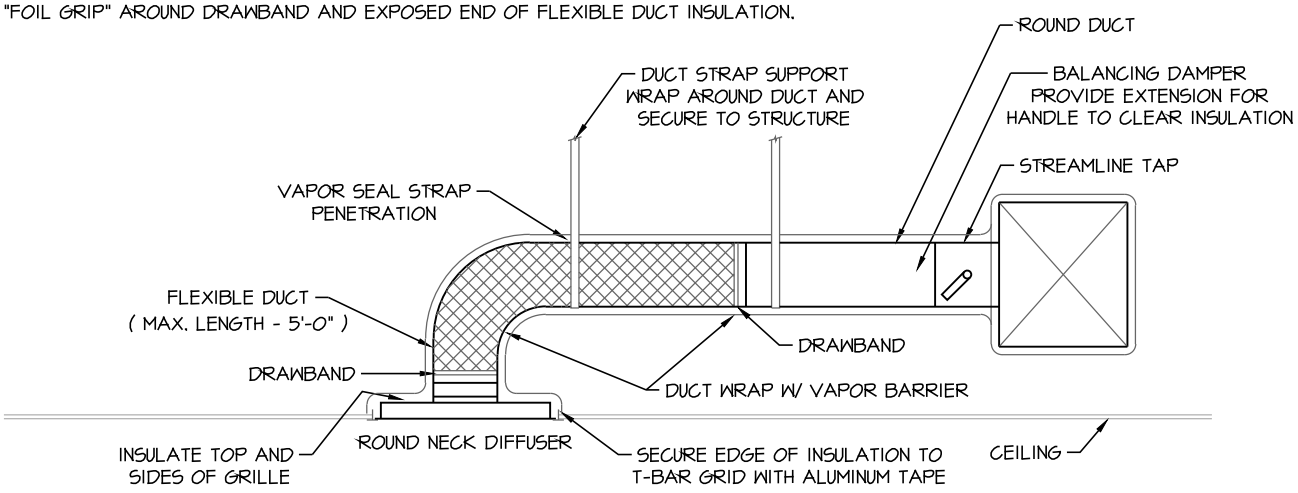
NOTE:
FLEXIBLE DUCT CONNECTIONS SHALL BE INSTALLED TO ADC STANDARDS AND SEALED TO UL STANDARDS PER AMC 603 AND 604.2.1. AS A MINIMUM, THE CONTRACTOR SHALL SECURE THE FLEXIBLE DUCT TO GRILLE AND METAL DUCT WITH DRAWBANDS, AND WRAP 3" WIDE ALUMINUM TAPE EQUAL TO HARDCAST "FOIL GRIP" AROUND DRAWBAND AND EXPOSED END OF FLEXIBLE DUCT INSULATION.



59 DIFFUSER CONNECTION TO ROUND DUCT

NOT TO SCALE

FOR ALL NON-SBS JOBS

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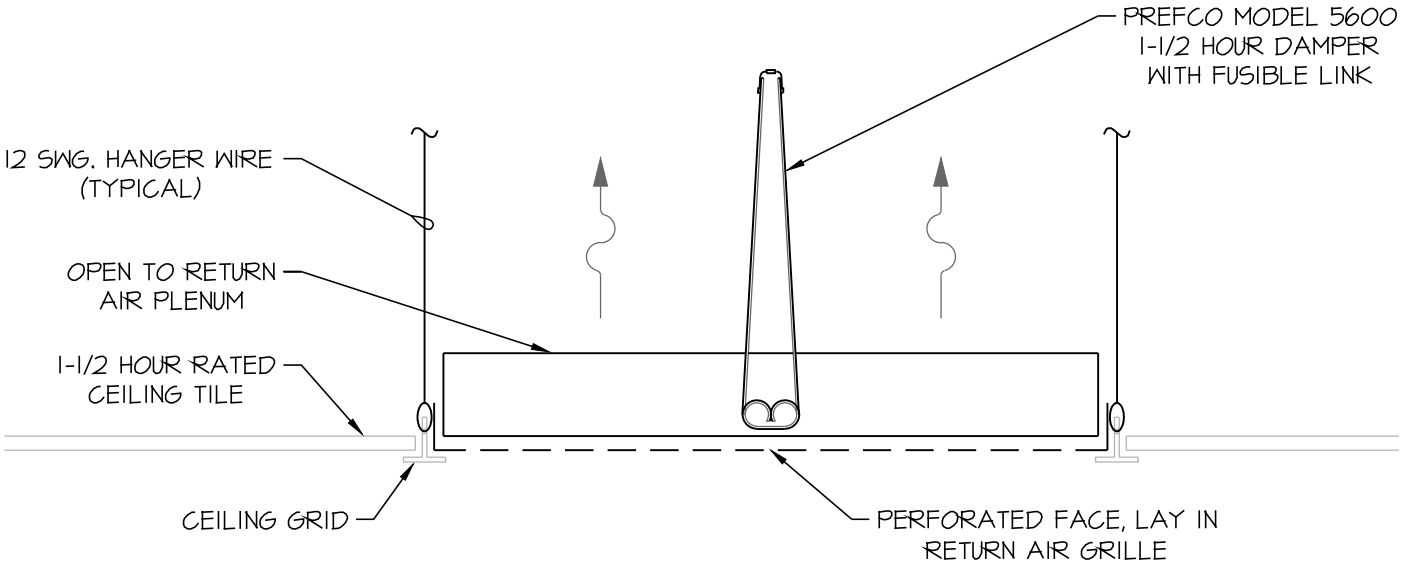

60 RETURN AIR GRILLE W/ FIRE DAMPER

NOT TO SCALE

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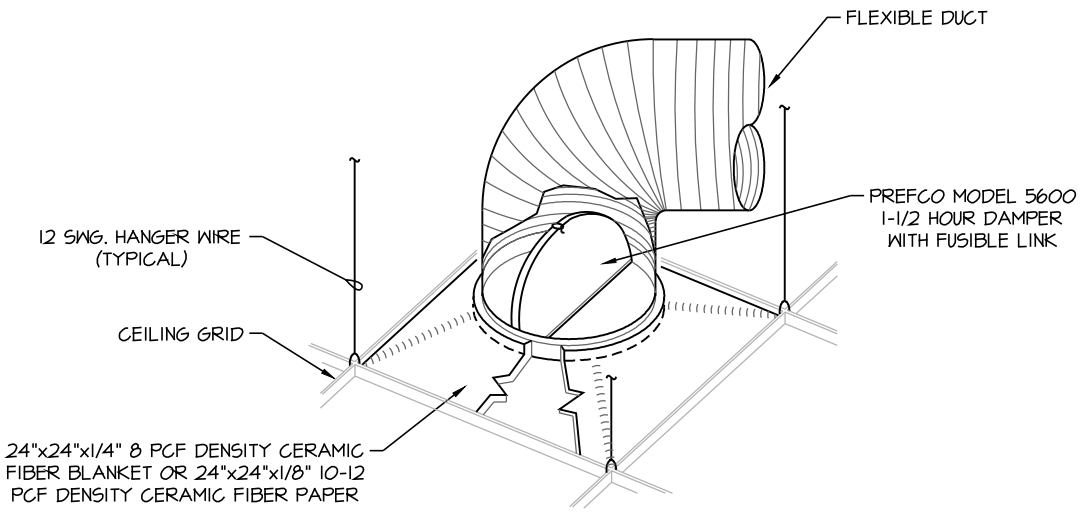

NOTE:
FLEXIBLE DUCT CONNECTIONS SHALL BE INSTALLED TO ADC STANDARDS AND SEALED TO UL STANDARDS PER AMC 603 AND 604.2.1. AS A MINIMUM, THE CONTRACTOR SHALL SECURE THE FLEXIBLE DUCT TO GRILLE AND METAL DUCT WITH DRAWBANDS, AND WRAP 3" WIDE ALUMINUM TAPE EQUAL TO HARDCAST "FOIL GRIP" AROUND DRAWBAND AND EXPOSED END OF FLEXIBLE DUCT INSULATION.

6 DIFFUSER CONNECTION W/ FIRE DAMPER

NOT TO SCALE

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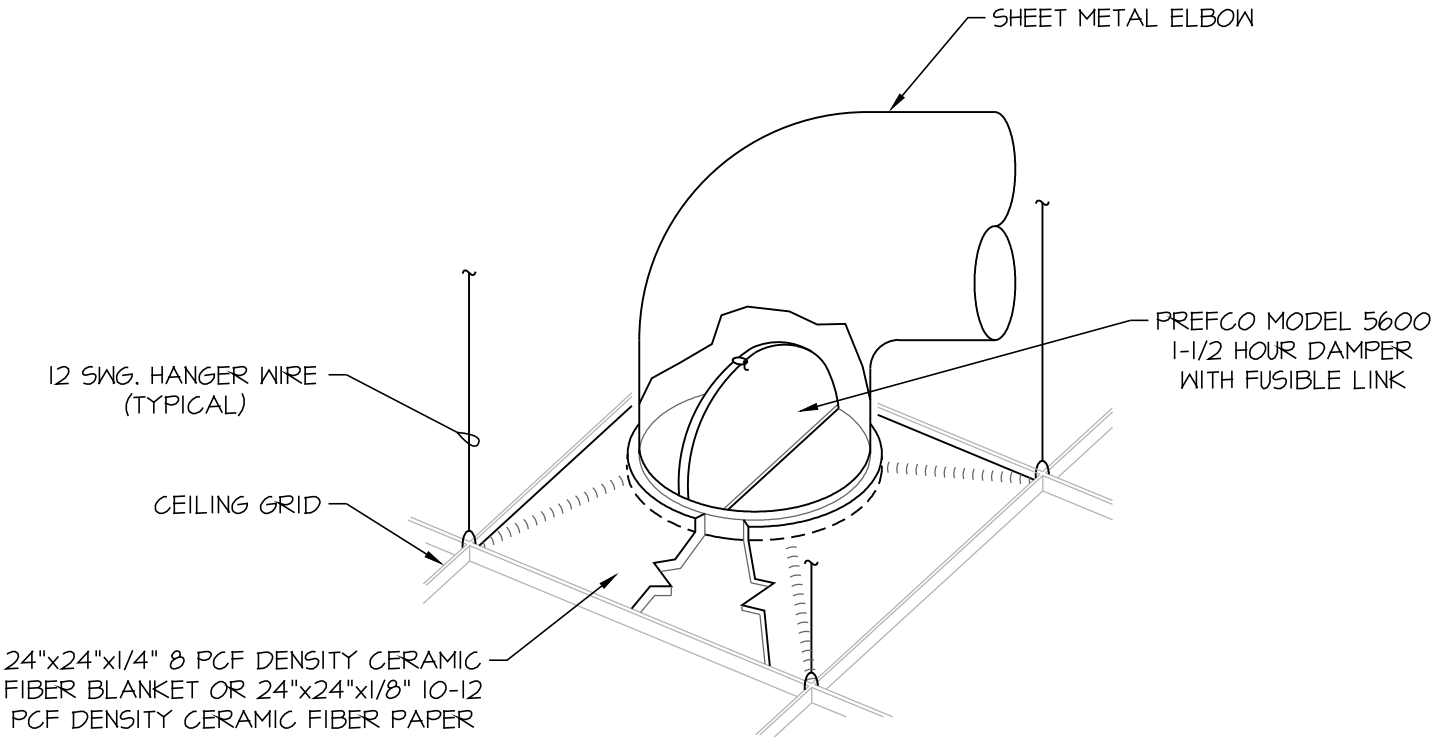

NOTE:
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62 DIFFUSER CONNECTION W/ FIRE DAMPER

NOT TO SCALE

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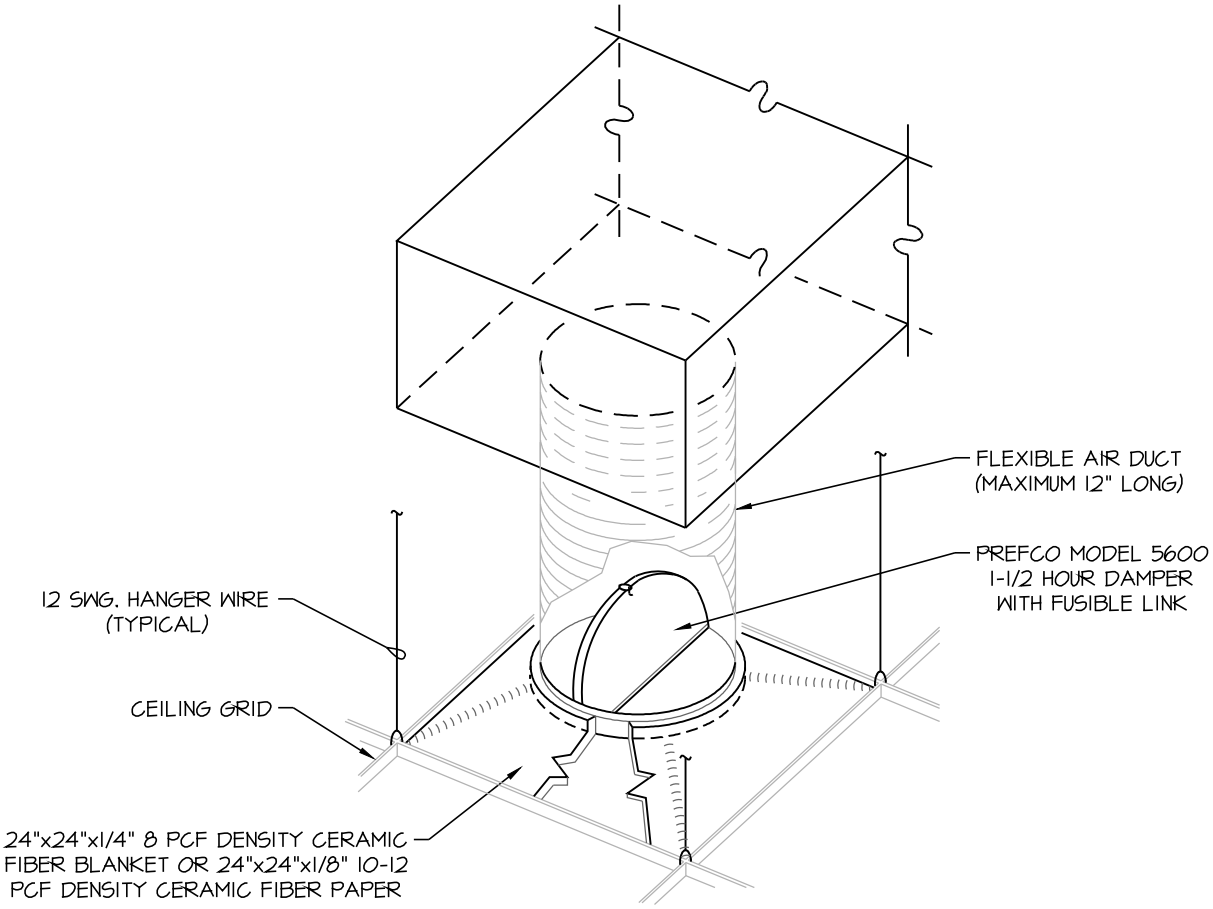

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FLEXIBLE DUCT CONNECTIONS SHALL BE INSTALLED TO ADC STANDARDS AND SEALED TO UL STANDARDS PER AMC 603 AND 604.2.1. AS A MINIMUM, THE CONTRACTOR SHALL SECURE THE FLEXIBLE DUCT TO ENDS OF METAL DUCT WITH DRAWBANDS, AND WRAP 3" WIDE ALUMINUM TAPE EQUAL TO HARDCAST "FOIL GRIP" AROUND DRAWBAND AND EXPOSED END OF FLEXIBLE DUCT INSULATION.

63 DIFFUSER CONNECTION W/ FIRE DAMPER

NOT TO SCALE

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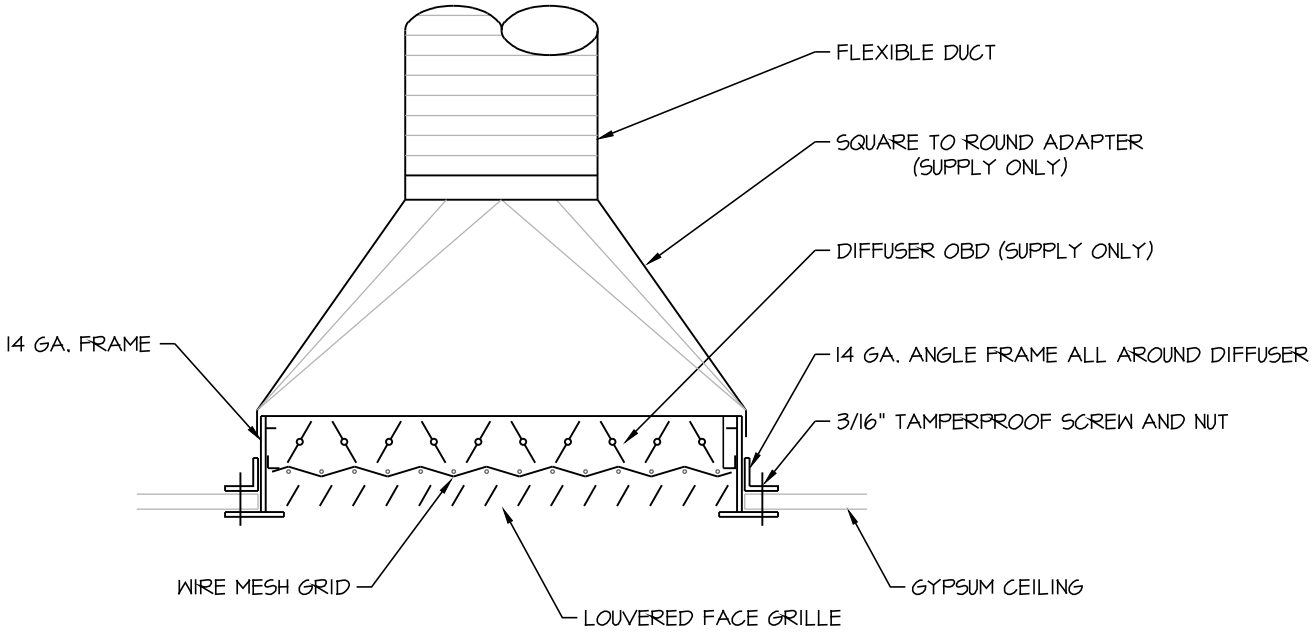

64 MINIMUM SECURITY DIFFUSER DETAIL

NOT TO SCALE

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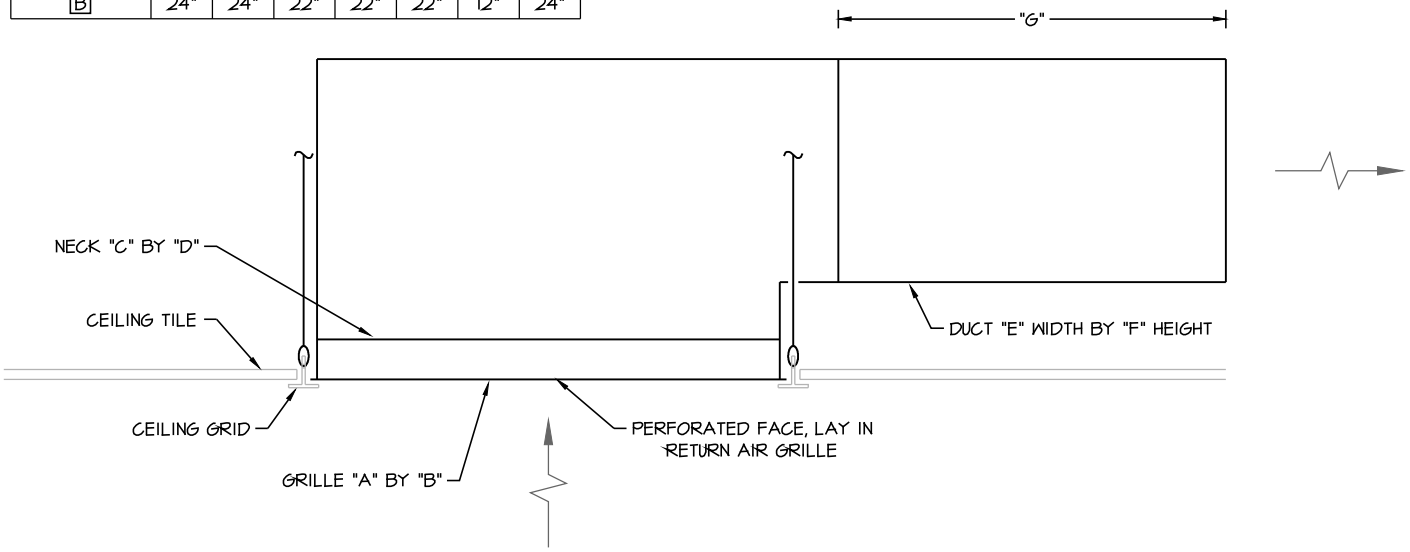
DESIGNATION	A	B	C	D	E	F	G
A	24"	12"	22"	11"	22"	12"	24"
B	24"	24"	22"	22"	22"	12"	24"



65 RETURN AIR GRILLE WITH ELL DETAIL

NOT TO SCALE

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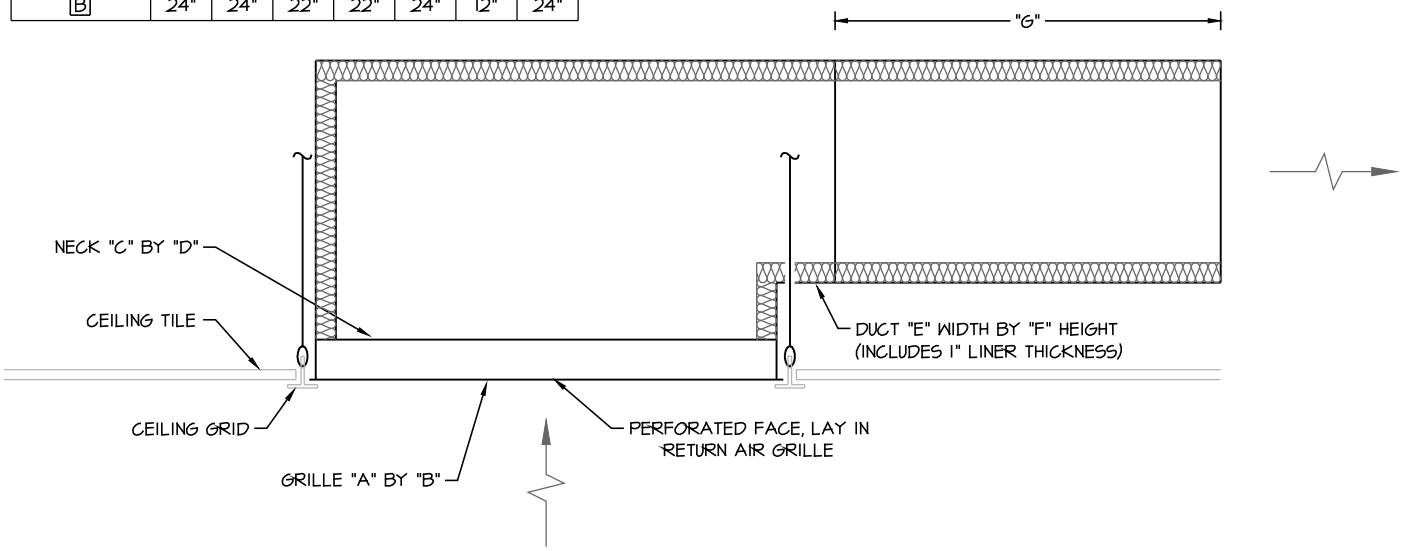
DESIGNATION	A	B	C	D	E	F	G
A	24"	12"	22"	11"	24"	12"	24"
B	24"	24"	22"	22"	24"	12"	24"



66 RETURN AIR GRILLE WITH INSULATED ELL DETAIL

NOT TO SCALE

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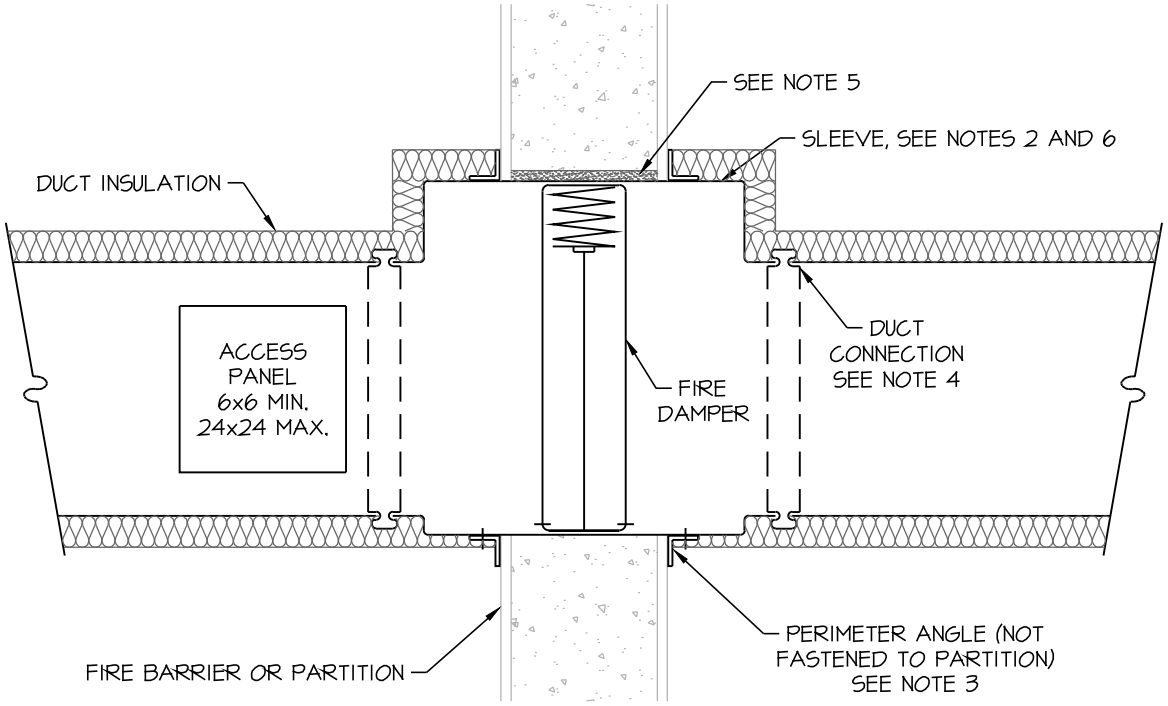

NOTES:

1. COMPLY W/ SMACNA "FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE FOR HVAC "SYSTEMS" AND NFPA 90A "INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS".
2. GALVANIZED SLEEVE GAGE SHALL NOT BE LESS THAN CONNECTING DUCT FOR BREAKAWAY CONNECTED DUCT. BREAKAWAY DUCT CONNECTION MAY BE OMITTED IF SLEEVE IS 16 GA. MINIMUM.
3. GALVANIZED STEEL PERIMETER ANGLE NOT LESS THAN 1-1/2x1-1/2x14 GAGE WITH 1" MINIMUM OVERLAP ON ON ALL SIDES.
4. BREAKAWAY DUCT CONNECTION, REFER TO SMACNA FIGURE 2-2 "UL ACCEPTED DUCT-SLEEVE CONNECTIONS" OF FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE. UL TESTED DUCT SEALANT MAY BE USED. BREAKAWAY DUCT CONNECTION MAY BE OMITTED IF SLEEVE IS 16 GA. MINIMUM.
5. PROVIDE 1/4" TO 1/2" CLEARANCE ON HEIGHT AND WIDTH. FILL OPEN SPACE WITH FIRE STOPPING MATERIAL.
6. FIRE DAMPER SLEEVE TO EXTEND 6" MINIMUM ON EACH SIDE.

67 VERTICAL FIRE DAMPER DETAIL

NOT TO SCALE

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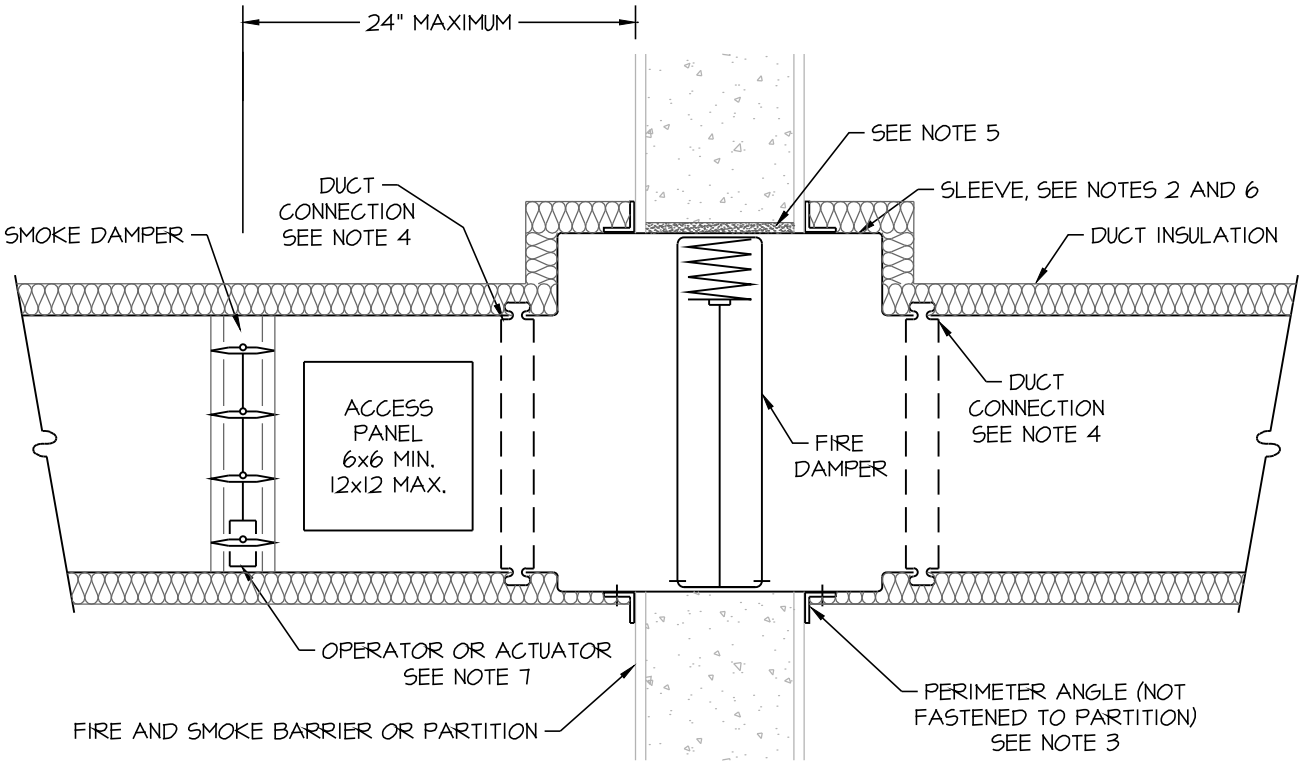

NOTES:

1. COMPLY W/ SMACNA "FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE FOR HVAC "SYSTEMS" AND NFPA 90A "INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS".
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6. FIRE DAMPER SLEEVE TO EXTEND 6" MINIMUM ON EACH SIDE.
   REFER TO CONTROL SCHEMATIC FOR APPLICABLE OPERATOR OR ACTUATOR

68 VERTICAL FIRE AND SMOKE DAMPER DETAIL

NOT TO SCALE

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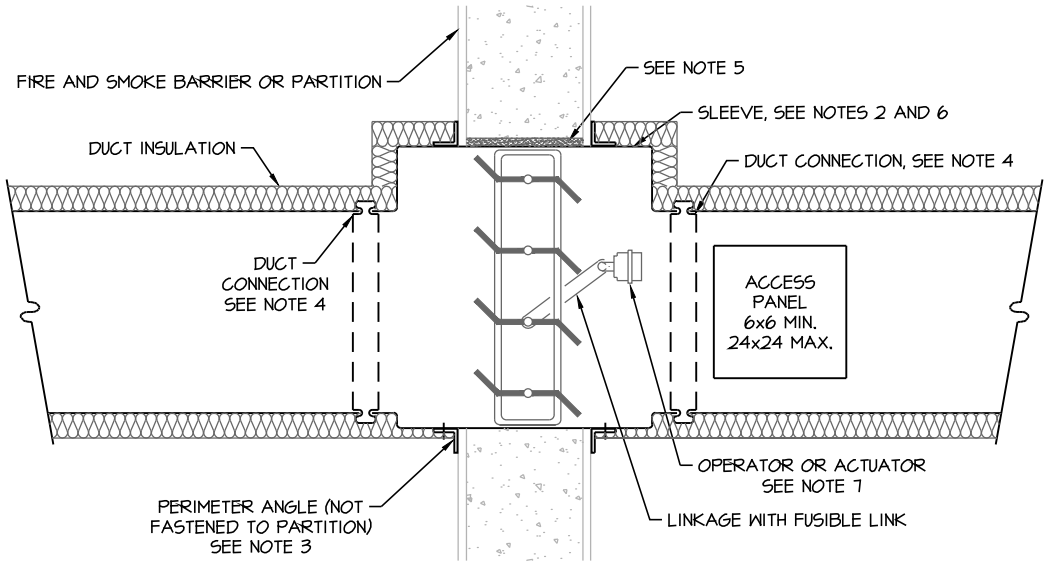

NOTES:

1. COMPLY W/ SMACNA "FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE FOR HVAC "SYSTEMS" AND NFPA 90A "INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS".
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5. PROVIDE 1/4" TO 1/2" CLEARANCE ON HEIGHT AND WIDTH. FILL OPEN SPACE WITH FIRE STOPPING MATERIAL.
6. FIRE DAMPER SLEEVE TO EXTEND 6" MINIMUM ON EACH SIDE.
   REFER TO CONTROL SCHEMATIC FOR APPLICABLE OPERATOR OR ACTUATOR

69 COMBINATION FIRE AND SMOKE DAMPER DETAIL

NOT TO SCALE

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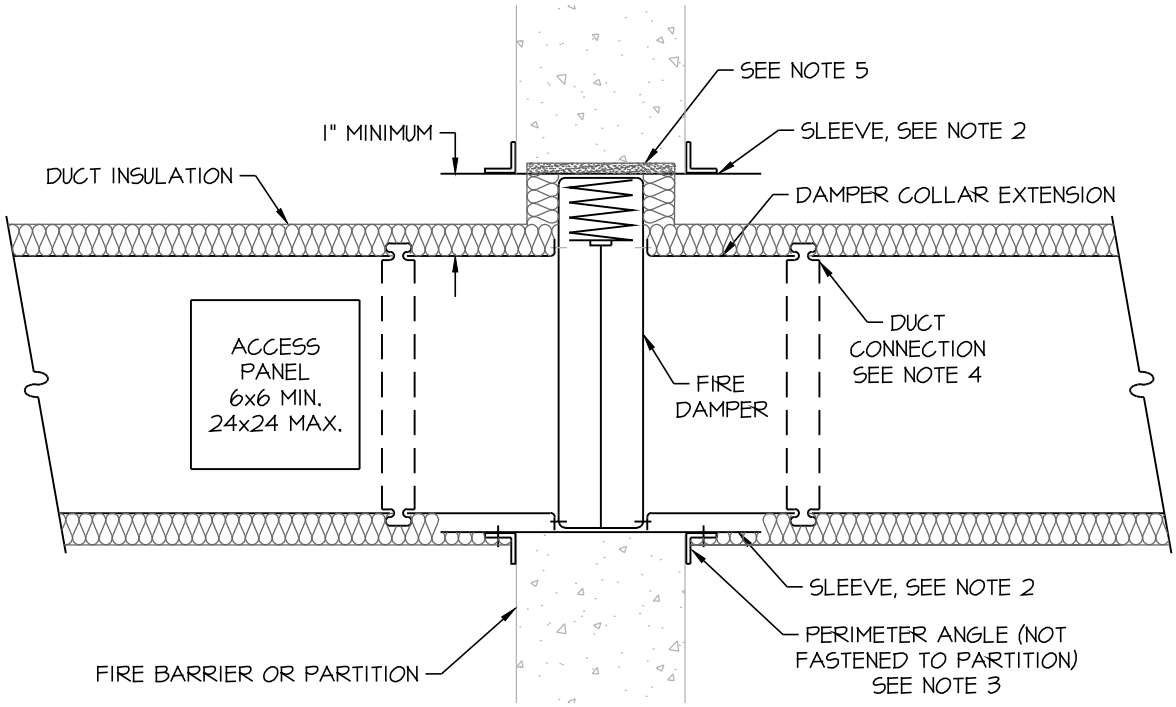

NOTES:

1. COMPLY W/ SMACNA "FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE FOR HVAC "SYSTEMS" AND NFPA 90A "INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS".
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5. PROVIDE 1/4" TO 1/2" CLEARANCE ON HEIGHT AND WIDTH. FILL OPEN SPACE WITH FIRE STOPPING MATERIAL.
6. FIRE DAMPER SLEEVE TO EXTEND 6" MINIMUM ON EACH SIDE.

10 VERTICAL FIRE DAMPER DETAIL

NOT TO SCALE

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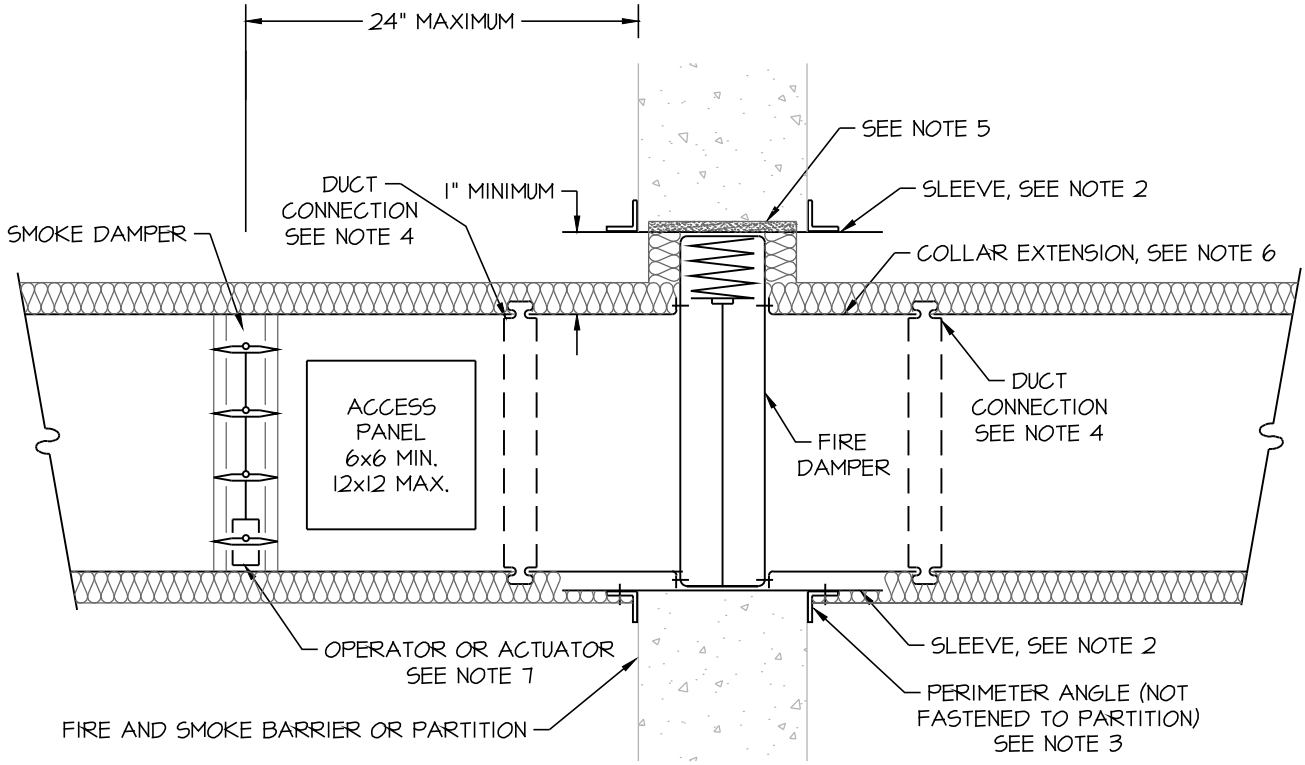

NOTES:

1. COMPLY W/ SMACNA "FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE FOR HVAC "SYSTEMS" AND NFPA 90A "INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS".
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5. PROVIDE 1/4" TO 1/2" CLEARANCE ON HEIGHT AND WIDTH. FILL OPEN SPACE WITH FIRE STOPPING MATERIAL.
6. FIRE DAMPER SLEEVE TO EXTEND 6" MINIMUM ON EACH SIDE.
   REFER TO CONTROL SCHEMATIC FOR APPLICABLE OPERATOR OR ACTUATOR

71 VERTICAL FIRE AND SMOKE DAMPER DETAIL

NOT TO SCALE

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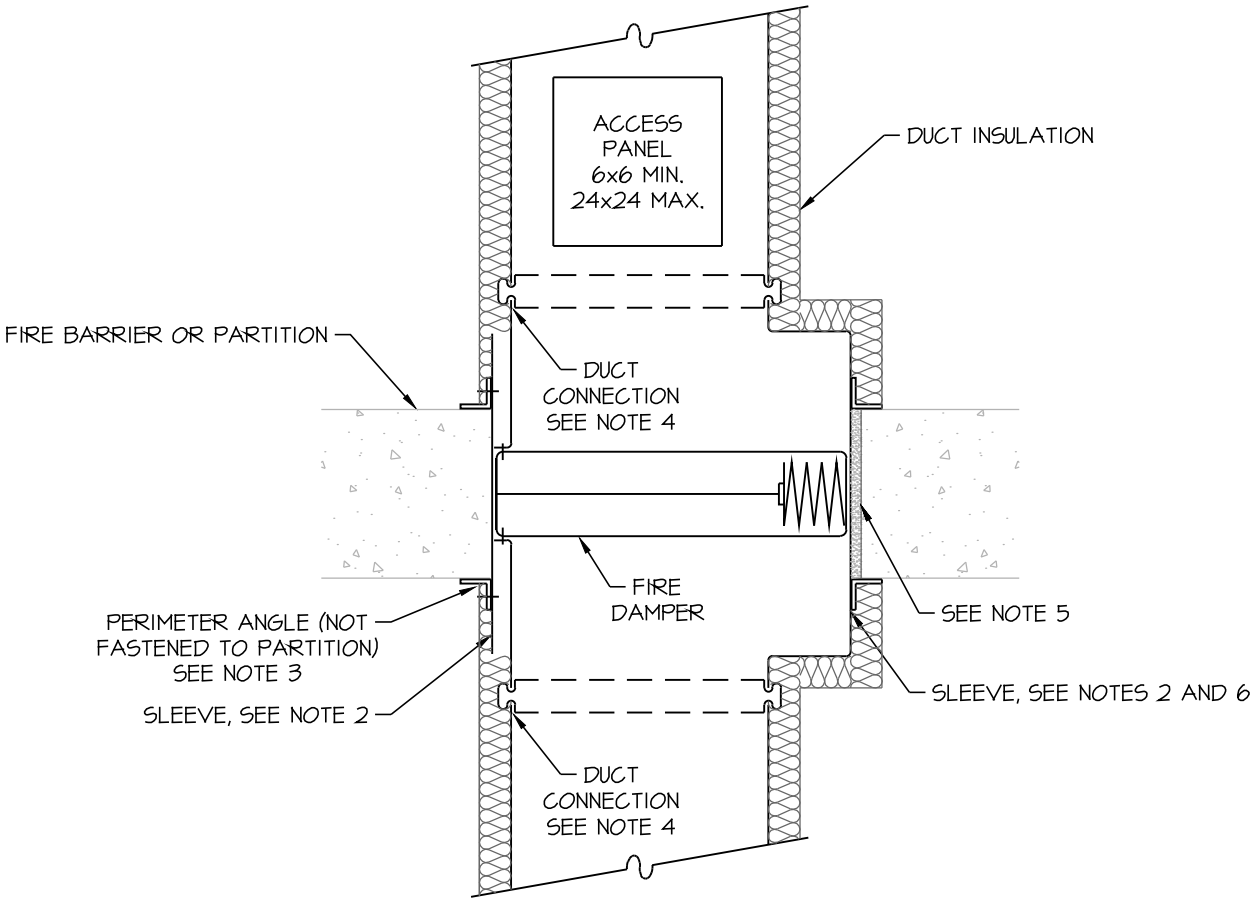

NOTES:

1. COMPLY W/ SMACNA "FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE FOR HVAC "SYSTEMS" AND NFPA 90A "INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS".
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5. PROVIDE 1/4" TO 1/2" CLEARANCE ON HEIGHT AND WIDTH. FILL OPEN SPACE WITH FIRE STOPPING MATERIAL.
6. FIRE DAMPER SLEEVE TO EXTEND 6" MINIMUM ON EACH SIDE.

72 HORIZONTAL FIRE DAMPER DETAIL

NOT TO SCALE

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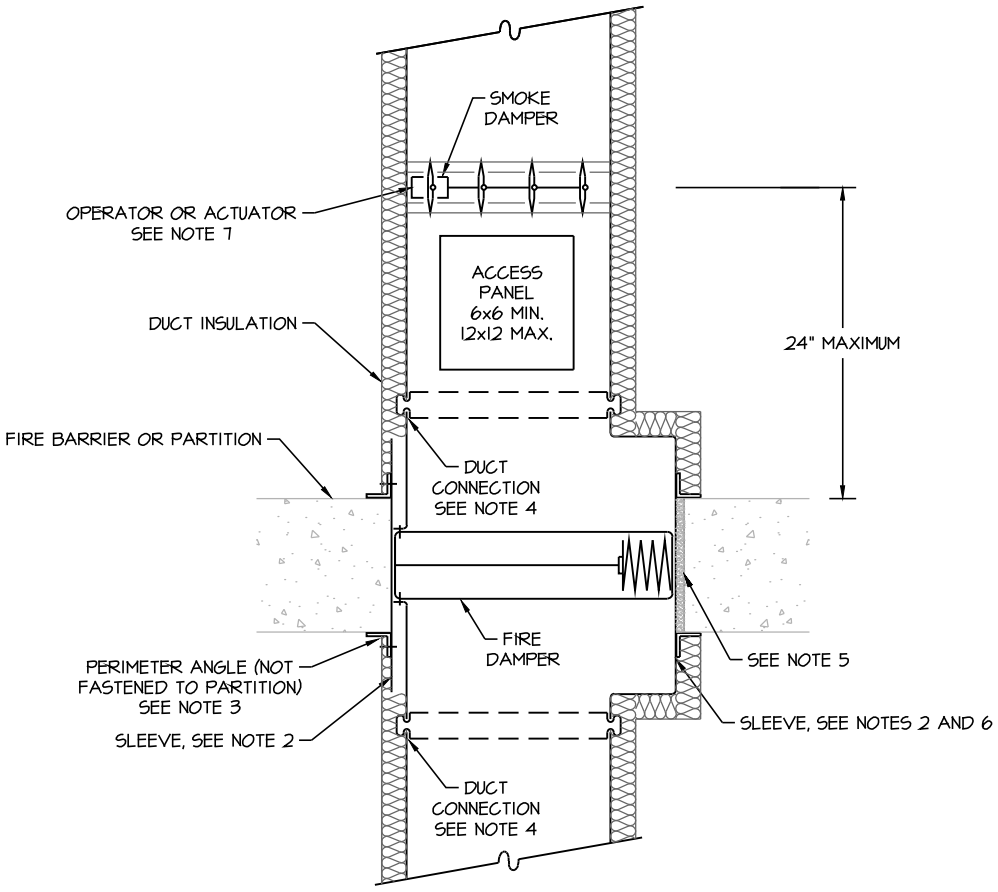

NOTES:

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4. BREAKAWAY DUCT CONNECTION, REFER TO SMACNA FIGURE 2-2 "UL ACCEPTED DUCT-SLEEVE CONNECTIONS" OF FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE. UL TESTED DUCT SEALANT MAY BE USED. BREAKAWAY DUCT CONNECTION MAY BE OMITTED IF SLEEVE IS 16 GA. MINIMUM.
5. PROVIDE 1/4" TO 1/2" CLEARANCE ON HEIGHT AND WIDTH. FILL OPEN SPACE WITH FIRE STOPPING MATERIAL.
6. FIRE DAMPER SLEEVE TO EXTEND 6" MINIMUM ON EACH SIDE.
7. REFER TO CONTROL SCHEMATIC FOR APPLICABLE OPERATOR OR ACTUATOR

73 HORIZONTAL FIRE AND SMOKE DAMPER DETAIL

NOT TO SCALE

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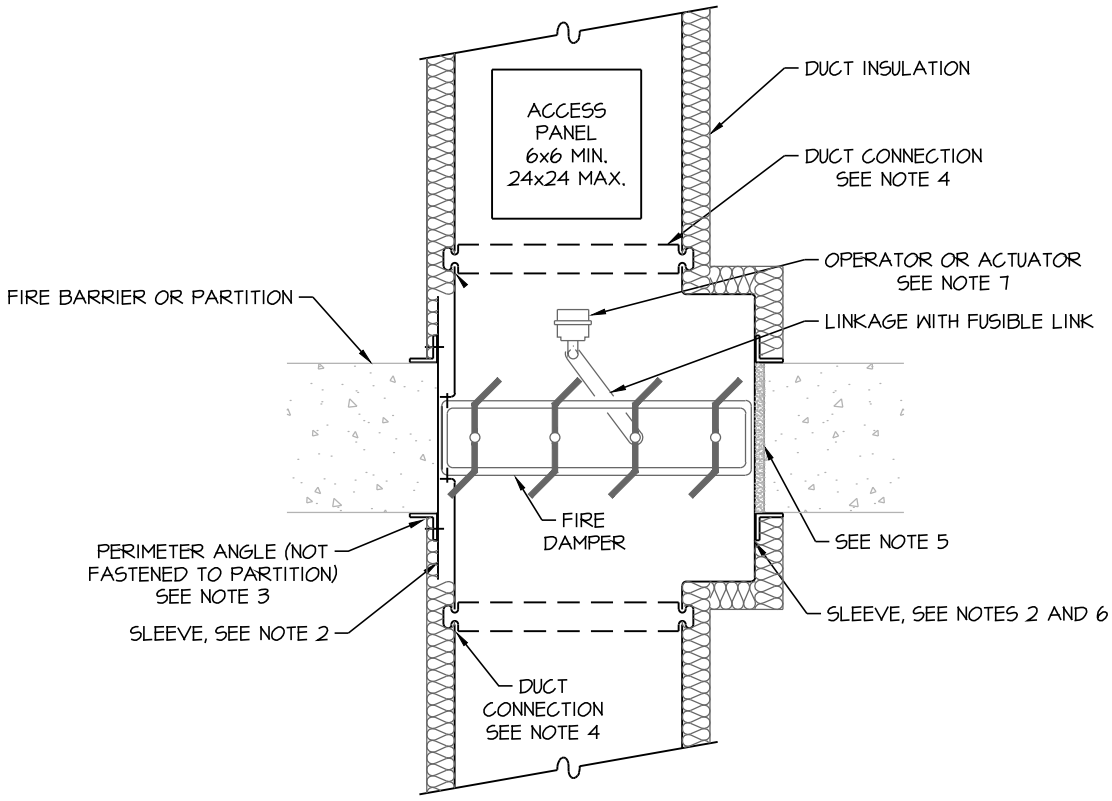
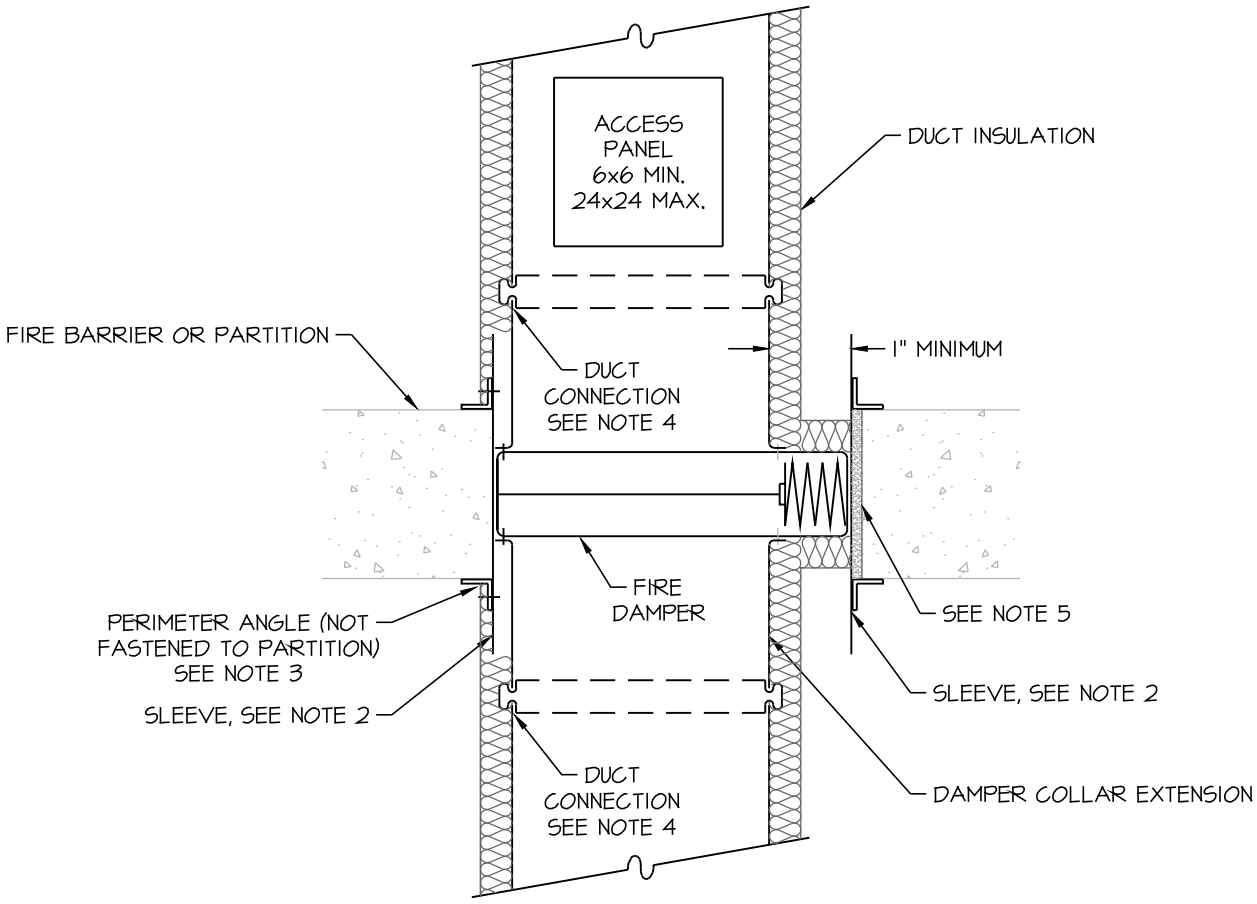


NOTES:

1. COMPLY W/ SMACNA "FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE FOR HVAC "SYSTEMS" AND NFPA 90A "INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS".
2. GALVANIZED SLEEVE GAGE SHALL NOT BE LESS THAN CONNECTING DUCT FOR BREAKAWAY CONNECTED DUCT. BREAKAWAY DUCT CONNECTION MAY BE OMITTED IF SLEEVE IS 16 GA. MINIMUM.
3. GALVANIZED STEEL PERIMETER ANGLE NOT LESS THAN 1-1/2x1-1/2x14 GAGE WITH 1" MINIMUM OVERLAP ON ON ALL SIDES.
4. BREAKAWAY DUCT CONNECTION, REFER TO SMACNA FIGURE 2-2 "UL ACCEPTED DUCT-SLEEVE CONNECTIONS" OF FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE. UL TESTED DUCT SEALANT MAY BE USED. BREAKAWAY DUCT CONNECTION MAY BE OMITTED IF SLEEVE IS 16 GA. MINIMUM.
5. PROVIDE 1/4" TO 1/2" CLEARANCE ON HEIGHT AND WIDTH. FILL OPEN SPACE WITH FIRE STOPPING MATERIAL.
6. FIRE DAMPER SLEEVE TO EXTEND 6" MINIMUM ON EACH SIDE.
7. REFER TO CONTROL SCHEMATIC FOR APPLICABLE OPERATOR OR ACTUATOR

74 COMBINATION FIRE AND SMOKE DAMPER DETAIL

NOT TO SCALE



NOTES:

1. COMPLY W/ SMACNA "FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE FOR HVAC "SYSTEMS" AND NFPA 90A "INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS".
2. GALVANIZED SLEEVE GAGE SHALL NOT BE LESS THAN CONNECTING DUCT FOR BREAKAWAY CONNECTED DUCT. BREAKAWAY DUCT CONNECTION MAY BE OMITTED IF SLEEVE IS 16 GA. MINIMUM.
3. GALVANIZED STEEL PERIMETER ANGLE NOT LESS THAN 1-1/2x1-1/2x14 GAGE WITH 1" MINIMUM OVERLAP ON ON ALL SIDES.
4. BREAKAWAY DUCT CONNECTION, REFER TO SMACNA FIGURE 2-2 "UL ACCEPTED DUCT-SLEEVE CONNECTIONS" OF FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE. UL TESTED DUCT SEALANT MAY BE USED. BREAKAWAY DUCT CONNECTION MAY BE OMITTED IF SLEEVE IS 16 GA. MINIMUM.
5. PROVIDE 1/4" TO 1/2" CLEARANCE ON HEIGHT AND WIDTH. FILL OPEN SPACE WITH FIRE STOPPING MATERIAL.
6. FIRE DAMPER SLEEVE TO EXTEND 6" MINIMUM ON EACH SIDE.

75 HORIZONTAL FIRE DAMPER DETAIL

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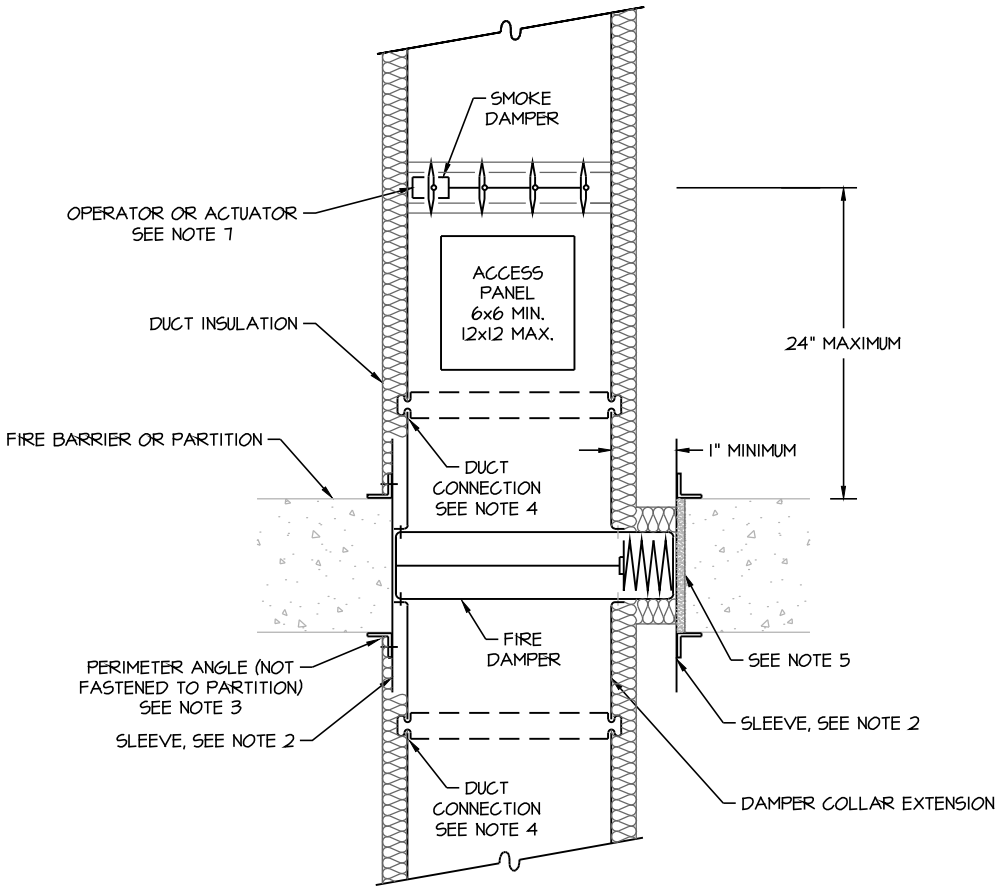

NOTES:

1. COMPLY W/ SMACNA "FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE FOR HVAC "SYSTEMS" AND NFPA 90A "INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS".
2. GALVANIZED SLEEVE GAGE SHALL NOT BE LESS THAN CONNECTING DUCT FOR BREAKAWAY CONNECTED DUCT. BREAKAWAY DUCT CONNECTION MAY BE OMITTED IF SLEEVE IS 16 GA. MINIMUM.
3. GALVANIZED STEEL PERIMETER ANGLE NOT LESS THAN 1-1/2x1-1/2x14 GAGE WITH 1" MINIMUM OVERLAP ON ON ALL SIDES.
4. BREAKAWAY DUCT CONNECTION, REFER TO SMACNA FIGURE 2-2 "UL ACCEPTED DUCT-SLEEVE CONNECTIONS" OF FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE. UL TESTED DUCT SEALANT MAY BE USED. BREAKAWAY DUCT CONNECTION MAY BE OMITTED IF SLEEVE IS 16 GA. MINIMUM.
5. PROVIDE 1/4" TO 1/2" CLEARANCE ON HEIGHT AND WIDTH. FILL OPEN SPACE WITH FIRE STOPPING MATERIAL.
6. FIRE DAMPER SLEEVE TO EXTEND 6" MINIMUM ON EACH SIDE.
7. REFER TO CONTROL SCHEMATIC FOR APPLICABLE OPERATOR OR ACTUATOR

76 HORIZONTAL FIRE AND SMOKE DAMPER DETAIL

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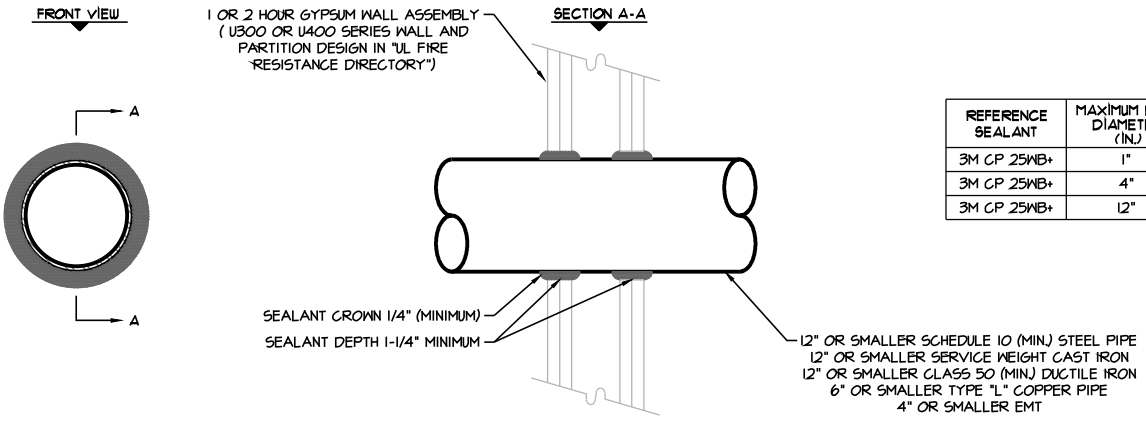

REFERENCE SEALANT	MAXIMUM PIPE DIAMETER (IN.)	ANNULAR SPACE (IN.)	FIRE RATING (HRS)
3M CP 25WB+	1"	0" TO 3/16"	2
3M CP 25WB+	4"	0" TO 1/2"	2
3M CP 25WB+	12"	3/16" TO 3/8"	2

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATION FOR A WALL TYPE. THE CONTRACTOR SHALL CONSULT THE FIRE STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND SPECIFIC INSTALLATION INSTRUCTIONS FOR THE WALLS AND PARTITIONS APPLICABLE TO THIS PROJECT.

77 METAL PIPE PENETRATION THRU RATED GYPSUM WALL

NOT TO SCALE

FOR ALL NON-SBS JOBS

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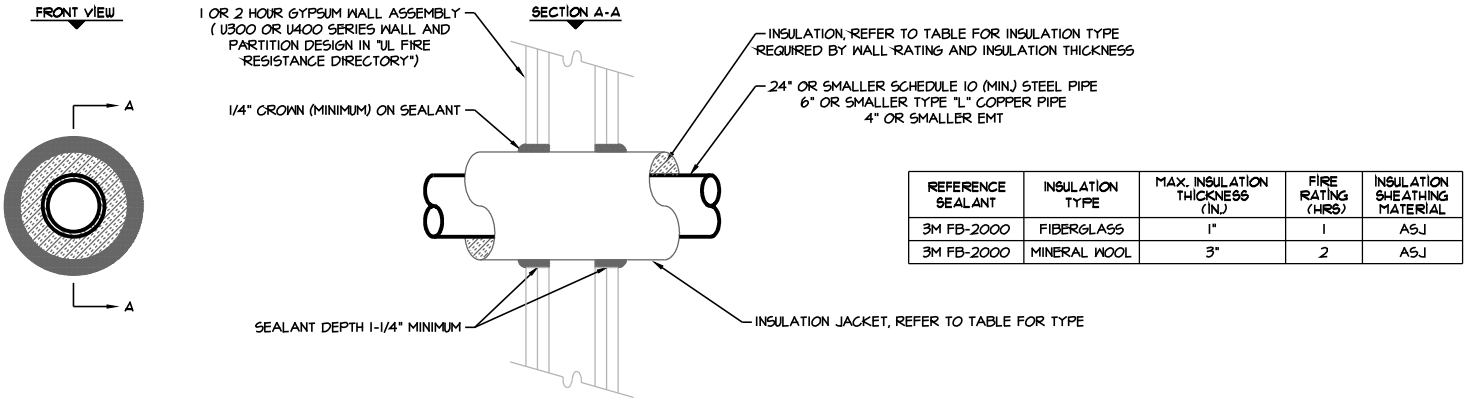

REFERENCE SEALANT	INSULATION TYPE	MAX. INSULATION THICKNESS (IN.)	FIRE RATING (HRS)	INSULATION SHEATHING MATERIAL
3M FB-2000	FIBERGLASS	1"	1	ASJ
3M FB-2000	MINERAL WOOL	3"	2	ASJ

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATION FOR A WALL TYPE. THE CONTRACTOR SHALL CONSULT THE FIRE STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND SPECIFIC INSTALLATION INSTRUCTIONS FOR THE WALLS AND PARTITIONS APPLICABLE TO THIS PROJECT.

78 INSULATED METAL PIPE PENETRATION THRU RATED GYPSUM WALL

NOT TO SCALE

FOR ALL NON-SBS JOBS

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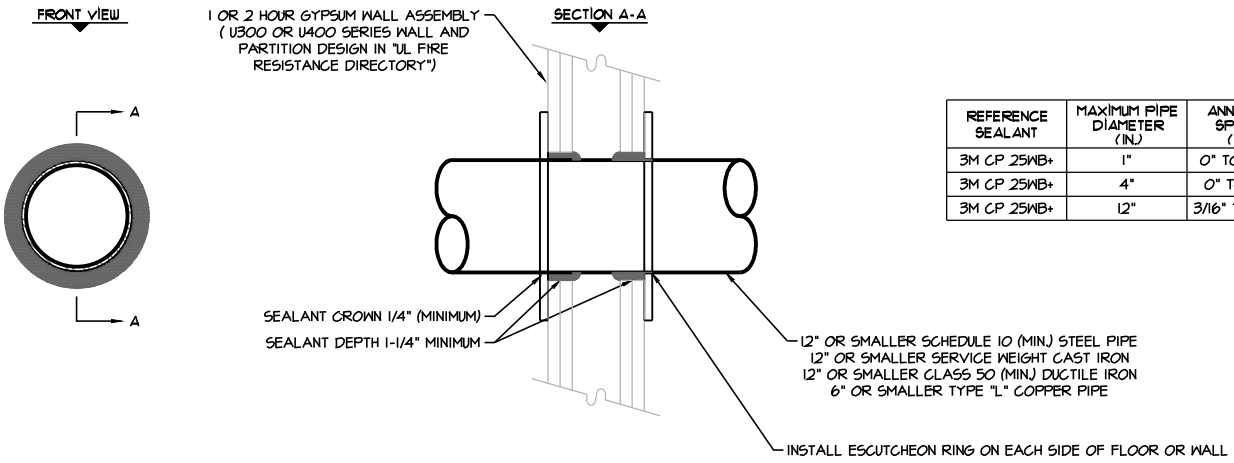

REFERENCE SEALANT	MAXIMUM PIPE DIAMETER (IN.)	ANNULAR SPACE (IN.)	FIRE RATING (HRS.)
3M CP 25WB+	1"	0" TO 3/16"	2
3M CP 25WB+	4"	0" TO 1/2"	2
3M CP 25WB+	12"	3/16" TO 3/8"	2

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATION FOR A WALL TYPE. THE CONTRACTOR SHALL CONSULT THE FIRE STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND SPECIFIC INSTALLATION INSTRUCTIONS FOR THE WALLS AND PARTITIONS APPLICABLE TO THIS PROJECT.

79 METAL PIPE PENETRATION THRU RATED GYPSUM WALL

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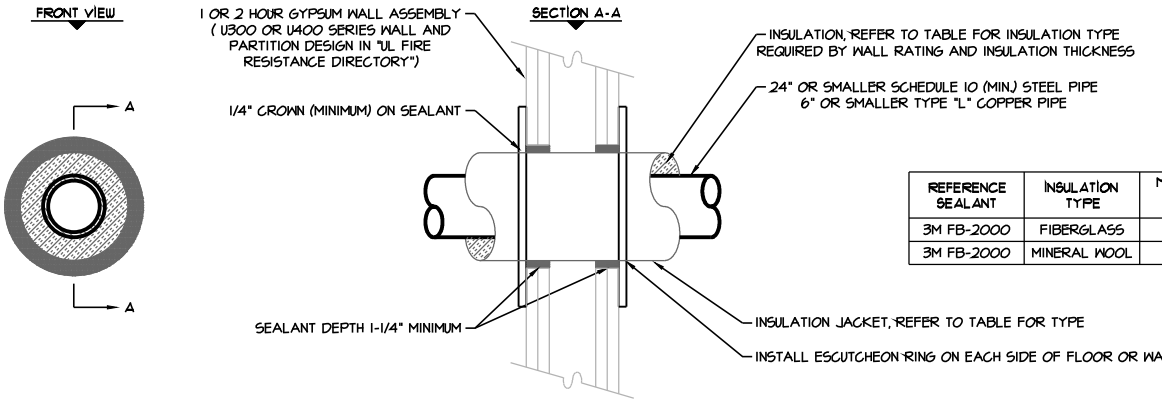

REFERENCE SEALANT	INSULATION TYPE	MAX. INSULATION THICKNESS (IN.)	FIRE RATING (HRS)	INSULATION SHEATHING MATERIAL
3M FB-2000	FIBERGLASS	1"	1	ASJ
3M FB-2000	MINERAL WOOL	3"	2	ASJ

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATION FOR A WALL TYPE. THE CONTRACTOR SHALL CONSULT THE FIRE STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND SPECIFIC INSTALLATION INSTRUCTIONS FOR THE WALLS AND PARTITIONS APPLICABLE TO THIS PROJECT.

80 INSULATED METAL PIPE PENETRATION THRU RATED GYPSUM WALL

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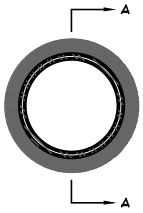
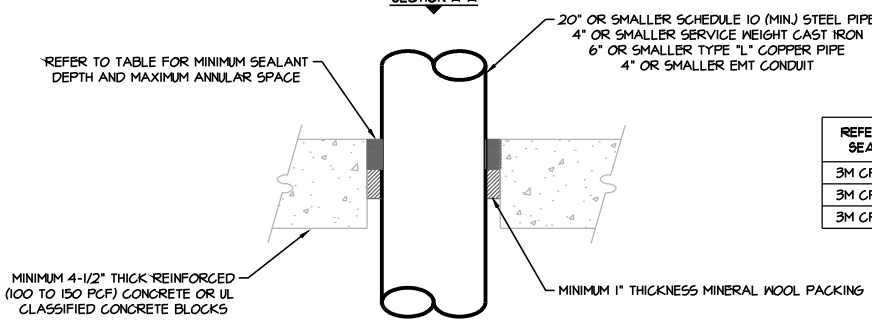
FRONT VIEW



SECTION A-A



REFERENCE SEALANT	MAXIMUM PIPE DIAMETER (IN.)	MAX. ANNULAR SPACE (IN.)	FIRE RATING (HRS)
3M CP 25N/S	10"	1"	2
3M CP 25N/S	10"	1"	2
3M CP 25N/S	20"	2-1/2"	2

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATION FOR A WALL TYPE. THE CONTRACTOR SHALL CONSULT THE FIRE STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND SPECIFIC INSTALLATION INSTRUCTIONS FOR THE WALLS AND PARTITIONS

81 METAL PIPE PENETRATION THRU RATED CONCRETE FLOOR OR WALL

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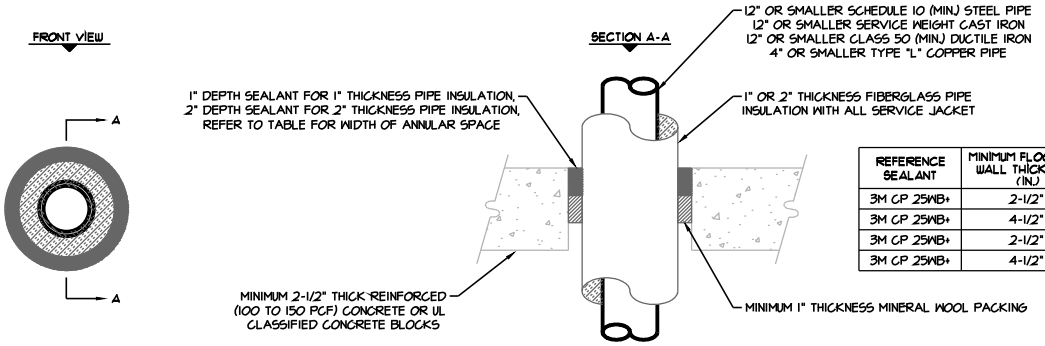

REFERENCE SEALANT	MINIMUM FLOOR OR WALL THICKNESS (IN.)	MAXIMUM PIPE DIAMETER (IN.)	MAX. INSULATION THICKNESS (IN.)	ANNULAR SPACE (IN.)	FIRE RATING (HRS)
3M CP 25WB+	2-1/2"	4"	1"	1/2" TO 2-3/8"	2
3M CP 25WB+	4-1/2"	4"	2"	1/2" TO 3-5/8"	2
3M CP 25WB+	2-1/2"	12"	1"	1/2" TO 1-1/2"	2
3M CP 25WB+	4-1/2"	12"	1"	1/2" TO 2-3/8"	2

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATION FOR A WALL TYPE. THE CONTRACTOR SHALL CONSULT THE FIRE STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND SPECIFIC INSTALLATION INSTRUCTIONS FOR THE WALLS AND PARTITIONS

82 INSULATED METAL PIPE PENETRATION THRU RATED CONCRETE FLOOR OR WALL

NOT TO SCALE

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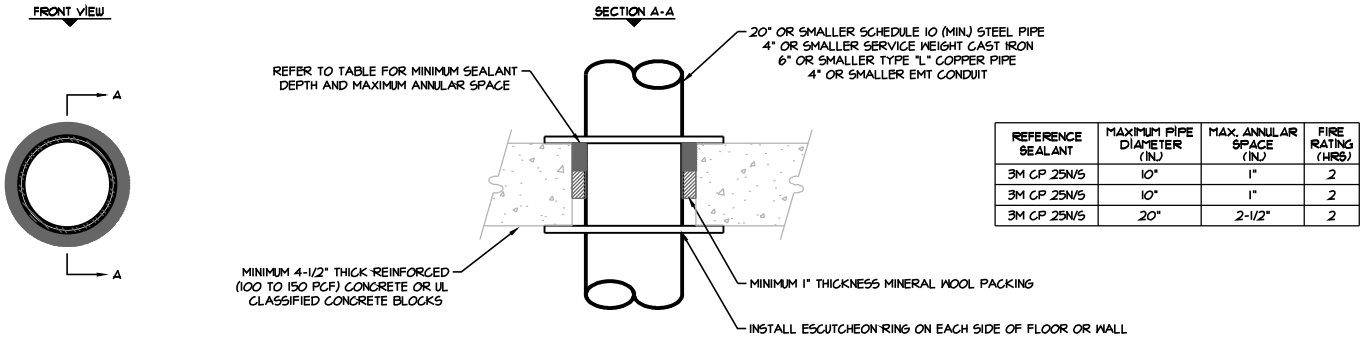

REFERENCE SEALANT	MAXIMUM PIPE DIAMETER (IN.)	MAX. ANNULAR SPACE (IN.)	FIRE RATING (HRS)
3M CP 25N/S	10"	1"	2
3M CP 25N/S	10"	1"	2
3M CP 25N/S	20"	2-1/2"	2

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATION FOR A WALL TYPE. THE CONTRACTOR SHALL CONSULT THE FIRE STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND SPECIFIC INSTALLATION INSTRUCTIONS FOR THE WALLS AND PARTITIONS

83 METAL PIPE PENETRATION THRU RATED CONCRETE FLOOR OR WALL

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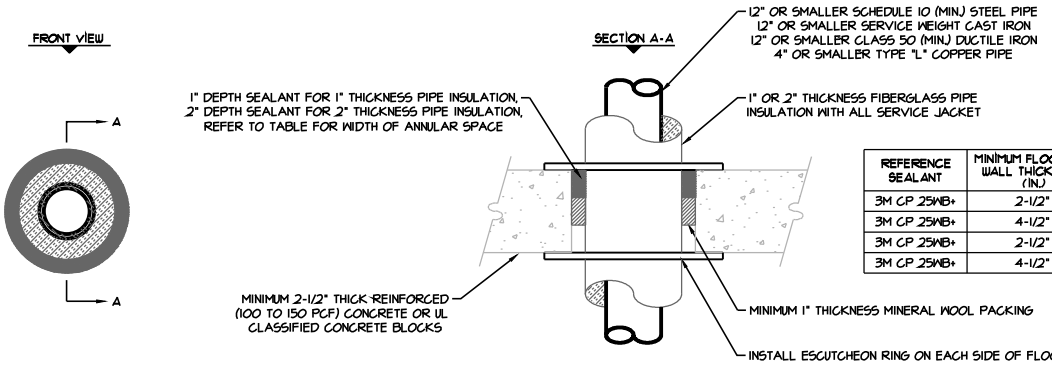

REFERENCE SEALANT	MINIMUM FLOOR OR WALL THICKNESS (IN.)	MAXIMUM PIPE DIAMETER (IN.)	MAX. INSULATION THICKNESS (IN.)	ANNULAR SPACE (IN.)	FIRE RATING (HRS.)
3M CP 25WB+	2-1/2"	4"	1"	1/2" TO 2-3/8"	2
3M CP 25WB+	4-1/2"	4"	2"	1/2" TO 3-5/8"	2
3M CP 25WB+	2-1/2"	12"	1"	1/2" TO 1-1/2"	2
3M CP 25WB+	4-1/2"	12"	1"	1/2" TO 2-3/8"	2

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATION FOR A WALL TYPE. THE CONTRACTOR SHALL CONSULT THE FIRE STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND SPECIFIC INSTALLATION INSTRUCTIONS FOR THE WALLS AND PARTITIONS

84 INSULATED METAL PIPE PENETRATION THRU RATED CONCRETE FLOOR OR WALL

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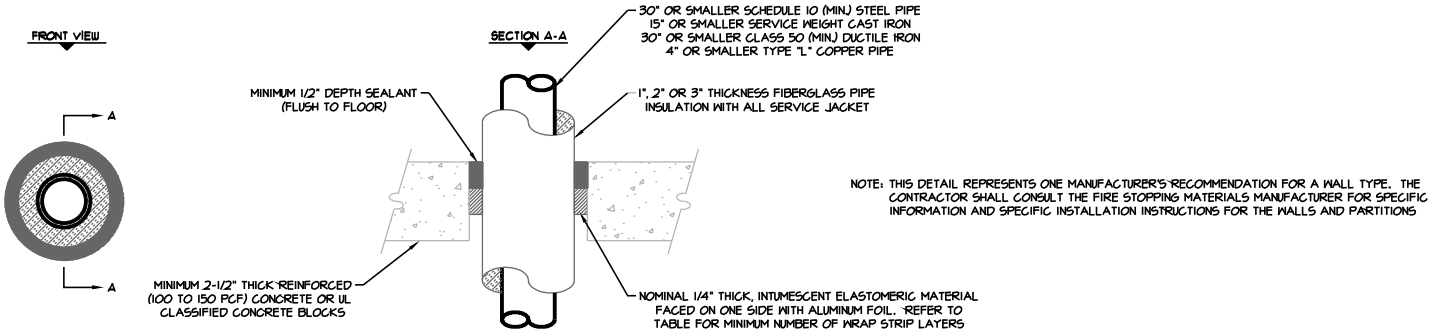

REFERENCE SEALANT	REFERENCE WRAP STRIP	MINIMUM FLOOR OR WALL THICKNESS (IN.)	MAXIMUM PIPE DIAMETER (IN.)	MAX. INSULATION THICKNESS (IN.)	ANNULAR SPACE (IN.)	MINIMUM NUMBER OF WRAP STRIP LAYERS	FIRE RATING (HRS)
3M CP 25WB+	3M FS-195+	2-1/2"	12"	1"	1/4" TO 3/8"	1	2
3M CP 25WB+	3M FS-195+	2-1/2"	6"	2"	1/2" TO 5/8"	2	2
3M CP 25WB+	3M FS-195+	4-1/2"	20"	1"	1/2" TO 1"	1	2
3M CP 25WB+	3M FS-195+	4-1/2"	30"	2"	3/4" TO 1-1/4"	2	2
3M CP 25WB+	3M FS-195+	4-1/2"	20"	3"	1" TO 1-1/2"	3	2

35 INSULATED METAL PIPE PENETRATION THRU RATED CONCRETE FLOOR OR WALL

NOT TO SCALE

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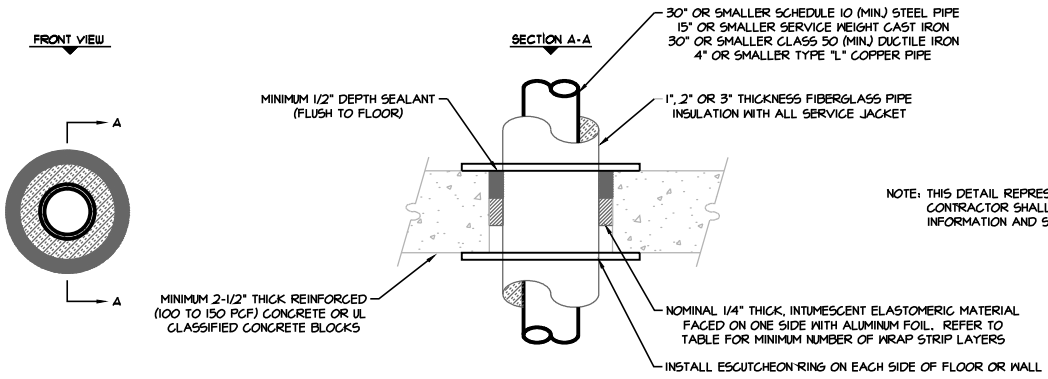

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATION FOR A WALL TYPE. THE CONTRACTOR SHALL CONSULT THE FIRE STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND SPECIFIC INSTALLATION INSTRUCTIONS FOR THE WALLS AND PARTITIONS

REFERENCE SEALANT	REFERENCE WRAP STRIP	MINIMUM FLOOR OR WALL THICKNESS (IN.)	MAXIMUM PIPE DIAMETER (IN.)	MAX. INSULATION THICKNESS (IN.)	ANNULAR SPACE (IN.)	MINIMUM NUMBER OF WRAP STRIP LAYERS	FIRE RATING (HRS.)
3M CP 25WB+	3M FS-195+	2-1/2"	12"	1"	1/4" TO 3/8"	1	2
3M CP 25WB+	3M FS-195+	2-1/2"	6"	2"	1/2" TO 5/8"	2	2
3M CP 25WB+	3M FS-195+	4-1/2"	20"	1"	1/2" TO 1"	1	2
3M CP 25WB+	3M FS-195+	4-1/2"	30"	2"	3/4" TO 1-1/4"	2	2
3M CP 25WB+	3M FS-195+	4-1/2"	20"	3"	1" TO 1-1/2"	3	2

86 INSULATED METAL PIPE PENETRATION THRU RATED CONCRETE FLOOR OR WALL

NOT TO SCALE

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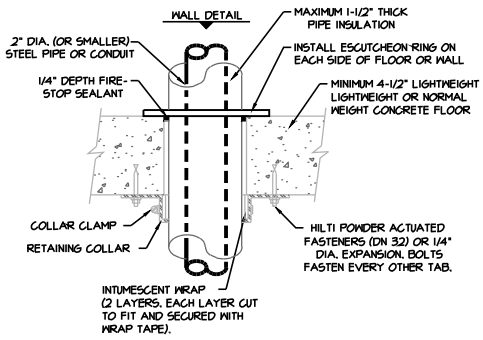

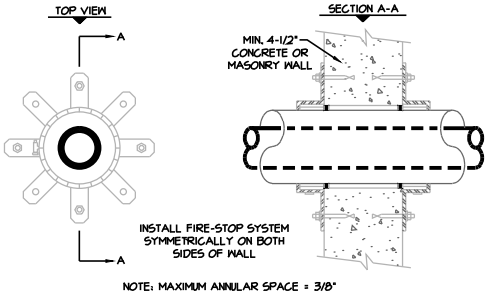

NOTE: MAXIMUM ANNULAR SPACE = 3/8"

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATIONS FOR GENERAL USE. APPLICATIONS MAY VARY, THEREFORE THE CONTRACTOR SHALL CONSULT THE FIRE-STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND INSTALLATION INSTRUCTIONS.

INSTRUCTIONS FOR INSTALLATION

STEP 1 - PREPARATION
ALL SURFACES SHOULD BE CLEAN, SOUND AND DRY PRIOR TO APPLICATION OF FIRE-STOPPING MATERIALS. DO NOT REMOVE PIPE INSULATION.

STEP 2 - FIRE-STOP SEALANT
SEAL THE ANNULAR SPACE AROUND THE PIPE WITH A 1/4" LAYER OF FIRE-STOP SEALANT.

STEP 3 - INTUMESCENT WRAP
MEASURE AND CUT ENOUGH INTUMESCENT WRAP TO COMPLETELY CIRCLE THE PIPE ONCE. WRAP IT SNUGLY AROUND THE PIPE, FOIL SIDE OUT, BUTTING THE ENDS, AND TAPE IN PLACE USING WRAP TAPE. INSTALL A SECOND LAYER OF WRAP IN THE SAME MANNER, THEN SLIDE BOTH LAYERS UP THE PIPE, BUTTING THEM AGAINST THE SURFACE OF THE WALL OR CEILING. WALL PENETRATIONS REQUIRE A SYMMETRICAL SYSTEM ON BOTH SIDES.

STEP 4 - RETAINING COLLAR
MEASURE AND CUT ENOUGH RETAINING COLLAR TO ENCIRCLE THE INTUMESCENT WRAP AND OVERLAP THE ENDS APPROXIMATELY 1". BEND THE ANCHOR TABS OUTWARD 90 DEGREES, THEN PLACE THE COLLAR SNUGLY AROUND THE WRAP AND TIGHTEN IT WITH A SINGLE COLLAR CLAMP AT MID HEIGHT. FASTEN THE ANCHOR TABS TO THE SUBSTRATE USING 1/4" DIA. EXPANSION BOLTS. TO COMPLETE THE INSTALLATION, BEND THE SUPPORT TABS INWARD TOWARD THE PIPE.

87 INSULATED METAL PIPE PENETRATION THRU RATED CONCRETE FLOOR OR WALL

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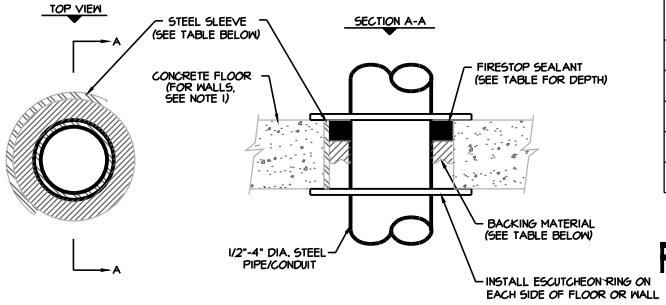

MINIMUM CONCRETE THICKNESS	MAX. SIZE PIPE/ CONDUIT	STEEL SLEEVE	ANNULAR SPACE	BACKING MATERIAL	FIRESTOP DEPTH	FIRE RATING (HR)
3-1/4"	4" DIA.	NO	3/4"	NONE OR FOAM	1-1/2"	2
3-1/4"	4" DIA.	NO	3/4"	3" MINERAL WOOL	1/2"	2
3-1/4"	4" DIA.	YES	3/4"	NONE OR FOAM	1-1/2"	2
3-1/4"	4" DIA.	YES	3/4"	3" MINERAL WOOL	1/2"	2
3-1/4"	4" DIA.	NO	3/4"	BACKER ROD OR FOAM	3/4"	1

INSTRUCTIONS FOR INSTALLATION

STEP 1 - PREPARATION
ALL SURFACES SHOULD BE CLEAN, SOUND AND DRY PRIOR TO APPLICATION OF FIRESTOPPING MATERIALS.

STEP 2 - BACKING MATERIAL
FILL AROUND THE PIPE, LEAVING APPROPRIATE SPACE FOR THE SEALANT, AND ALLOW THE FOAM TO CURE.

STEP 3 - FIRESTOP SEALANT
APPLY REQUIRED DEPTH OF FIRESTOP SEALANT AND TOOL WITH PUTTY KNIFE UNTIL FLUSH WITH THE SURFACE. WALL PENETRATIONS REQUIRE SEALANT ON BOTH SIDES. LEAVE COMPLETED SEAL UNDISTURBED FOR 48 HOURS.

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NOTES: 1. IN WALLS, INSTALL FIRESTOP SYSTEM SYMMETRICALLY ON BOTH SIDES.

2. IF WALLS ARE MASONRY, MINIMUM THICKNESS = 8".

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATIONS FOR GENERAL USE. APPLICATIONS MAY VARY, THEREFORE THE CONTRACTOR SHALL CONSULT THE FIRE-STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND INSTALLATION INSTRUCTIONS.

88 METAL PIPE PENETRATION THRU RATED CONCRETE FLOOR OR WALL

NOT TO SCALE

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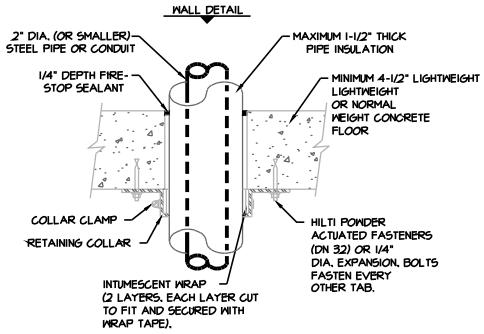

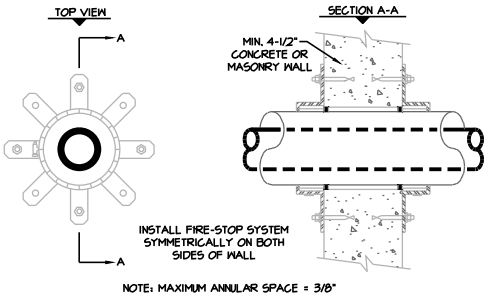

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATIONS FOR GENERAL USE. APPLICATIONS MAY VARY, THEREFORE THE CONTRACTOR SHALL CONSULT THE FIRE-STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND INSTALLATION INSTRUCTIONS.

INSTRUCTIONS FOR INSTALLATION

STEP 1 - PREPARATION
ALL SURFACES SHOULD BE CLEAN, SOUND AND DRY PRIOR TO APPLICATION OF FIRE-STOPPING MATERIALS. DO NOT REMOVE PIPE INSULATION.

STEP 2 - FIRE-STOP SEALANT
SEAL THE ANNULAR SPACE AROUND THE PIPE WITH A 1/4" LAYER OF FIRE-STOP SEALANT.

STEP 3 - INTUMESCENT WRAP
MEASURE AND CUT ENOUGH INTUMESCENT WRAP TO COMPLETELY CIRCLE THE PIPE ONCE. WRAP IT SNUGLY AROUND THE PIPE, FOIL SIDE OUT, BUTTING THE ENDS, AND TAPE IN PLACE USING WRAP TAPE. INSTALL A SECOND LAYER OF WRAP IN THE SAME MANNER, THEN SLIDE BOTH LAYERS UP THE PIPE, BUTTING THEM AGAINST THE SURFACE OF THE WALL OR CEILING. WALL PENETRATIONS REQUIRE A SYMMETRICAL SYSTEM ON BOTH SIDES.

STEP 4 - RETAINING COLLAR
MEASURE AND CUT ENOUGH RETAINING COLLAR TO ENCIRCLE THE INTUMESCENT WRAP AND OVERLAP THE ENDS APPROXIMATELY 1". BEND THE ANCHOR TABS OUTWARD 90 DEGREES, THEN PLACE THE COLLAR SNUGLY AROUND THE WRAP AND TIGHTEN IT WITH A SINGLE COLLAR CLAMP AT MID HEIGHT. FASTEN THE ANCHOR TABS TO THE SUBSTRATE USING 1/4" DIA. EXPANSION BOLTS. TO COMPLETE THE INSTALLATION, BEND THE SUPPORT TABS INWARD TOWARD THE PIPE.

89 INSULATED METAL PIPE PENETRATION THRU RATED CONCRETE FLOOR OR WALL

NOT TO SCALE

FOR ALL NON-SBS JOBS

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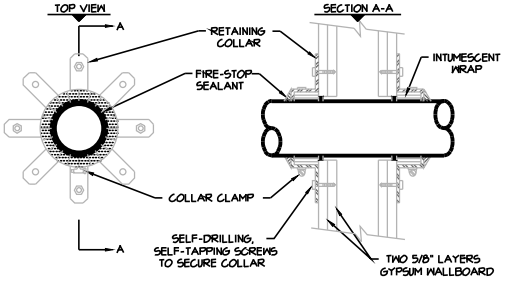

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATIONS FOR GENERAL USE. APPLICATIONS MAY VARY, THEREFORE THE CONTRACTOR SHALL CONSULT THE FIRE-STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND INSTALLATION INSTRUCTIONS.

PIPE TYPE	MAX. PIPE DIA.	PIPING SYSTEM *	ANNULAR SPACE (IN.)	NO. OF LAYERS OF WRAP	"F" RATING (HRS)
INSULATED STEEL (SEE NOTE BELOW)	3"	V,C	1/4	3	2

* V = VENTED PIPING SYSTEM (PROCESS OR SUPPLY PIPING)
C = CLOSED PIPING SYSTEM (DRAIN, WASTE, OR VENT)

NOTE: MAX. 3" DIAMETER STEEL PIPE WITH UP TO 1-1/2" INSULATION.

INSTRUCTIONS FOR INSTALLATION

STEP 1 - PREPARATION
ALL SURFACES SHOULD BE CLEAN, SOUND AND DRY PRIOR TO APPLICATION OF FIRE-STOPPING MATERIALS.

STEP 2 - FIRE-STOP SEALANT
SEAL THE ANNULAR SPACE AROUND THE PIPE WITH A 1/4" LAYER OF FIRE-STOP SEALANT.

STEP 3 - INTUMESCENT WRAP
MEASURE AND CUT ENOUGH INTUMESCENT WRAP TO COMPLETELY CIRCLE THE PIPE 3 TIMES. WRAP IT SNUGLY AROUND THE PIPE AND SECURE IN PLACE USING WRAP TAPE OR STEEL TIE WIRE. (OPTIONALLY, EACH LAYER OF WRAP MAY BE CUT TO FIT AND HELD IN PLACE WITH WRAP TAPE). SLIDE THE WRAPS TOWARD THE OPENING AND BUTT THEM AGAINST THE WALL.

STEP 4 - RETAINING COLLAR
MEASURE AND CUT ENOUGH RETAINING COLLAR TO ENCIRCLE THE INTUMESCENT WRAP AND OVERLAP THE ENDS APPROXIMATELY 1". BEND THE ANCHOR TABS OUTWARD 90 DEGREES, THEN PLACE THE COLLAR SNUGLY AROUND THE WRAP SO THE ANCHOR TABS ARE FLUSH WITH THE WALL. SECURE THE COLLAR WITH A SINGLE COLLAR CLAMP AT MID HEIGHT. THEN FASTEN THE ANCHOR TABS TO THE WALL USING SCREWS OR TOGGLE BOLTS. FINALLY, BEND THE SUPPORT TABS INWARD TOWARD THE PIPE AND SEAL THEM WITH A GENEROUS BEAD OF FIRE-STOP SEALANT.

FOR ALL NON-SBS JOBS

90 INSULATED METAL PIPE PENETRATION THRU RATED GYPSUM WALL

NOT TO SCALE

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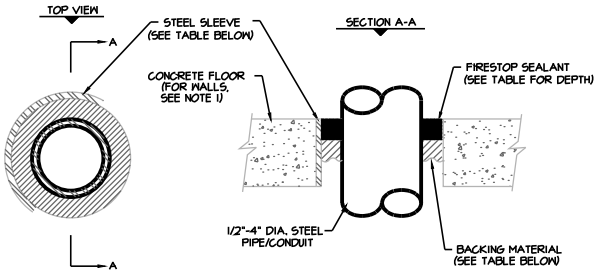

MINIMUM CONCRETE THICKNESS	MAX. SIZE PIPE/ CONDUIT	STEEL SLEEVE	ANNULAR SPACE	BACKING MATERIAL	FIRESTOP DEPTH	FIRE RATING (HR)
3-1/4"	4" DIA.	NO	3/4"	NONE OR FOAM	1-1/2"	2
3-1/4"	4" DIA.	NO	3/4"	3" MINERAL WOOL	1/2"	2
3-1/4"	4" DIA.	YES	3/4"	NONE OR FOAM	1-1/2"	2
3-1/4"	4" DIA.	YES	3/4"	3" MINERAL WOOL	1/2"	2
3-1/4"	4" DIA.	NO	3/4"	BACKER ROD OR FOAM	3/4"	1

INSTRUCTIONS FOR INSTALLATION

STEP 1 - PREPARATION
ALL SURFACES SHOULD BE CLEAN, SOUND AND DRY PRIOR TO APPLICATION OF FIRESTOPPING MATERIALS.

STEP 2 - BACKING MATERIAL
FILL AROUND THE PIPE, LEAVING APPROPRIATE SPACE FOR THE SEALANT, AND ALLOW THE FOAM TO CURE.

STEP 3 - FIRESTOP SEALANT
APPLY REQUIRED DEPTH OF FIRESTOP SEALANT AND TOOL WITH PUTTY KNIFE UNTIL FLUSH WITH THE SURFACE. WALL PENETRATIONS REQUIRE SEALANT ON BOTH SIDES. LEAVE COMPLETED SEAL UNDISTURBED FOR 48 HOURS.

FOR ALL NON-SBS JOBS

NOTES: 1. IN WALLS, INSTALL FIRESTOP SYSTEM SYMMETRICALLY ON BOTH SIDES.

2. IF WALLS ARE MASONRY, MINIMUM THICKNESS = 8".

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATIONS FOR GENERAL USE. APPLICATIONS MAY VARY, THEREFORE THE CONTRACTOR SHALL CONSULT THE FIRE-STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND INSTALLATION INSTRUCTIONS.

91 METAL PIPE PENETRATION THRU RATED CONCRETE FLOOR OR WALL

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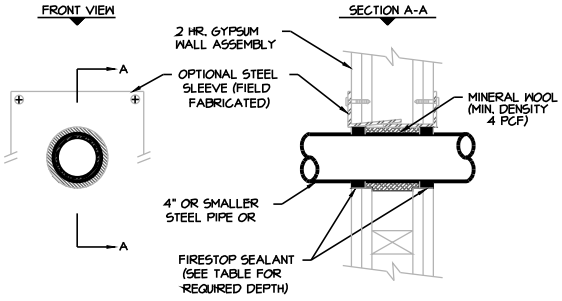


PIPE DIA.	STEEL SLEEVE	ANNULAR SPACE (IN.)	MINERAL WOOL	CS 240 DEPTH	FIRE RATING (HRS)
1/2"-4"	YES	3/4	4"	1/2"	2
1/2"-4"	NO	3/4	3"	1"	2

NOTE: THIS DETAIL REPRESENTS ONE MANUFACTURER'S RECOMMENDATIONS FOR GENERAL USE. APPLICATIONS MAY VARY, THEREFORE THE CONTRACTOR SHALL CONSULT THE FIRE-STOPPING MATERIALS MANUFACTURER FOR SPECIFIC INFORMATION AND INSTALLATION INSTRUCTIONS.

INSTRUCTIONS FOR INSTALLATION

STEP 1 - PREPARATION
ALL SURFACES SHOULD BE CLEAN, SOUND AND DRY PRIOR TO APPLICATION OF FIRESTOPPING MATERIALS.

STEP 2 - STEEL SLEEVE (OPTIONAL)
IF SLEEVE WILL NOT BE INSTALLED, SKIP TO STEP 3. IF A SLEEVE WILL BE INSTALLED, USE 25 GA. GALVANIZED SHEET METAL TO FORM A CYLINDER WITH MOUNTING FLANGES AS SHOWN ON THE DRAWING. ATTACH THE FLANGES WITH 4 DRYWALL SCREWS ON BOTH SIDES OF THE WALL.

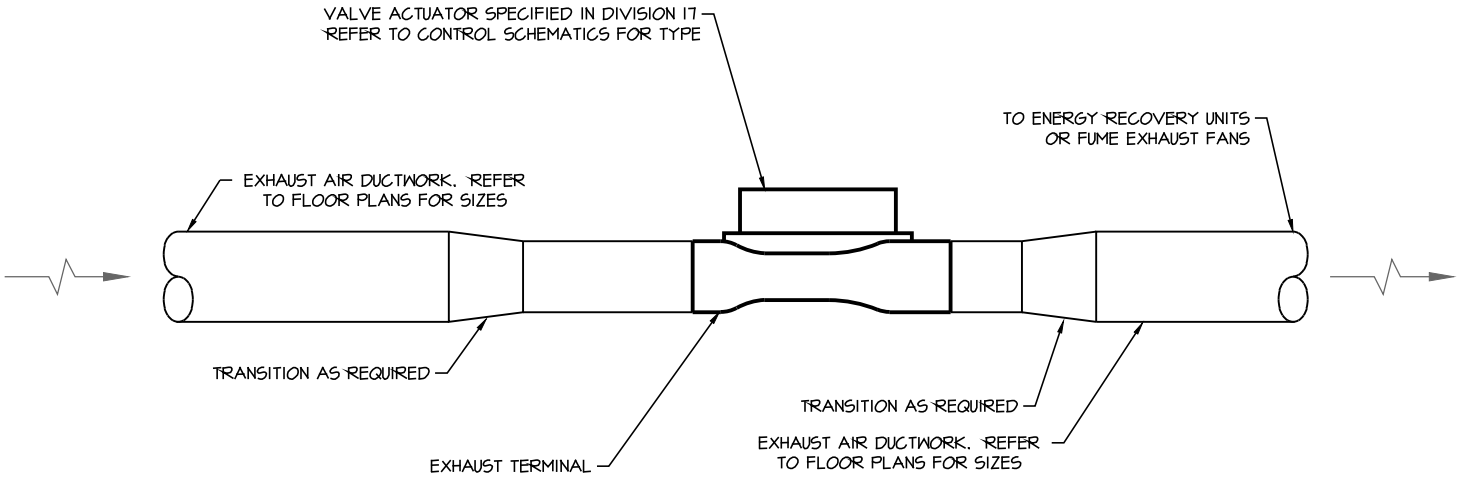
STEP 3 - BACKING MATERIAL
WITHOUT SLEEVE
FIRMLY PACK MINERAL WOOL (MINIMUM DENSITY OF 4 LBS/CU.FT.) INTO THE OPENING TO A DEPTH OF 3". USE WRAP TAPE OR TIE WIRE TO KEEP MINERAL WOOL FROM FALLING INTO WALL CAVITY. LEAVE 1" SPACE ON BOTH SIDES OF THE WALL FOR FIRESTOP SEALANT.
WITH SLEEVE
FIRMLY PACK MINERAL WOOL INTO THE OPENING TO A DEPTH OF 4". LEAVE 1/2" SPACE ON BOTH SIDES OF THE WALL FOR FIRESTOP SEALANT.

STEP 4 - FIRESTOP SEALANT
APPLY A 1" DEPTH (1/2" IF SLEEVE WAS USED) OF FIRESTOP SEALANT OVER THE MINERAL WOOL ON BOTH SIDES OF THE WALL UNTIL FLUSH WITH THE WALL. TOOL WITH A PUTTY KNIFE FOR A SMOOTH APPEARANCE. LEAVE COMPLETE SEAL UNDISTURBED FOR 48 HOURS.

FOR ALL NON-SBS JOBS

92 METAL PIPE PENETRATION THRU RATED GYPSUM WALL

NOT TO SCALE



93 TYPICAL EXHAUST air valve DETAIL

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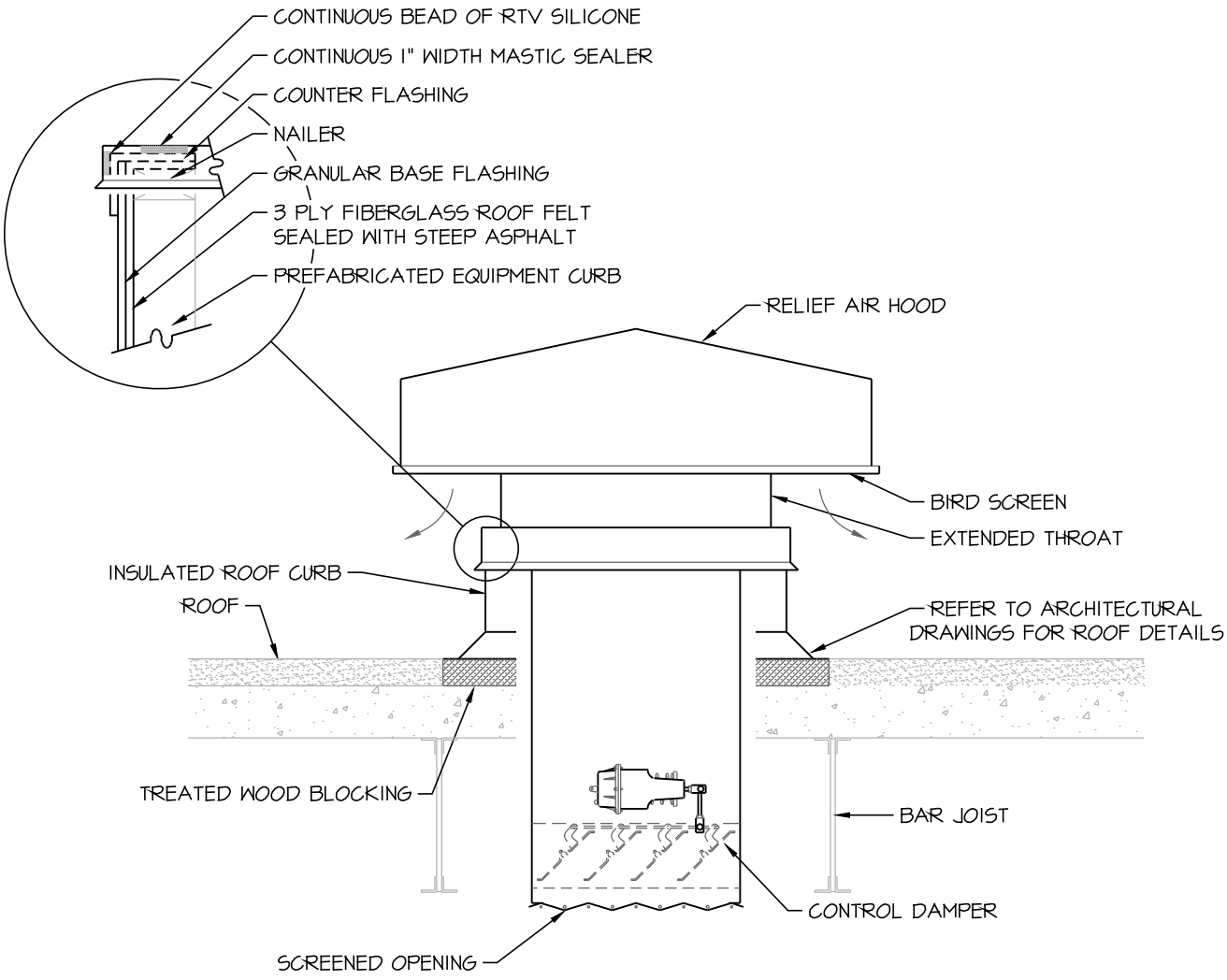

94 ELEVATOR HOISTWAY RELIEF VENT DETAIL

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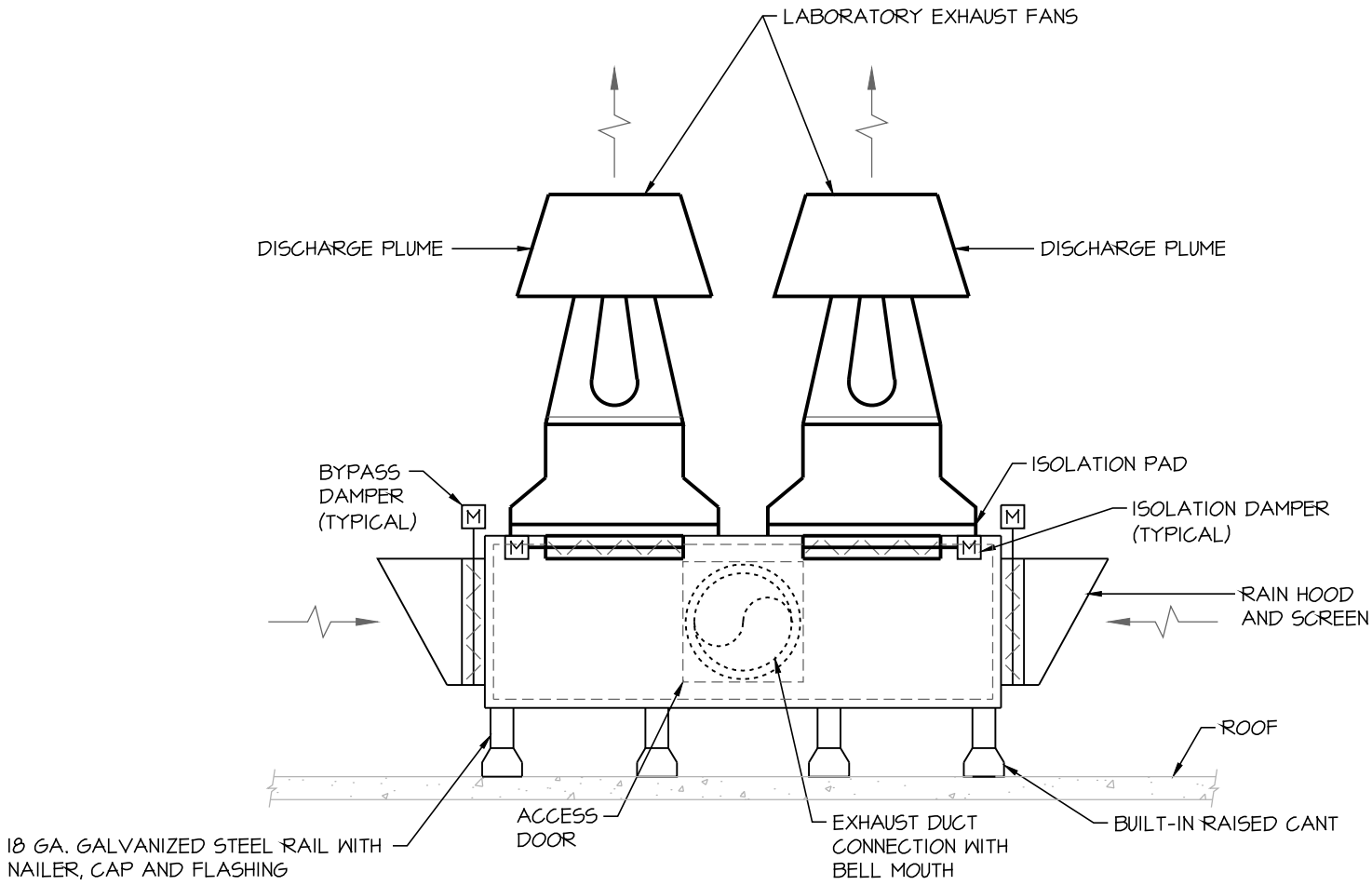

95 LABORATORY EXHAUST FAN DETAIL

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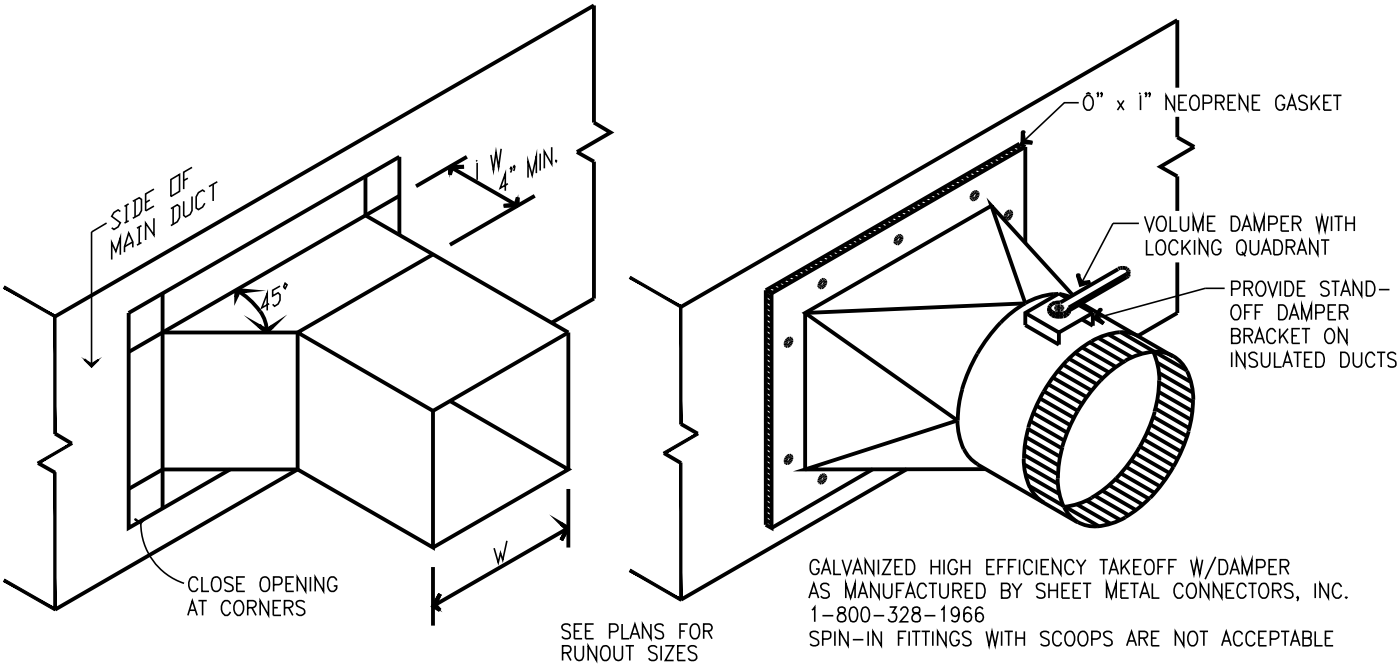

96 MANUAL BALANCING DAMPER

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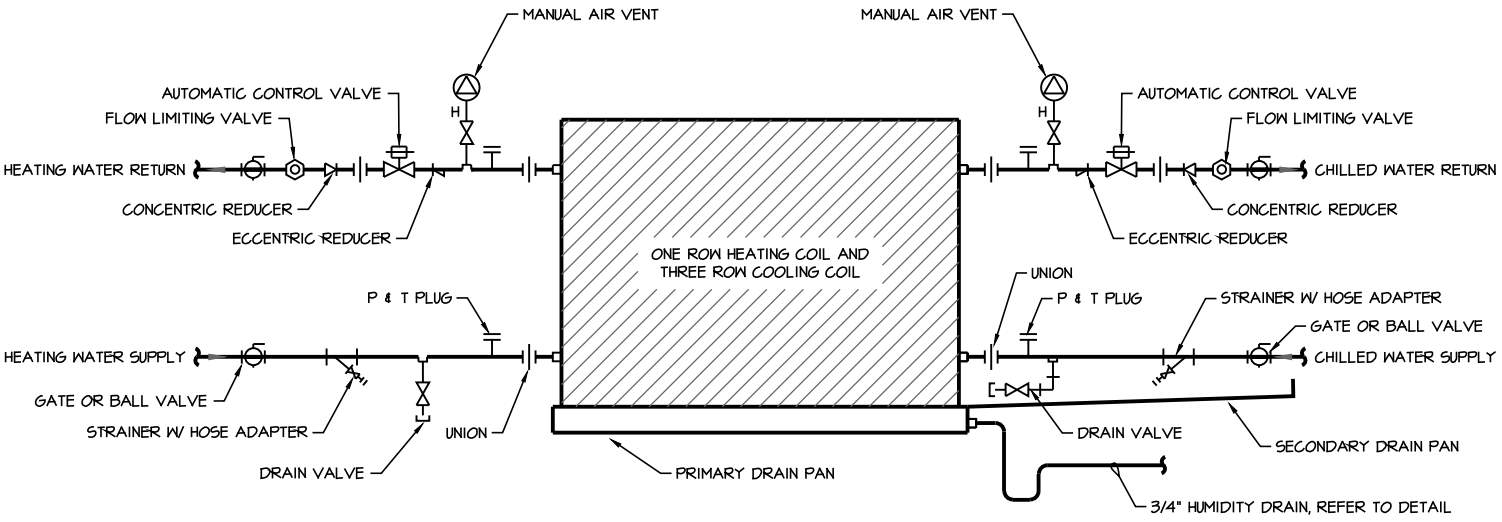

97 VERTICAL FAN COIL UNIT PIPING DETAIL

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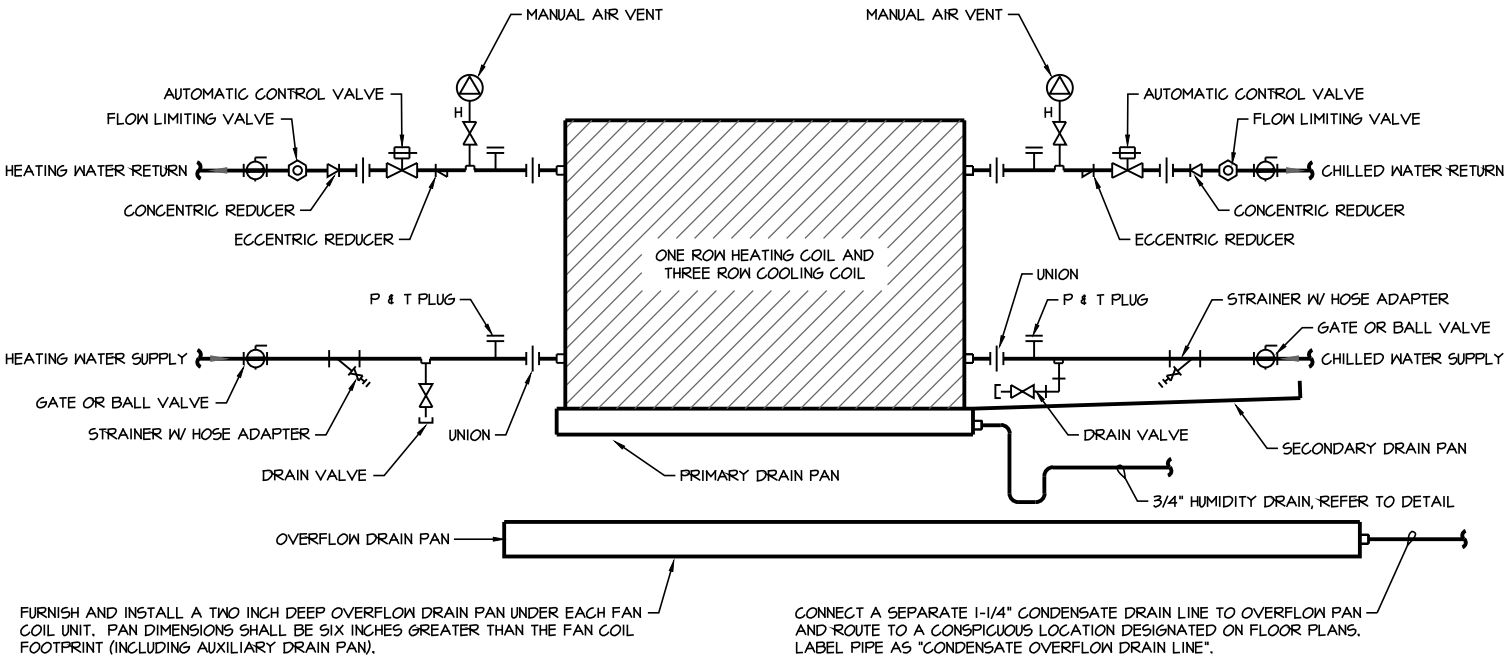

98 HORIZONTAL FAN COIL UNIT PIPING DETAIL

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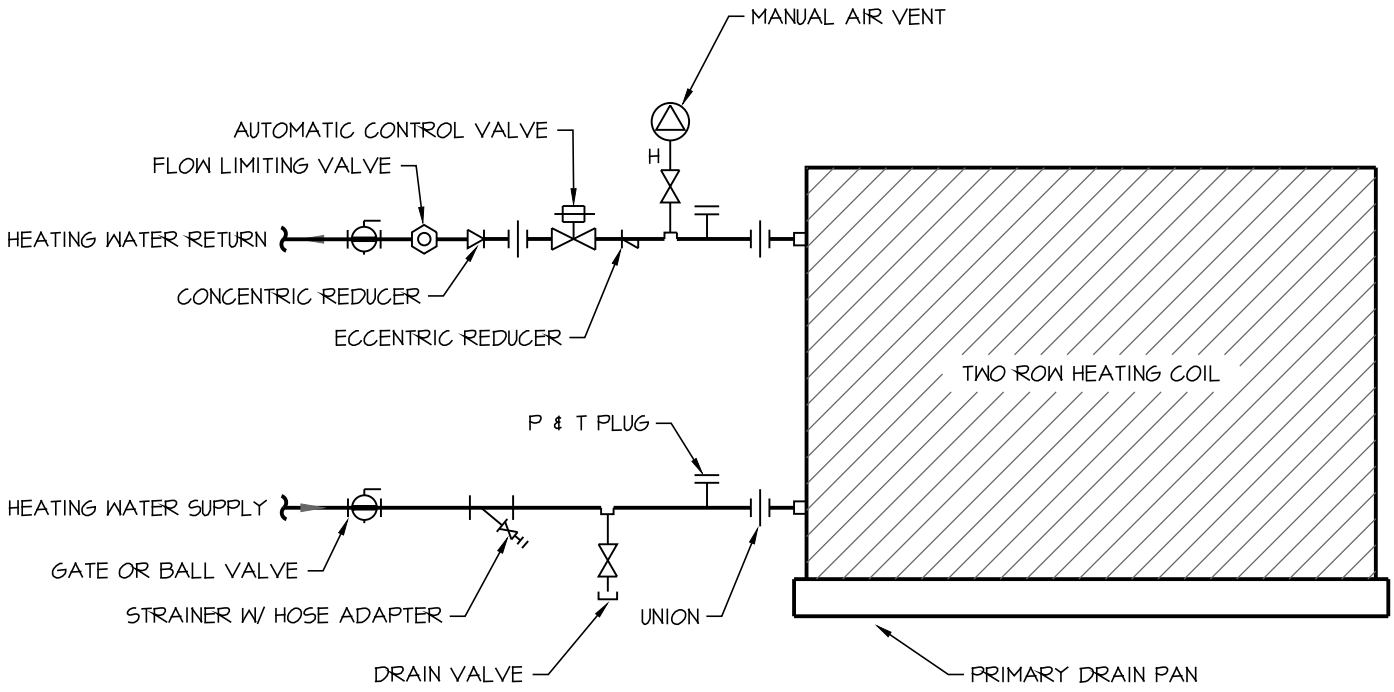
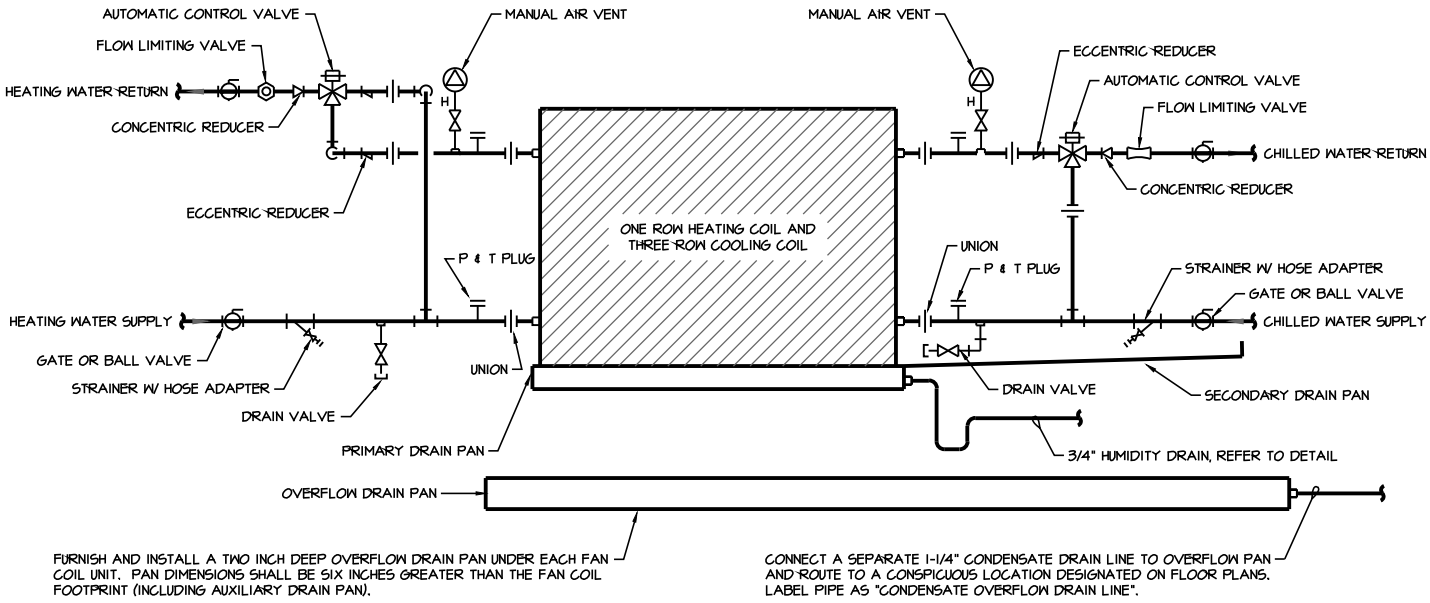


99 HEATING ONLY FAN COIL UNIT PIPING DETAIL

NOT TO SCALE



100 HORIZONTAL FAN COIL UNIT PIPING DETAIL

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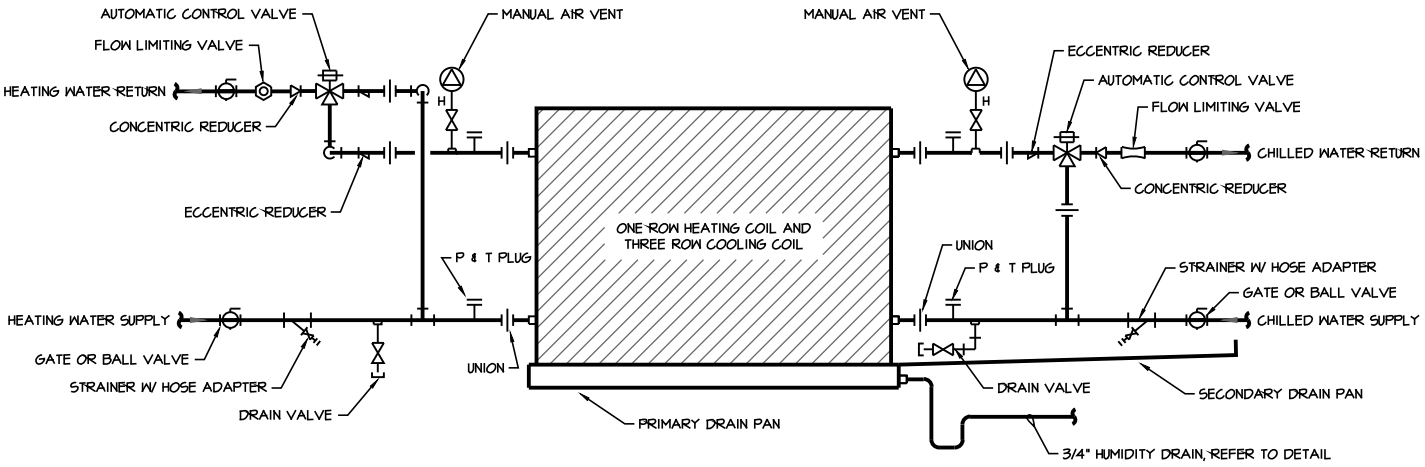

VERTICAL FAN COIL UNIT PIPING DETAIL

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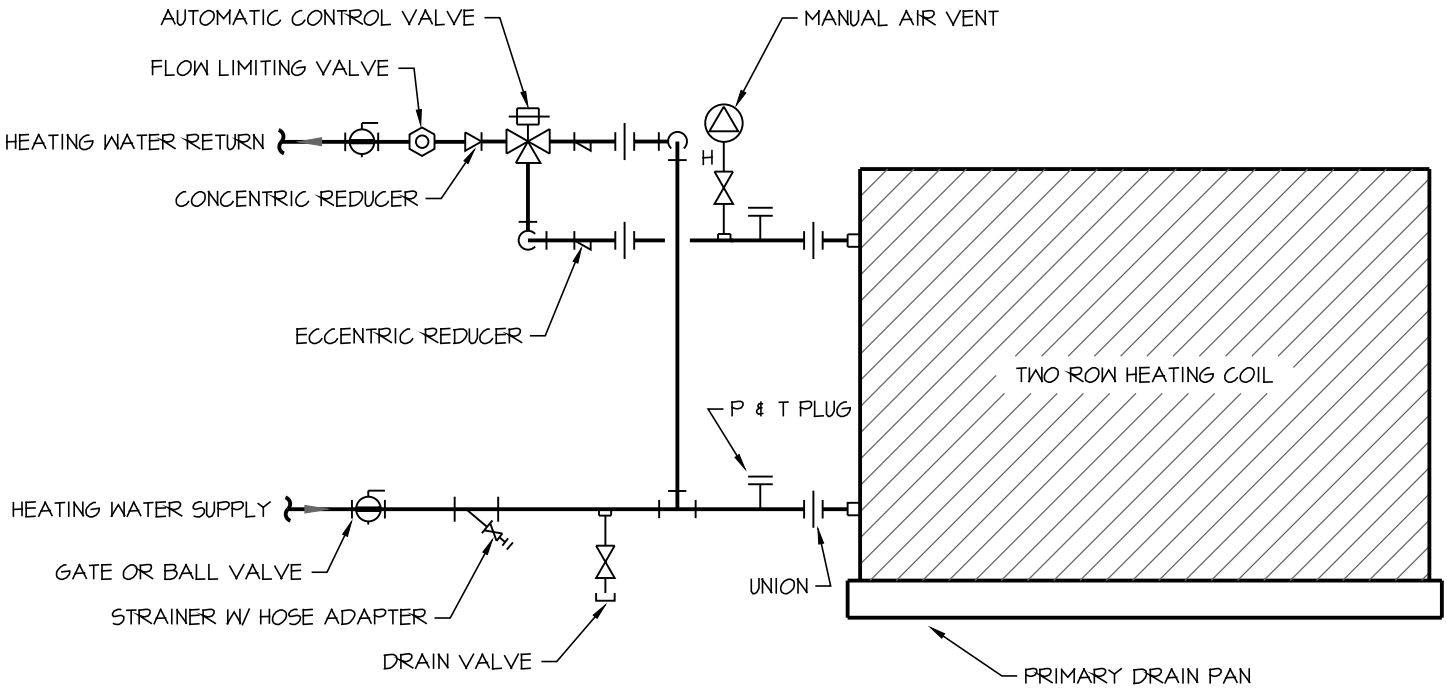

02 HEATING ONLY FAN COIL UNIT PIPING DETAIL

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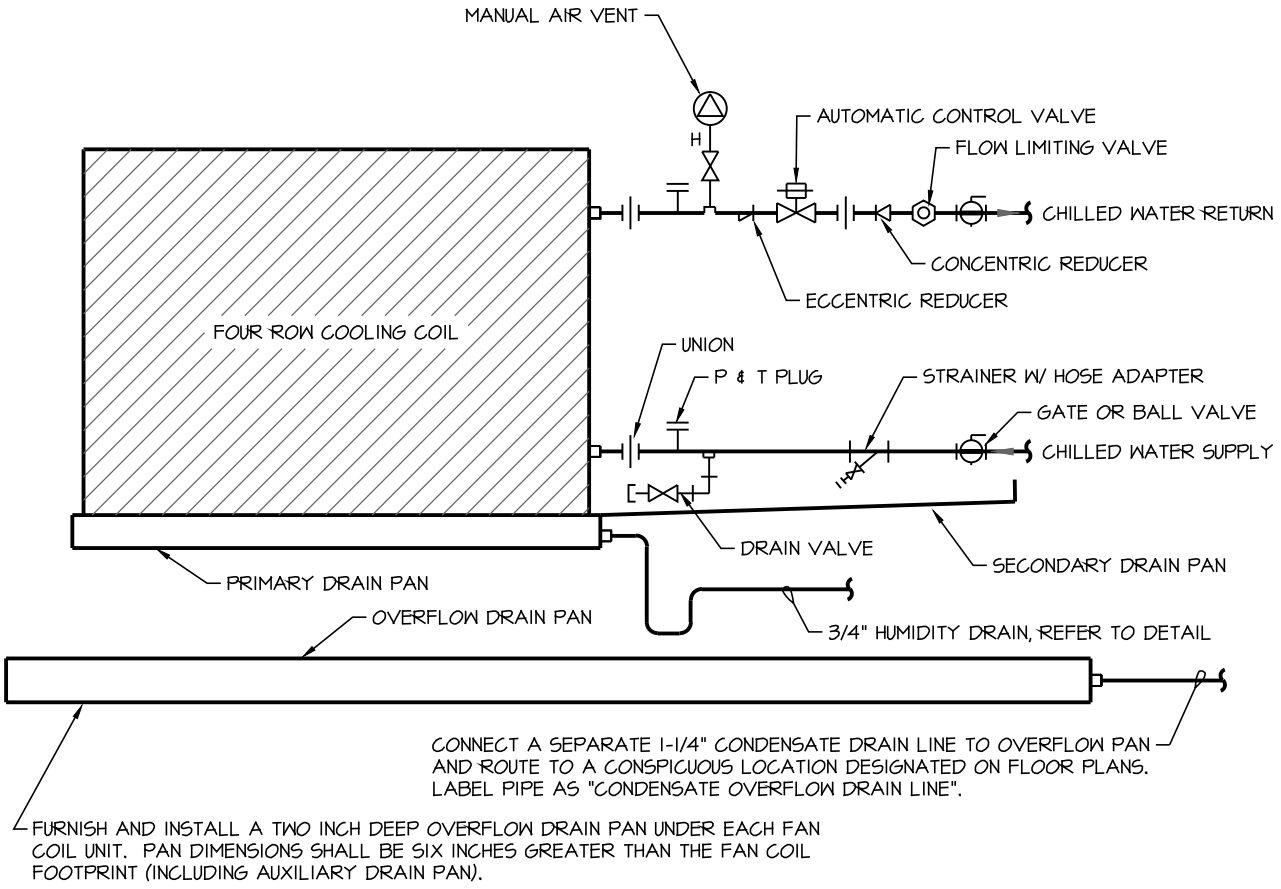

03 COOLING ONLY FAN COIL UNIT PIPING DETAIL

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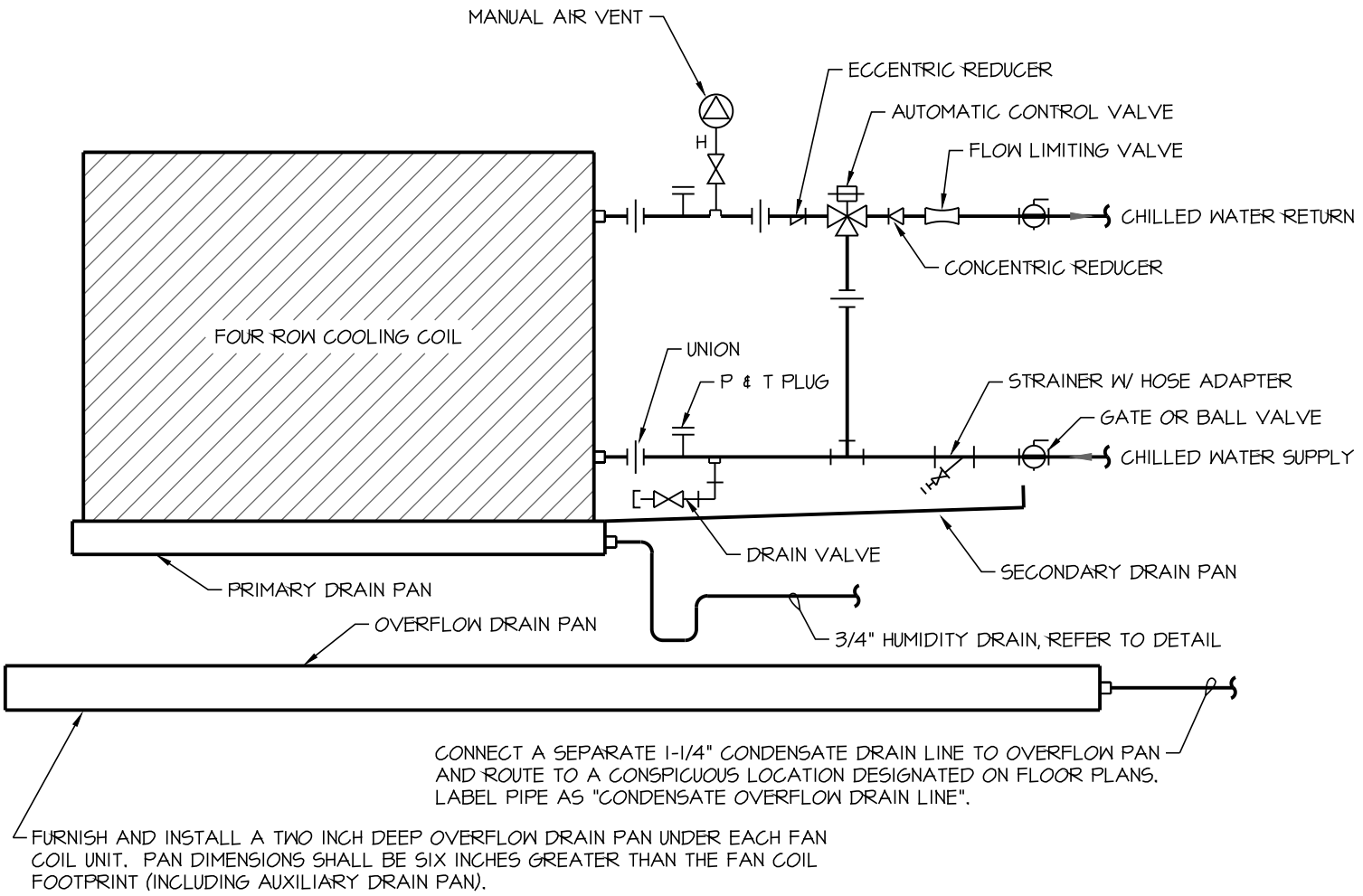

04 COOLING ONLY FAN COIL UNIT PIPING DETAIL

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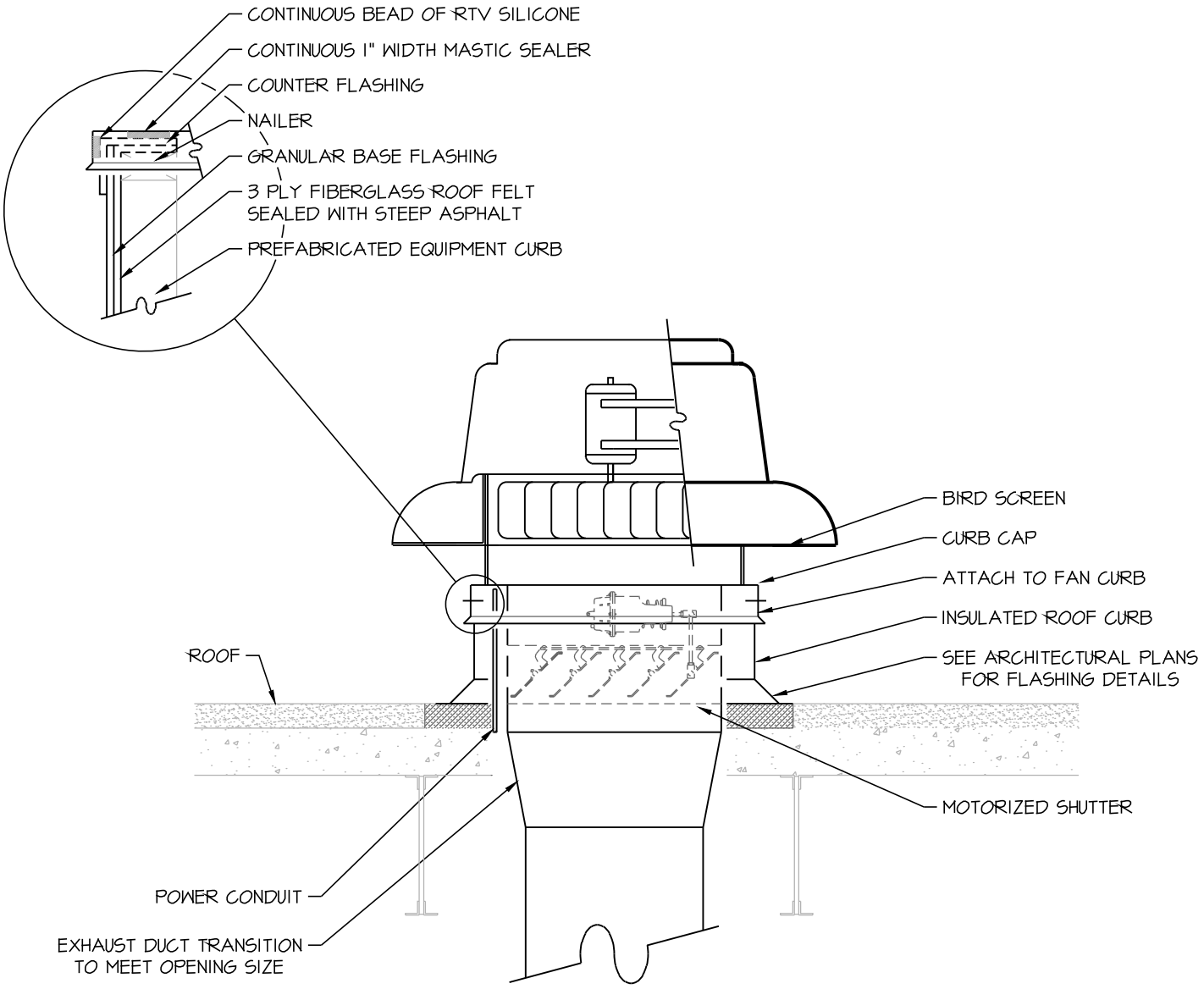

05 ROOFTOP DOWNBLAST EXHAUST FAN DETAIL

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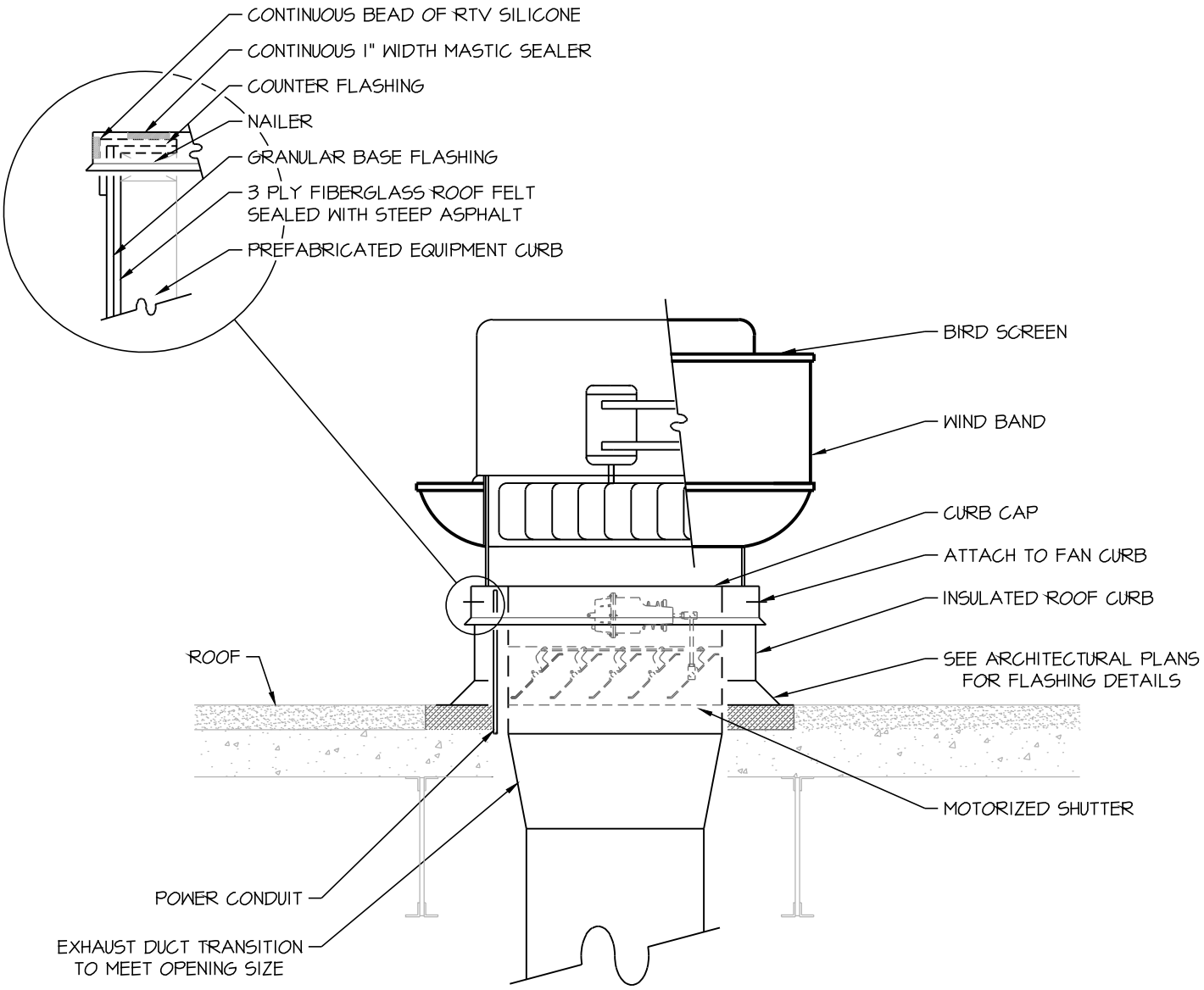

06 ROOFTOP UPBLAST EXHAUST FAN DETAIL

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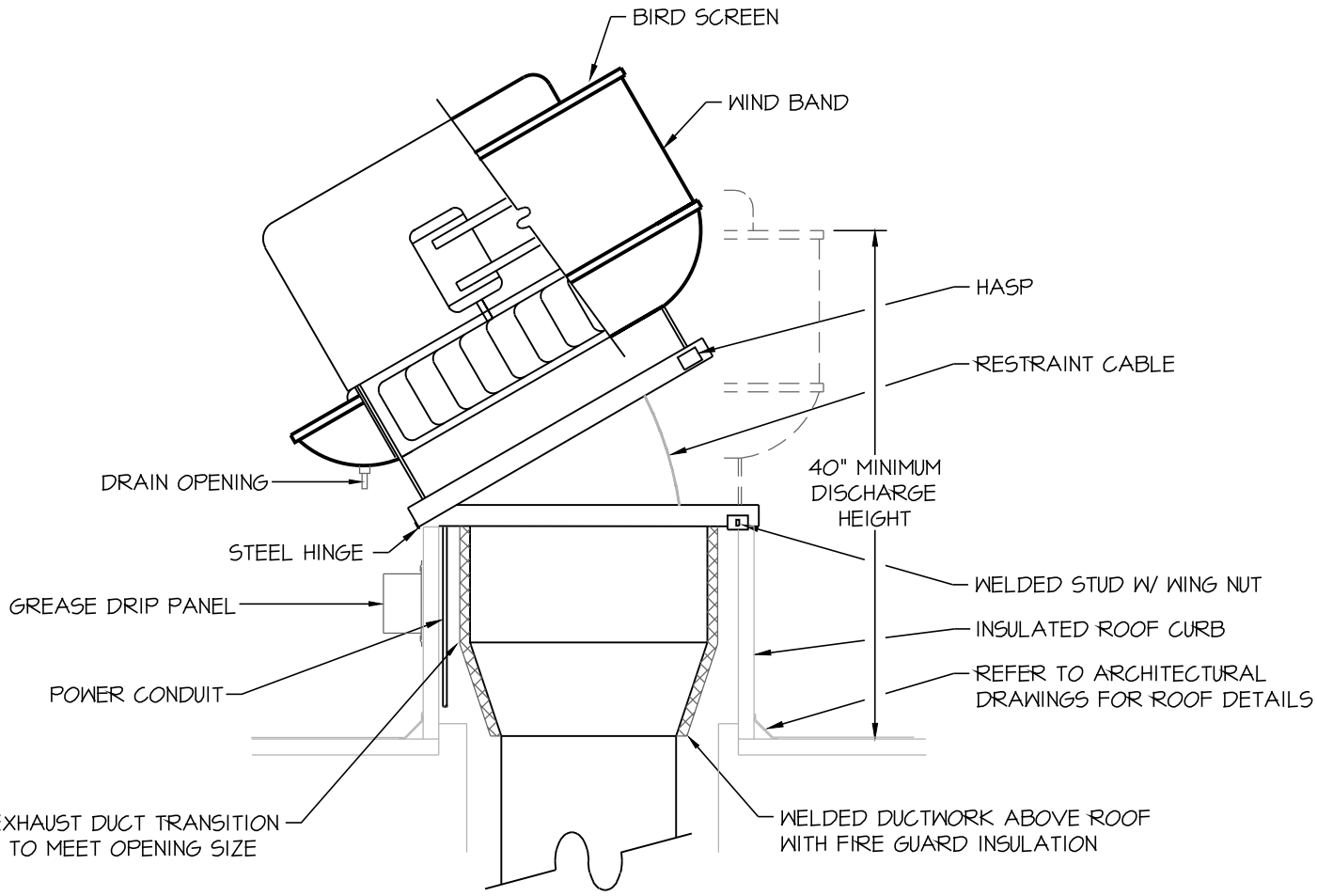

ROOFTOP UPBLAST EXHAUST FAN (KITCHEN DETAIL

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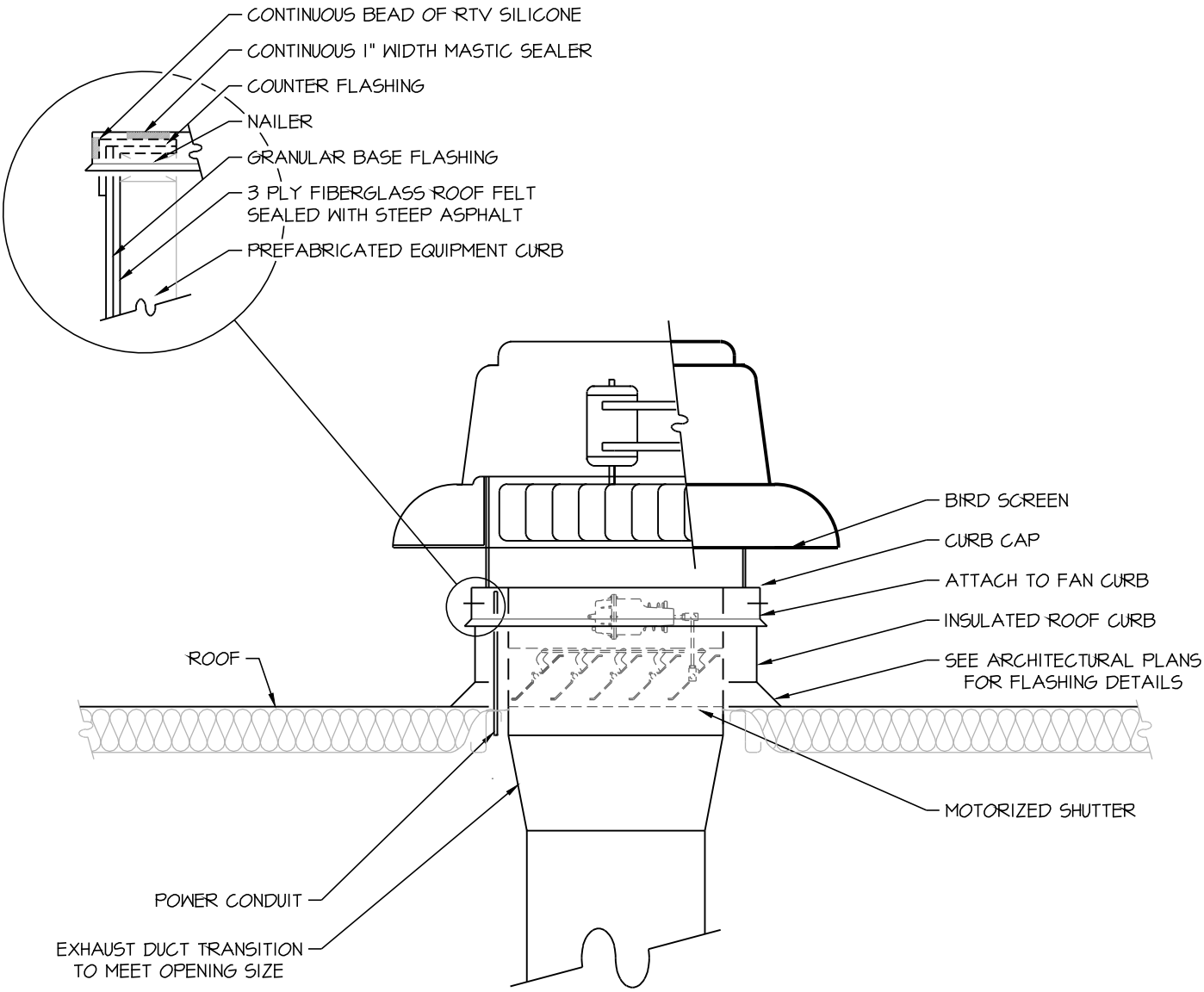

108 ROOFTOP DOWNBLAST EXHAUST FAN DETAIL

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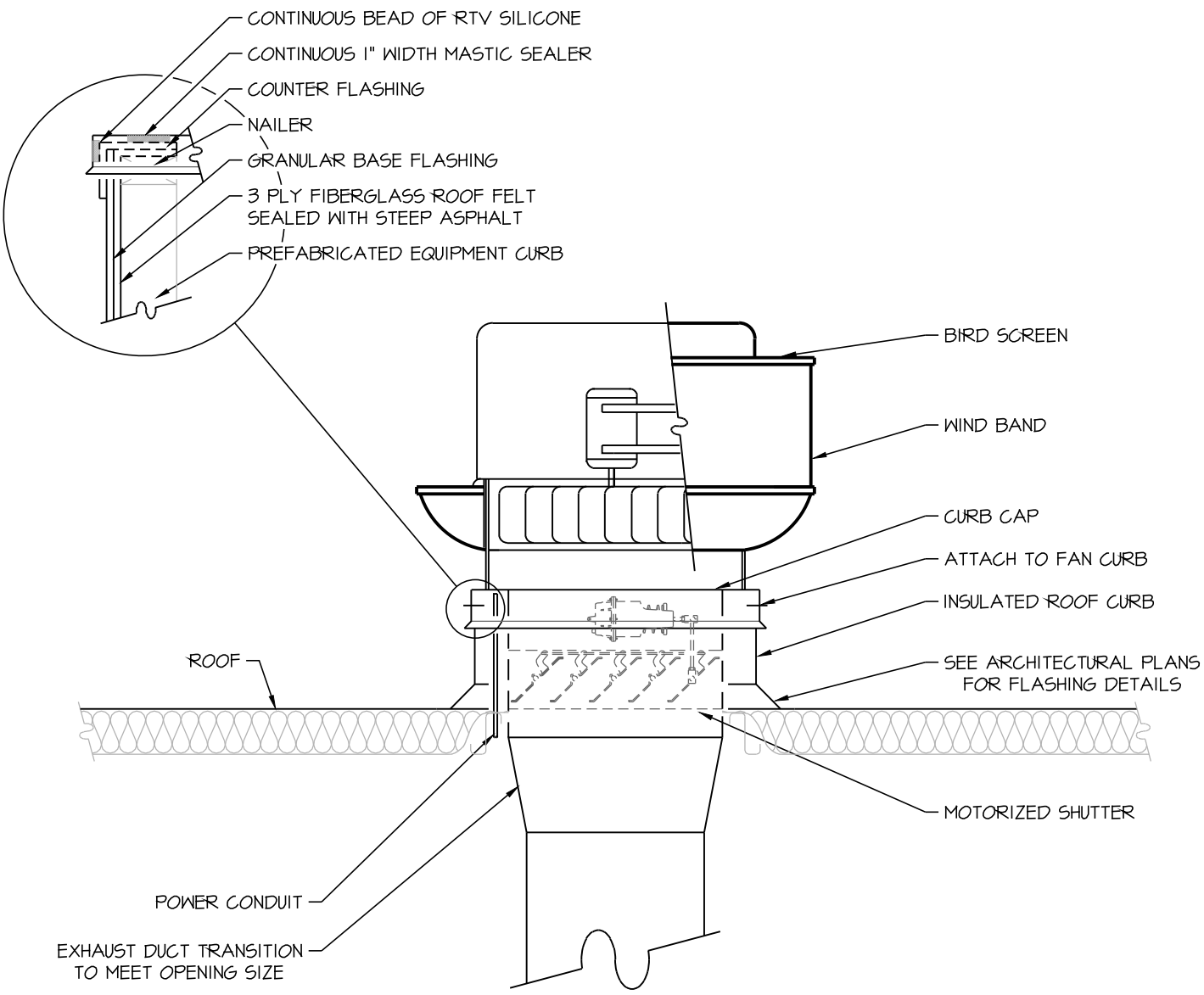

09 ROOFTOP UPBLAST EXHAUST FAN DETAIL

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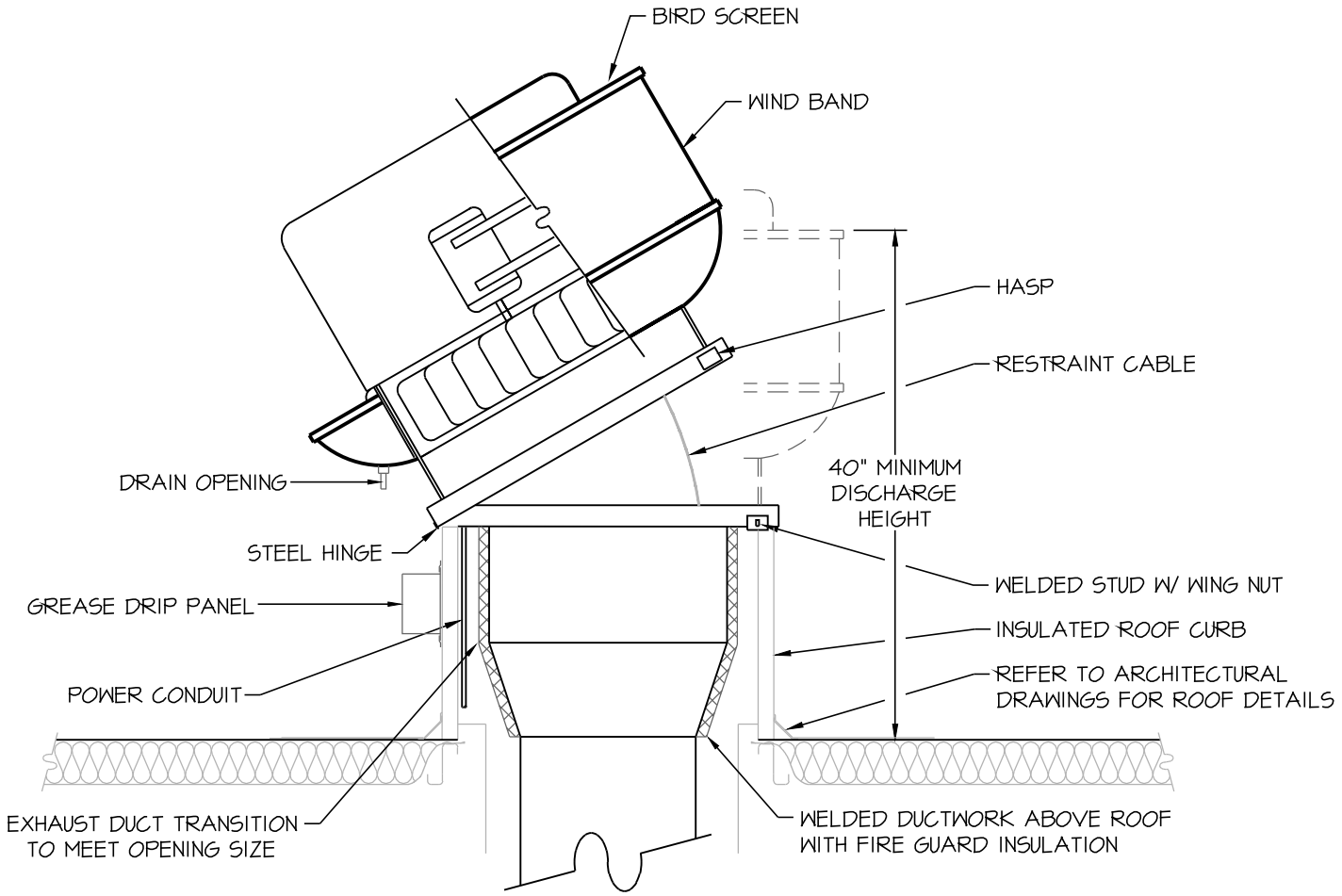

110 ROOFTOP UPBLAST EXHAUST FAN (KITCHEN DETAIL

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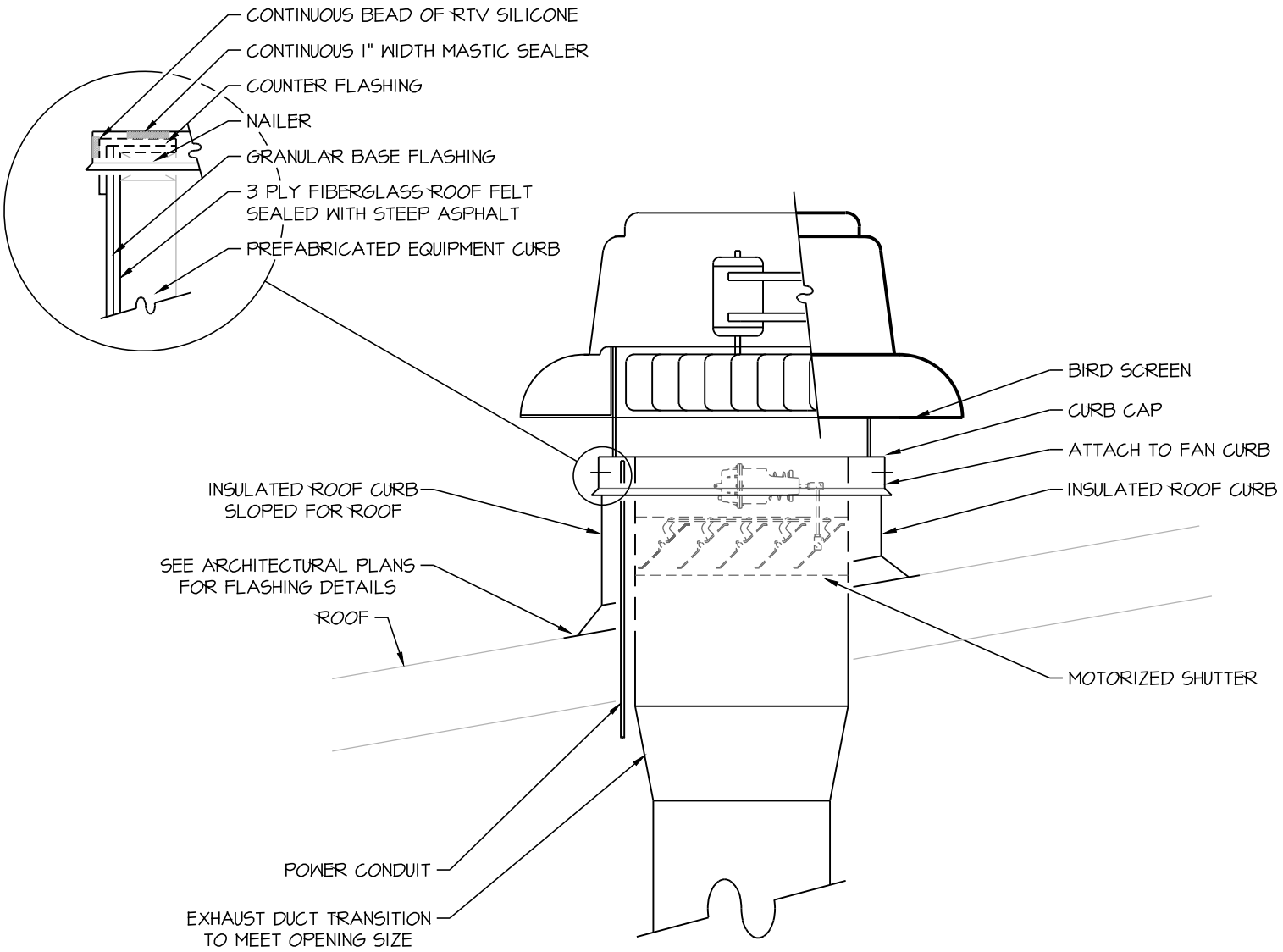

111 ROOFTOP DOWNBLAST EXHAUST FAN DETAIL

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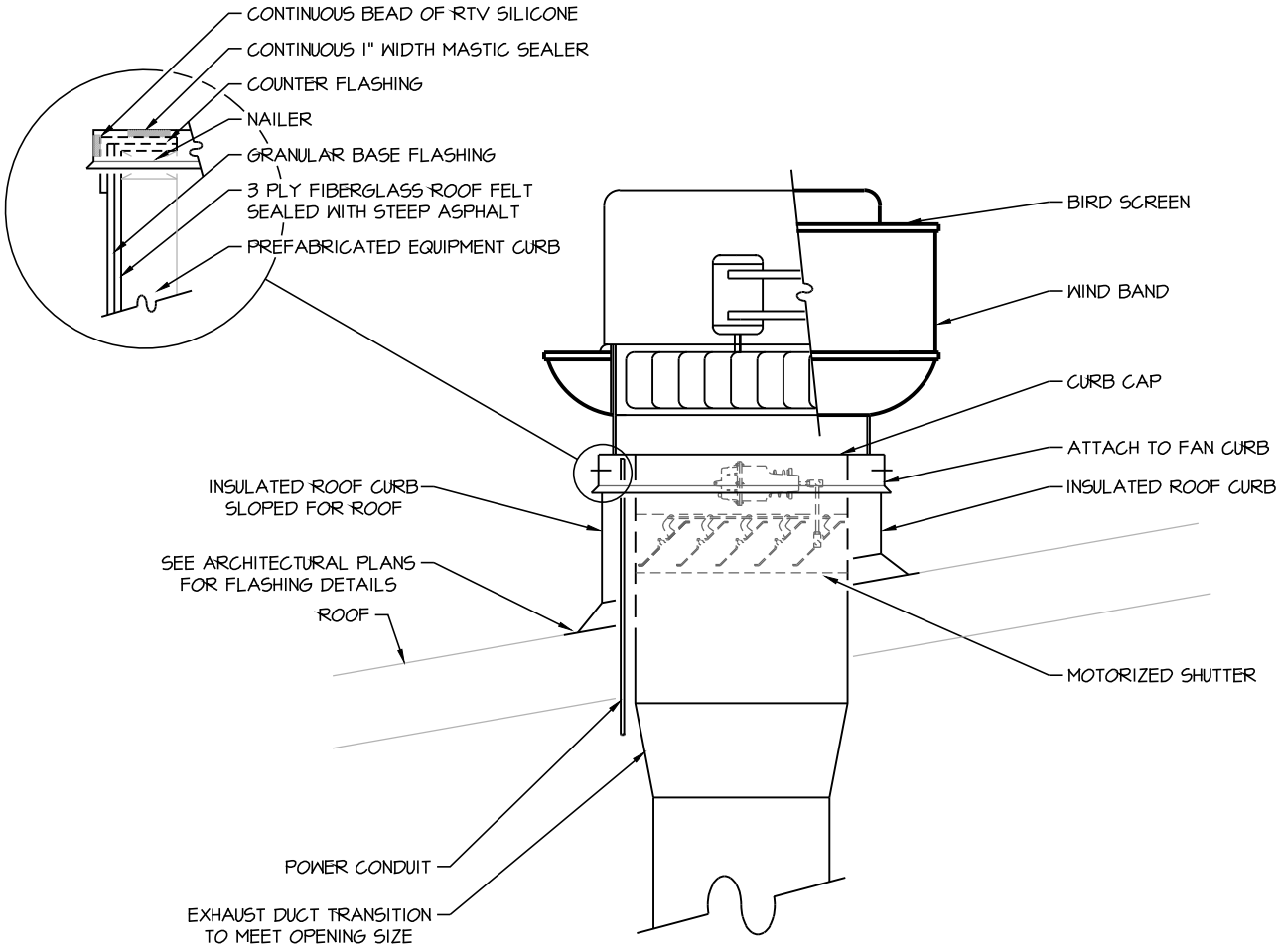

112 ROOFTOP UPBLAST EXHAUST FAN DETAIL

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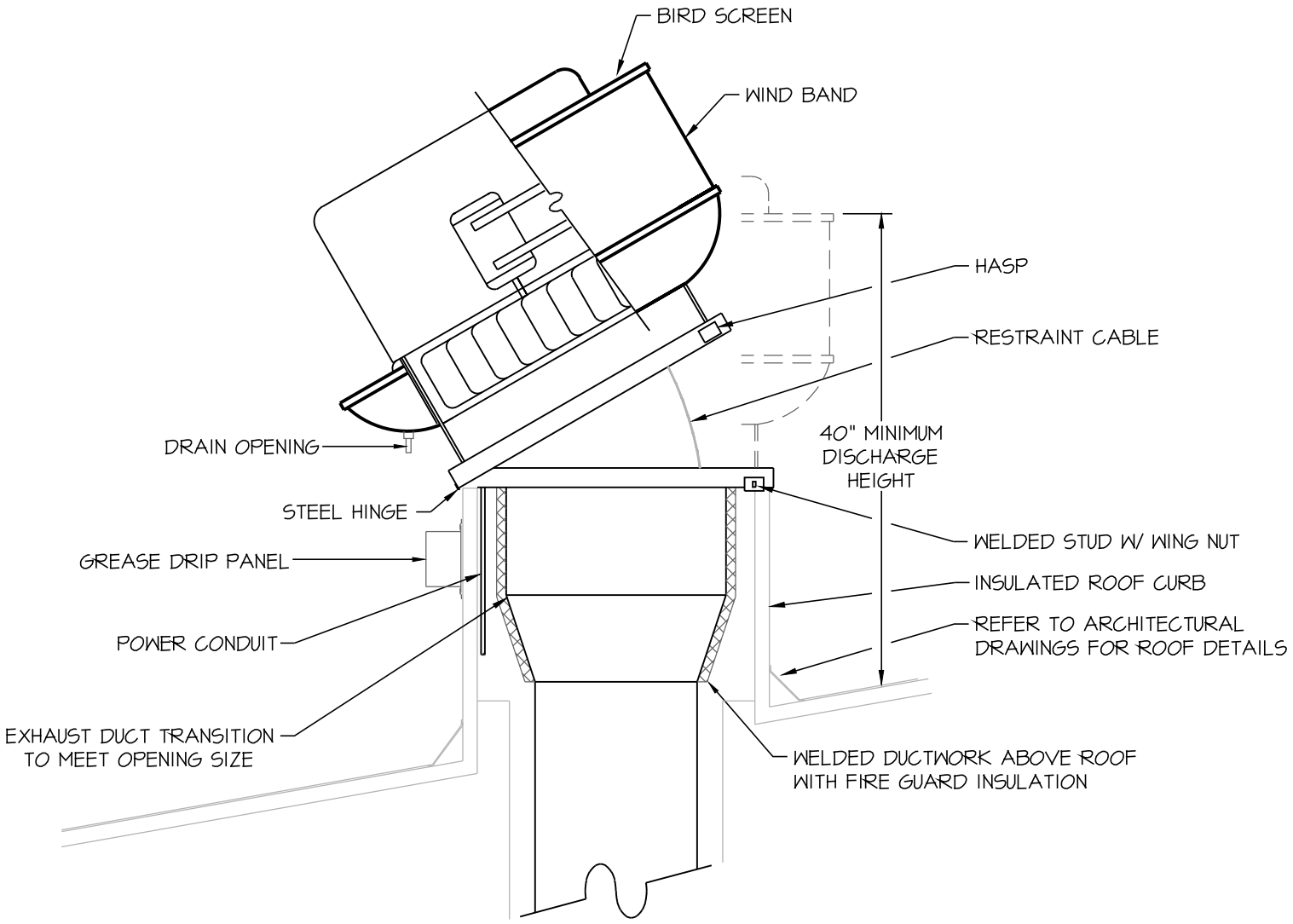

113 ROOFTOP UPBLAST EXHAUST FAN (KITCHEN DETAIL

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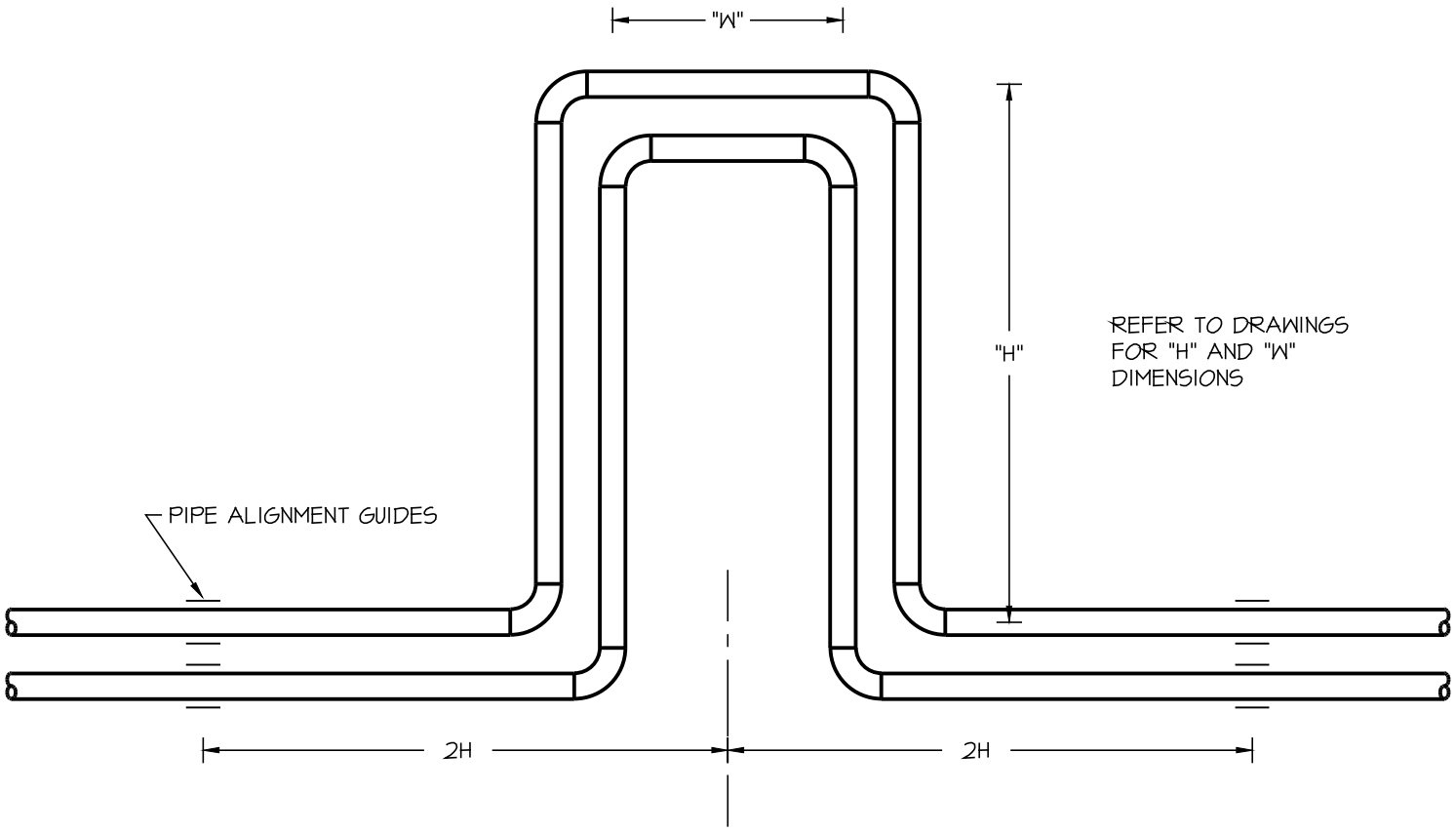

114 EXPANSION LOOP DETAIL

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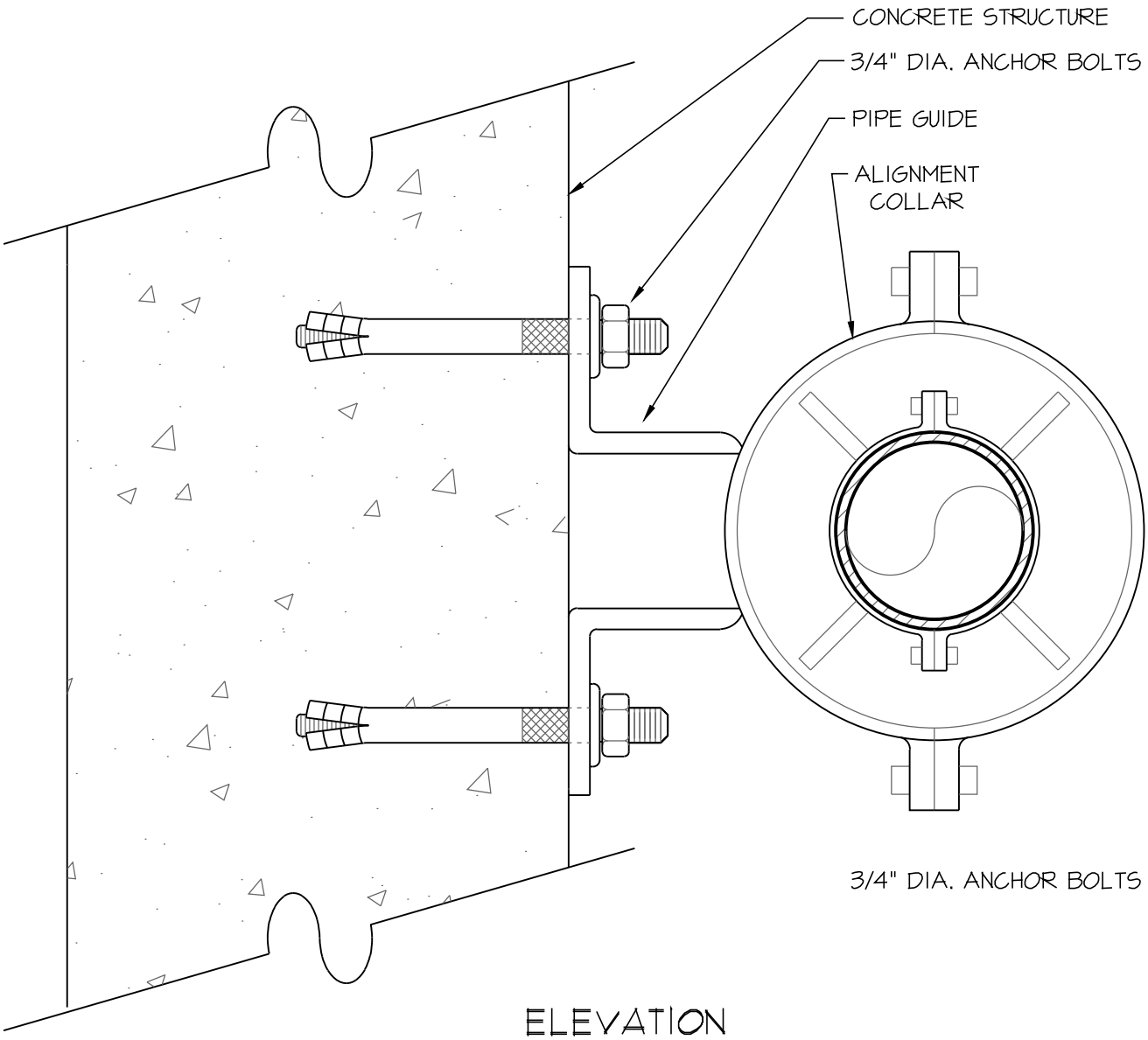

115 PIPE GUIDE DETAIL

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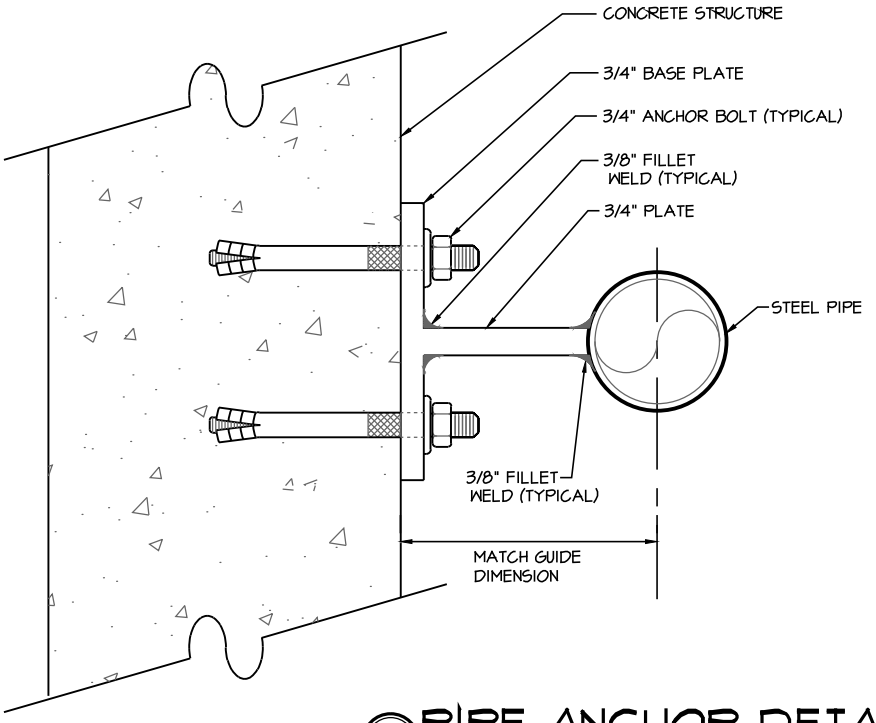

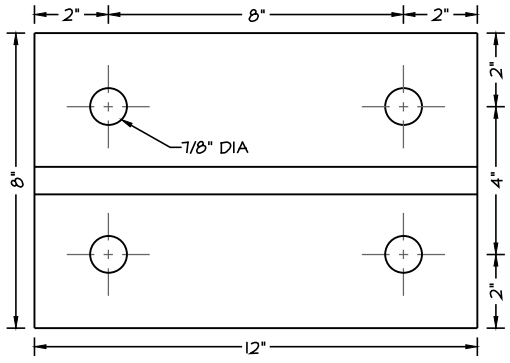

BASE PLATE (PLAN VIEW)

16 PIPE ANCHOR DETAIL

NOT TO SCALE

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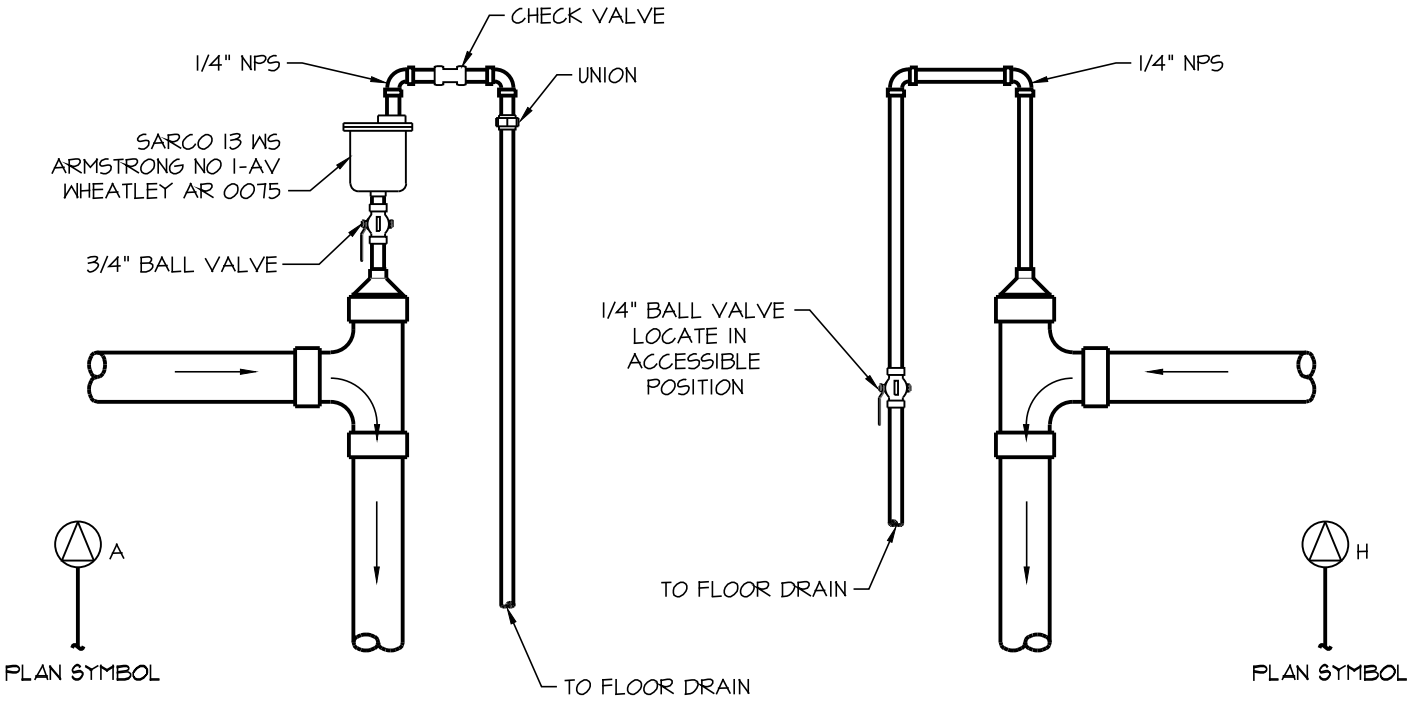
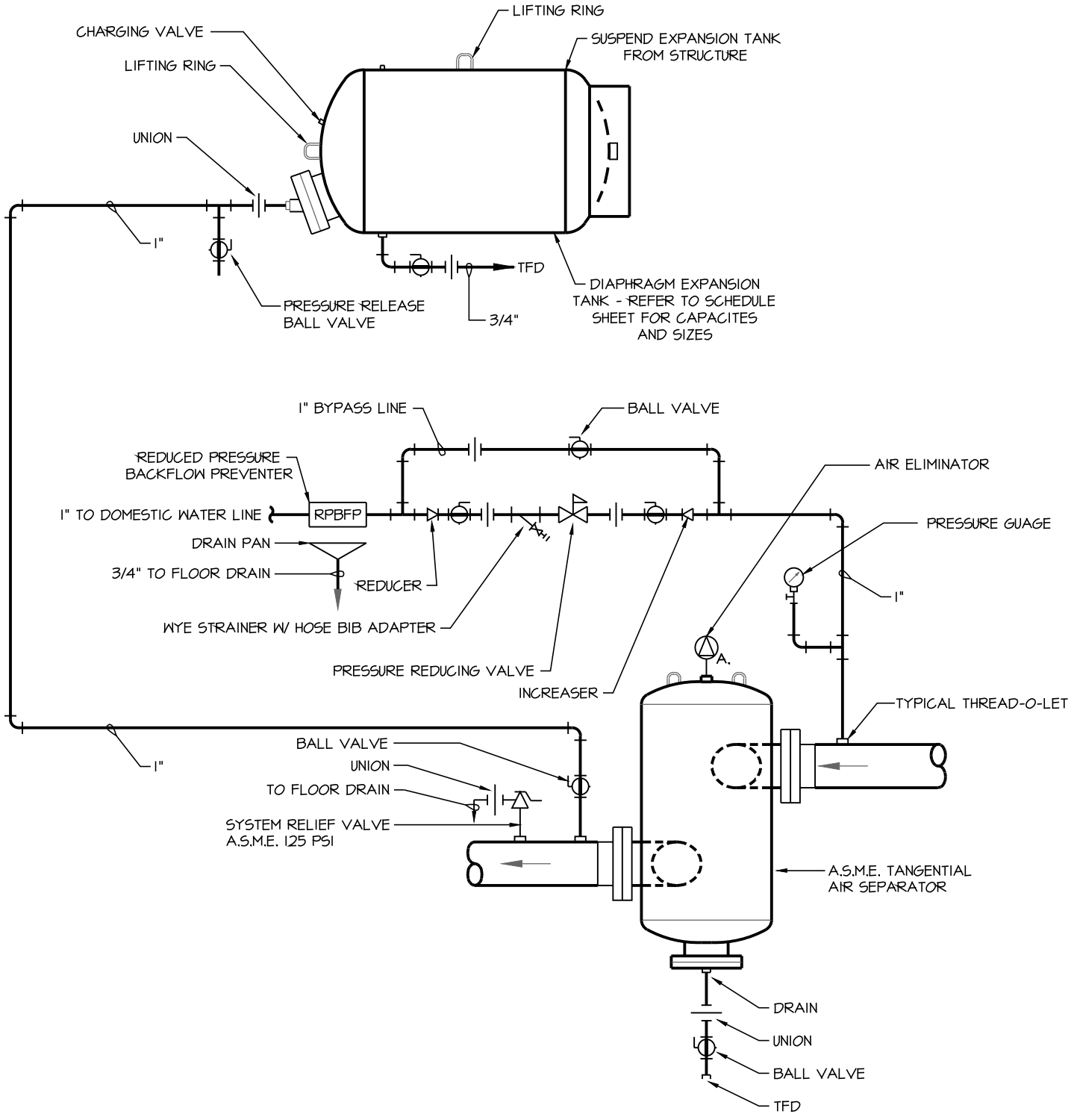


AUTOMATIC
AIR VENT

MANUAL OR HAND OPERATED
AIR VENT

117 AIR ELIMINATOR DETAIL

NOT TO SCALE



118 AIR CONTROL PIPING DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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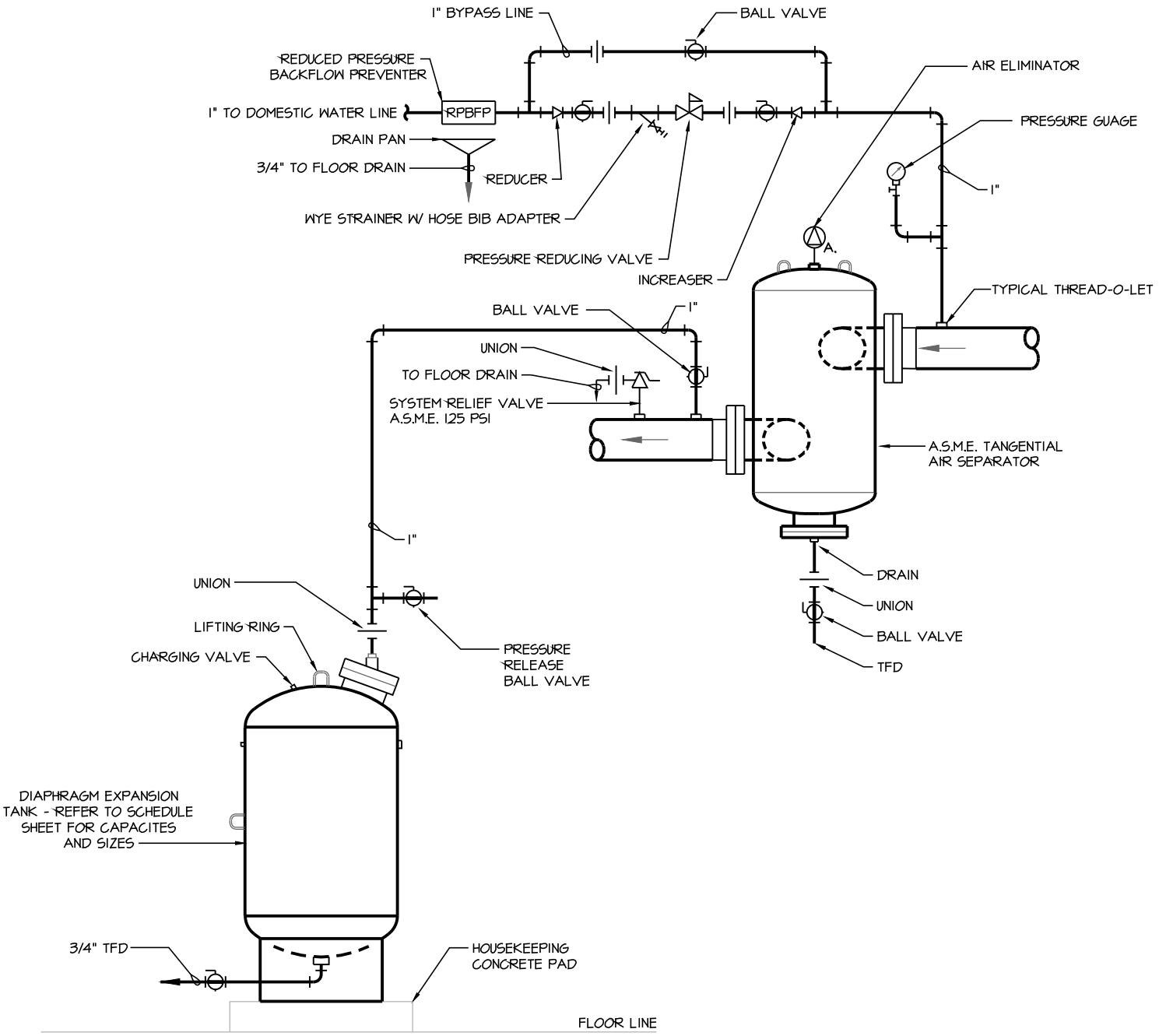

119 AIR CONTROL PIPING DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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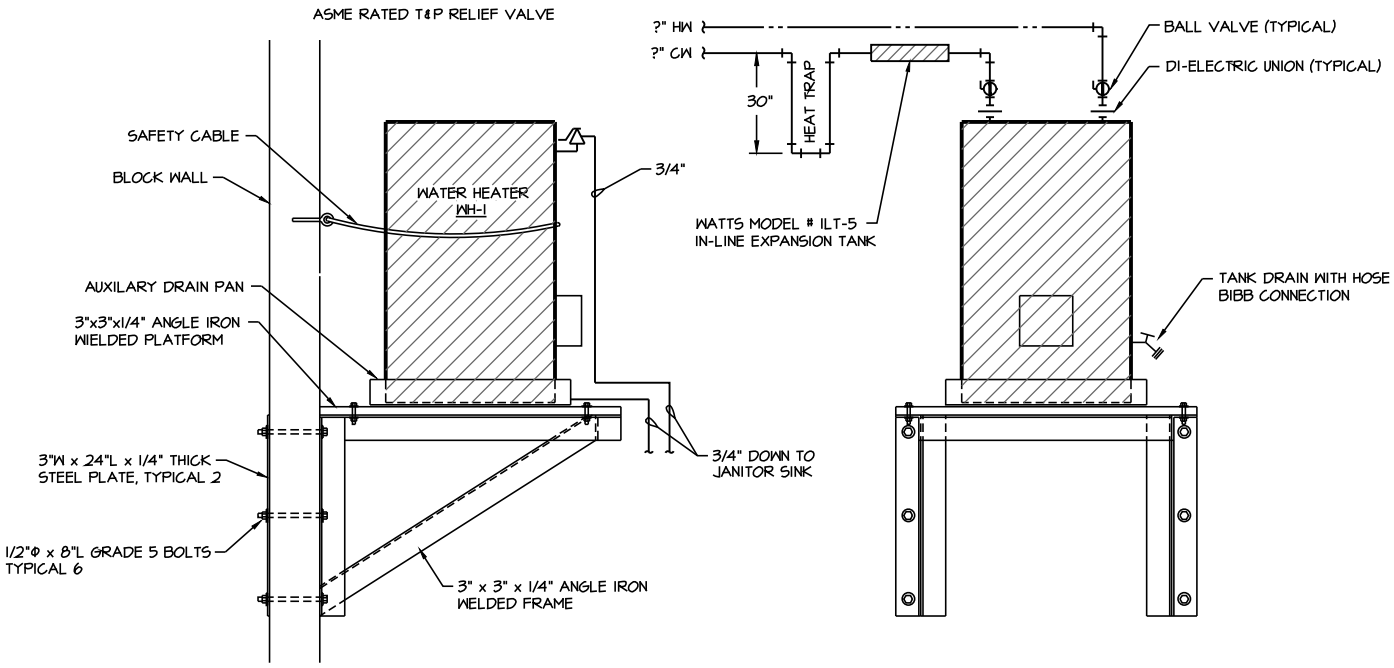

20 WATER HEATER DETAIL

UNIVERSITY OF ARKANSAS

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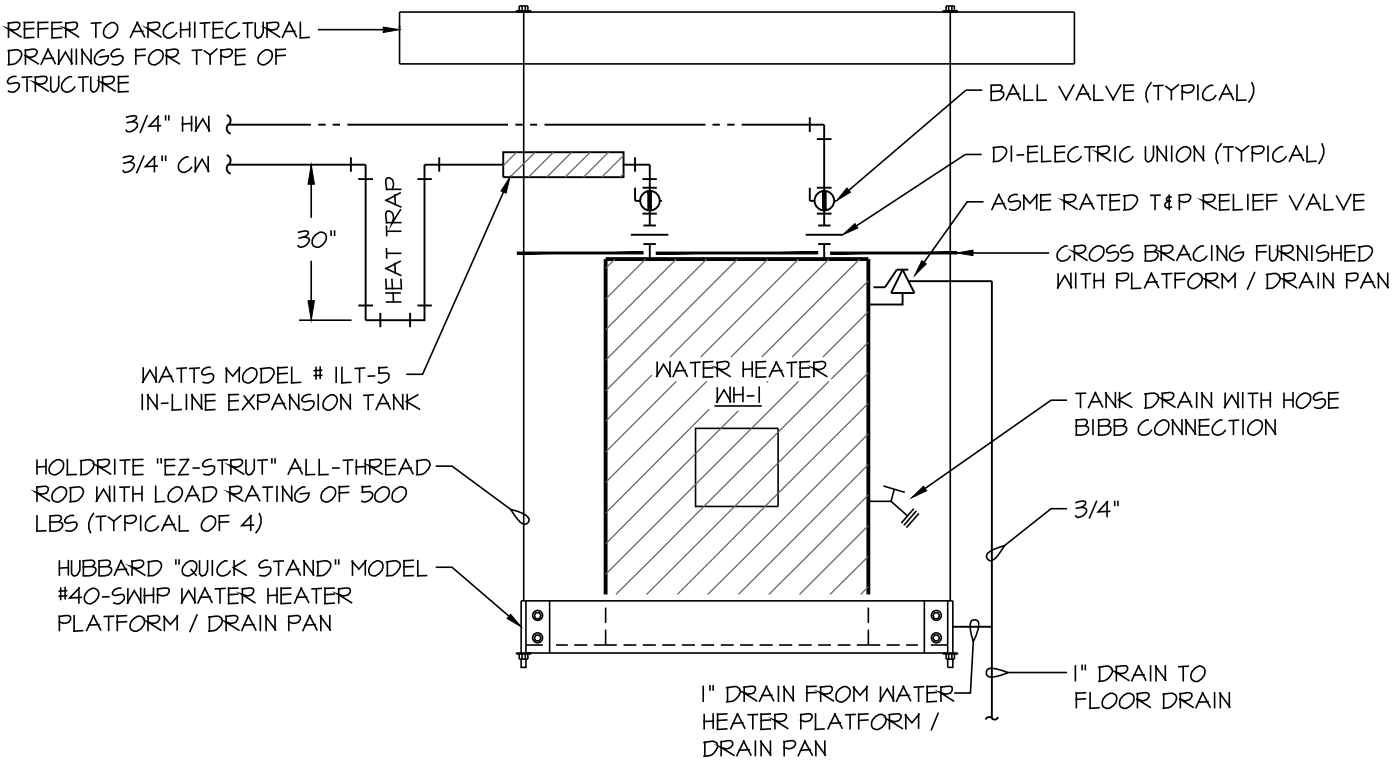

121 WATER HEATER DETAIL

SCALE: NONE

UNIVERSITY OF ARKANSAS

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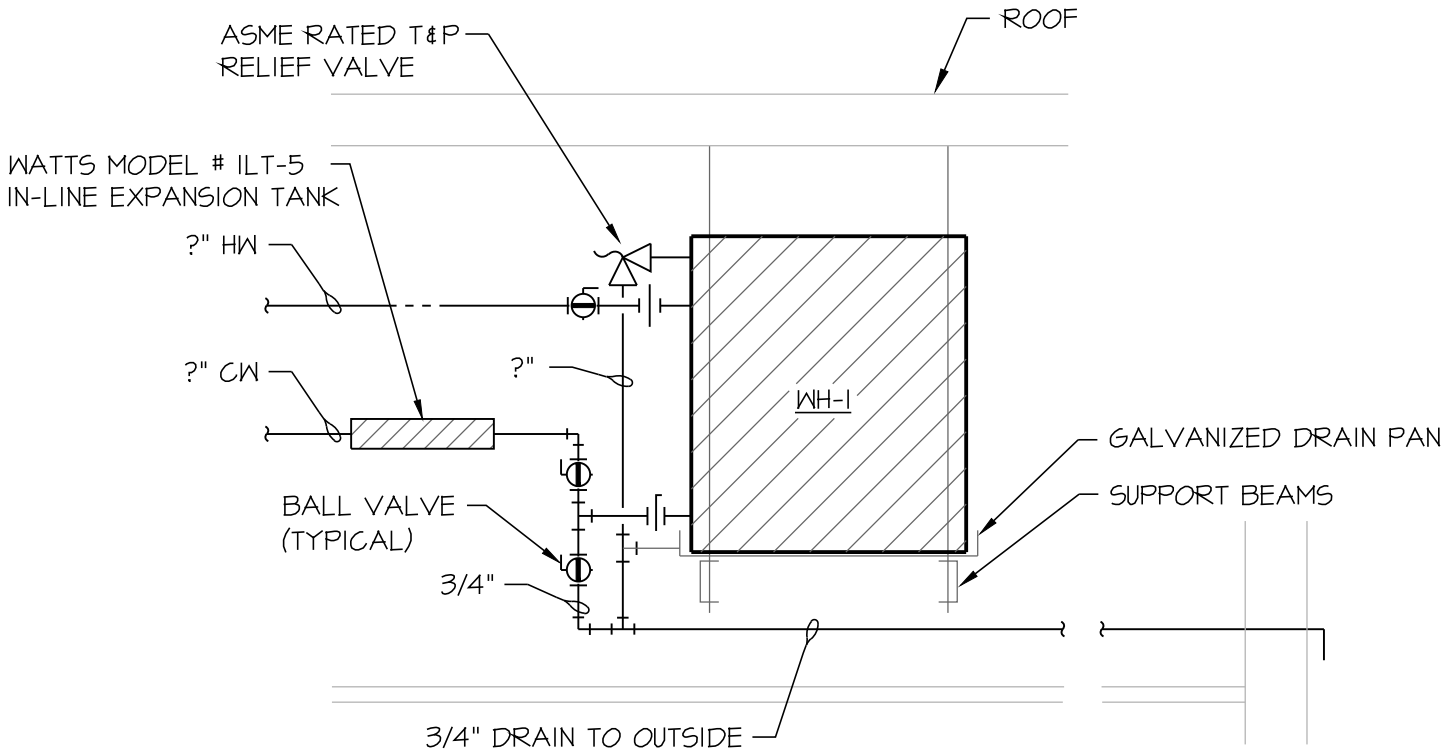

122 WATER HEATER DETAIL

SCALE: NONE

UNIVERSITY OF ARKANSAS

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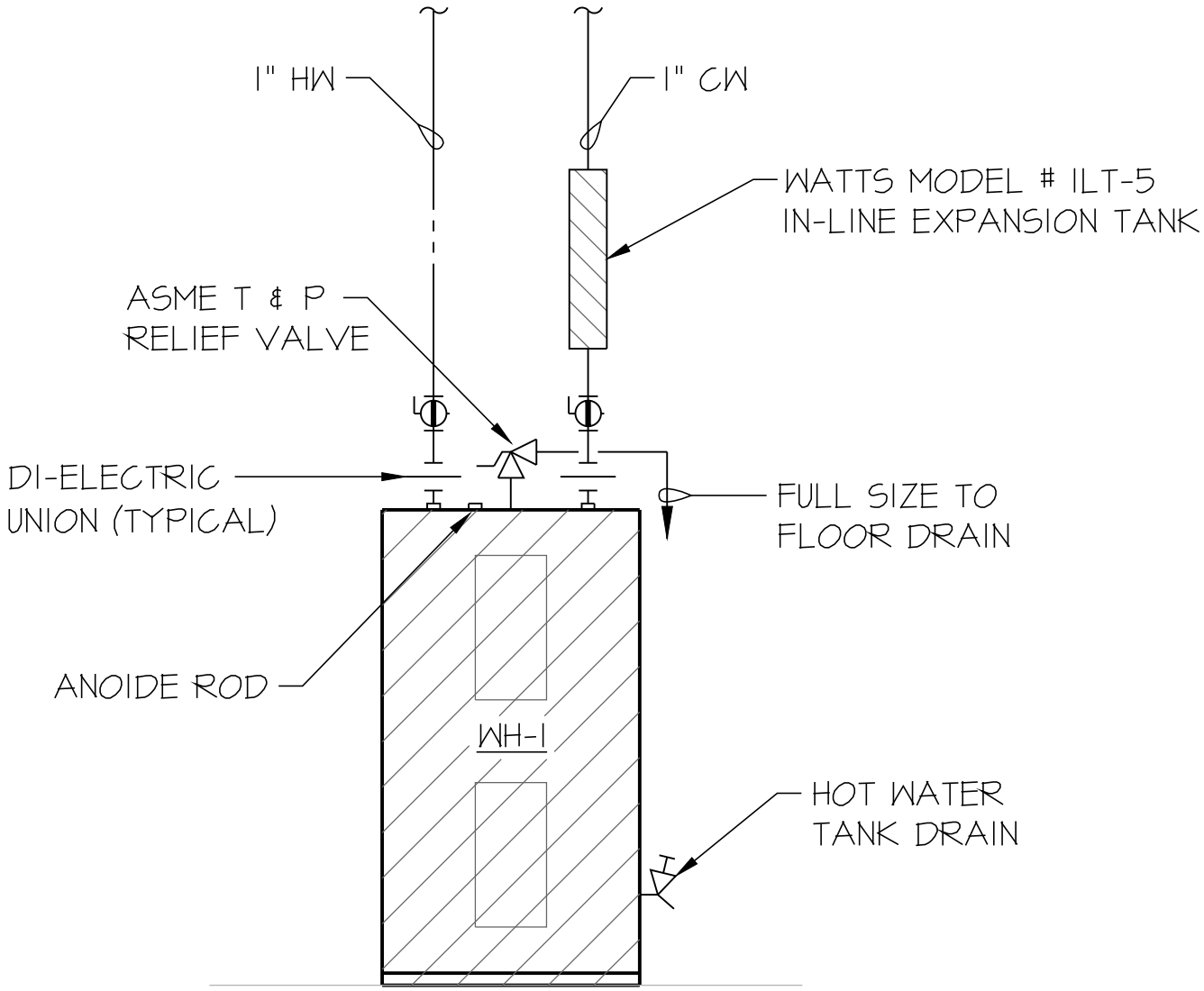

123 WATER HEATER DETAIL

SCALE: NONE

UNIVERSITY OF ARKANSAS

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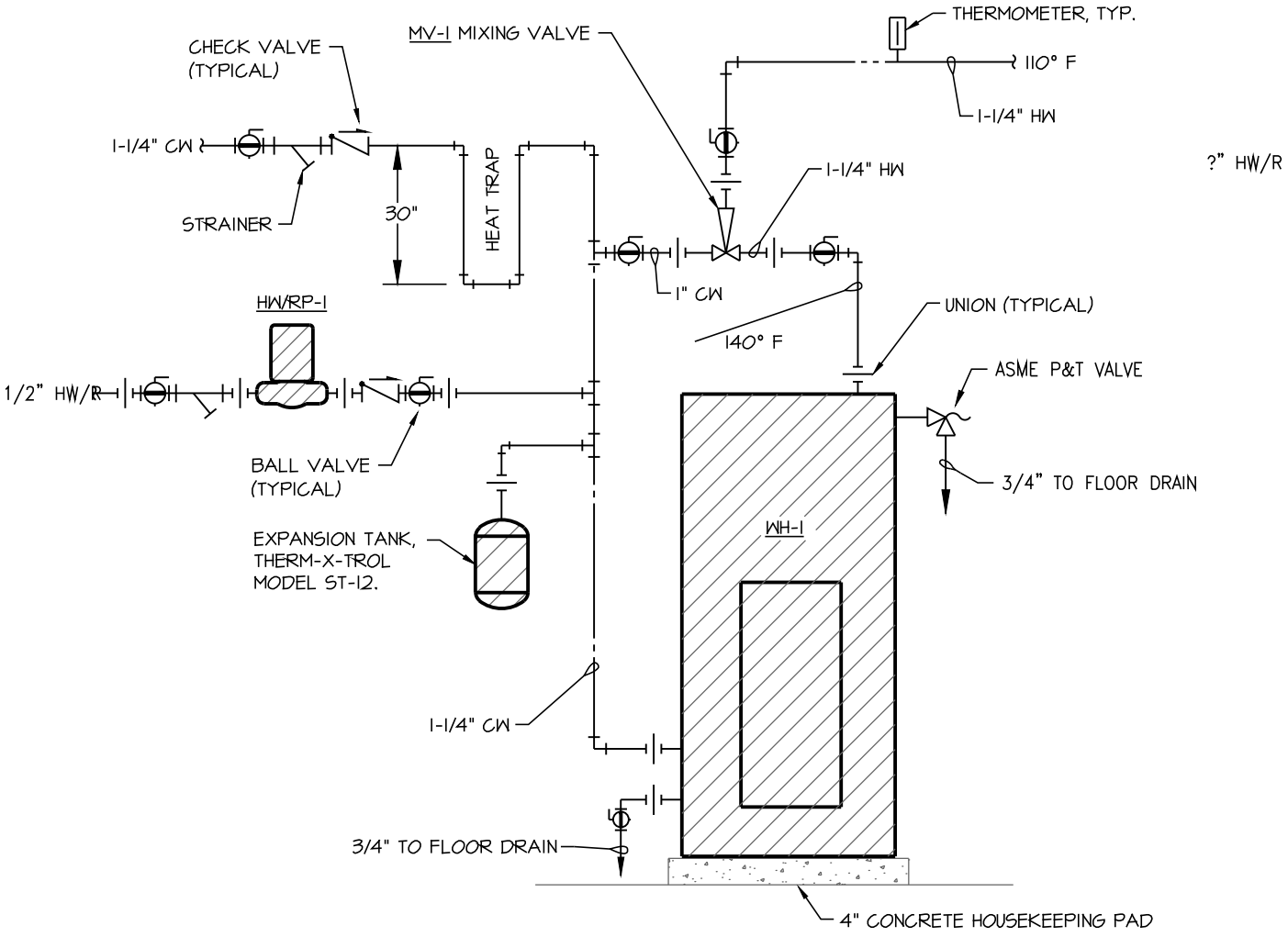

24 WATER HEATER DETAIL

SCALE: NONE

UNIVERSITY OF ARKANSAS

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DATE: XX/XX/XX

SHEET NO: Det 124

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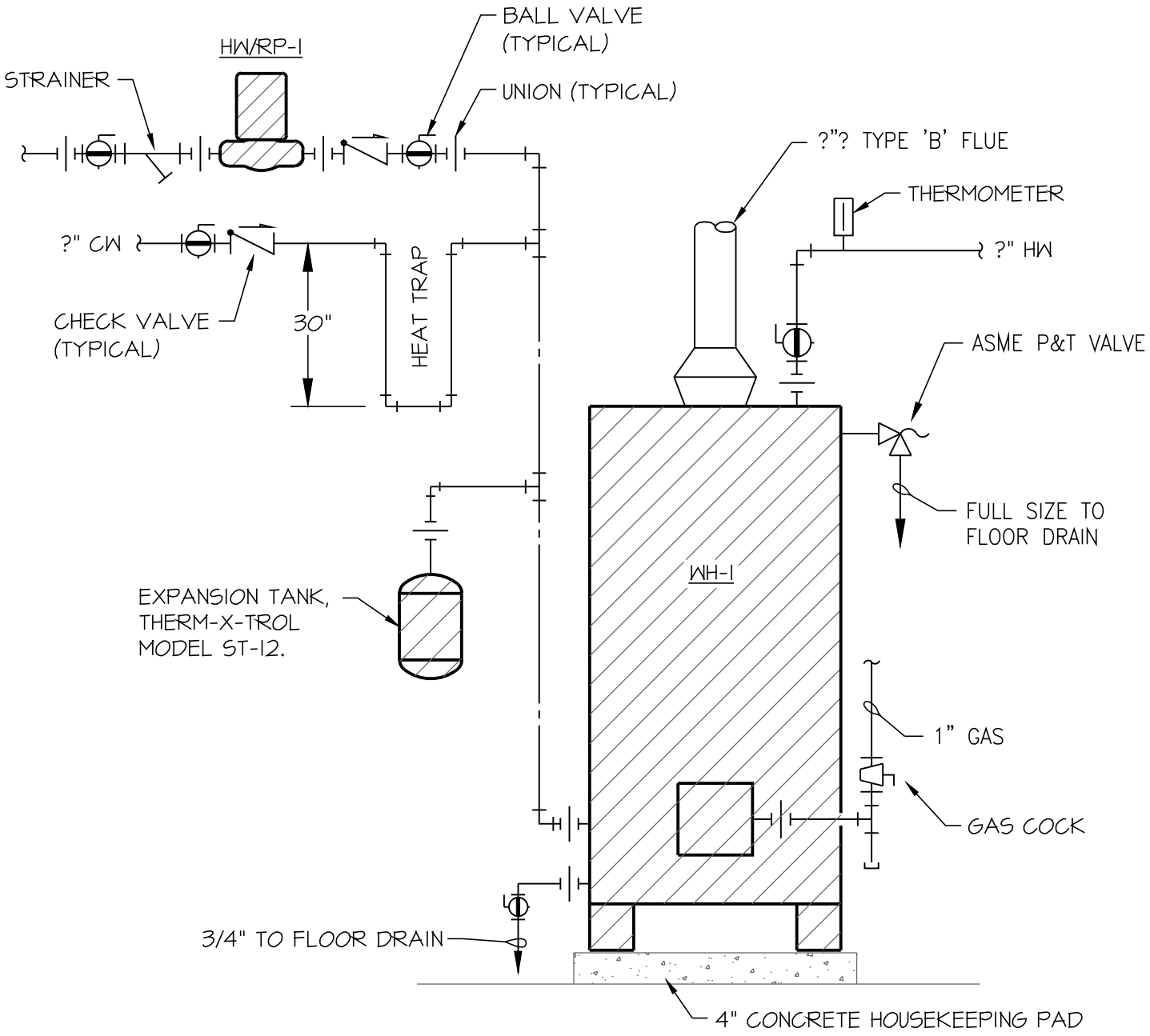
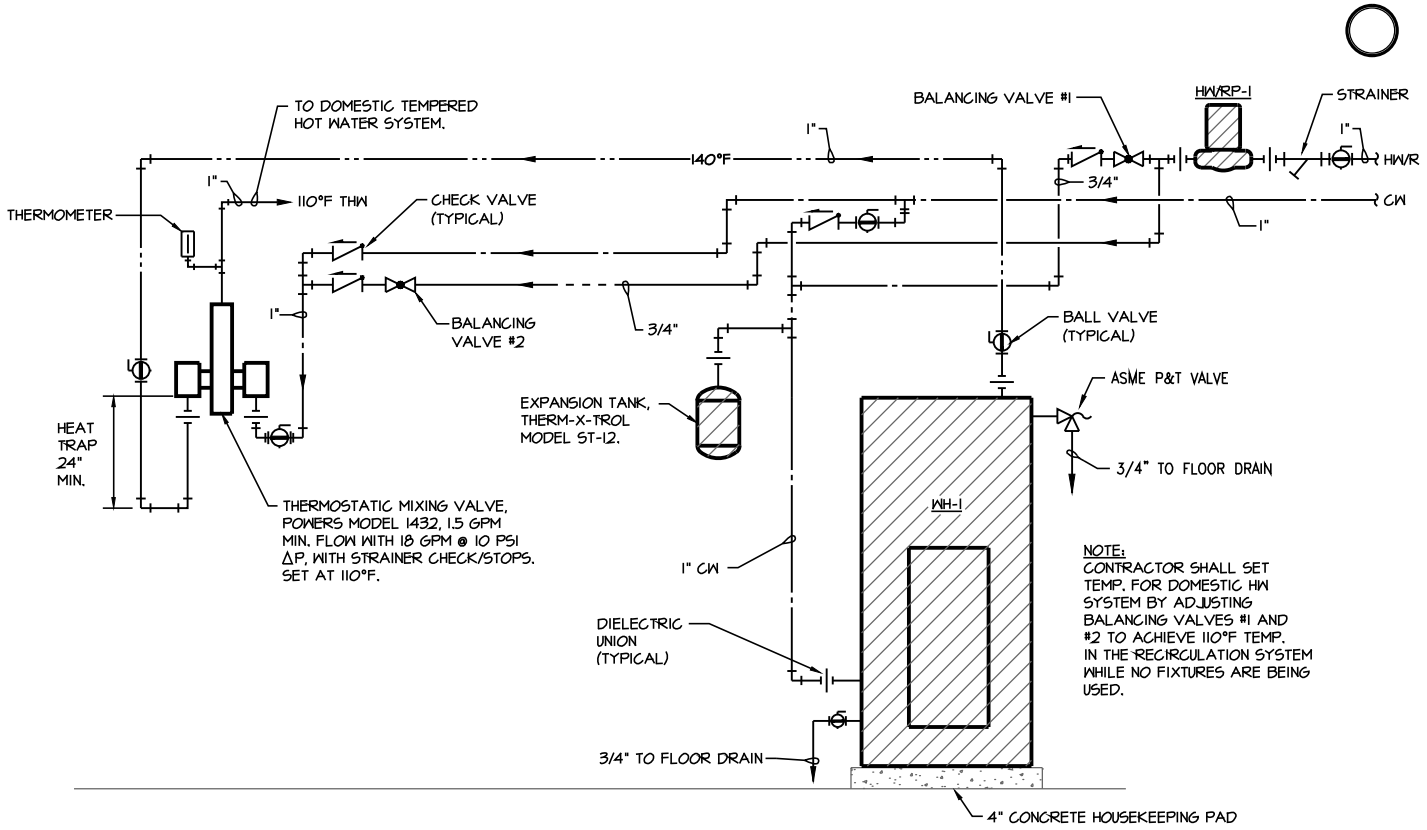


125 WATER HEATER DETAIL

SCALE: NONE



126 WATER HEATER DETAIL and Return Pump

SCALE: NONE

UNIVERSITY OF ARKANSAS

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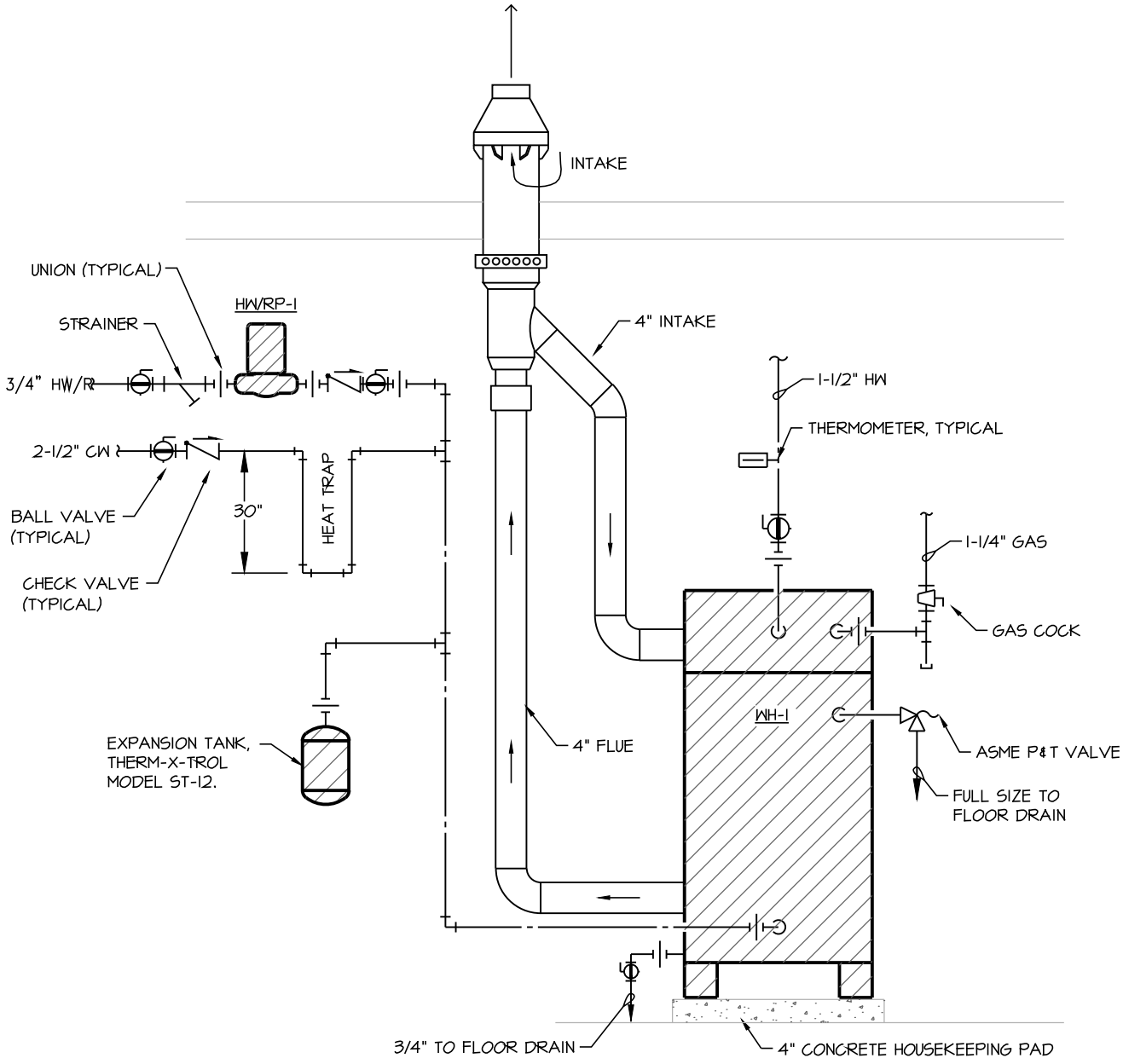

27 WATER HEATER DETAIL

SCALE: NONE

UNIVERSITY OF ARKANSAS

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Det 127
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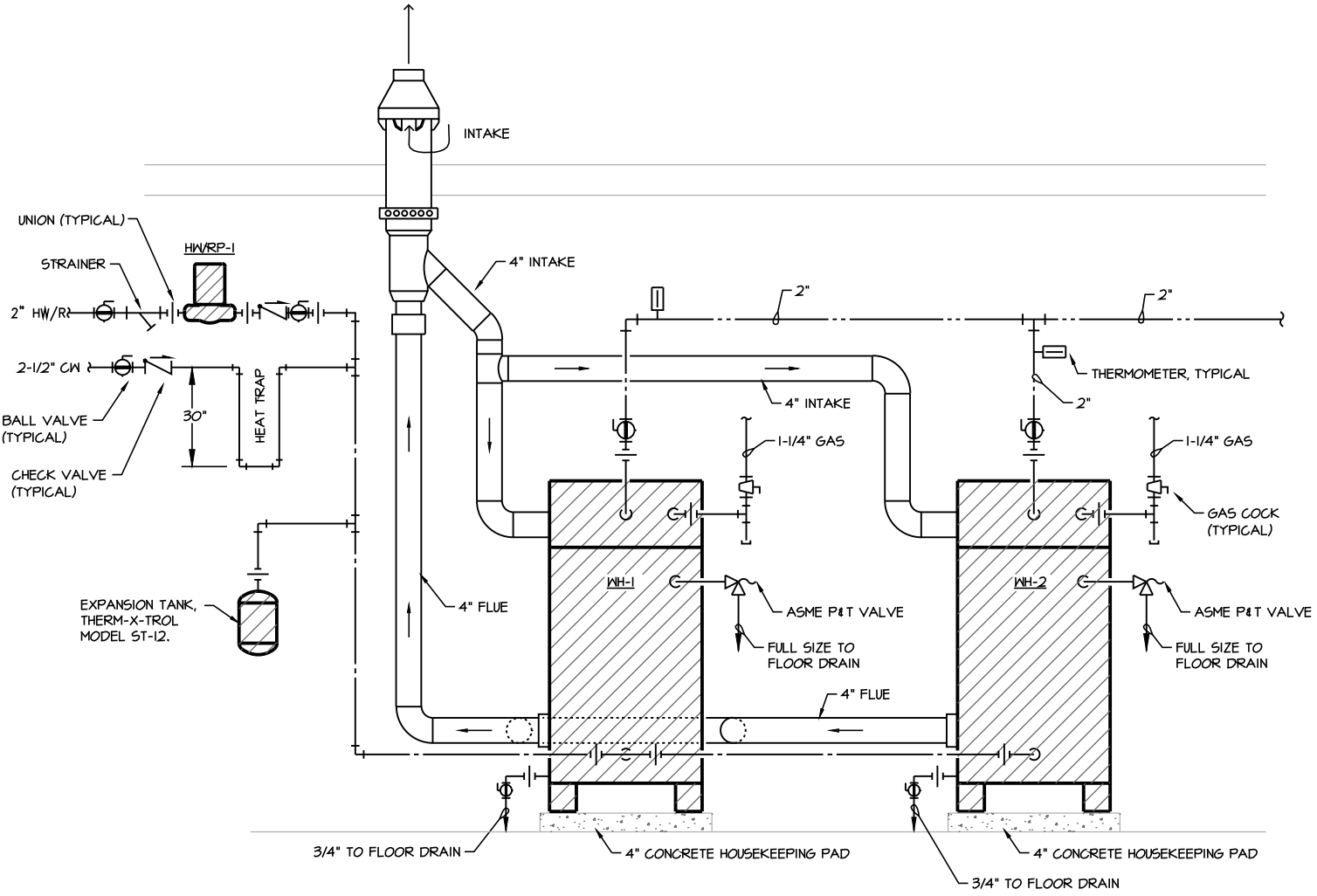

28 WATER HEATERS (WH-1, WH-2) DETAIL

SCALE: NONE

BALL VALVE

UNIVERSITY OF ARKANSAS

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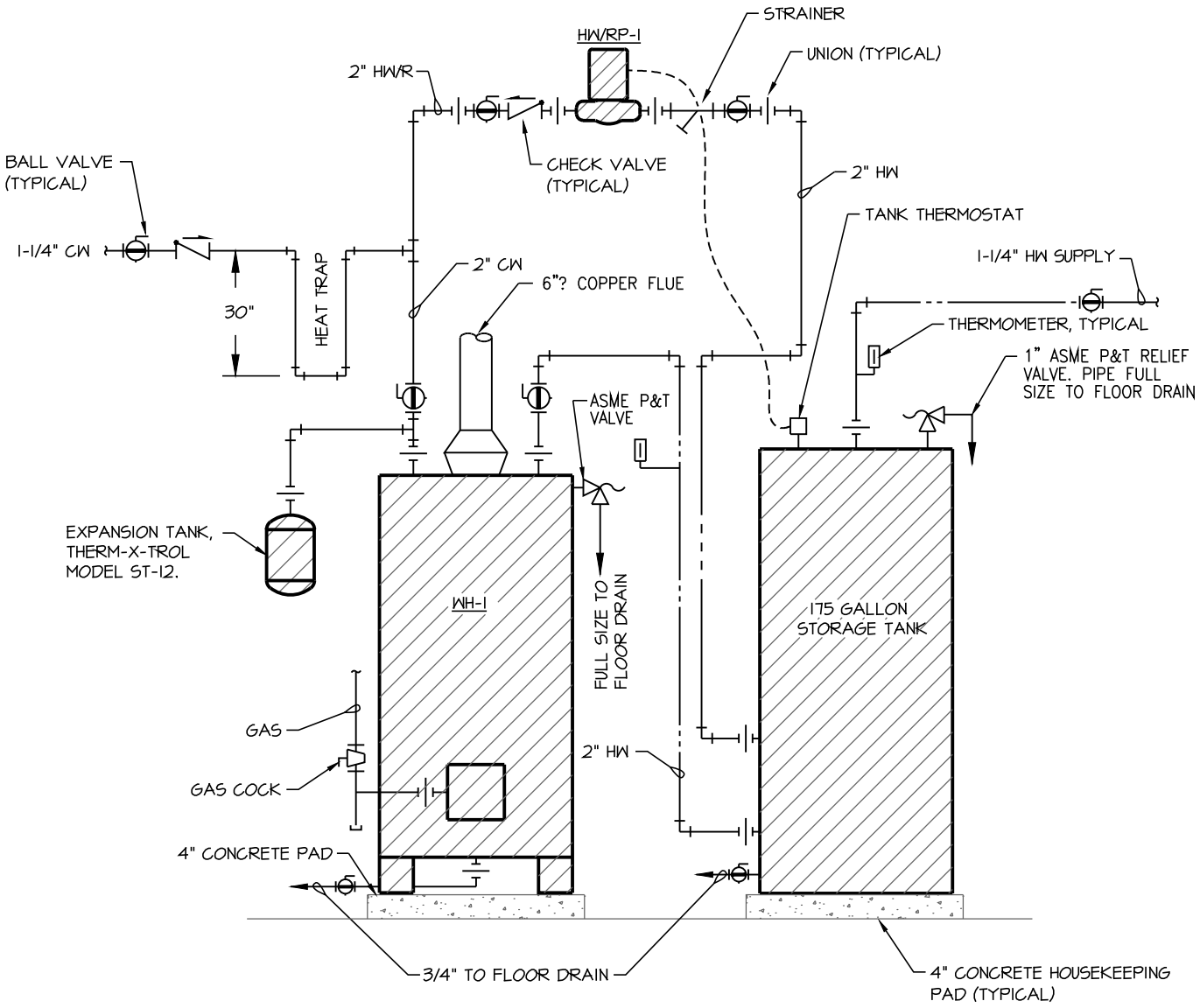

29 DOMESTIC WATER HEATER/STORAGE TANK DETAIL

SCALE: NONE

UNIVERSITY OF ARKANSAS

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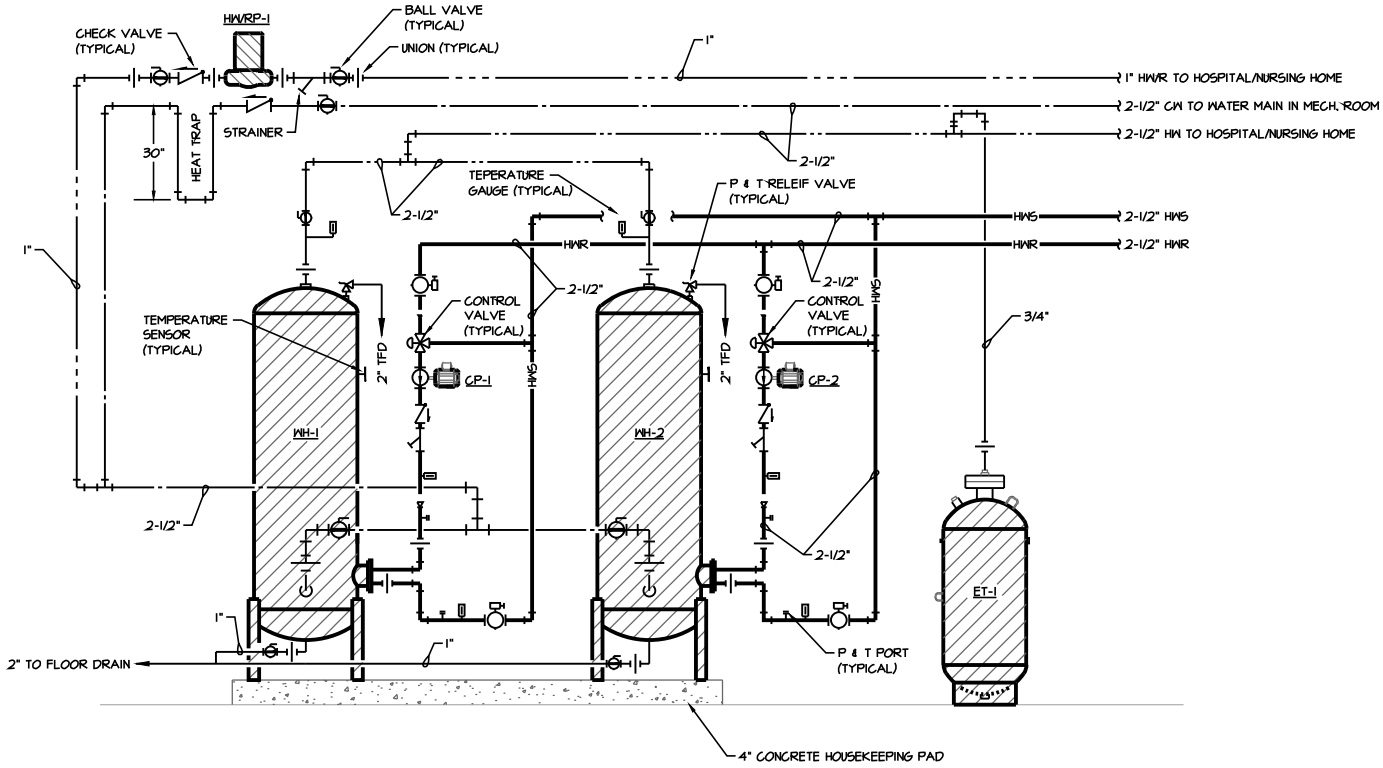

30 DOMESTIC WATER HEATER DETAIL and return control valve with temperature sensor

SCALE: NONE

UNIVERSITY OF ARKANSAS

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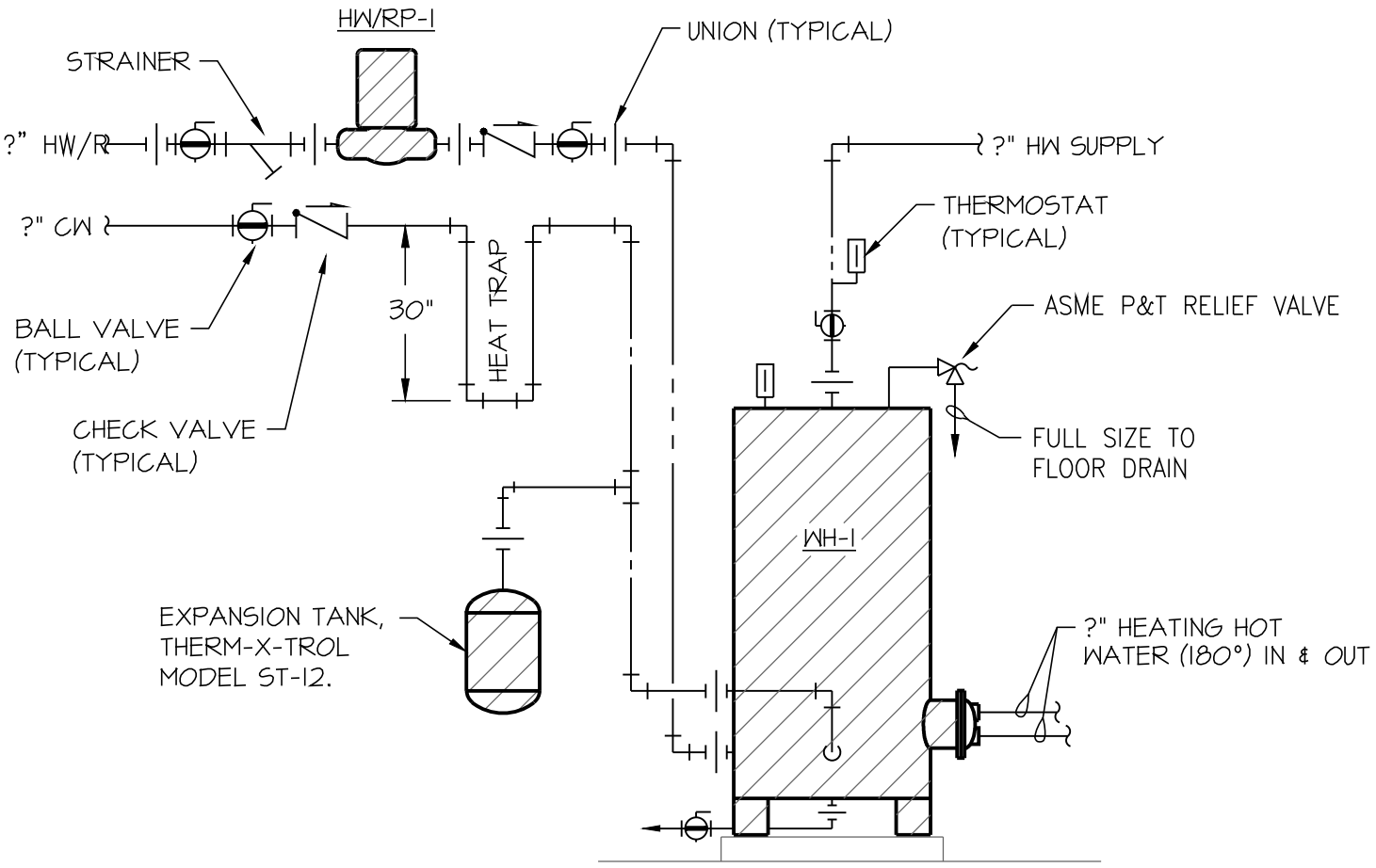

131 WATER HEATER DETAIL

SCALE: NONE

UNIVERSITY OF ARKANSAS

University of Arkansas at Fayetteville
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DATE: XX/XX/XX
SHEET NO:

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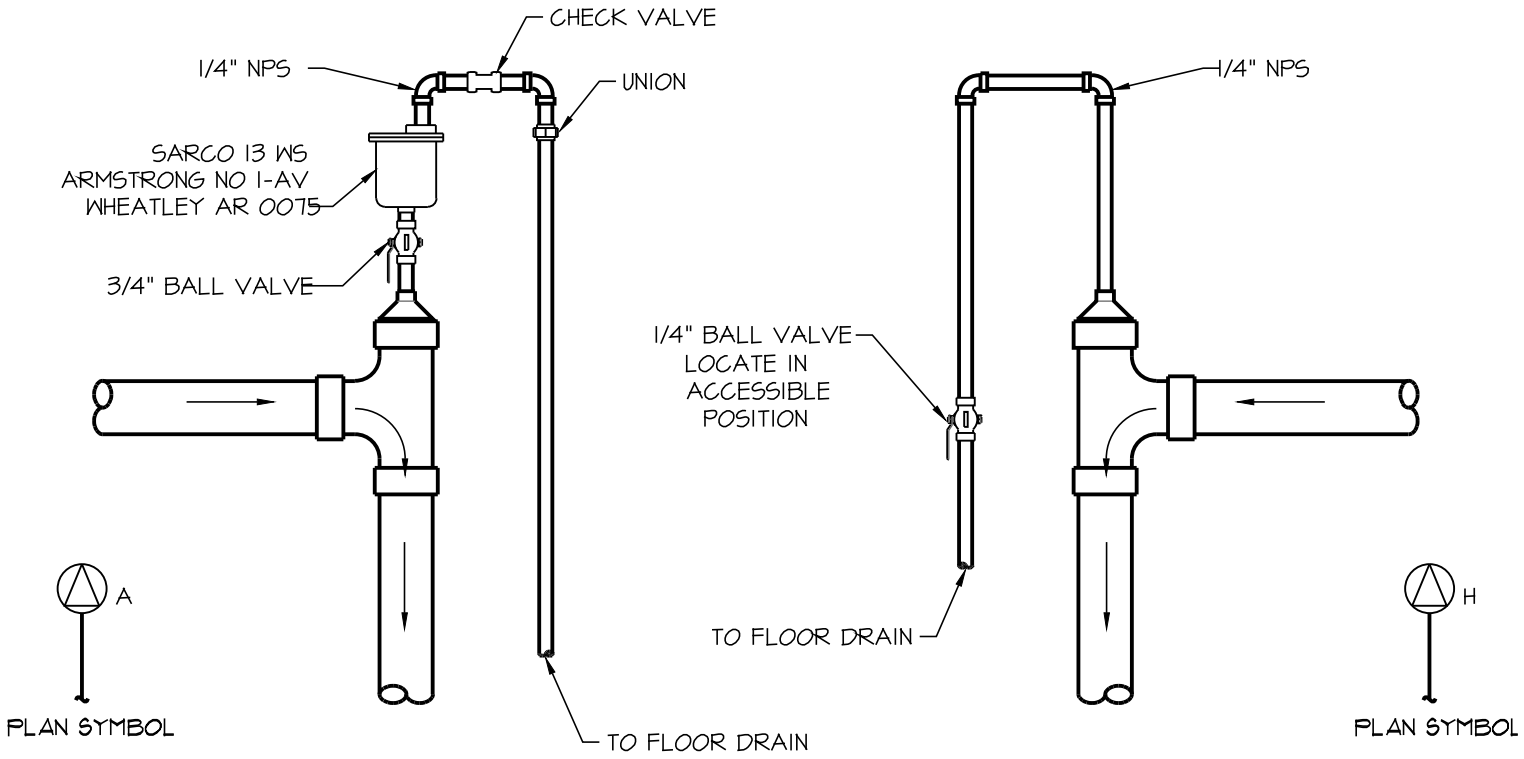
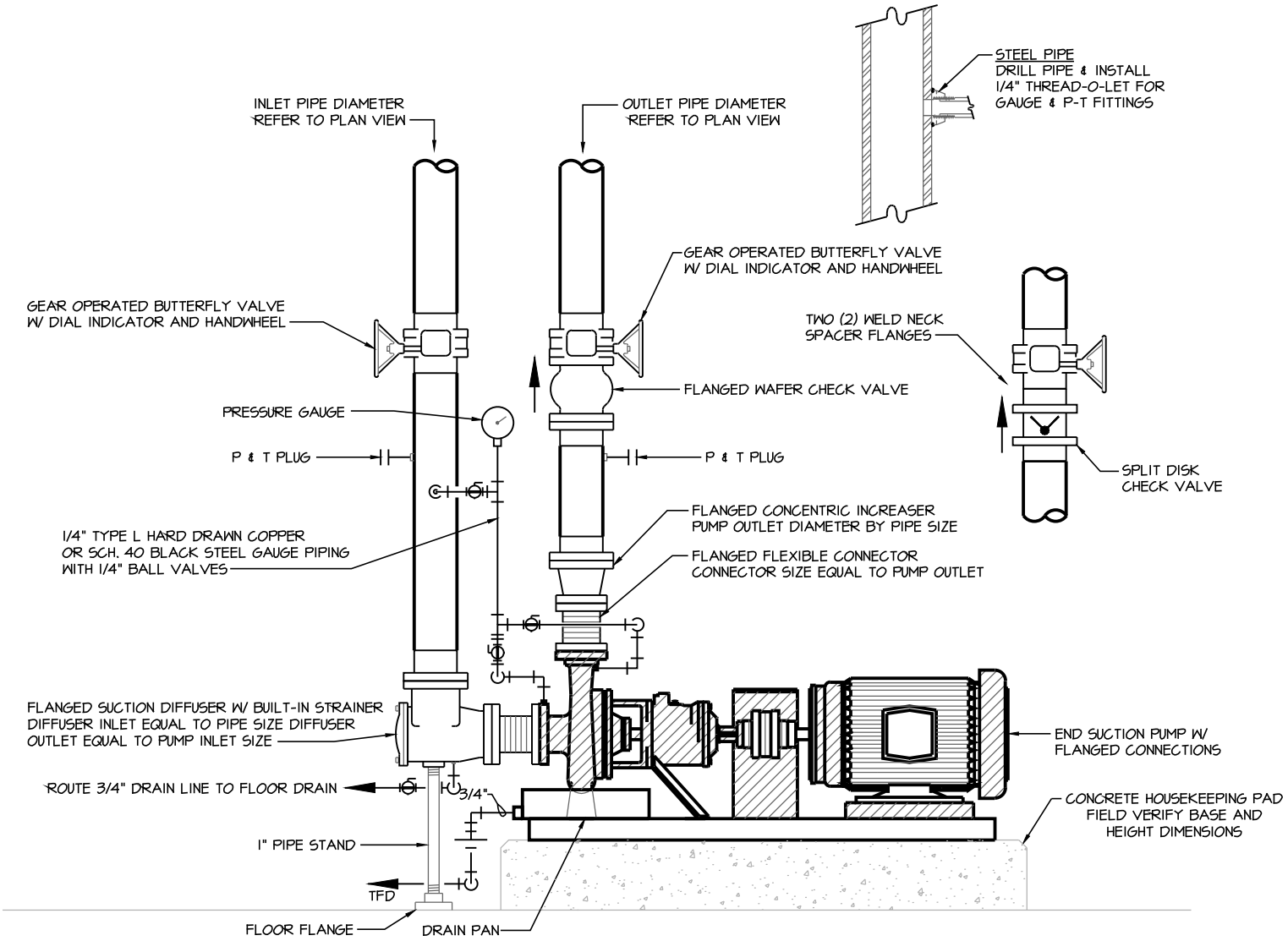


AUTOMATIC
AIR VENT

MANUAL OR HAND OPERATED
AIR VENT

32 AIR ELIMINATOR DETAIL

NOT TO SCALE



33 FLANGED END SUCTION PUMP PIPING DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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DATE: XX/XX/XX
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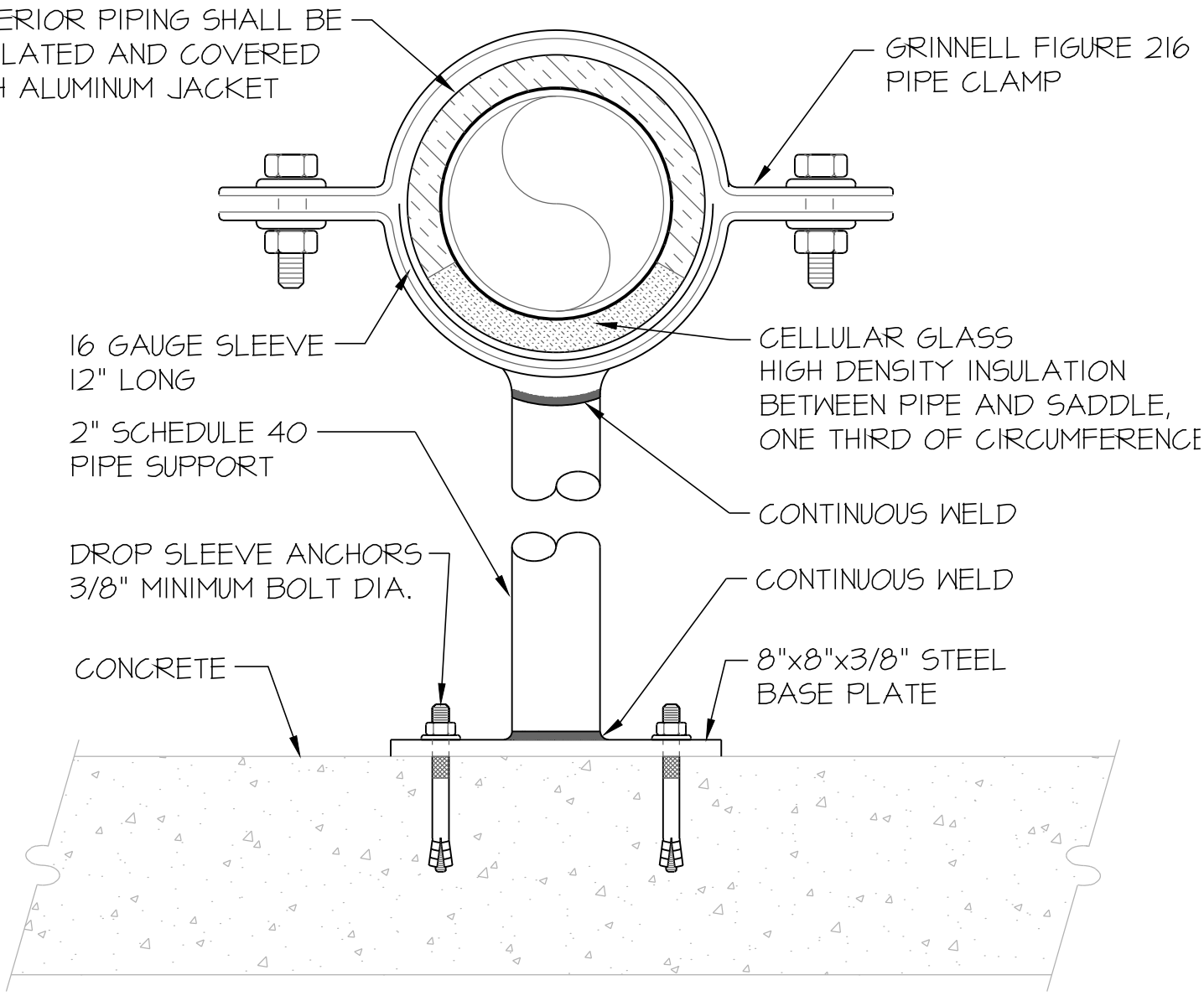

34 PIPE STANCHION DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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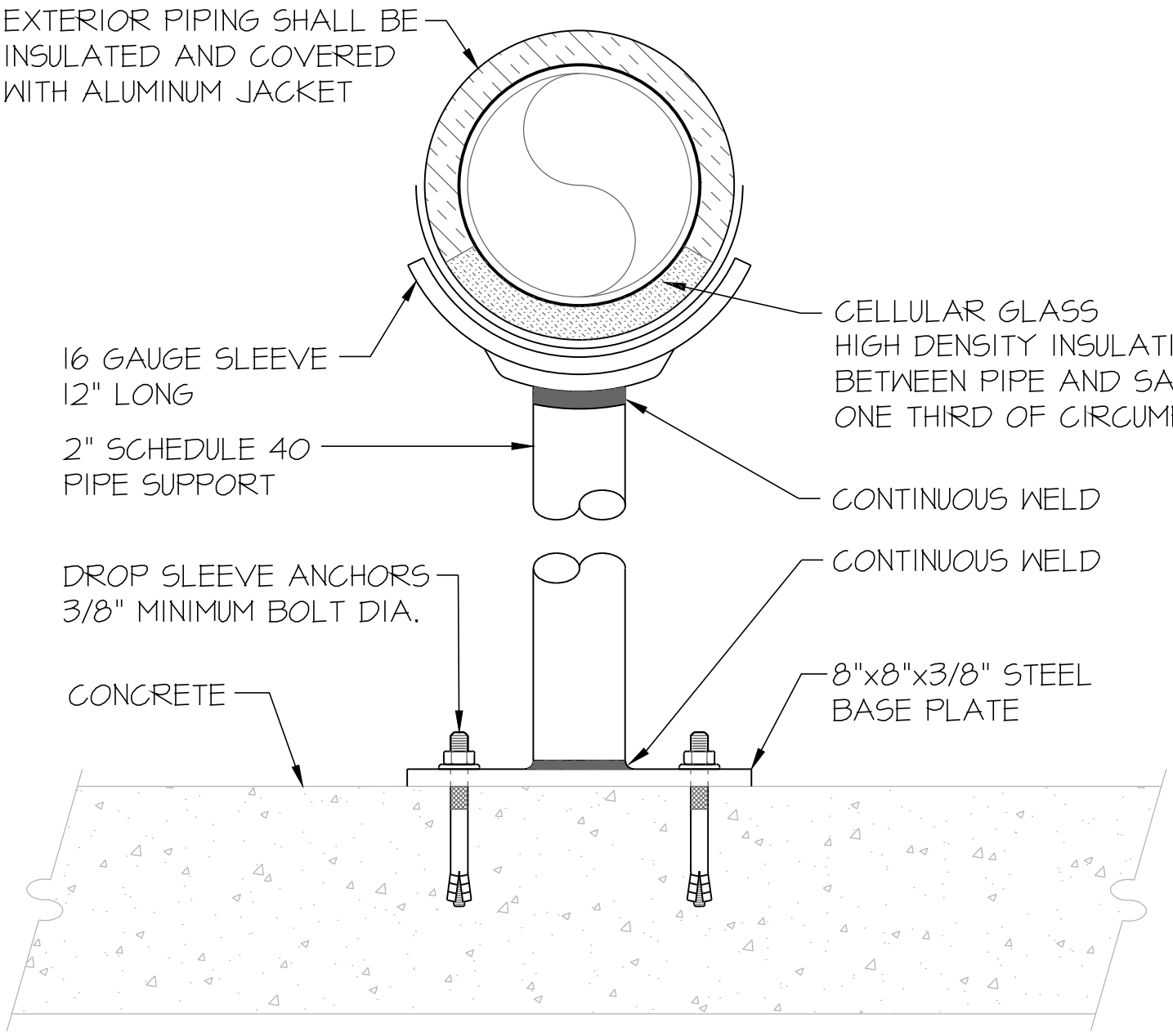

135 PIPE STANCHION DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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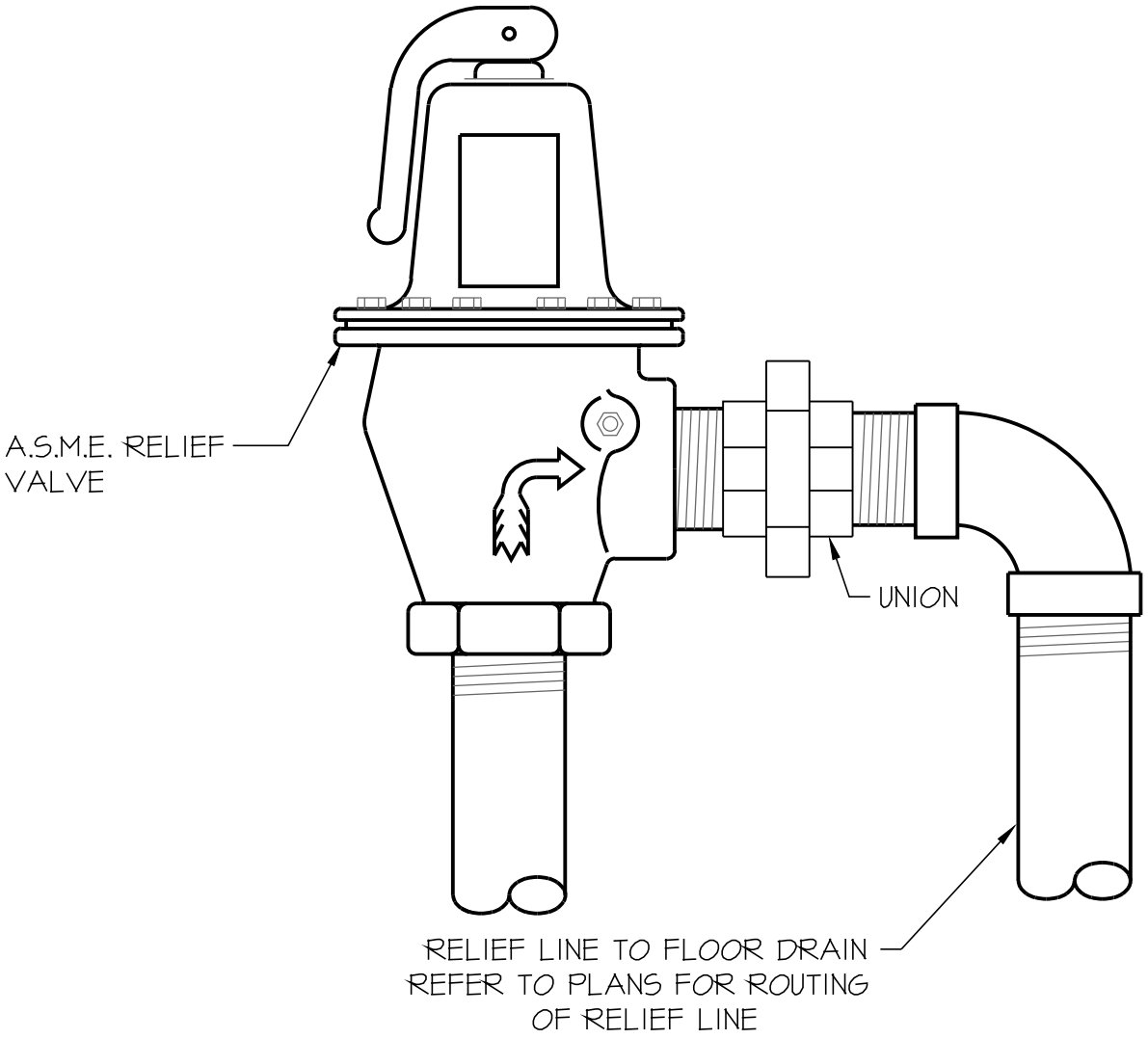

36 WATER RELIEF VALVE DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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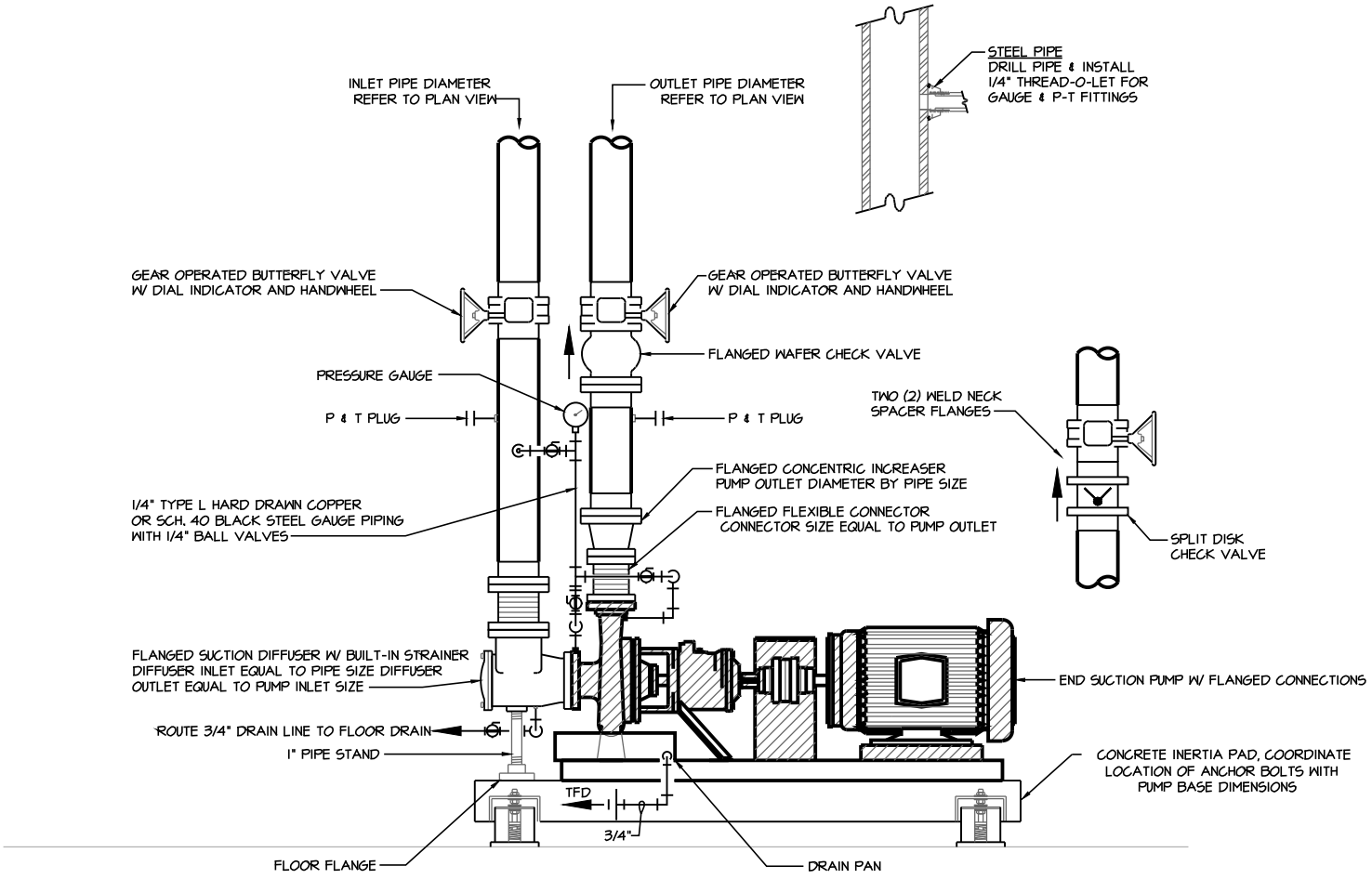

37 FLANGED END SUCTION PUMP WITH INERTIA BASE PIPING DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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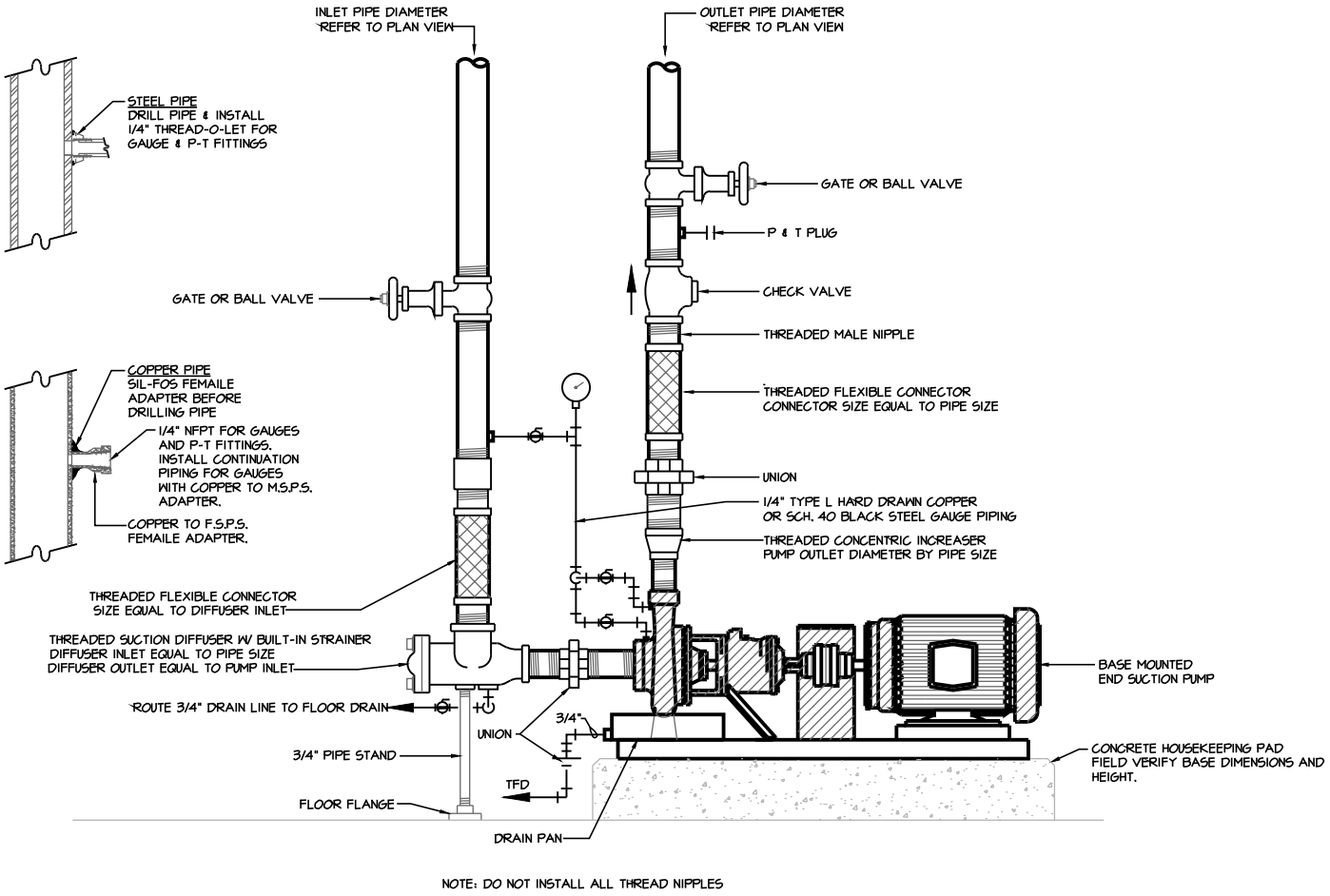

NOTE: DO NOT INSTALL ALL THREAD NIPPLES

38 BASE MOUNTED END SUCTION PUMP PIPING DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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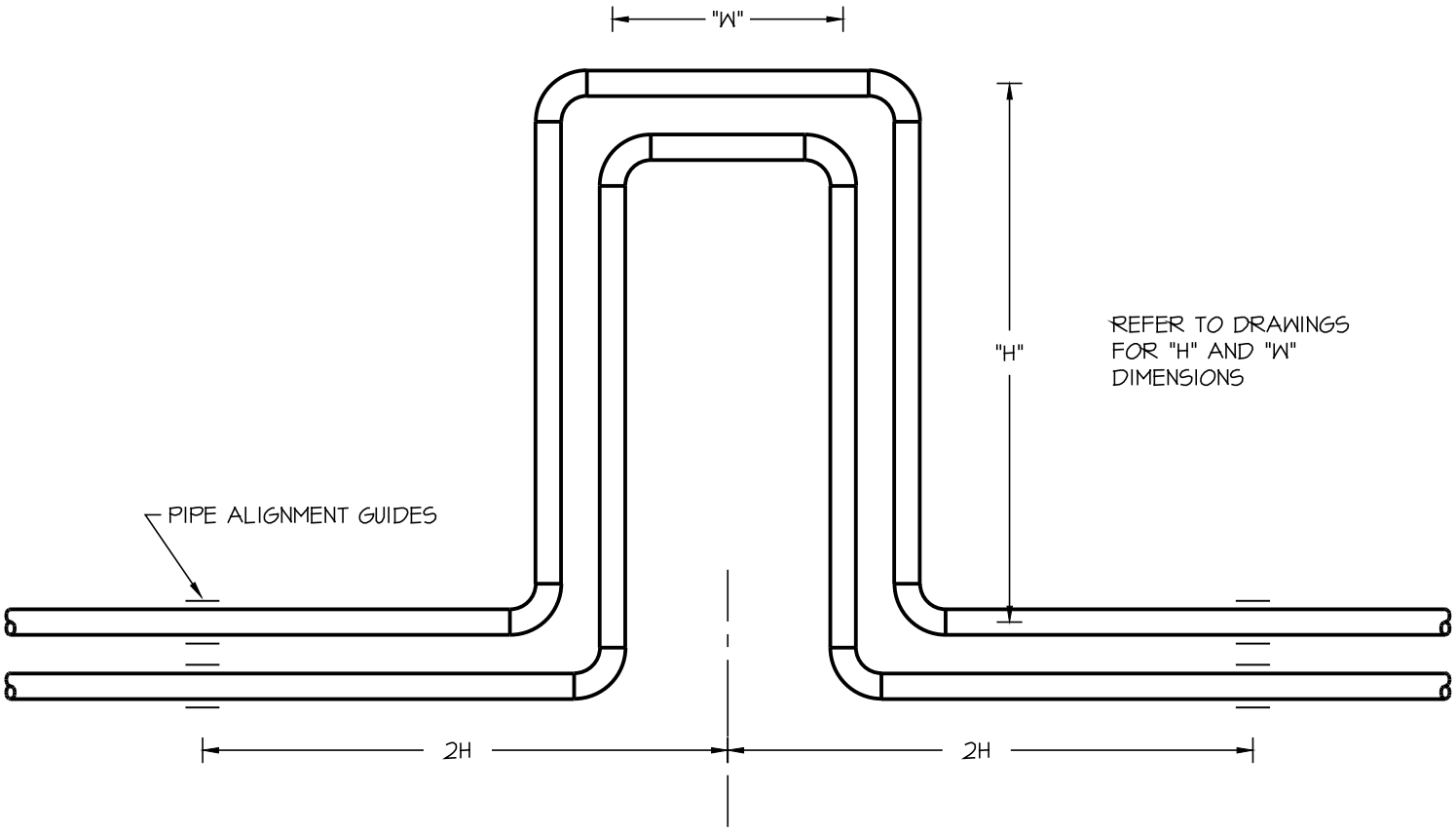

39 EXPANSION LOOP DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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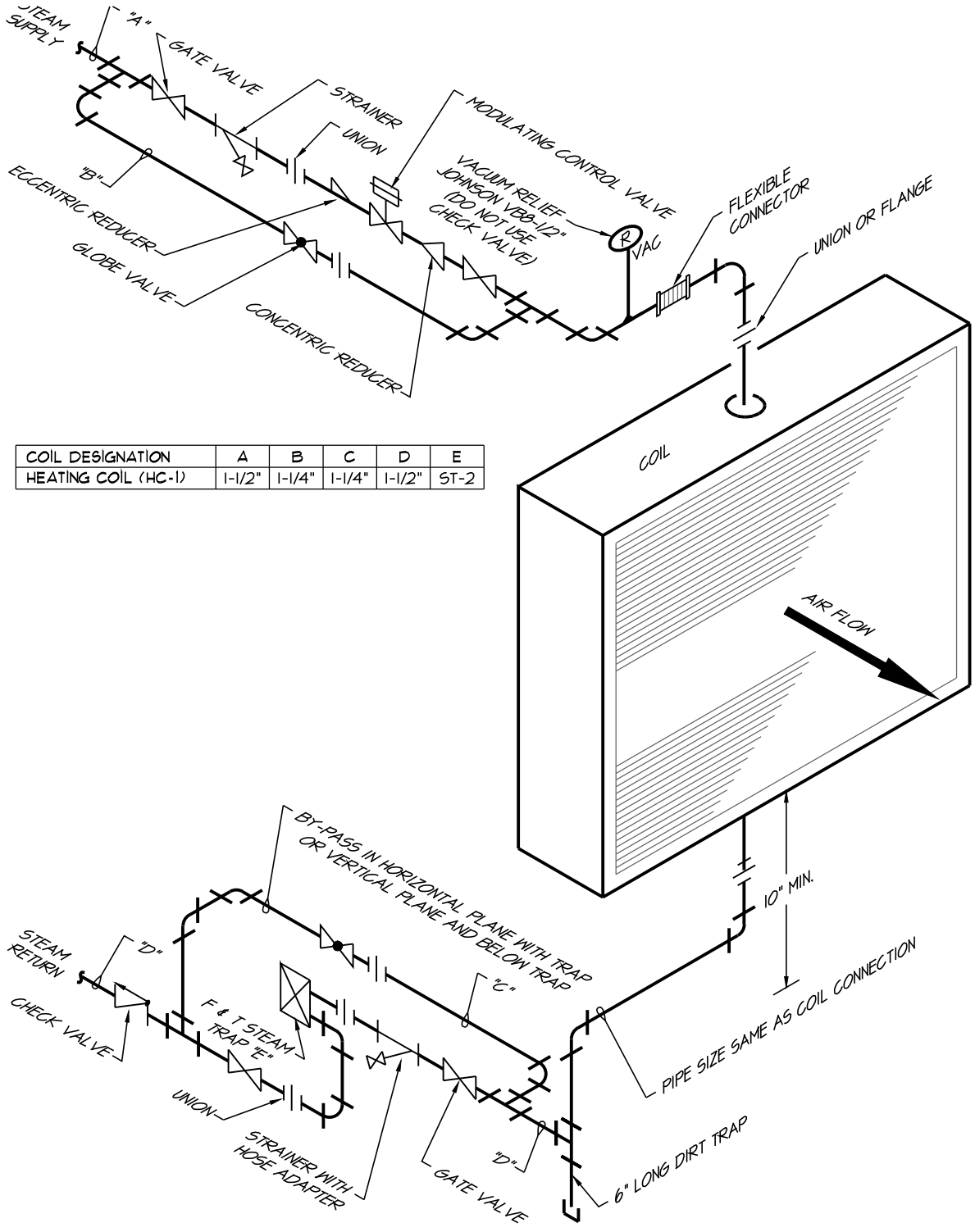

COIL DESIGNATION	A	B	C	D	E
HEATING COIL (HC-1)	1-1/2"	1-1/4"	1-1/4"	1-1/2"	ST-2

14 STEAM PREHEAT COIL PIPING DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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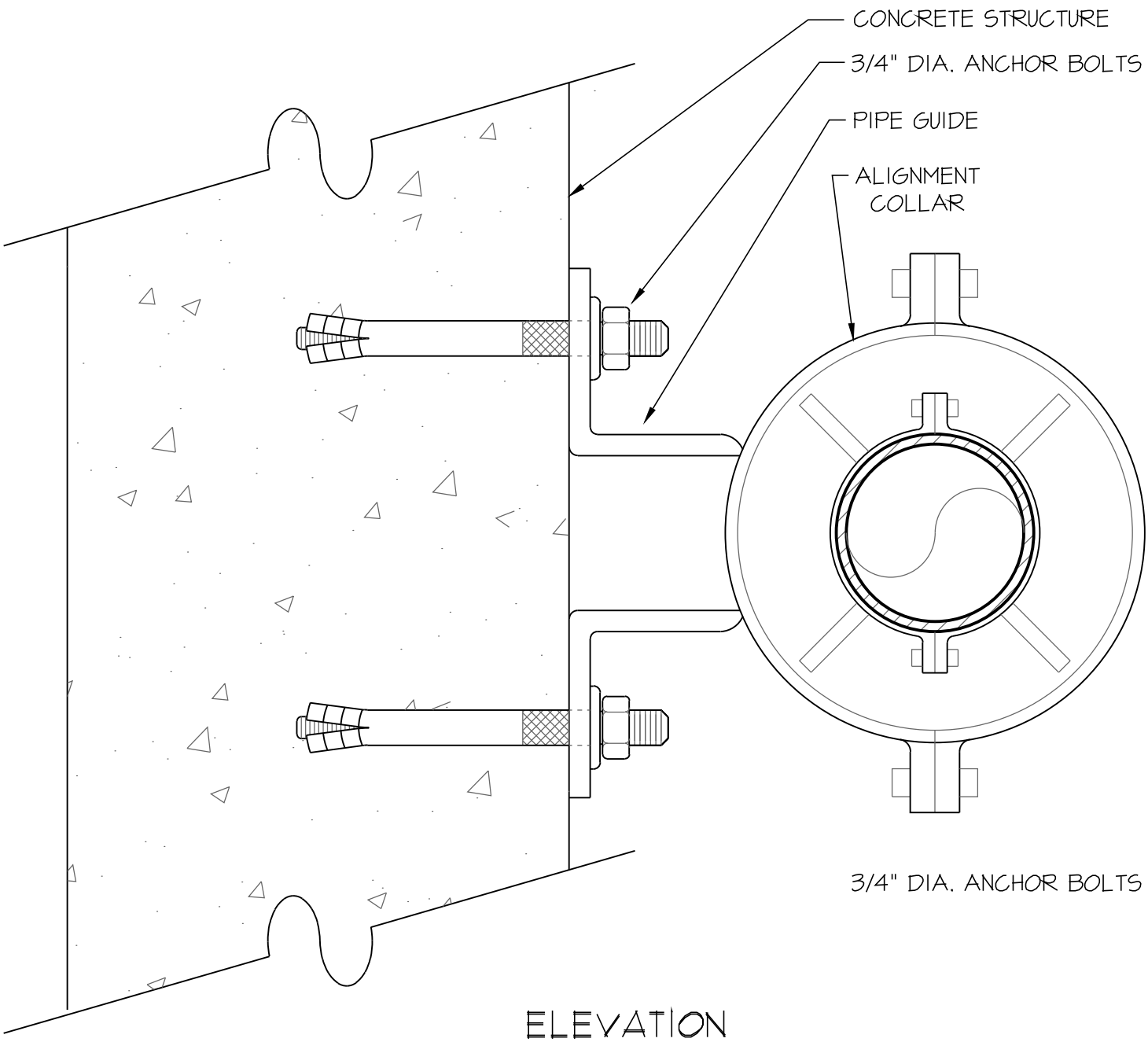

140 PIPE GUIDE DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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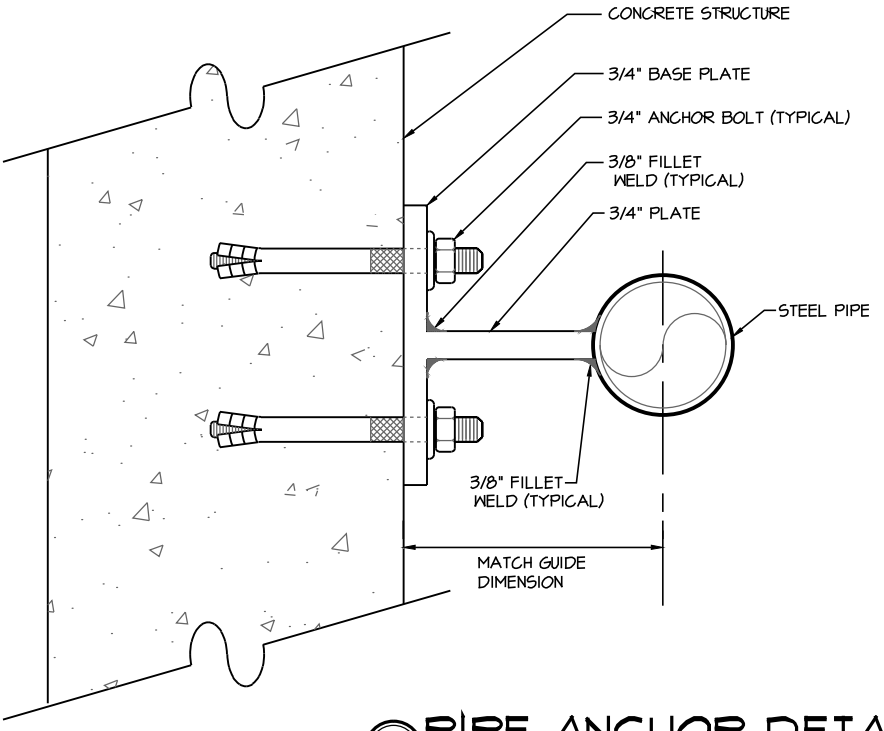
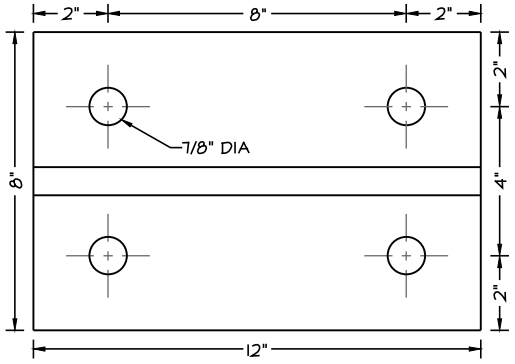
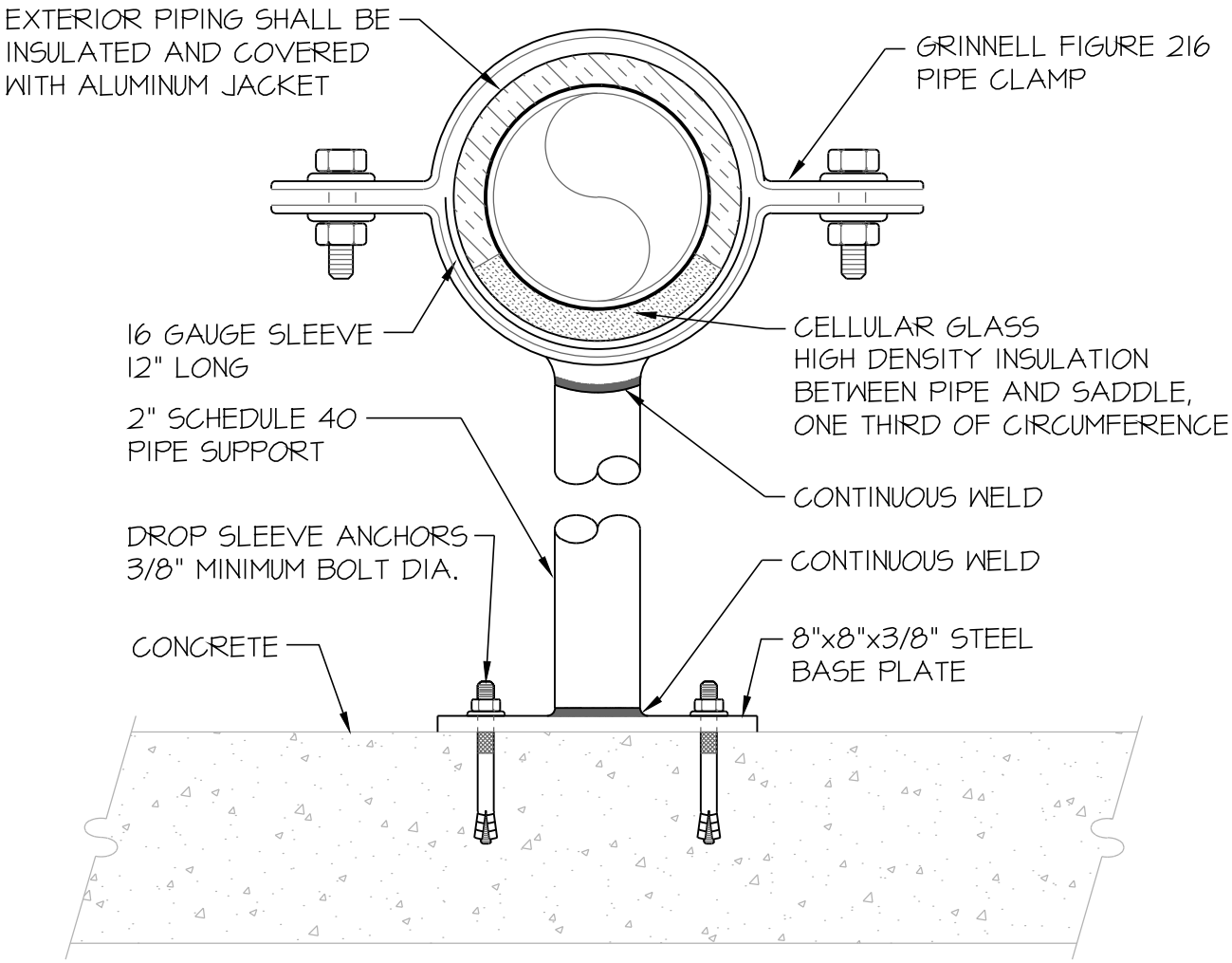




BASE PLATE (PLAN VIEW)

141 PIPE ANCHOR DETAIL

NOT TO SCALE



142 PIPE STANCHION DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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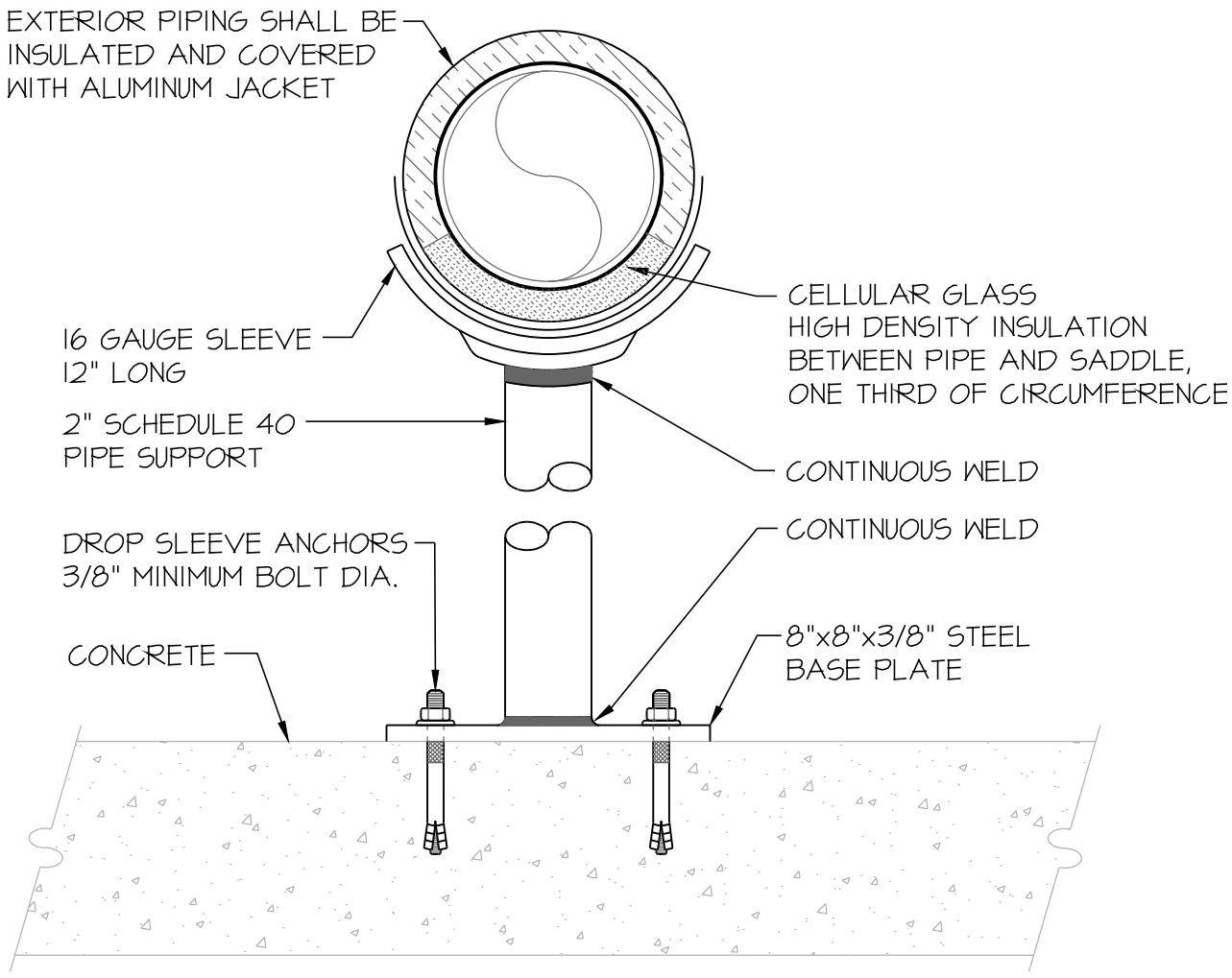
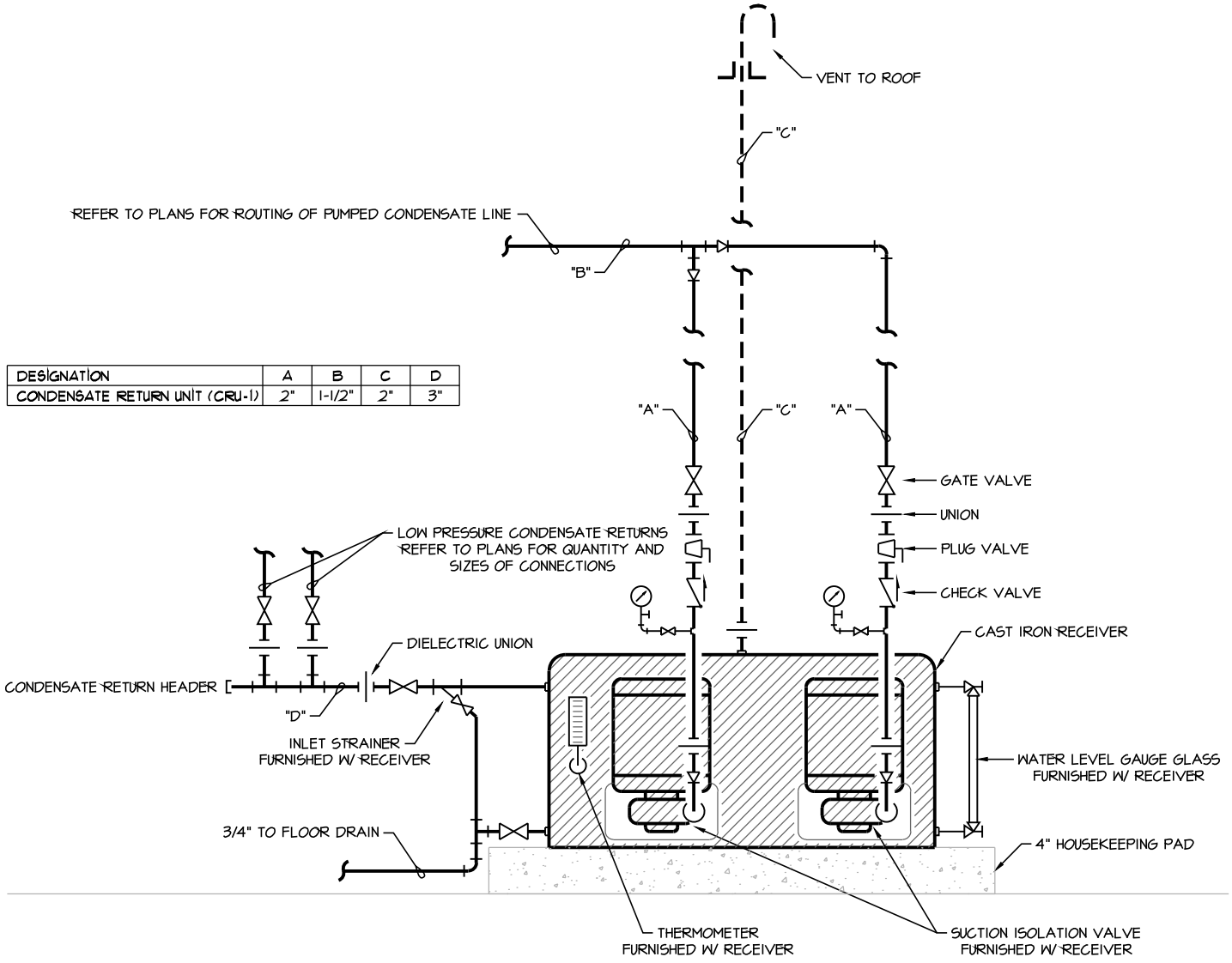


43 PIPE STANCHION DETAIL

NOT TO SCALE

DESIGNATION	A	B	C	D
CONDENSATE RETURN UNIT (CRU-1)	2"	1-1/2"	2"	3"



44 CONDENSATE RETURN PUMP PIPING DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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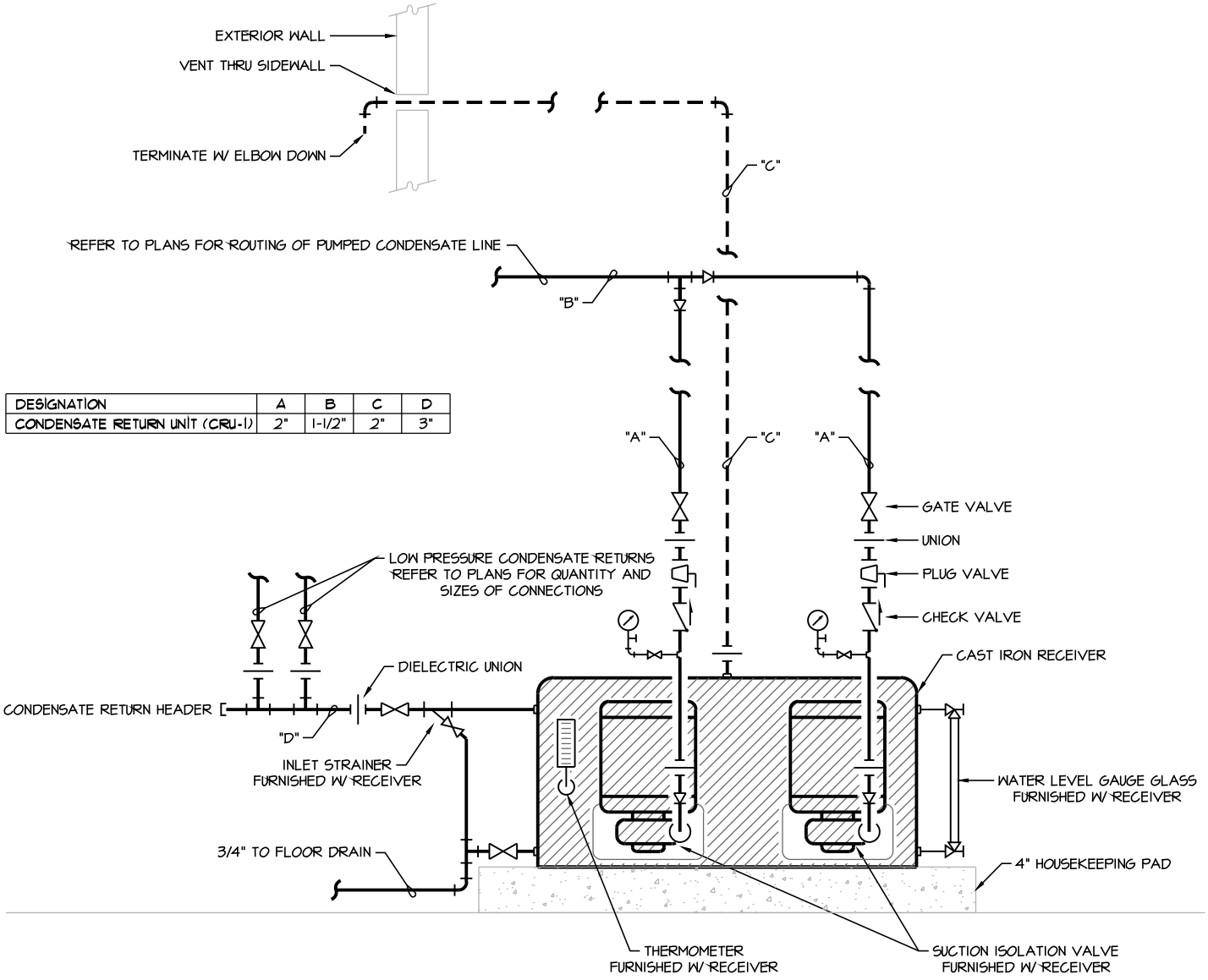

DESIGNATION	A	B	C	D
CONDENSATE RETURN UNIT (CRU-1)	2"	1-1/2"	2"	3"

45 CONDENSATE RETURN PUMP PIPING DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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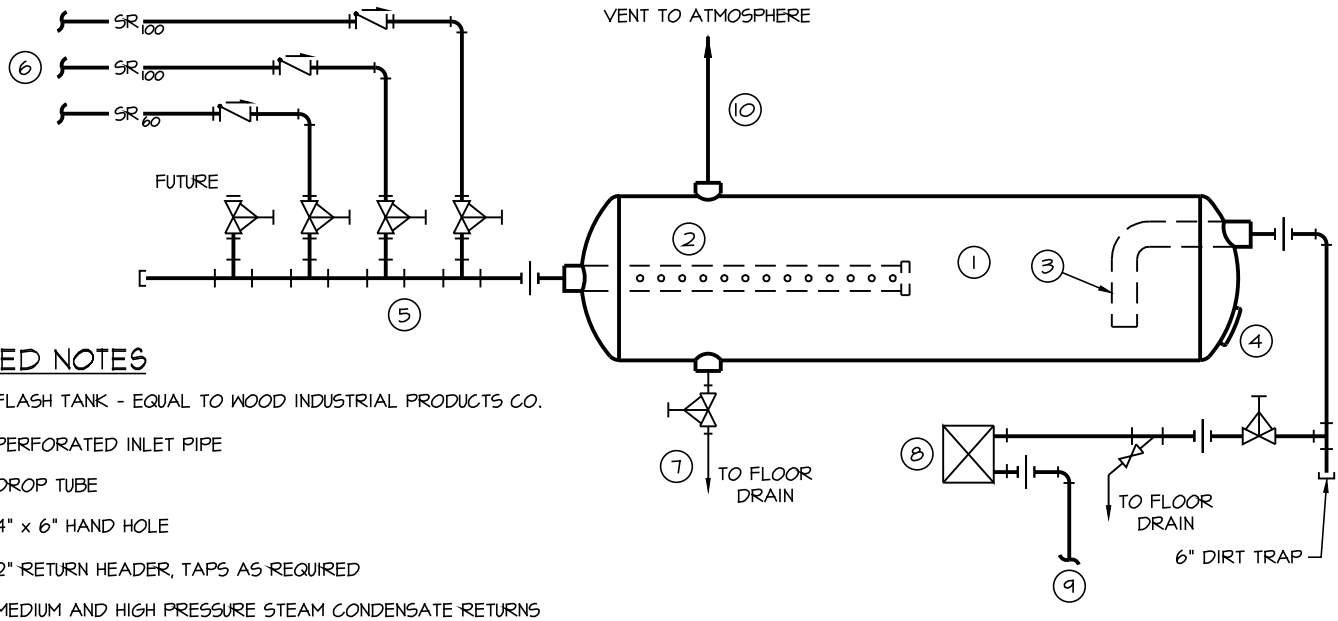
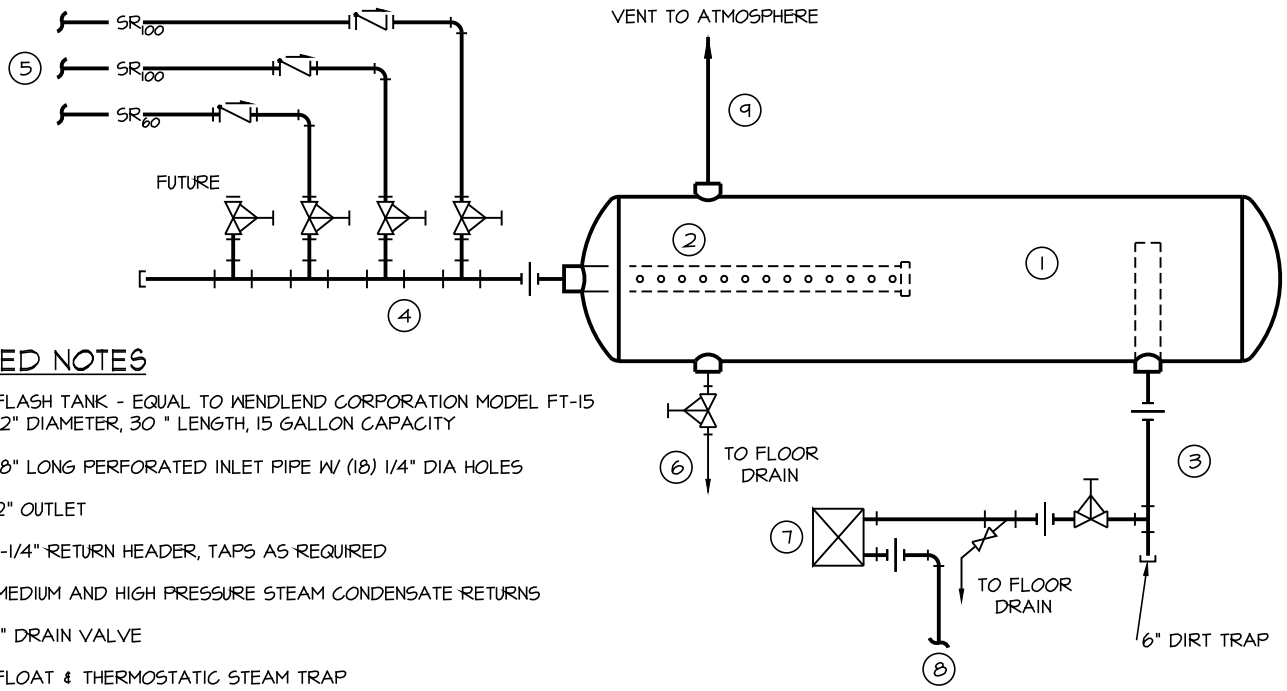


KEYED NOTES

1. FLASH TANK - EQUAL TO WOOD INDUSTRIAL PRODUCTS CO.
2. PERFORATED INLET PIPE
3. DROP TUBE
4. 4" x 6" HAND HOLE
5. 2" RETURN HEADER, TAPS AS REQUIRED
6. MEDIUM AND HIGH PRESSURE STEAM CONDENSATE RETURNS
7. 1" DRAIN VALVE
8. FLOAT & THERMOSTATIC STEAM TRAP
9. TO CONDENSATE RETURN UNIT
10. 2" VENT THRU ROOF

46 FLASH TANK PIPING DETAIL

NOT TO SCALE



KEYED NOTES

1. FLASH TANK - EQUAL TO WENDLEND CORPORATION MODEL FT-15 12" DIAMETER, 30 " LENGTH, 15 GALLON CAPACITY
2. 18" LONG PERFORATED INLET PIPE W/ (18) 1/4" DIA HOLES
3. 2" OUTLET
4. 1-1/4" RETURN HEADER, TAPS AS REQUIRED
5. MEDIUM AND HIGH PRESSURE STEAM CONDENSATE RETURNS
6. 1" DRAIN VALVE
7. FLOAT & THERMOSTATIC STEAM TRAP
8. TO CONDENSATE RETURN UNIT
9. 2" VENT THRU ROOF

47 FLASH TANK PIPING DETAIL

NOT TO SCALE

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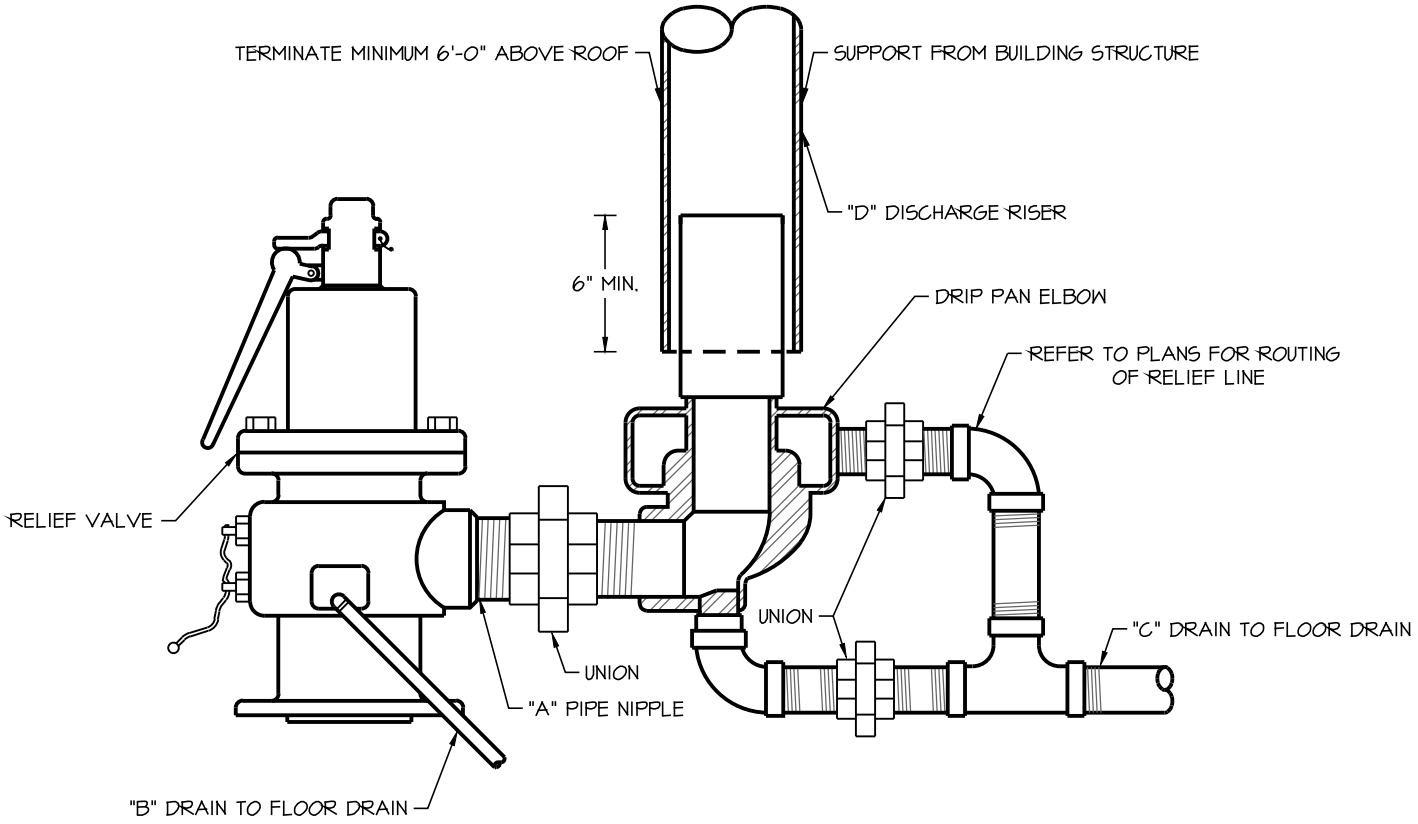

DESIGNATION	A	B	C	D
RELIEF VALVE (RV-1)	3/4"	1/2"	3/4"	1"

48 STEAM RELIEF VALVE W/ DRIP PAN ELBOW DETAIL

NOT TO SCALE

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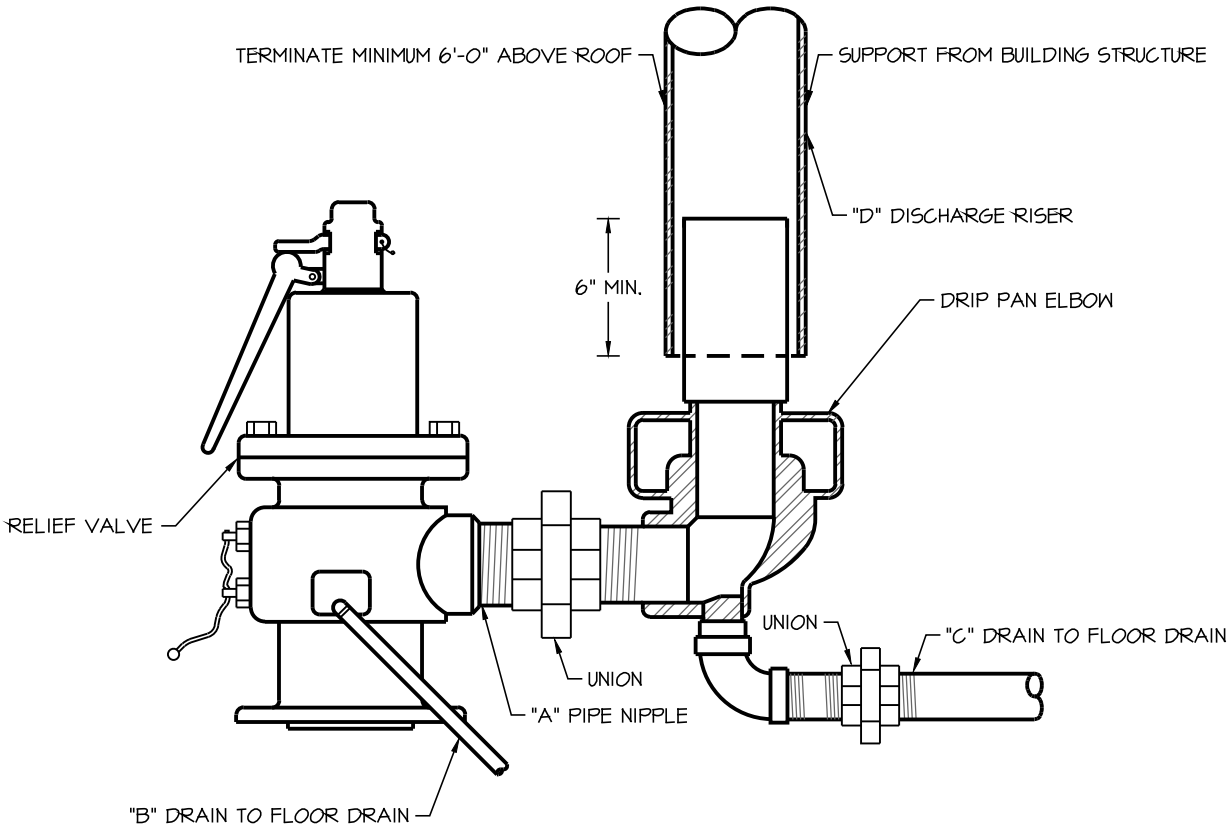
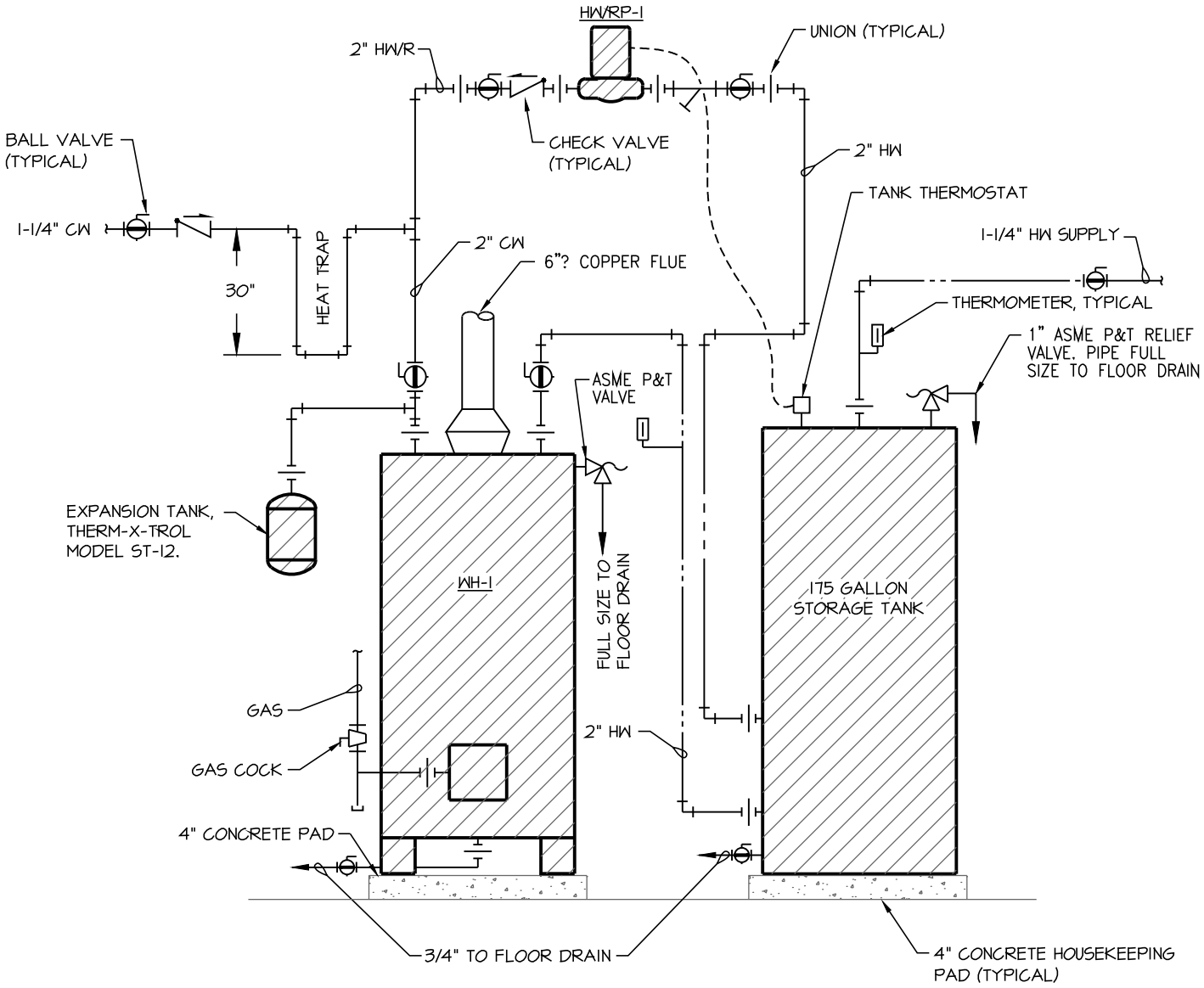


DESIGNATION	A	B	C	D
RELIEF VALVE (RV-1)	3/4"	1/2"	3/4"	1"

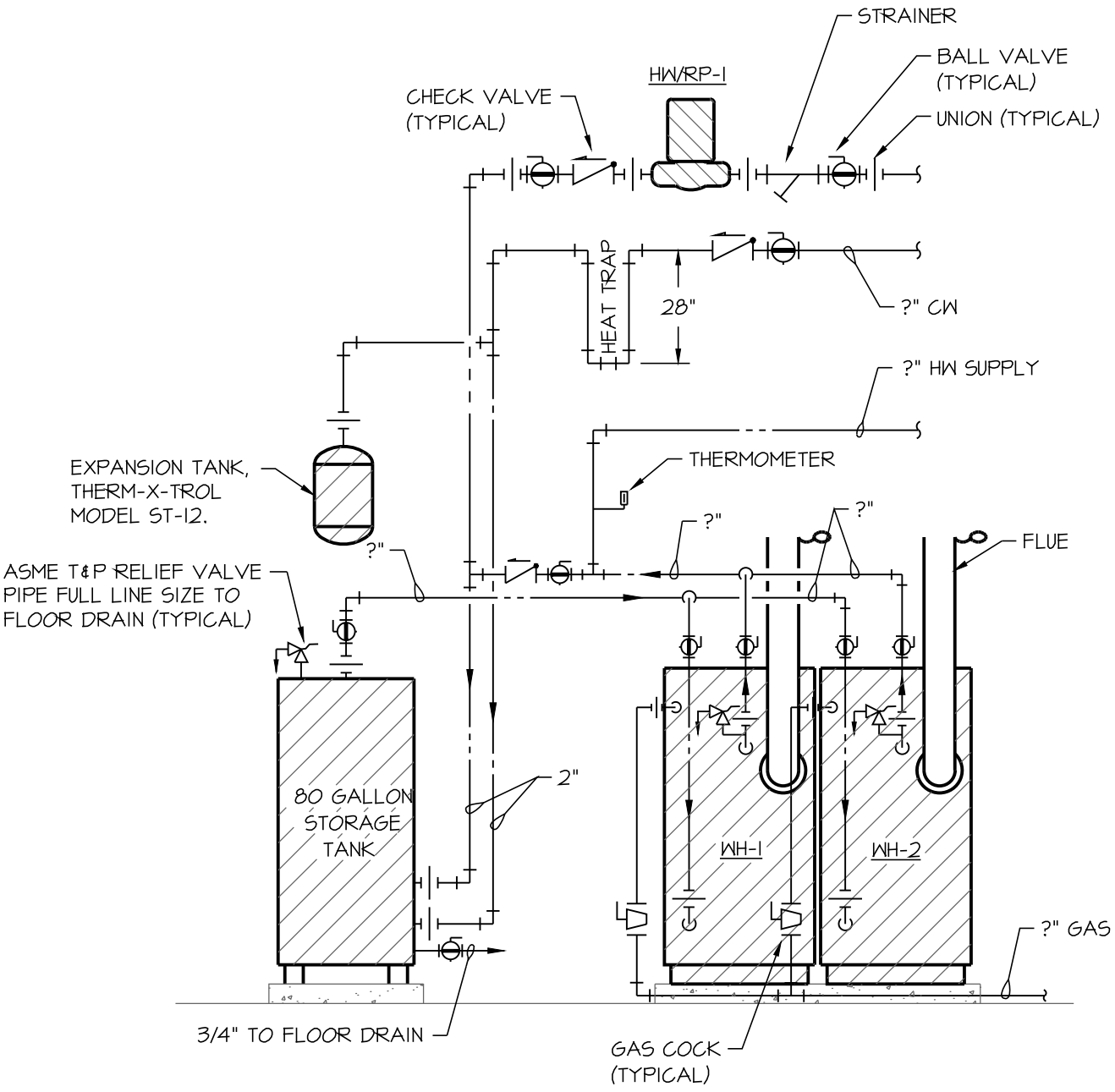
49 STEAM RELIEF VALVE W/ DRIP PAN ELBOW DETAIL

NOT TO SCALE



150 DOMESTIC WATER HEATER/STORAGE TANK DETAI

SCALE: NONE



151 DOMESTIC WATER HEATER DETAIL

SCALE: NONE

UNIVERSITY OF ARKANSAS

University of Arkansas at Fayetteville
Design Guide Details

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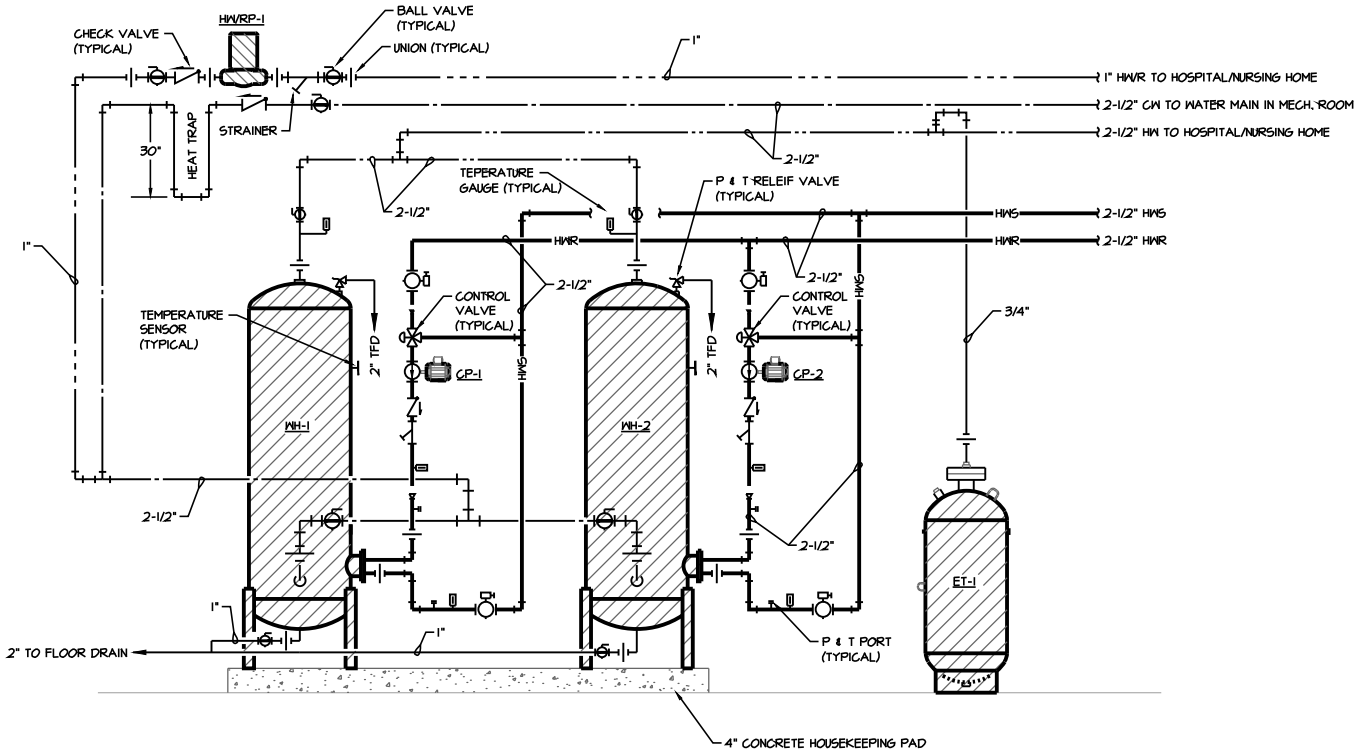

52 DOMESTIC WATER HEATER DETAIL and return control valve with temperature sensor
SCALE: NONE

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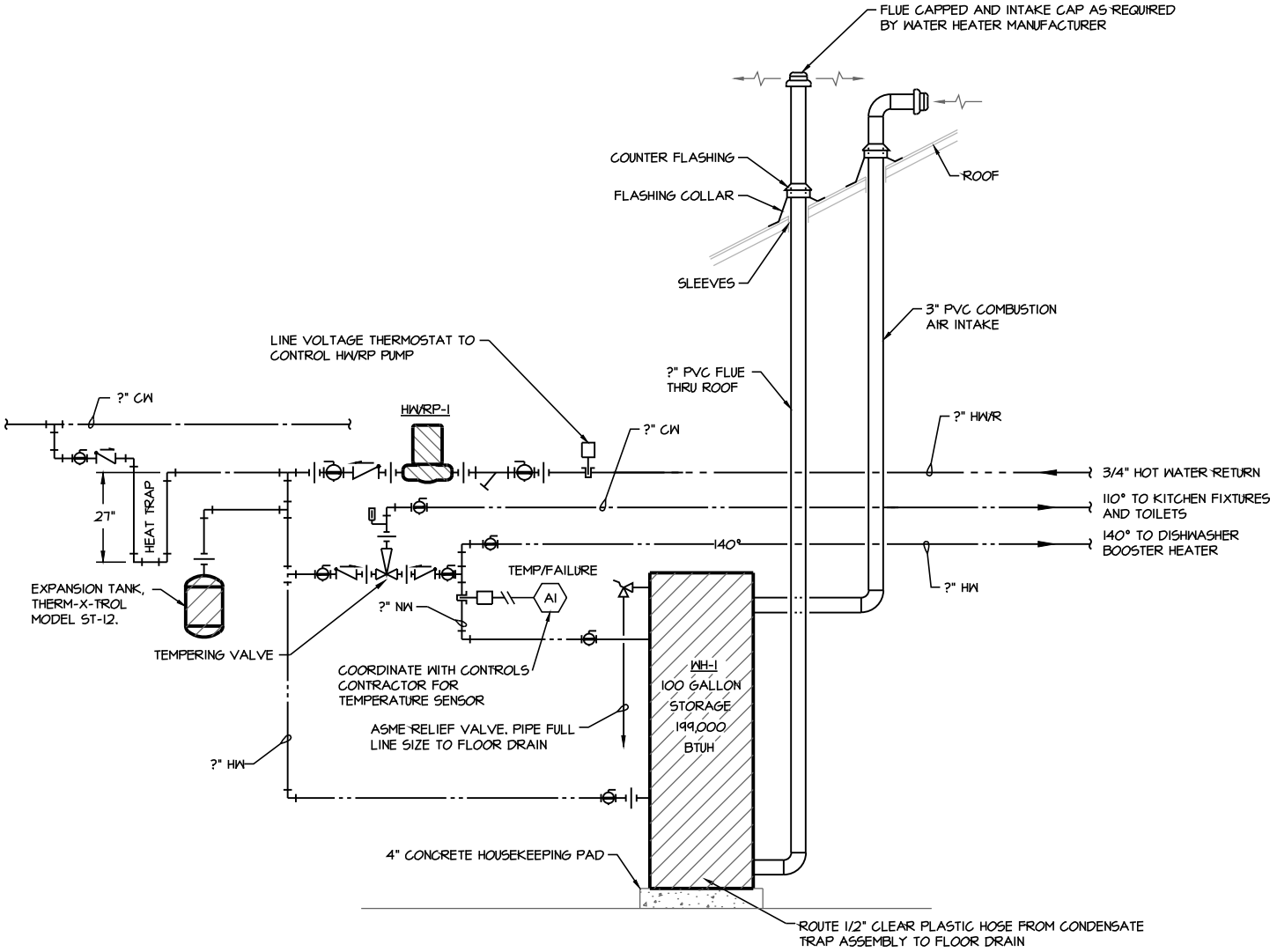

53 DOMESTIC WATER HEATER DETAIL

SCALE: NONE

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DATE: XX/XX/XX

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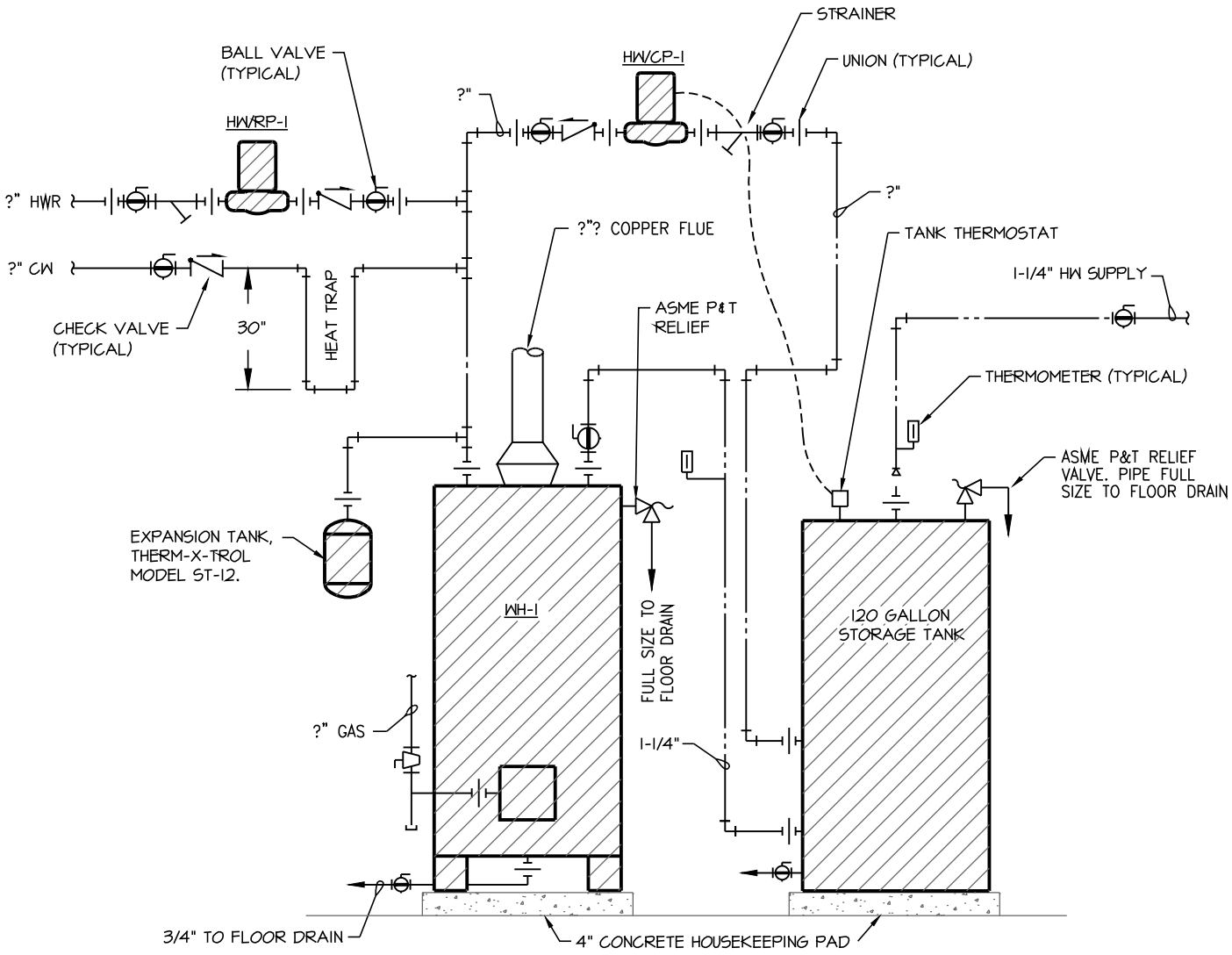

54 DOMESTIC WATER HEATER DETAIL

SCALE: NONE

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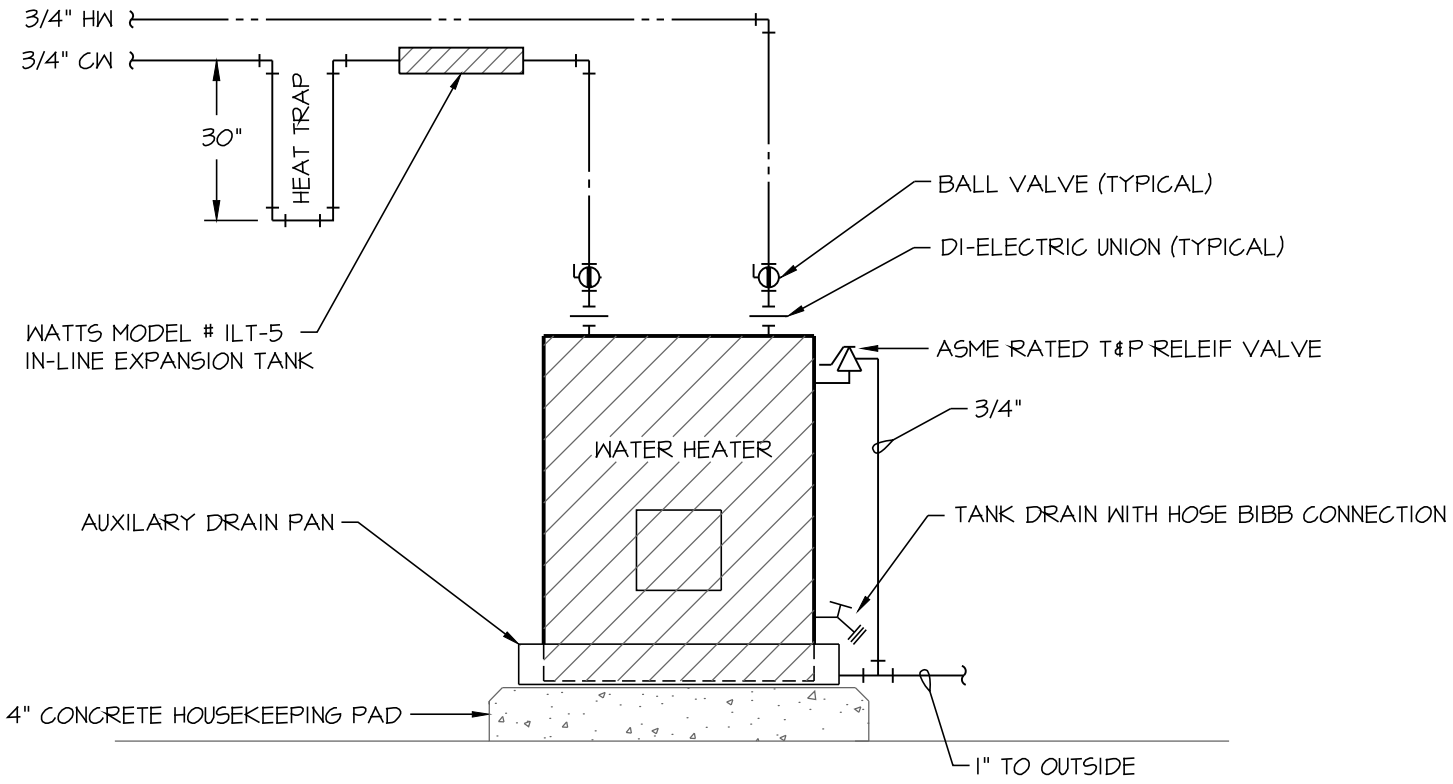

55 DOMESTIC WATER HEATER DETAIL

SCALE: NONE

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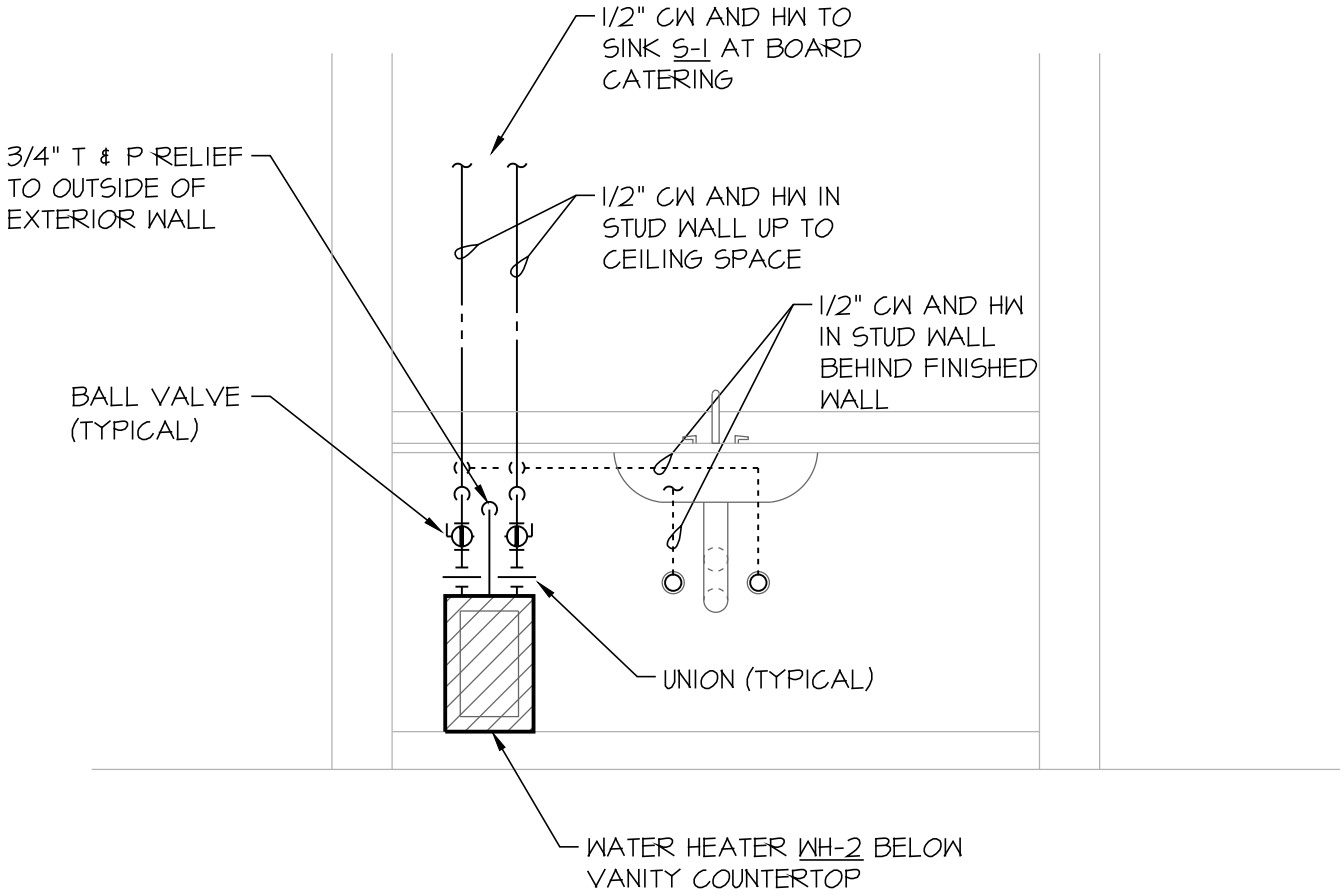

56 WATER HEATER (WH-2) DETAIL

SCALE: NONE

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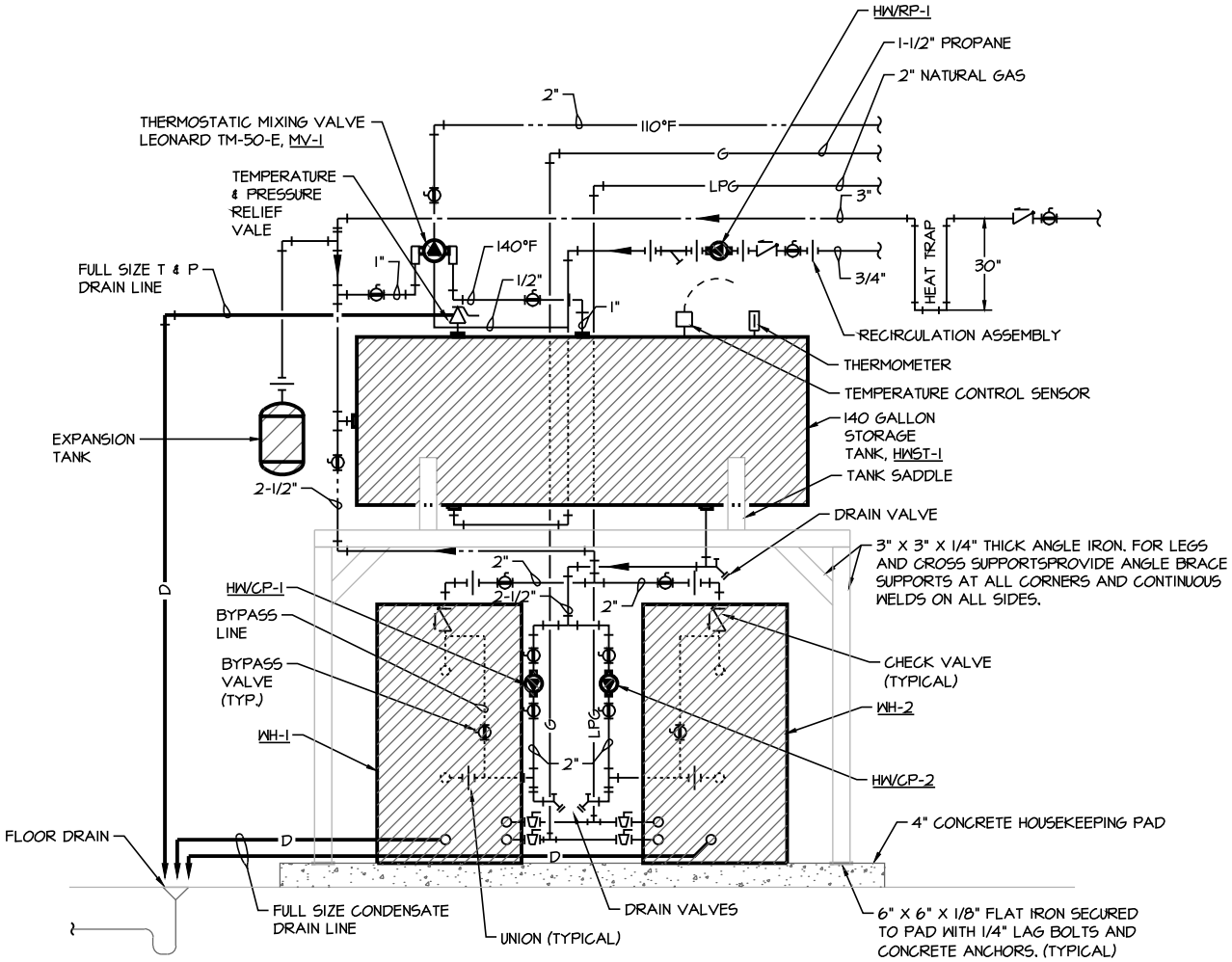

57 DOMESTIC WATER HEATER DETAIL and return pump detail

SCALE: NOT TO SCALE

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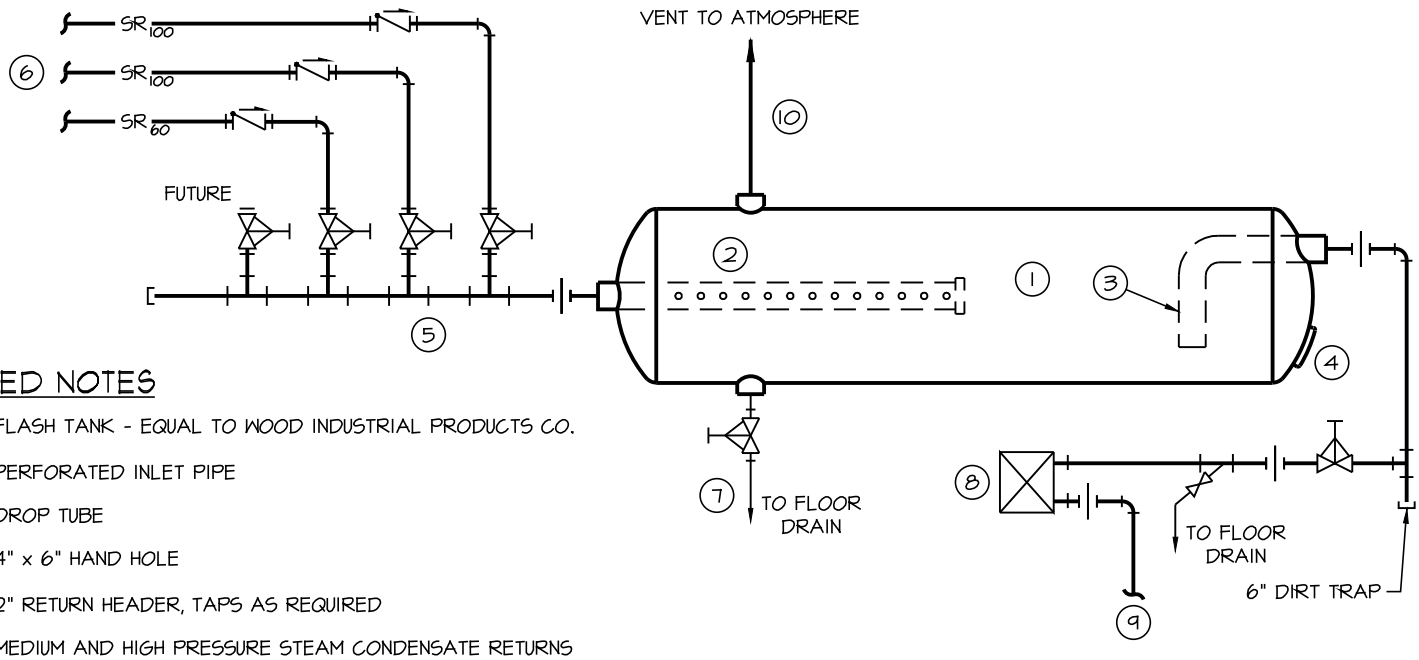
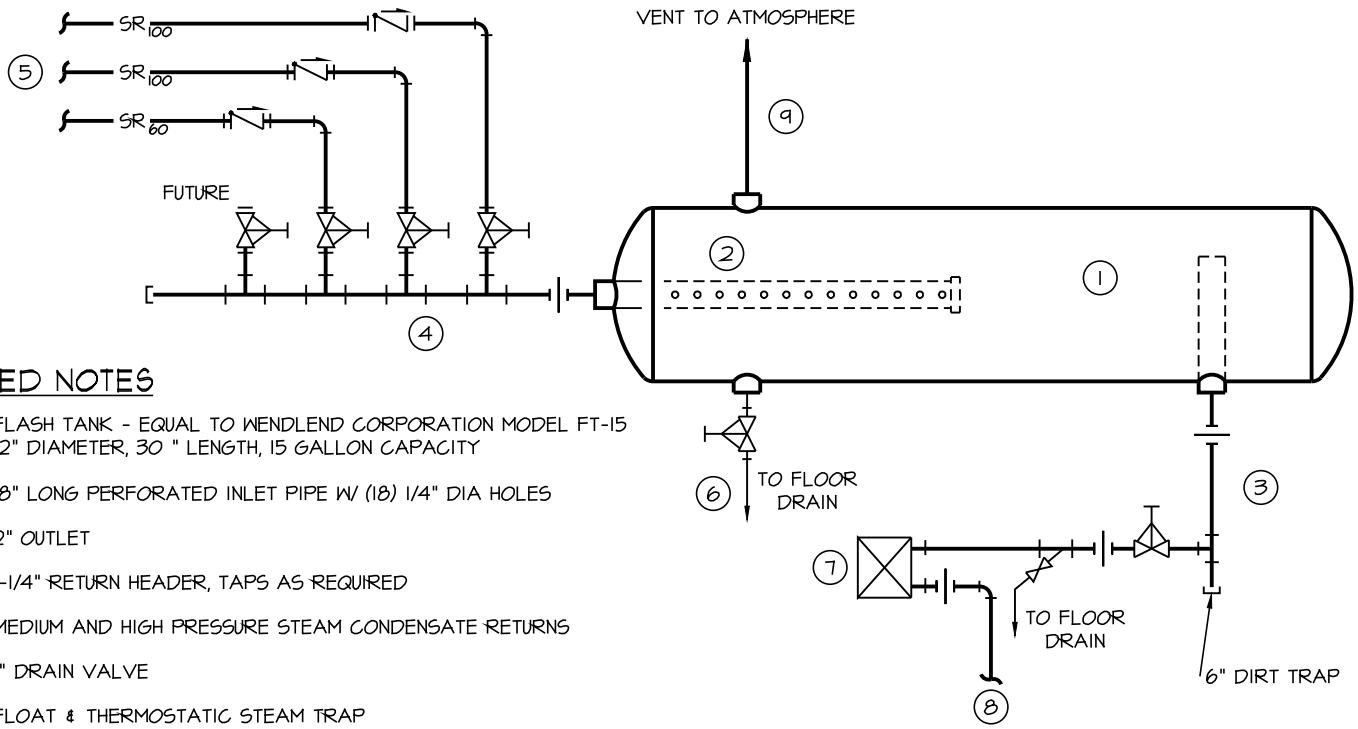


KEYED NOTES

1. FLASH TANK - EQUAL TO WOOD INDUSTRIAL PRODUCTS CO.
2. PERFORATED INLET PIPE
3. DROP TUBE
4. 4" x 6" HAND HOLE
5. 2" RETURN HEADER, TAPS AS REQUIRED
6. MEDIUM AND HIGH PRESSURE STEAM CONDENSATE RETURNS
7. 1" DRAIN VALVE
8. FLOAT & THERMOSTATIC STEAM TRAP
9. TO CONDENSATE RETURN UNIT
10. 2" VENT THRU ROOF

58 FLASH TANK PIPING DETAIL

NOT TO SCALE



KEYED NOTES

1. FLASH TANK - EQUAL TO WENDLEND CORPORATION MODEL FT-15 12" DIAMETER, 30 " LENGTH, 15 GALLON CAPACITY
2. 18" LONG PERFORATED INLET PIPE W/ (18) 1/4" DIA HOLES
3. 2" OUTLET
4. 1-1/4" RETURN HEADER, TAPS AS REQUIRED
5. MEDIUM AND HIGH PRESSURE STEAM CONDENSATE RETURNS
6. 1" DRAIN VALVE
7. FLOAT & THERMOSTATIC STEAM TRAP
8. TO CONDENSATE RETURN UNIT
9. 2" VENT THRU ROOF

59 FLASH TANK PIPING DETAIL

NOT TO SCALE

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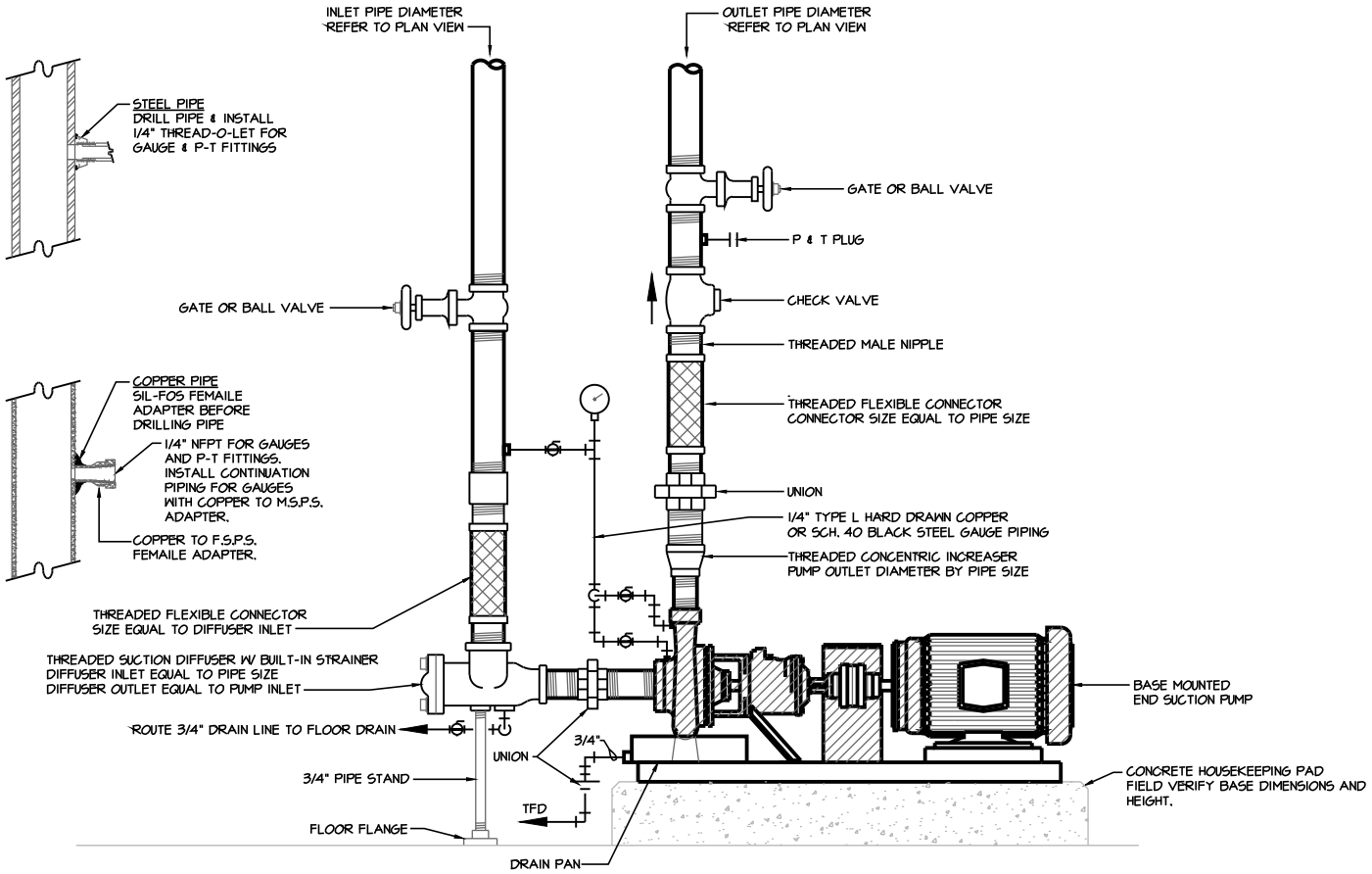

NOTE: DO NOT INSTALL ALL THREAD NIPPLES

60 BASE MOUNTED END SUCTION PUMP PIPING DETAIL

NOT TO SCALE

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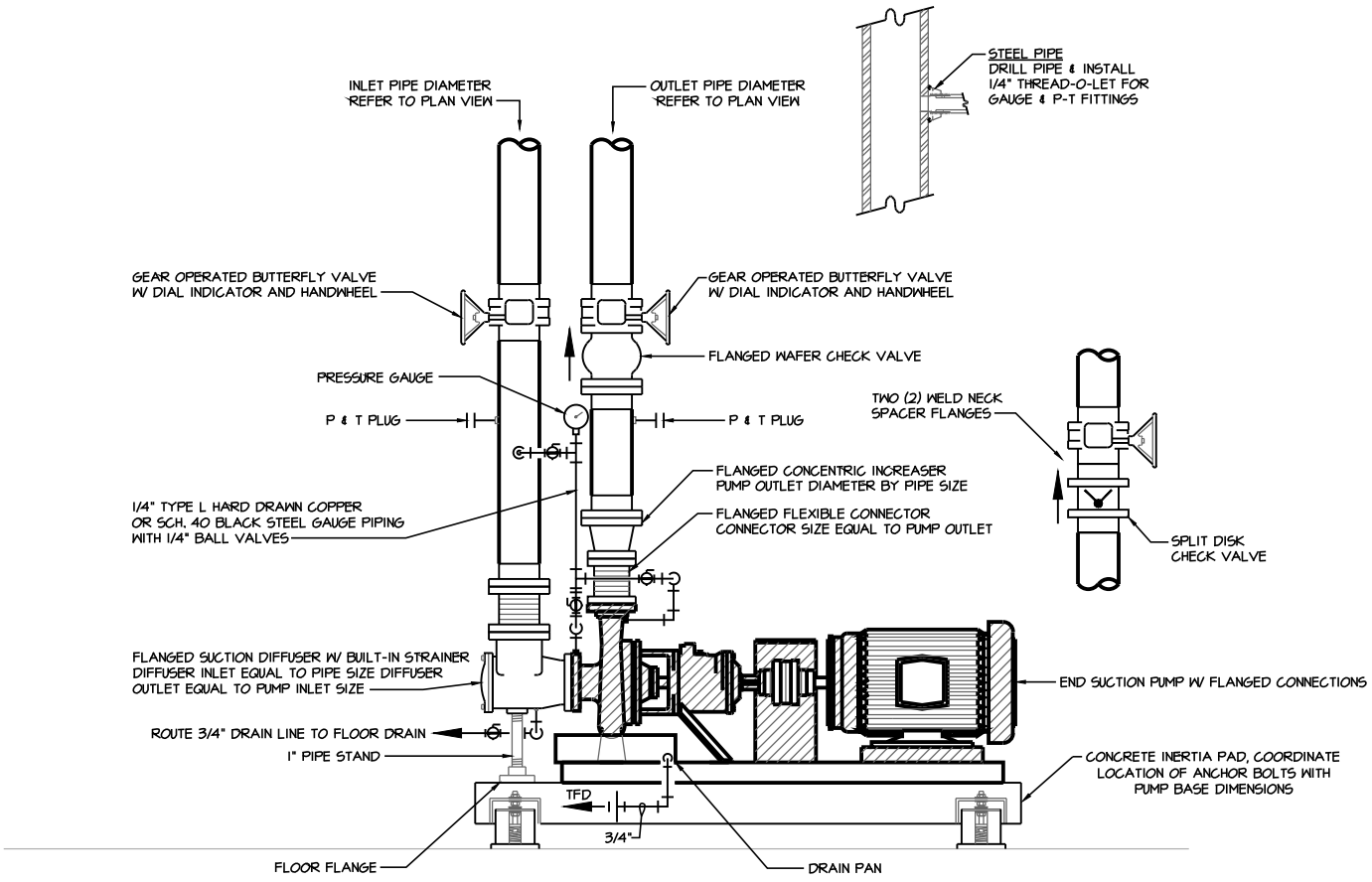

16 FLANGED END SUCTION PUMP WITH INERTIA BASE PIPING DETAIL

NOT TO SCALE

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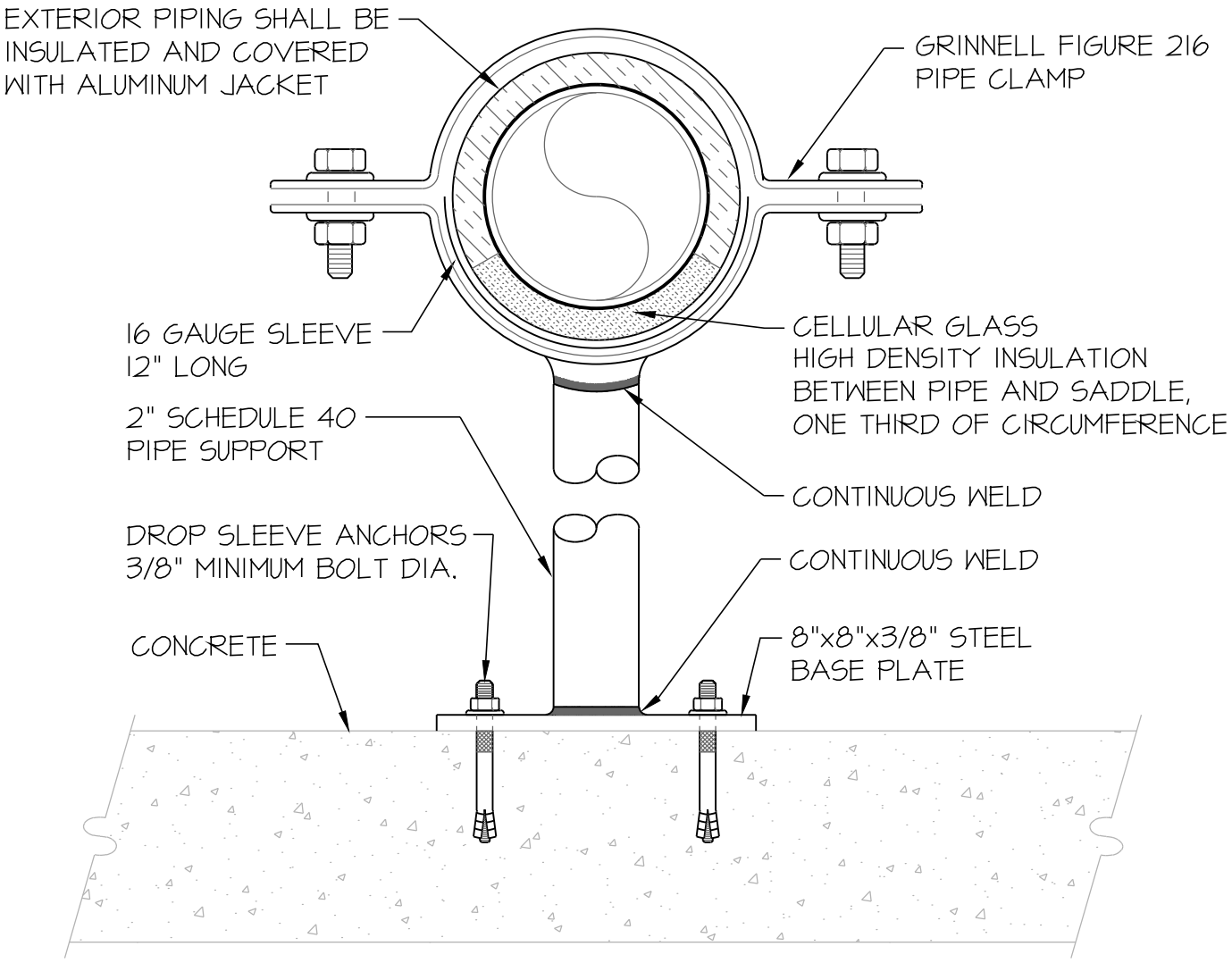

162 PIPE STANCHION DETAIL

NOT TO SCALE

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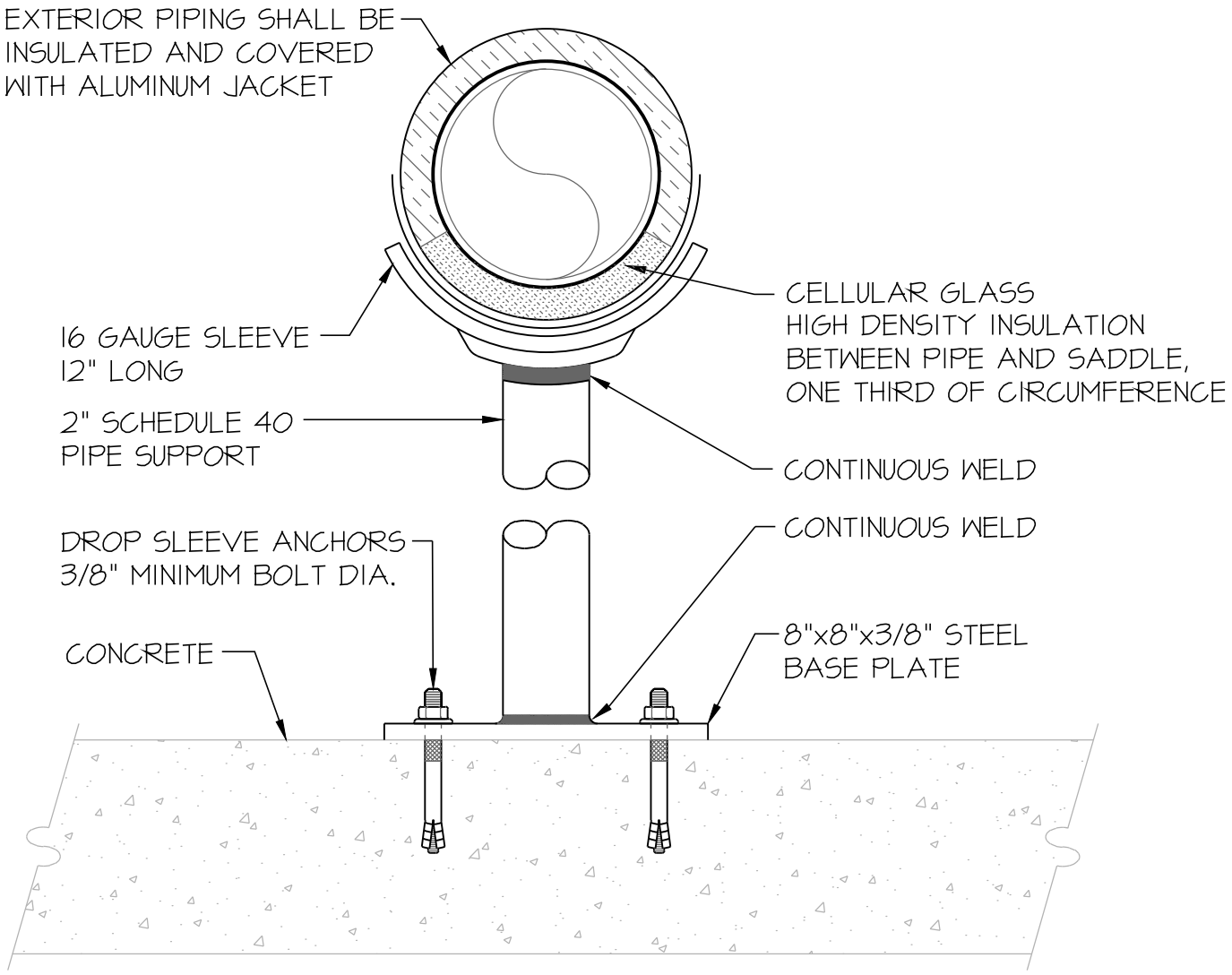
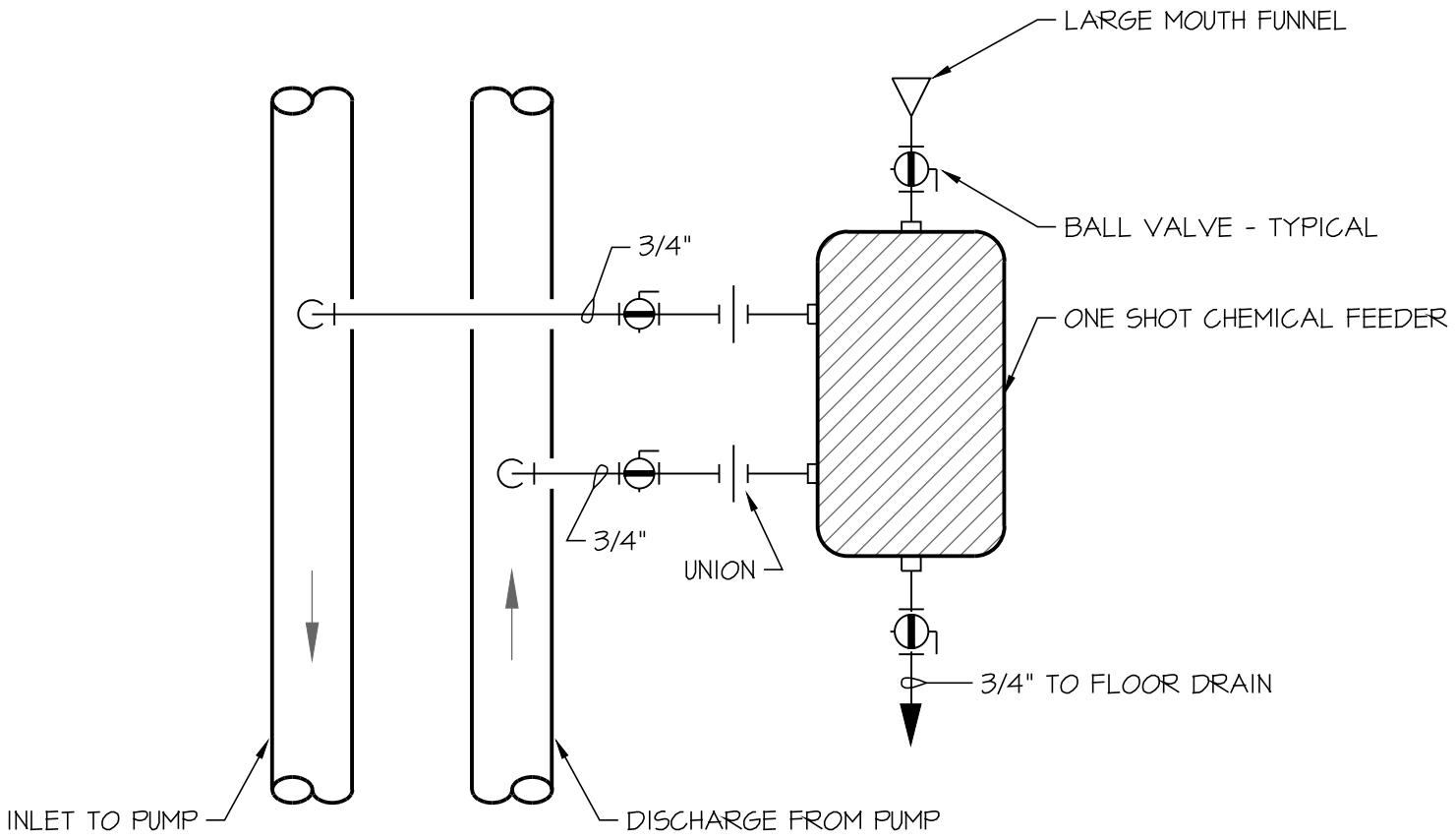


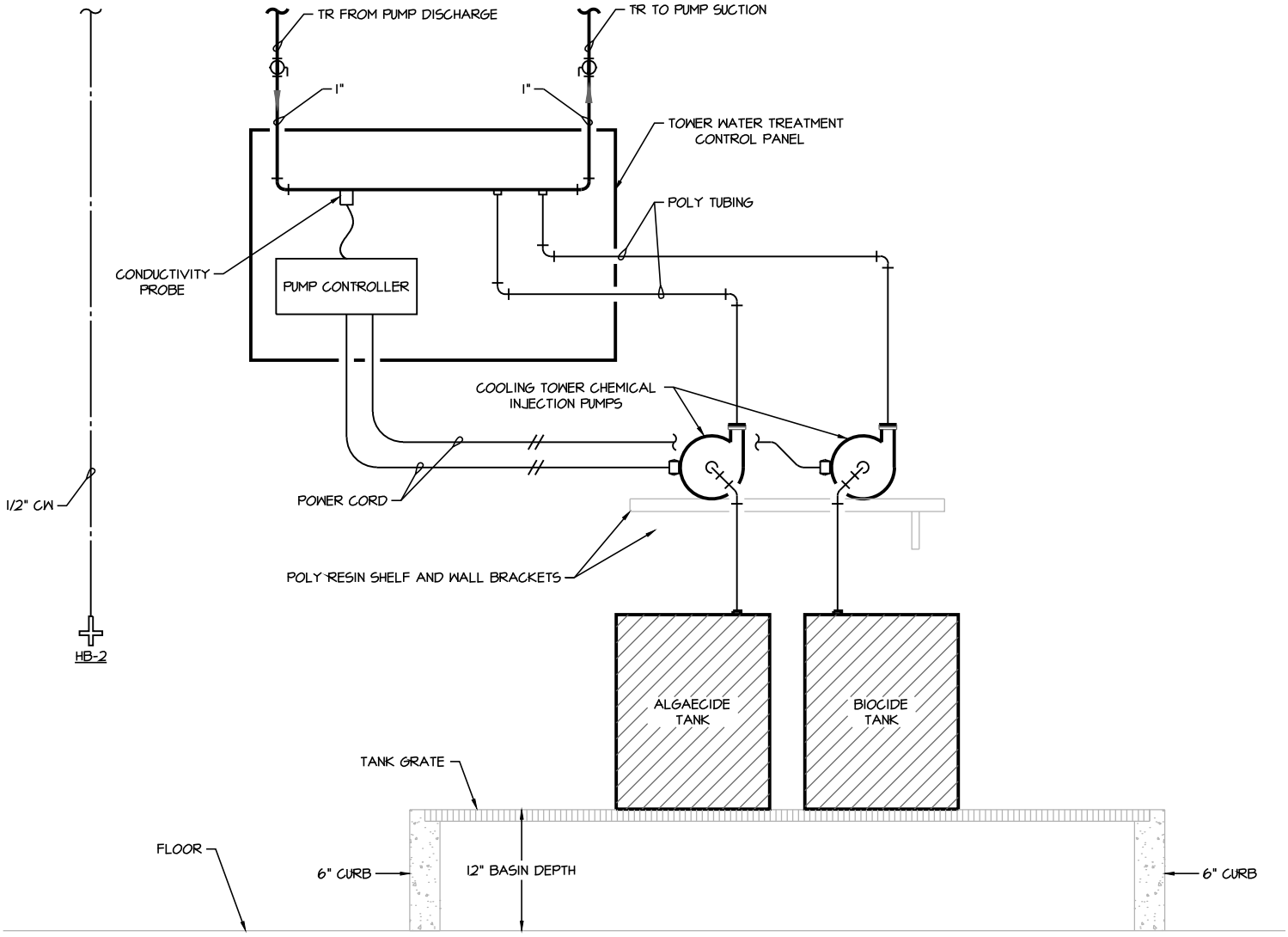
163 PIPE STANCHION DETAIL

NOT TO SCALE



64 CHEMICAL FEEDER PIPING DETAIL

NOT TO SCALE



165 COOLING TOWER CHEMICAL TREATMENT SYSTEM PIPING DIAGRAM

NOT TO SCALE

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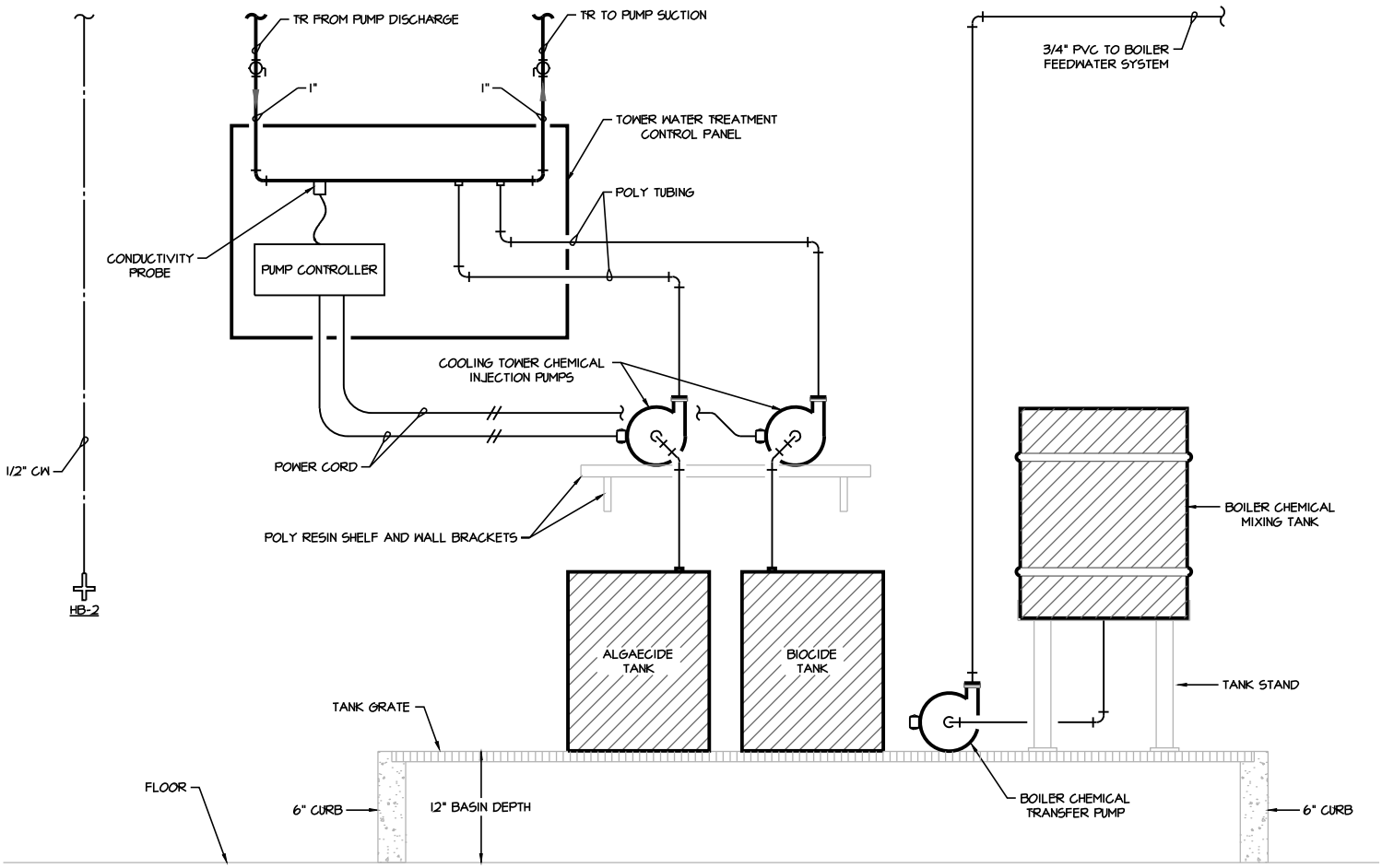

66 CHEMICAL TREATMENT SYSTEM PIPING DIAGRAM

NOT TO SCALE

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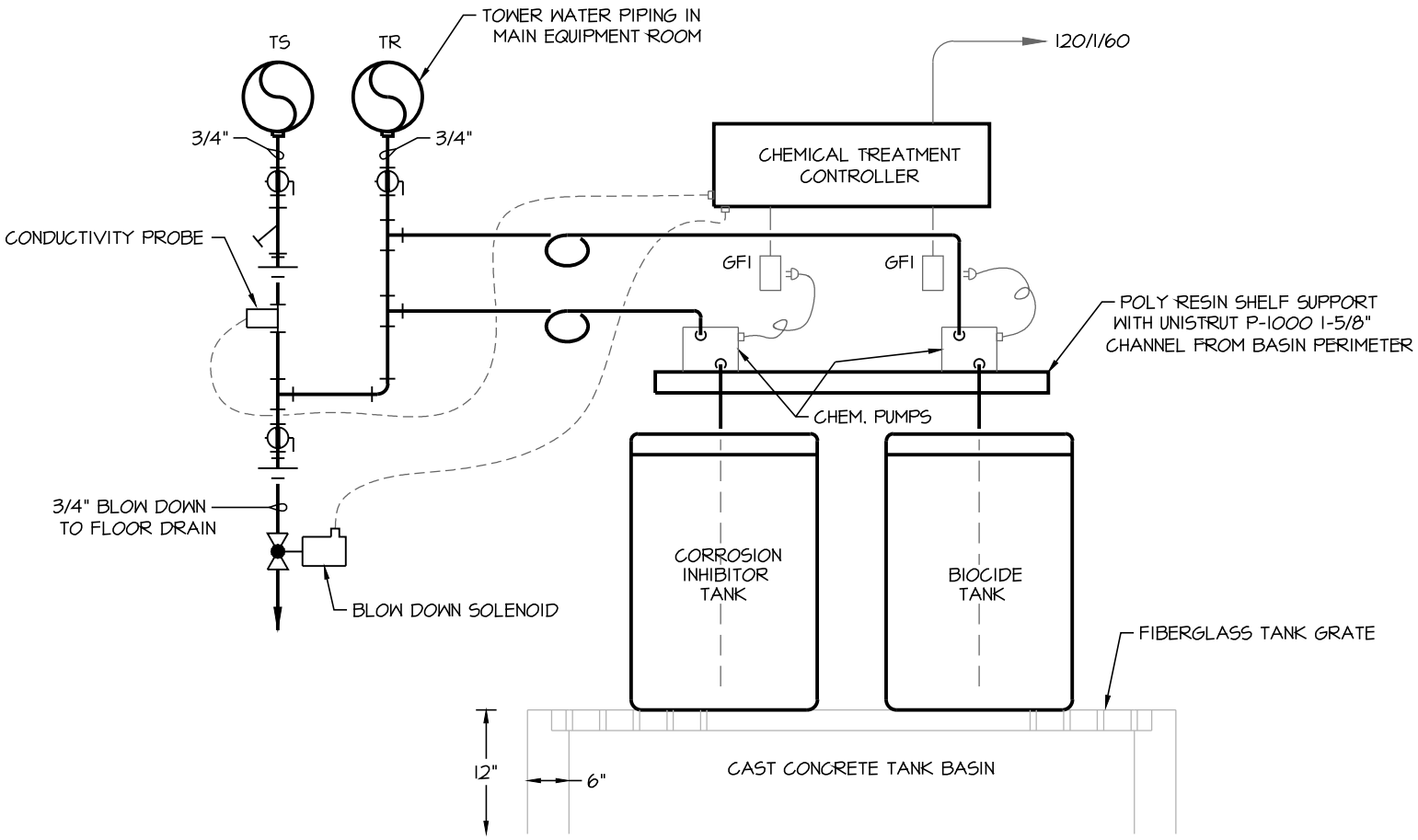

6 TOWER CHEMICAL TREATMENT PIPING

NOT TO SCALE

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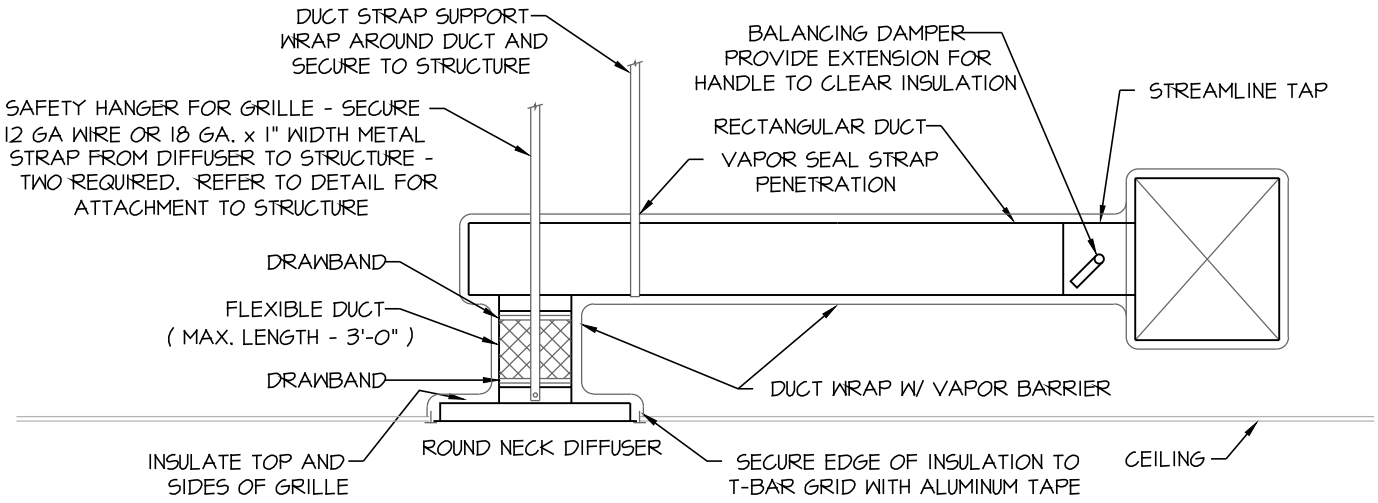
NOTE:
FLEXIBLE DUCT CONNECTIONS SHALL BE INSTALLED TO ADC STANDARDS AND SEALED TO UL STANDARDS PER AMC 603 AND 604.2.1. AS A MINIMUM, THE CONTRACTOR SHALL SECURE THE FLEXIBLE DUCT TO GRILLE AND METAL DUCT WITH DRAWBANDS, AND WRAP 3" WIDE ALUMINUM TAPE EQUAL TO HARDCAST "FOIL GRIP" AROUND DRAWBAND AND EXPOSED END OF FLEXIBLE DUCT INSULATION.



68 DIFFUSER CONNECTION TO RECTANGULAR DUCT

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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Det 168
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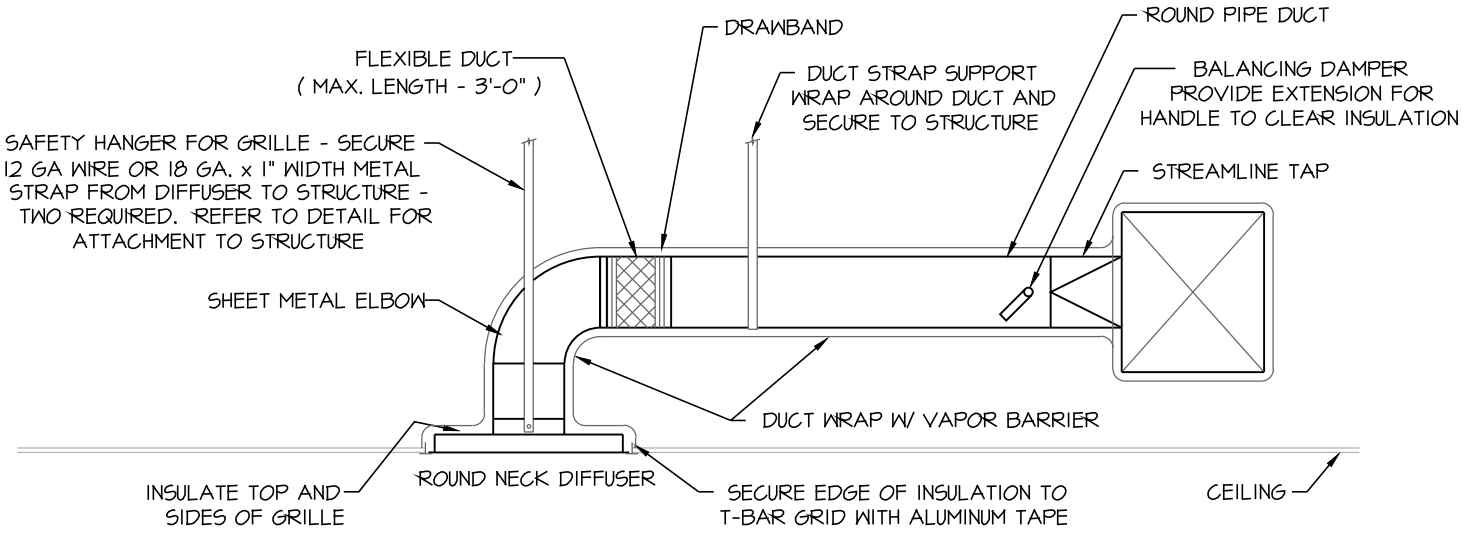
NOTE:
FLEXIBLE DUCT CONNECTIONS SHALL BE INSTALLED TO ADC STANDARDS AND SEALED TO UL STANDARDS PER AMC 603 AND 604.2.1. AS A MINIMUM, THE CONTRACTOR SHALL SECURE THE FLEXIBLE DUCT TO ENDS OF METAL DUCT WITH DRAWBANDS, AND WRAP 3" WIDE ALUMINUM TAPE EQUAL TO HARDCAST "FOIL GRIP" AROUND DRAWBAND AND EXPOSED END OF FLEXIBLE DUCT INSULATION.



69 DIFFUSER CONNECTION TO ROUND DUCT

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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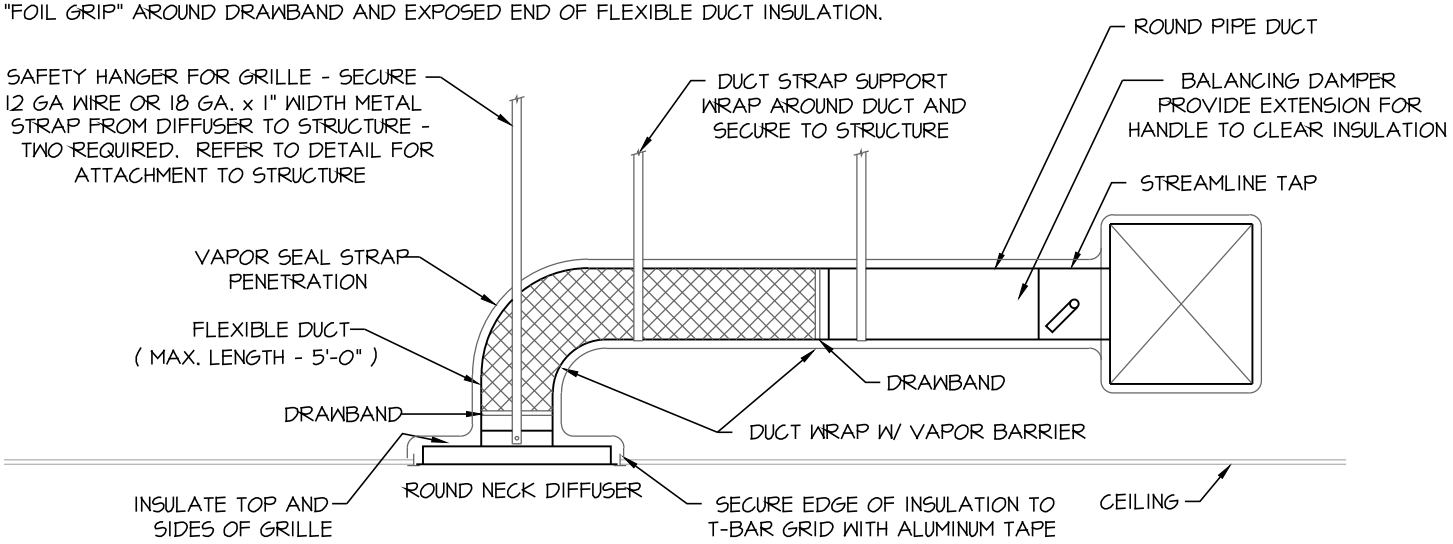
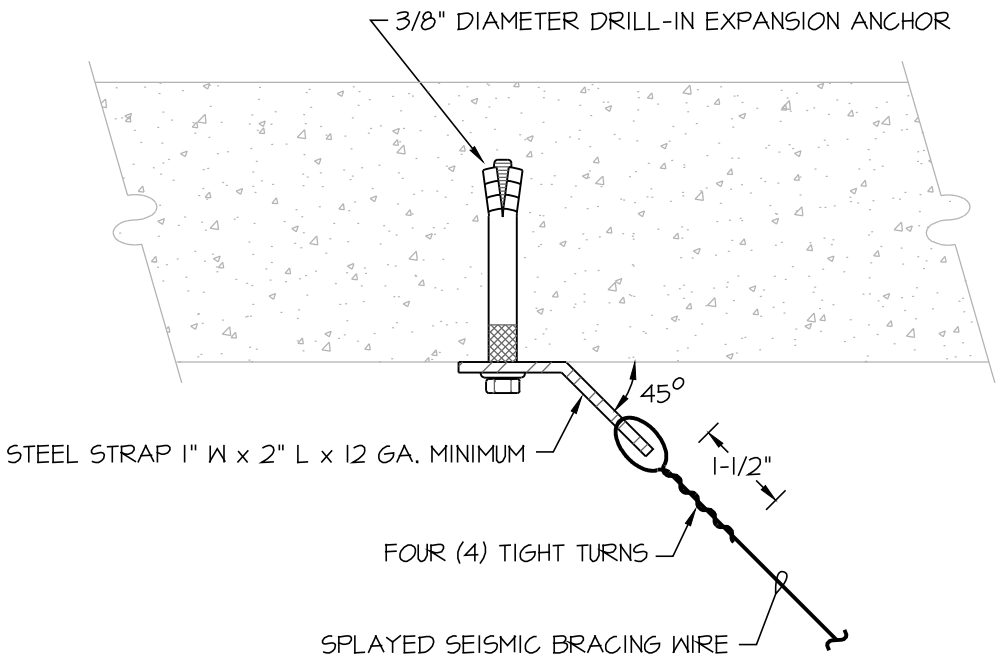
NOTE:
FLEXIBLE DUCT CONNECTIONS SHALL BE INSTALLED TO ADC STANDARDS AND SEALED TO UL STANDARDS PER AMC 603 AND 604.2.1. AS A MINIMUM, THE CONTRACTOR SHALL SECURE THE FLEXIBLE DUCT TO GRILLE AND METAL DUCT WITH DRAWBANDS, AND WRAP 3" WIDE ALUMINUM TAPE EQUAL TO HARDCAST "FOIL GRIP" AROUND DRAWBAND AND EXPOSED END OF FLEXIBLE DUCT INSULATION.



170 DIFFUSER CONNECTION TO ROUND DUCT

NOT TO SCALE



171 BRACING WIRE ATTACHMENT DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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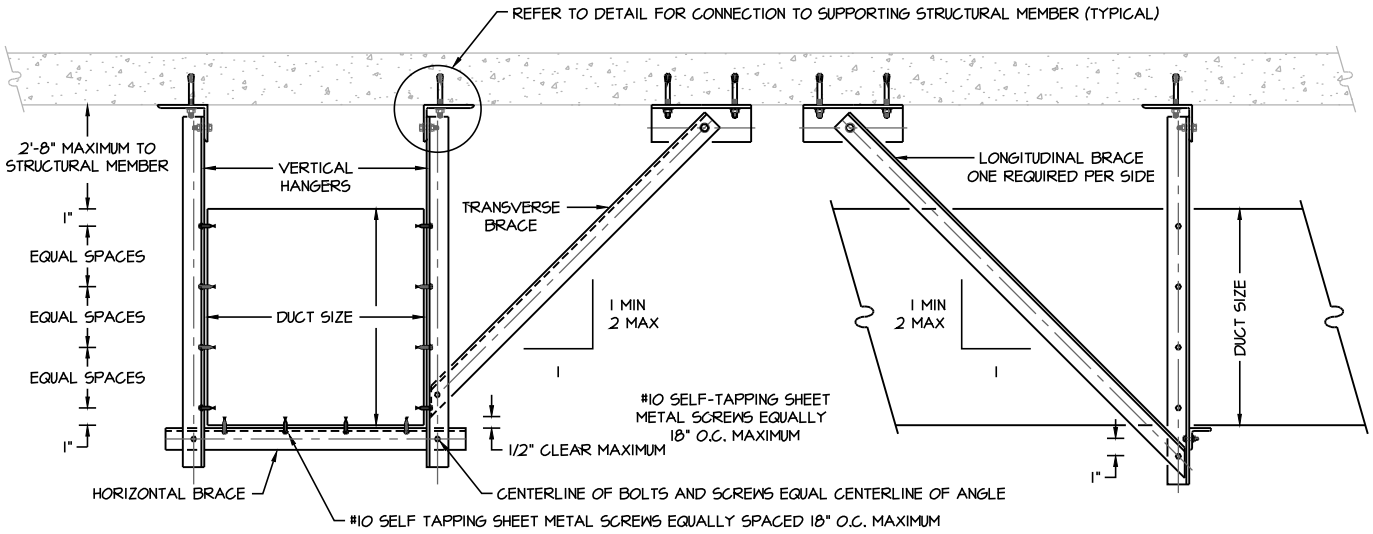

NOTE:

WHEN A COMBINATION OF DUCTS IS USED IN LIEU OF ONE DUCT, AT LEAST TWO SIDES OF EACH DUCT MUST BE CONNECTED TO VERTICAL OR HORIZONTAL ANGLES AND THE COMBINED WEIGHT SHALL NOT EXCEED THAT GIVEN IN THE TABLES IN CHAPTER 5 OF SMACNA'S "SEISMIC RESTRAINT GUIDELINES FOR MECHANICAL SYSTEMS".

172 SIDE BRACING FOR RECTANGULAR DUCT DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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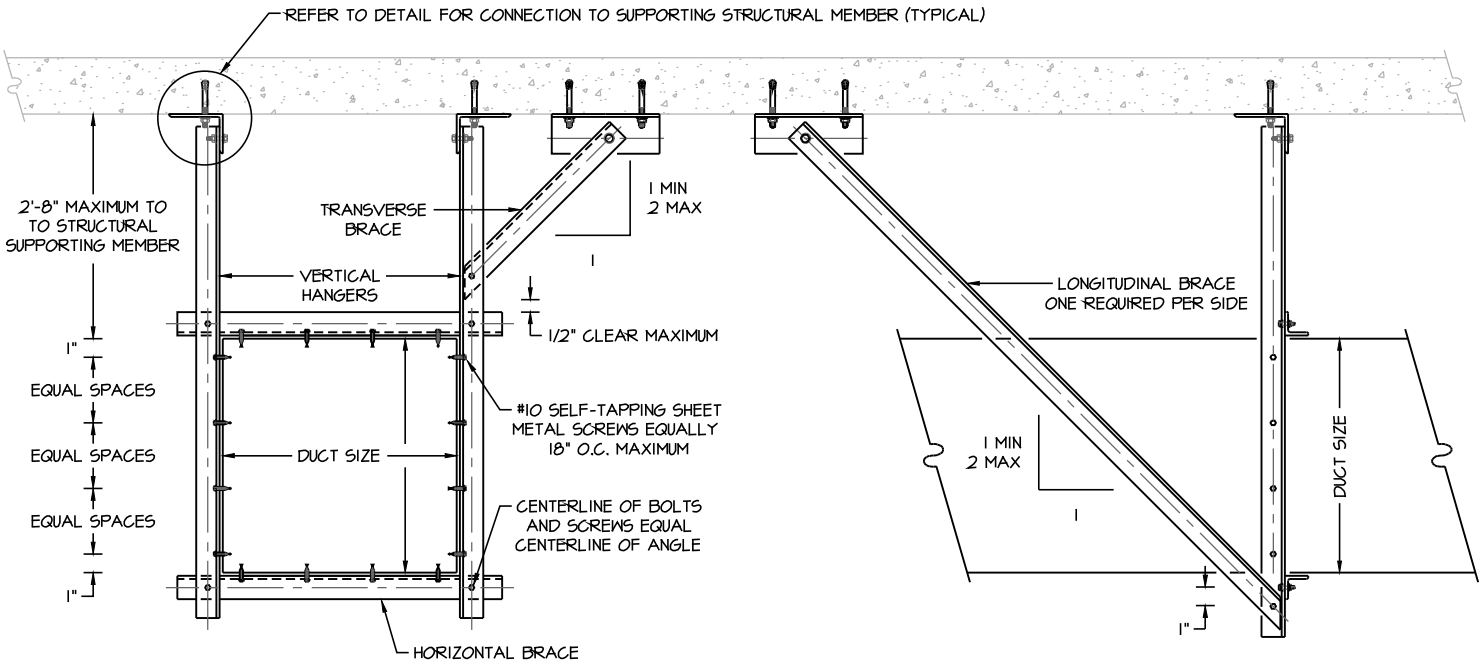

NOTE:

WHEN A COMBINATION OF DUCTS IS USED IN LIEU OF ONE DUCT, AT LEAST TWO SIDES OF EACH DUCT MUST BE CONNECTED TO VERTICAL OR HORIZONTAL ANGLES AND THE COMBINED WEIGHT SHALL NOT EXCEED THAT GIVEN IN THE TABLES IN CHAPTER 5 OF SMACNA'S "SEISMIC RESTRAINT GUIDELINES FOR MECHANICAL SYSTEMS".

(173) SIDE BRACING FOR RECTANGULAR DUCT DETAIL

NOT TO SCALE

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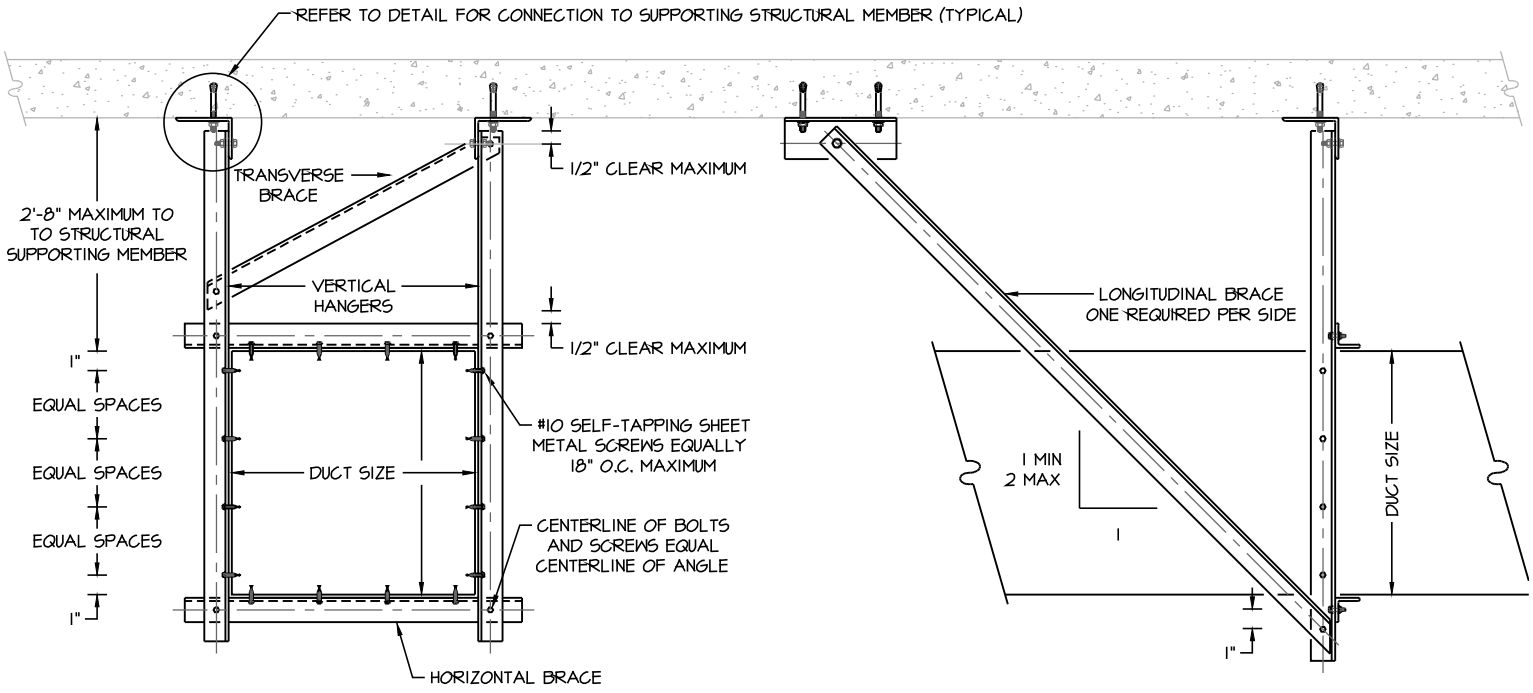

NOTE:

WHEN A COMBINATION OF DUCTS IS USED IN LIEU OF ONE DUCT, AT LEAST TWO SIDES OF EACH DUCT MUST BE CONNECTED TO VERTICAL OR HORIZONTAL ANGLES AND THE COMBINED WEIGHT SHALL NOT EXCEED THAT GIVEN IN THE TABLES IN CHAPTER 5 OF SMACNA'S "SEISMIC RESTRAINT GUIDELINES FOR MECHANICAL SYSTEMS".

14 CENTER BRACING FOR RECTANGULAR DUCT DETAIL

NOT TO SCALE

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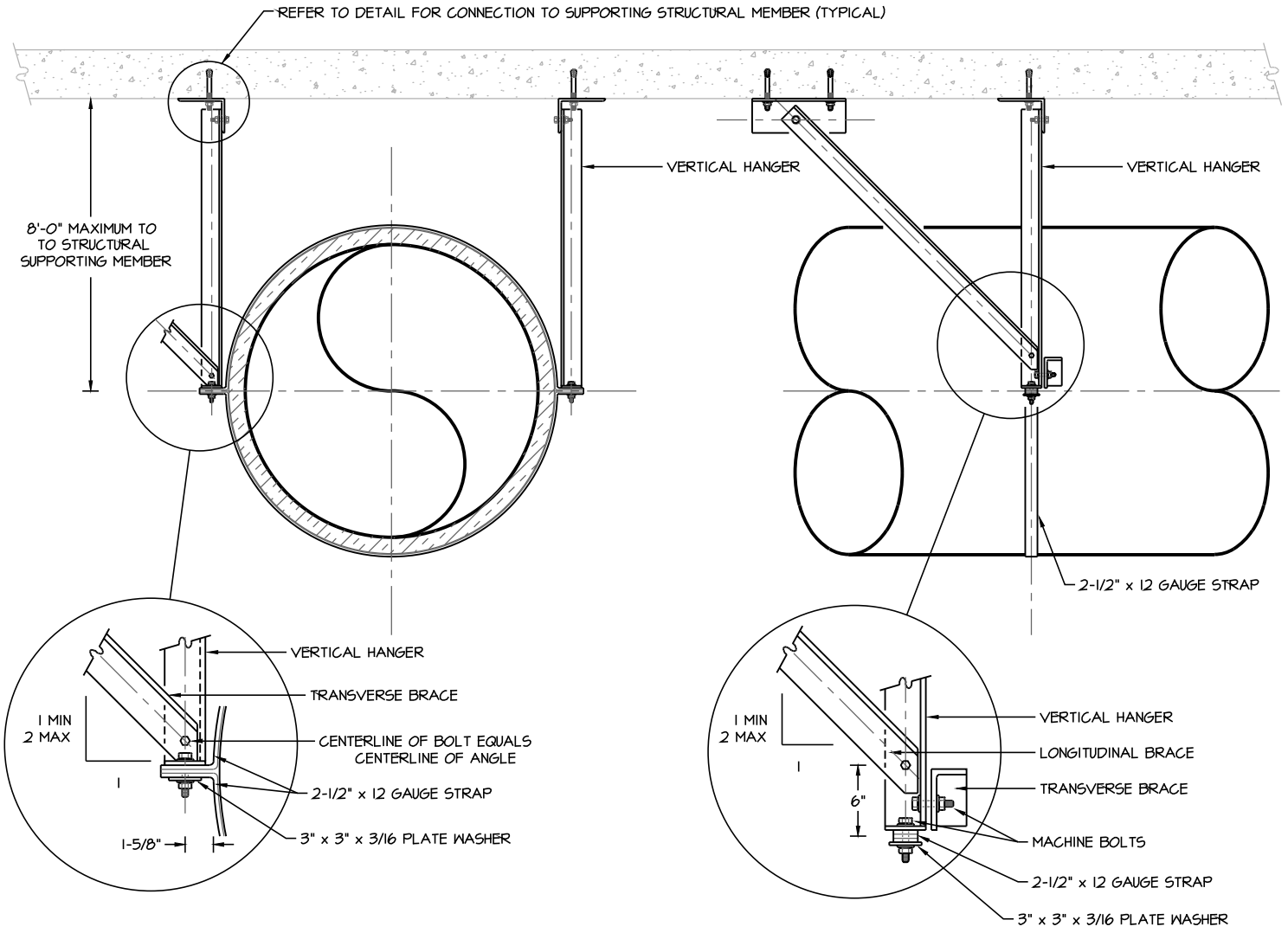

75 DOUBLE HANGER BRACING FOR ROUND DUCT DETAIL

NOT TO SCALE

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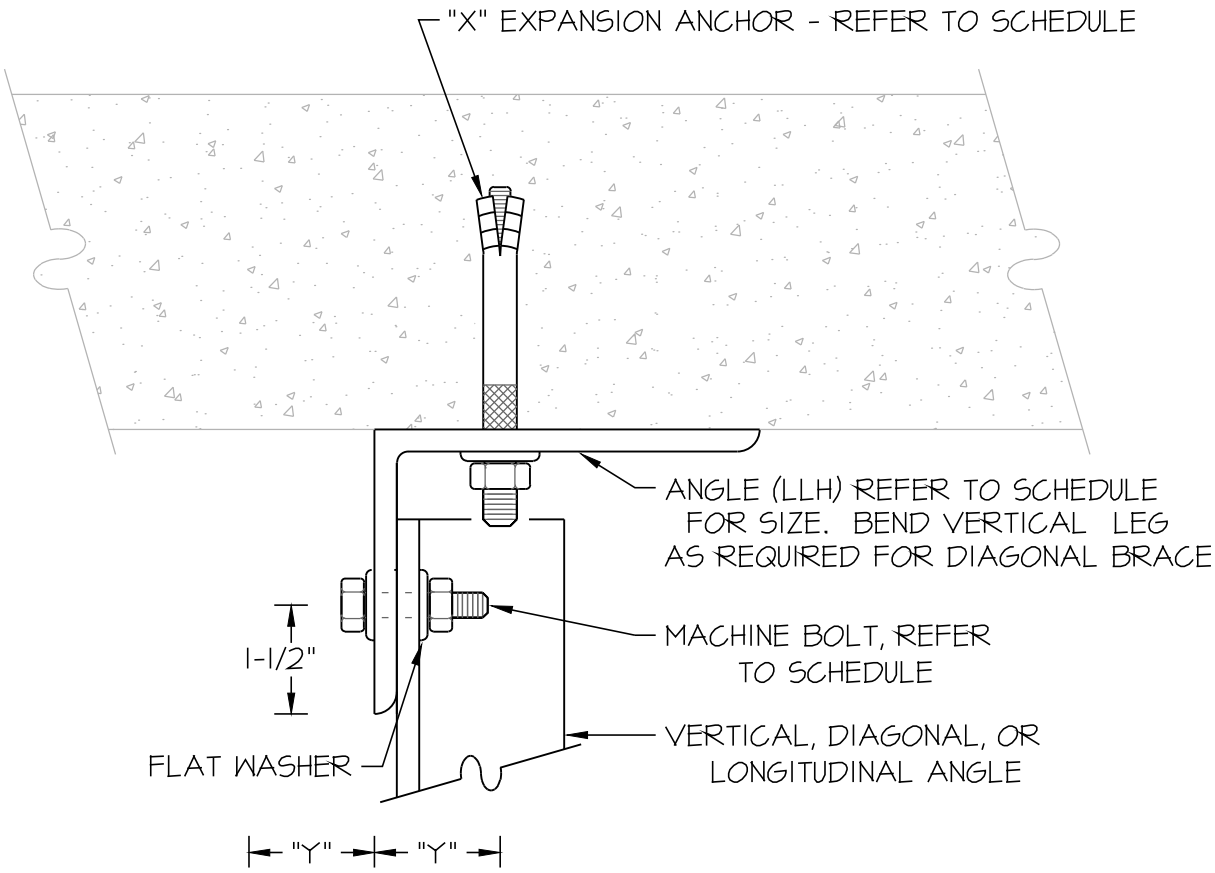
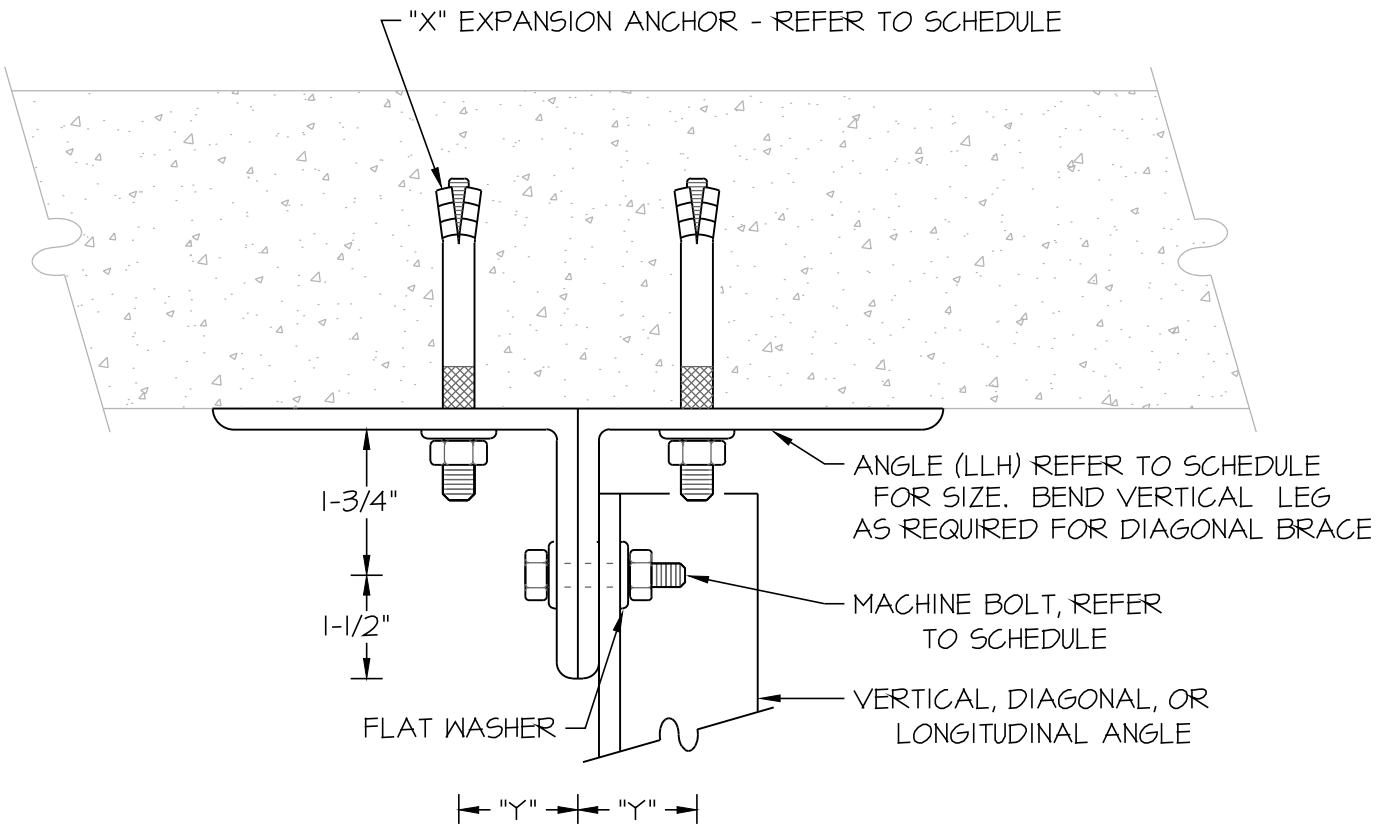


TYPE	MAXIMUM LOAD CAPACITY (LBS)	EXPANSION ANCHORS TO CONCRETE "X"	SPREADER SIZE	MACHINE BOLT AT END OF BRACE	DISTANCE OF BOLT TO ANGLE "Y"	ANGLE TO SUPPORTING STRUCTURAL MEMBER
A	1040	1/2"	C4x5.4	3/8"	1-3/8"	3-1/2x2-1/2x3/8 BY 3" LLH
B	1415	5/8"	C4x5.4	3/8"	1-3/4"	5x3x3/8 BY 3" LLH

176 ANCHOR CONNECTION DETAIL

NOT TO SCALE



TYPE	MAXIMUM LOAD CAPACITY (LBS)	EXPANSION ANCHORS TO CONCRETE "X"	SPREADER SIZE	MACHINE BOLT AT END OF BRACE	DISTANCE OF BOLT TO ANGLE "Y"	ANGLE TO SUPPORTING STRUCTURAL MEMBER
A	1586	2 - 1/2"	C5x6.7	1/2"	3"	2 - 4x3x3/8 BY 4" LLH
B	2020	2 - 5/8"	C6x8.5	1/2"	3-3/4"	2 - 5x3x3/8 BY 4" LLH
C	2870	2 - 3/4"	C8x11.5	5/8"	4-1/2"	2 - 6x3-1/2x3/8 BY 4" LLH

177 ANCHOR CONNECTION DETAIL

NOT TO SCALE

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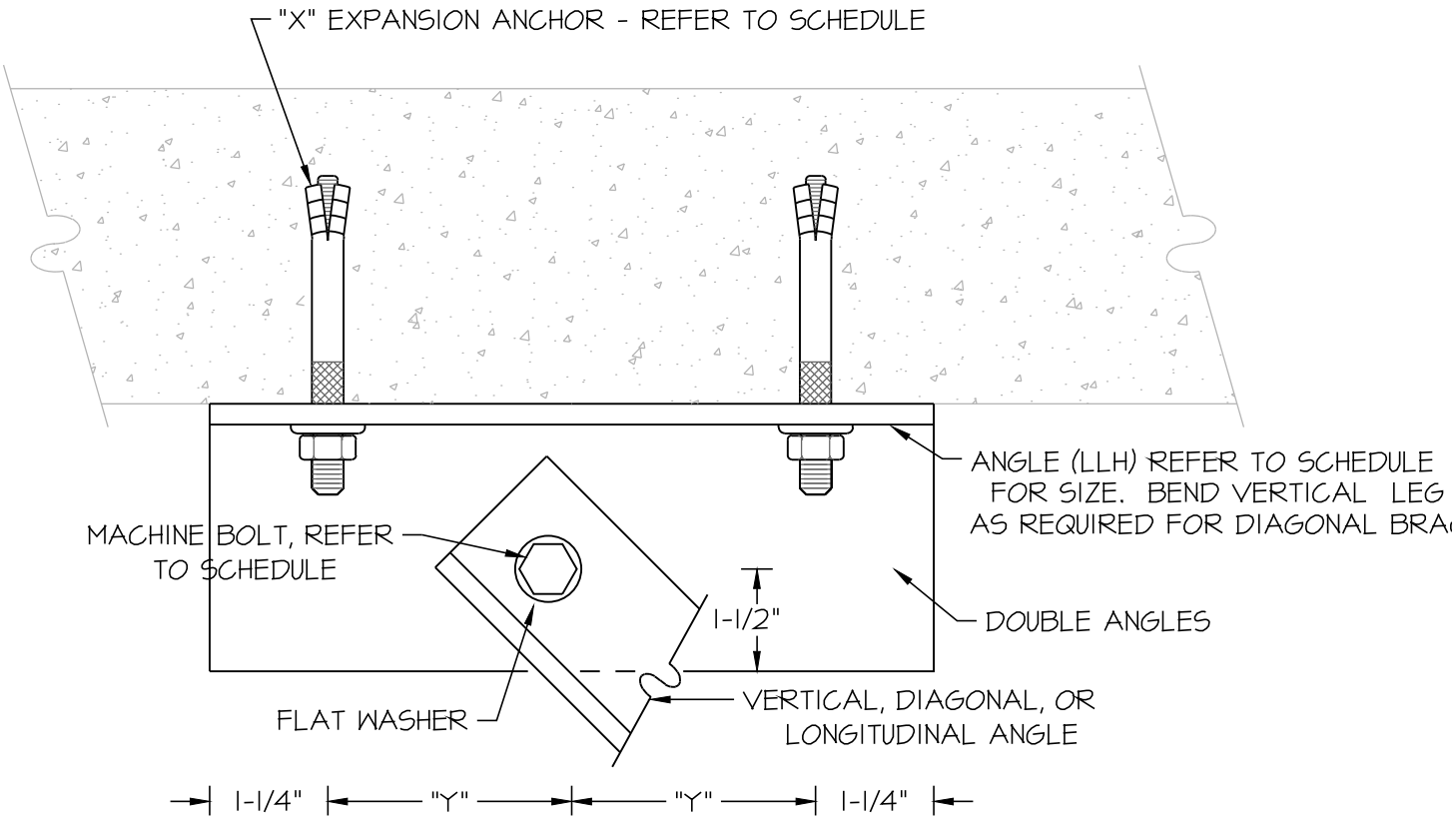
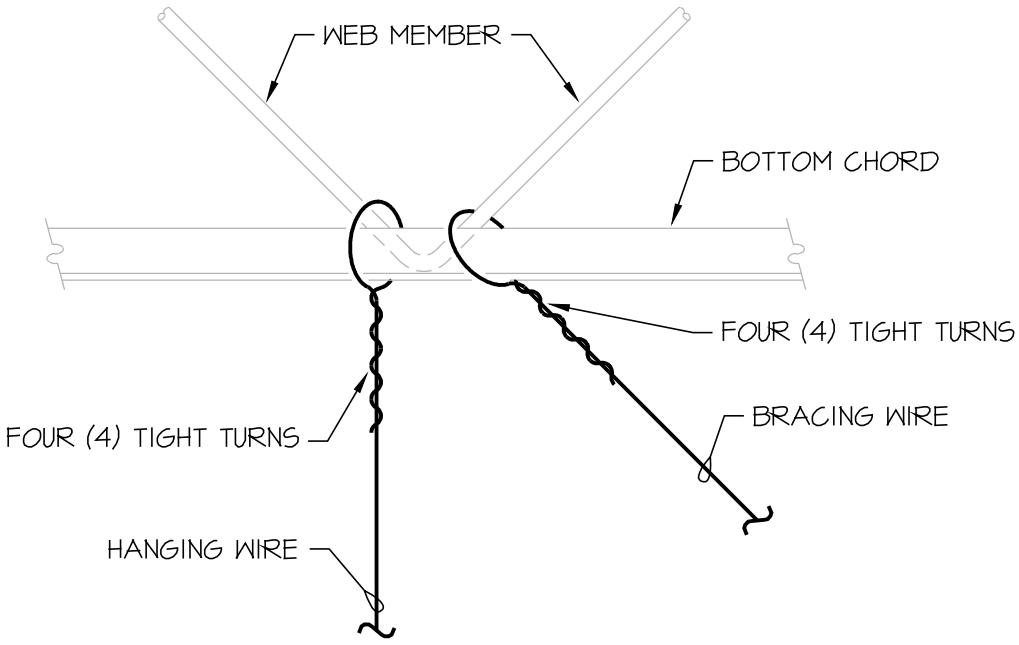


TYPE	MAXIMUM LOAD CAPACITY (LBS)	EXPANSION ANCHORS TO CONCRETE "X"	SPREADER SIZE	MACHINE BOLT AT END OF BRACE	DISTANCE OF BOLT TO ANGLE "Y"	ANGLE TO SUPPORTING STRUCTURAL MEMBER
F	4600	4 - 5/8"	C9x13.4	3/4"	3-3/4"	2 - 5x3x3/8 BY 10" LLH
G	7040	4 - 3/4"	C10x15.3	7/8"	4-1/2"	2 -6x3-1/2x1/2 BY 11-1/2" LLH
H	9240	4 - 7/8"	C12x20.7	1"	5-1/4"	2 - 8x4x3/4 BY 13-1/2" LLH

78 ANCHOR CONNECTION DETAIL

NOT TO SCALE



179 BRACING WIRE PARALLEL TO TRUSS

NOT TO SCALE

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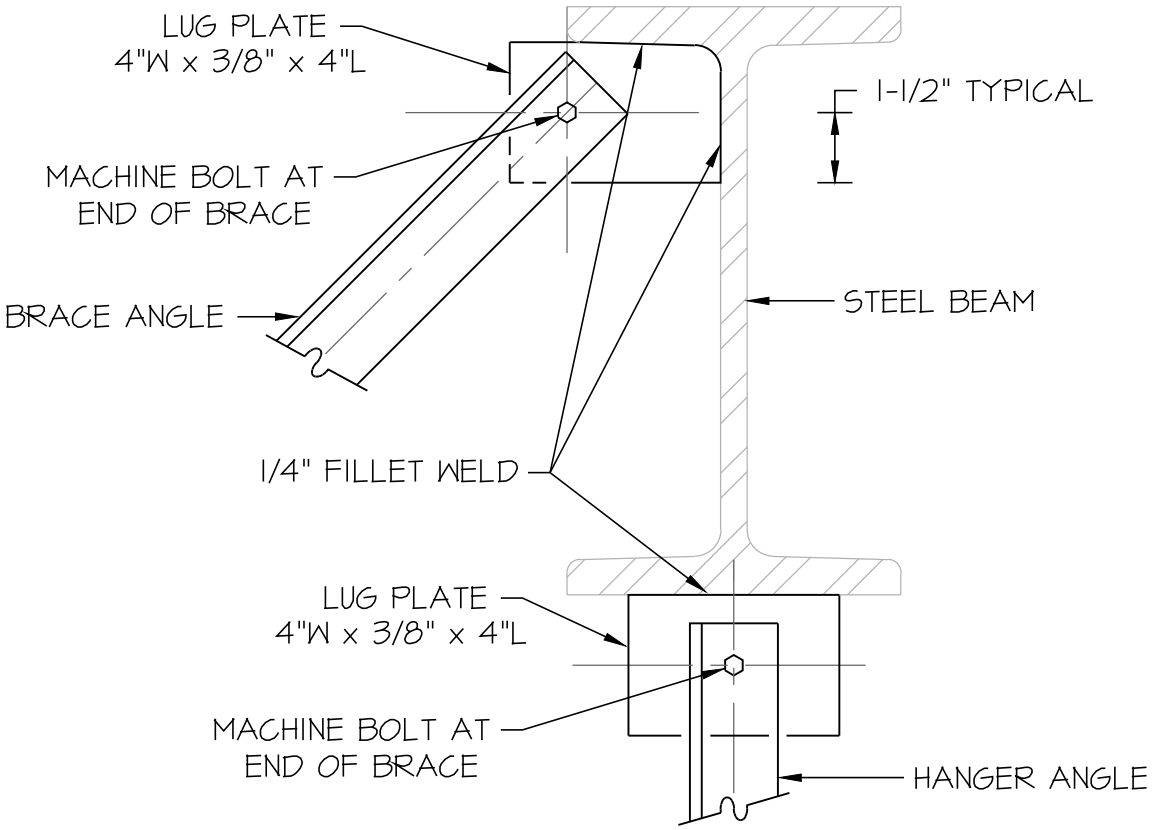

180 BRACE CONNECTIONS TO STEEL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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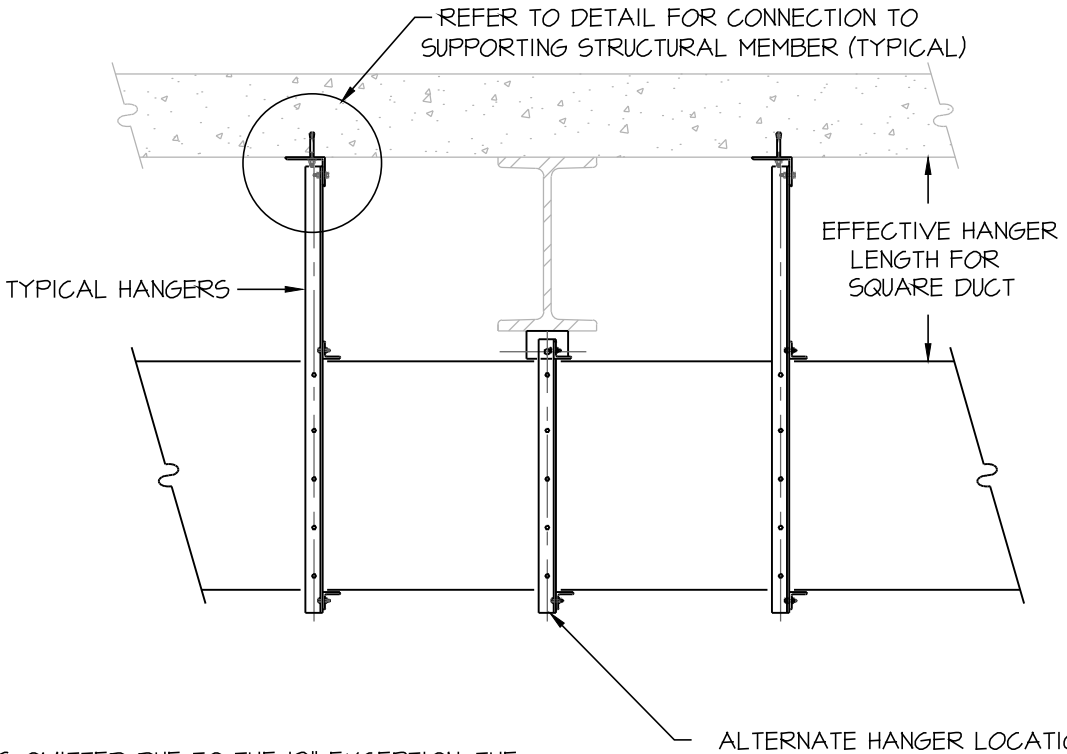

NOTE:

WHERE BRACING IS OMITTED DUE TO THE 12" EXCEPTION, THE EFFECTIVE HANGER LENGTH MUST BE LESS THAN 12" AS SHOWN BELOW. A SNUG FIT TO THE BEAM DOES NOT MEET THIS REQUIREMENT.

181 DUCTS HUNG BELOW STEEL BEAMS DETAIL

NOT TO SCALE

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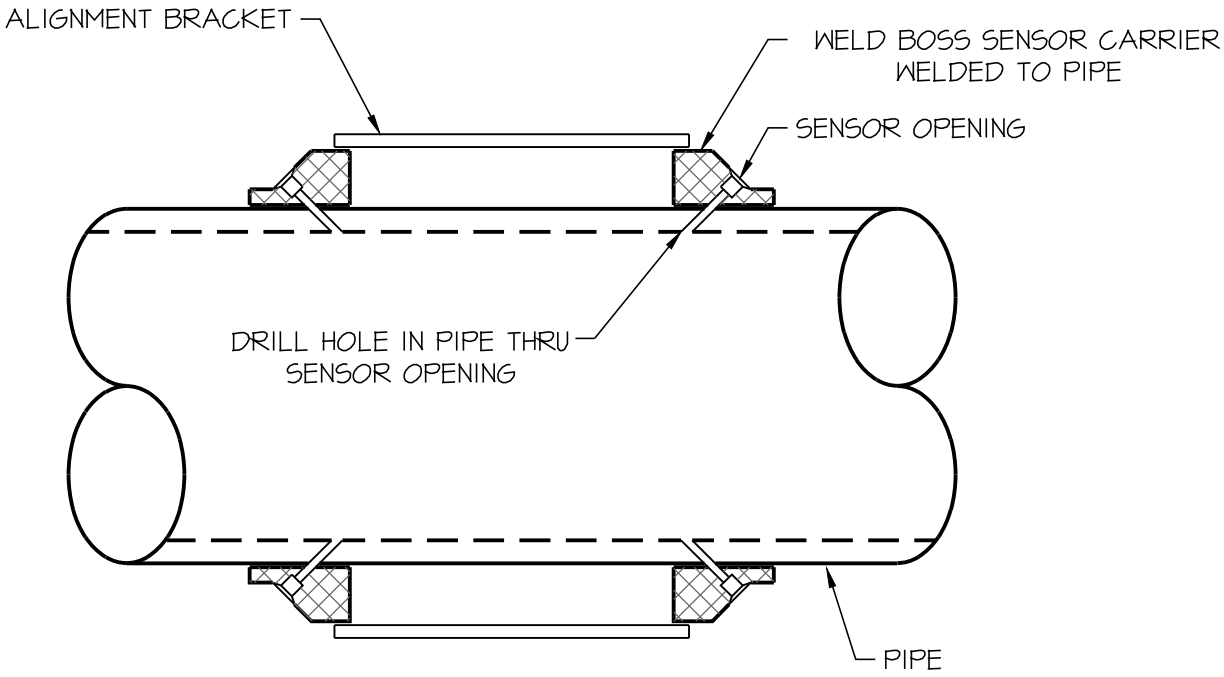

182 ULTRASONIC FLOW METER DETAIL

NOT TO SCALE

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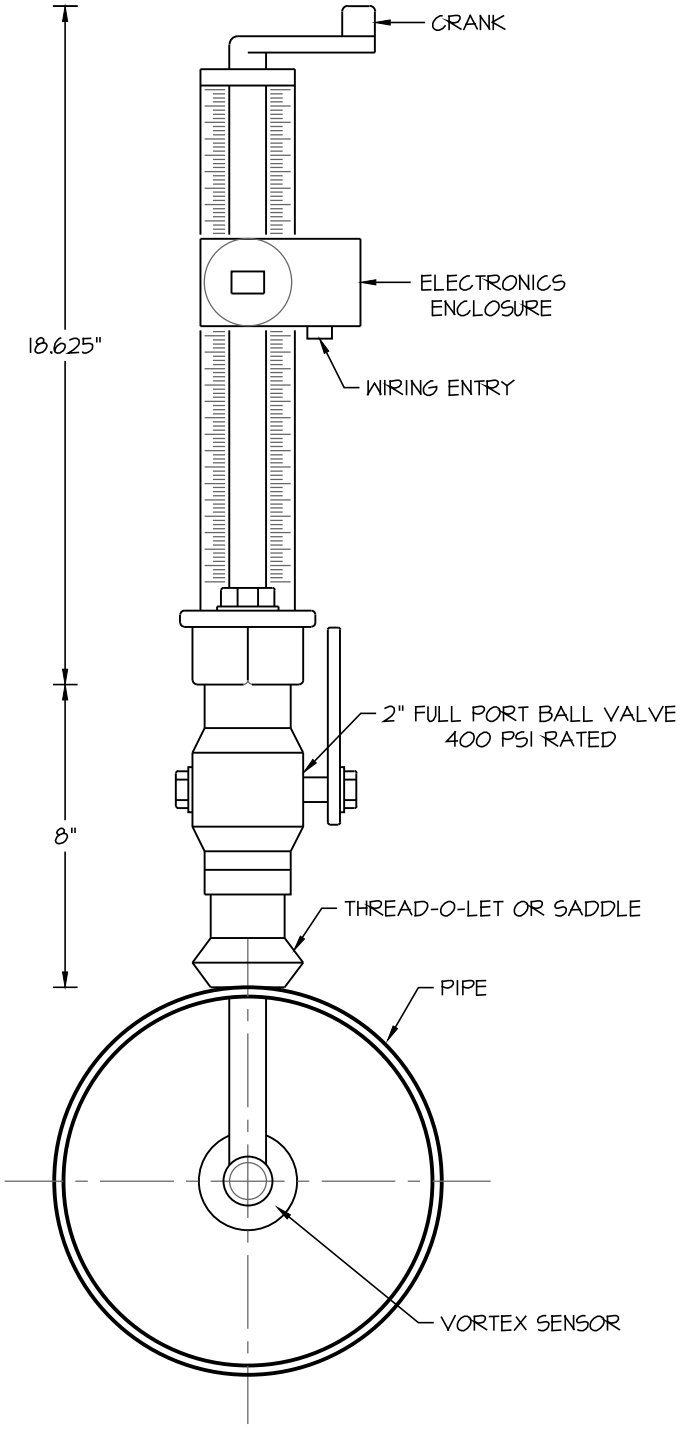

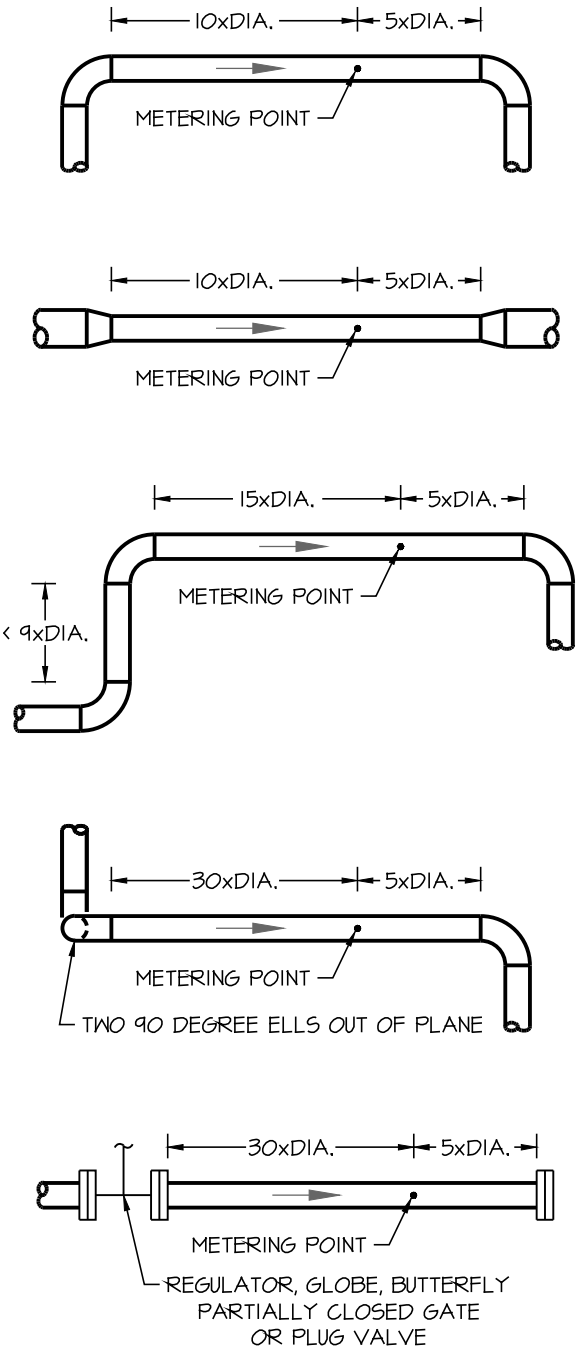

STRAIGHT RUN REQUIREMENTS

183 VORTEX SHEDDING FLOW METER DETAIL

NOT TO SCALE

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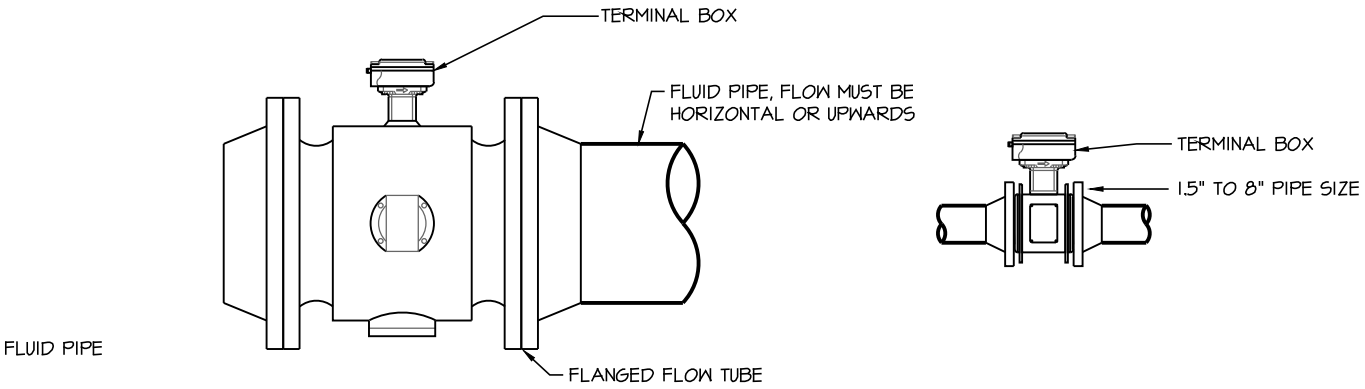
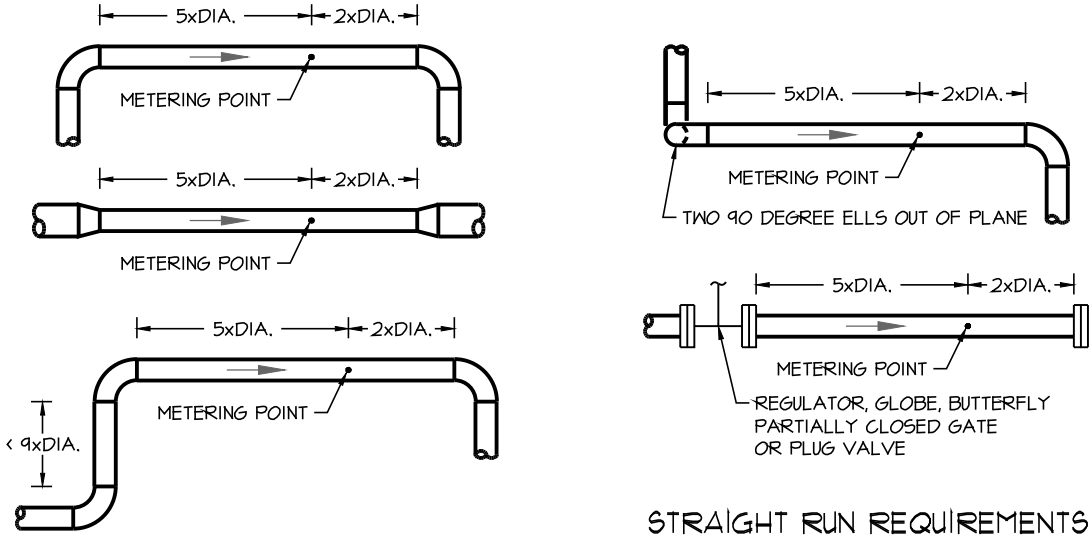


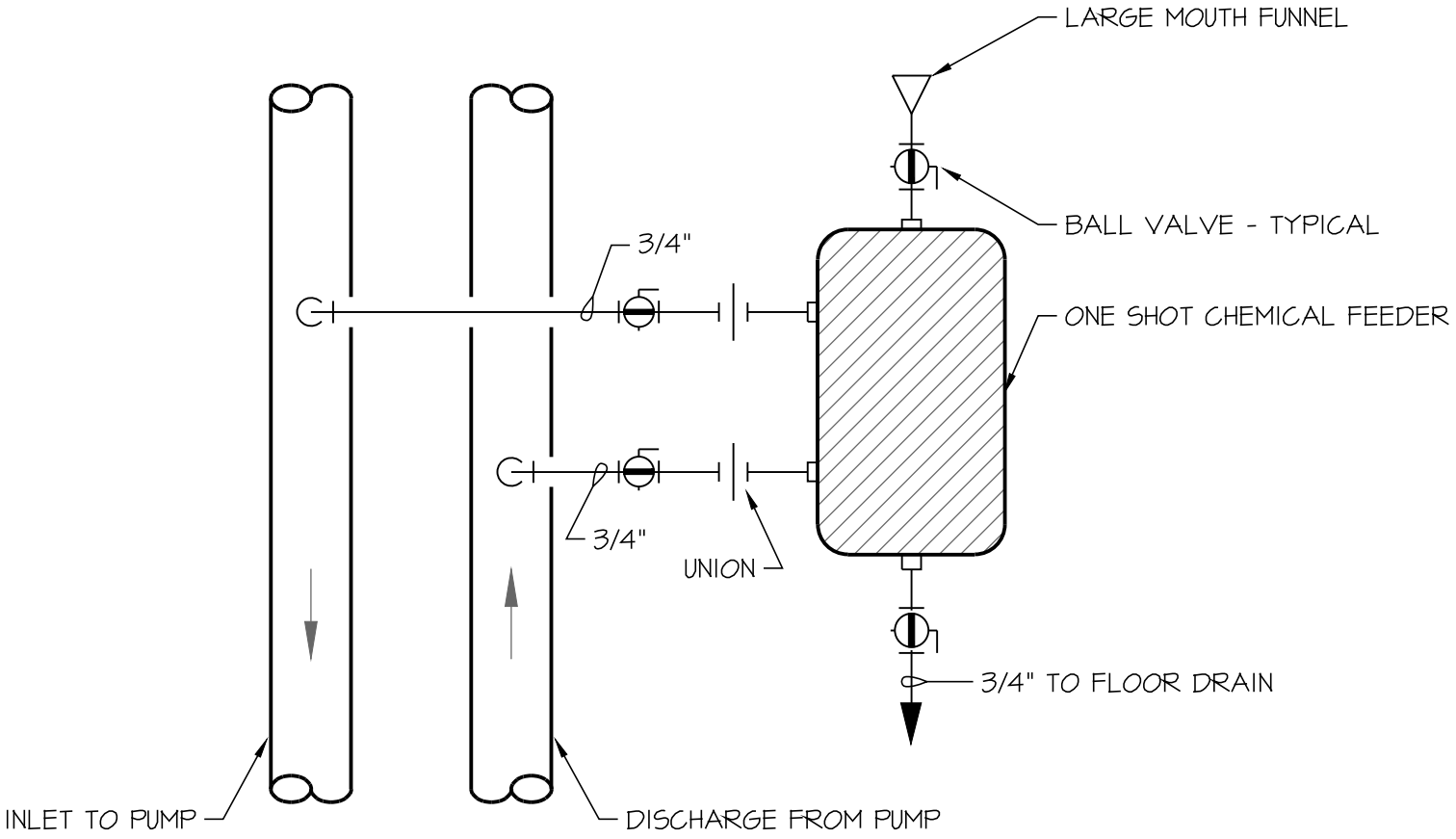


STRAIGHT RUN REQUIREMENTS

184 MAGNETIC FLOW METER DETAIL

NOT TO SCALE

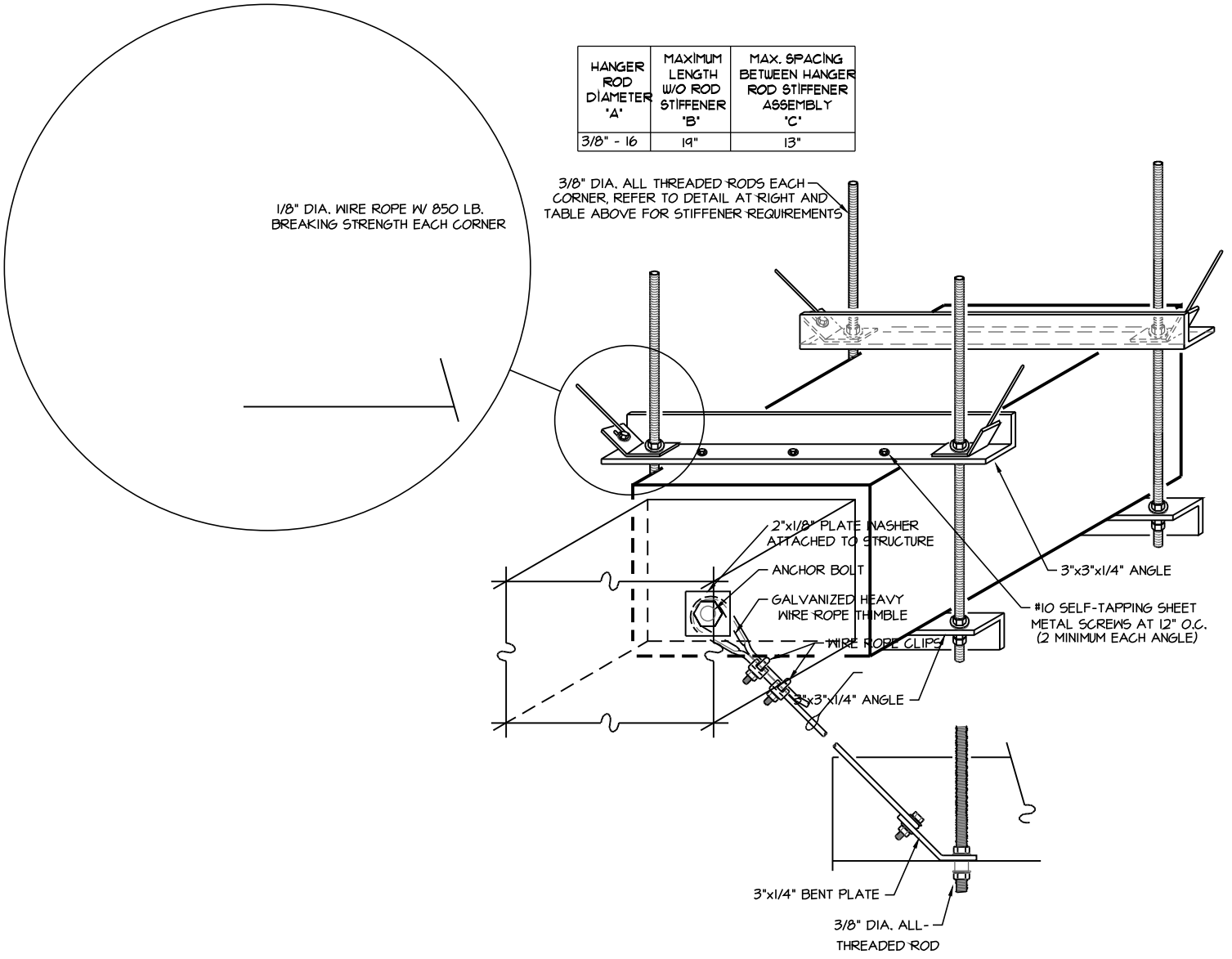
REVISED 06-09-04



185 CHEMICAL FEEDER PIPING DETAIL

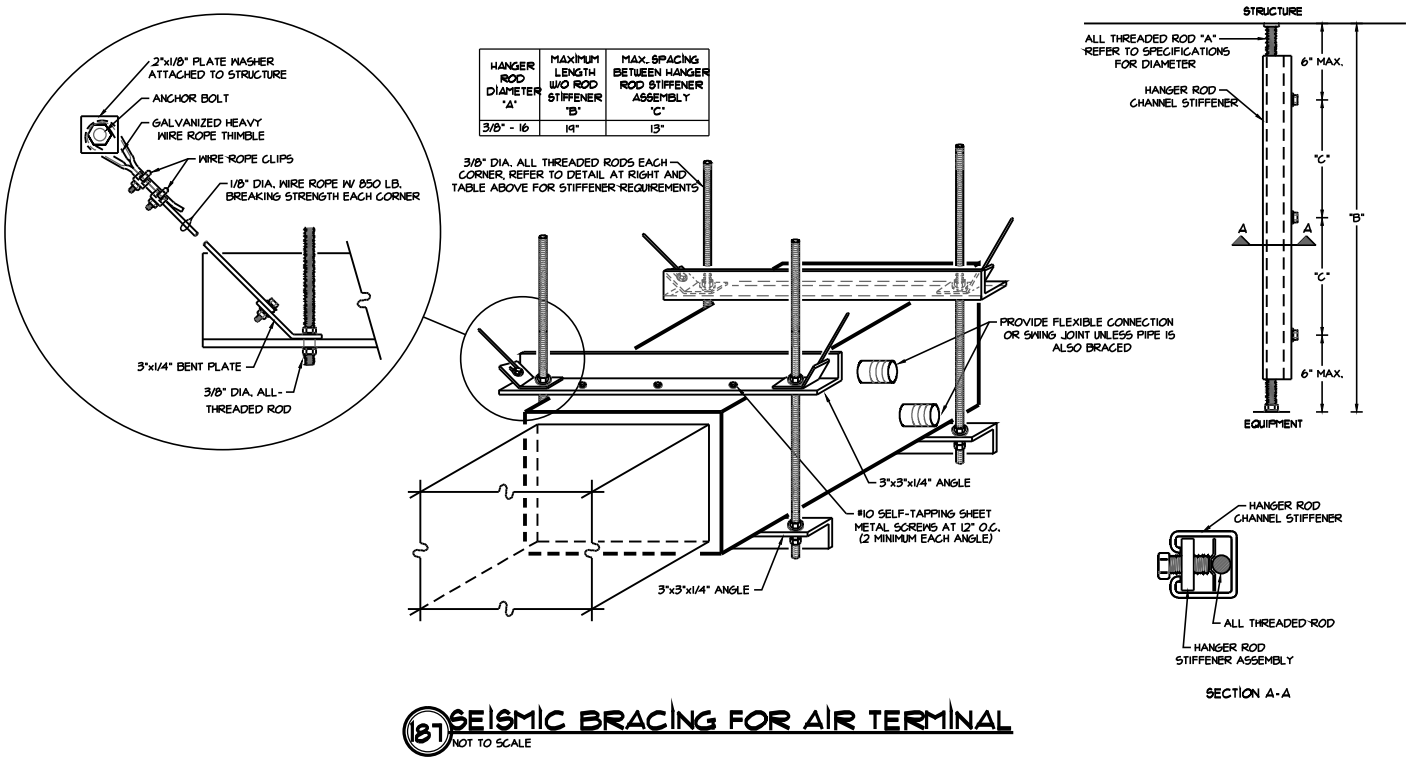
NOT TO SCALE

HANGER ROD DIAMETER 'A'	MAXIMUM LENGTH W/O ROD STIFFENER 'B'	MAX. SPACING BETWEEN HANGER ROD STIFFENER ASSEMBLY 'C'
3/8" - 16	19"	13"



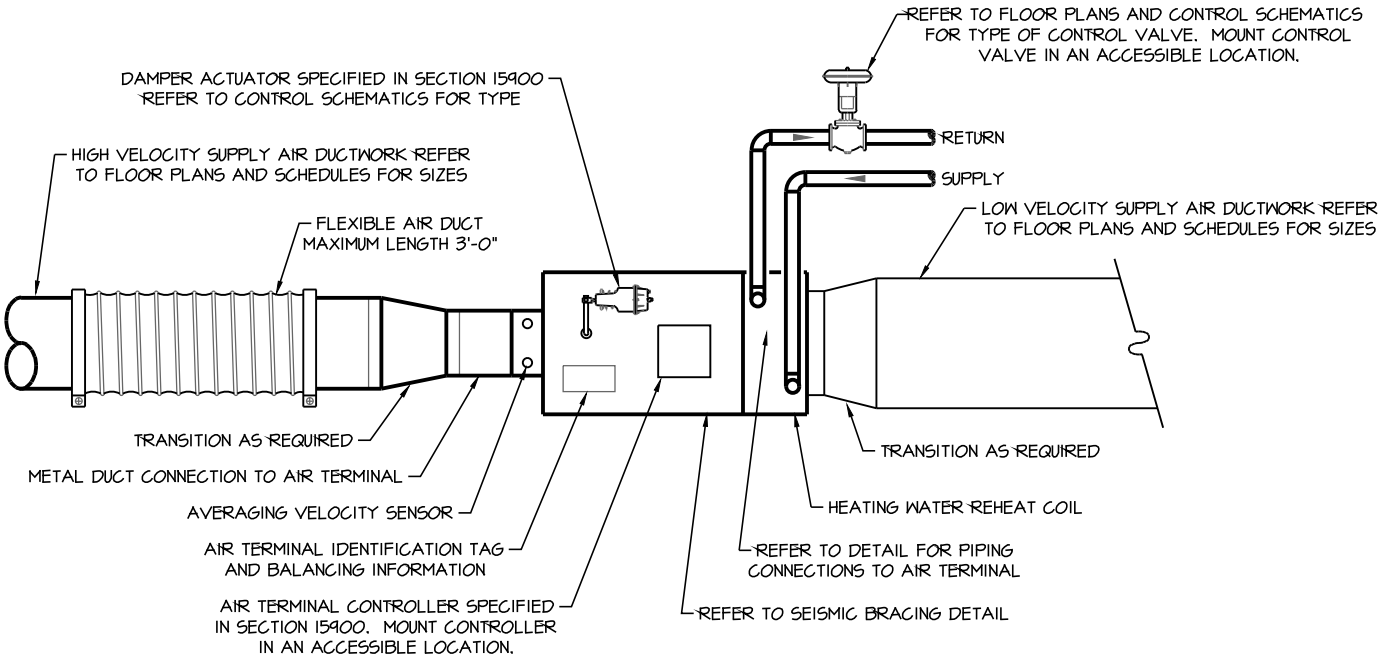
186 SEISMIC BRACING FOR AIR TERMINAL

NOT TO SCALE



187 SEISMIC BRACING FOR AIR TERMINAL

NOT TO SCALE



188 TYPICAL AIR TERMINAL DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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Design Guide Details

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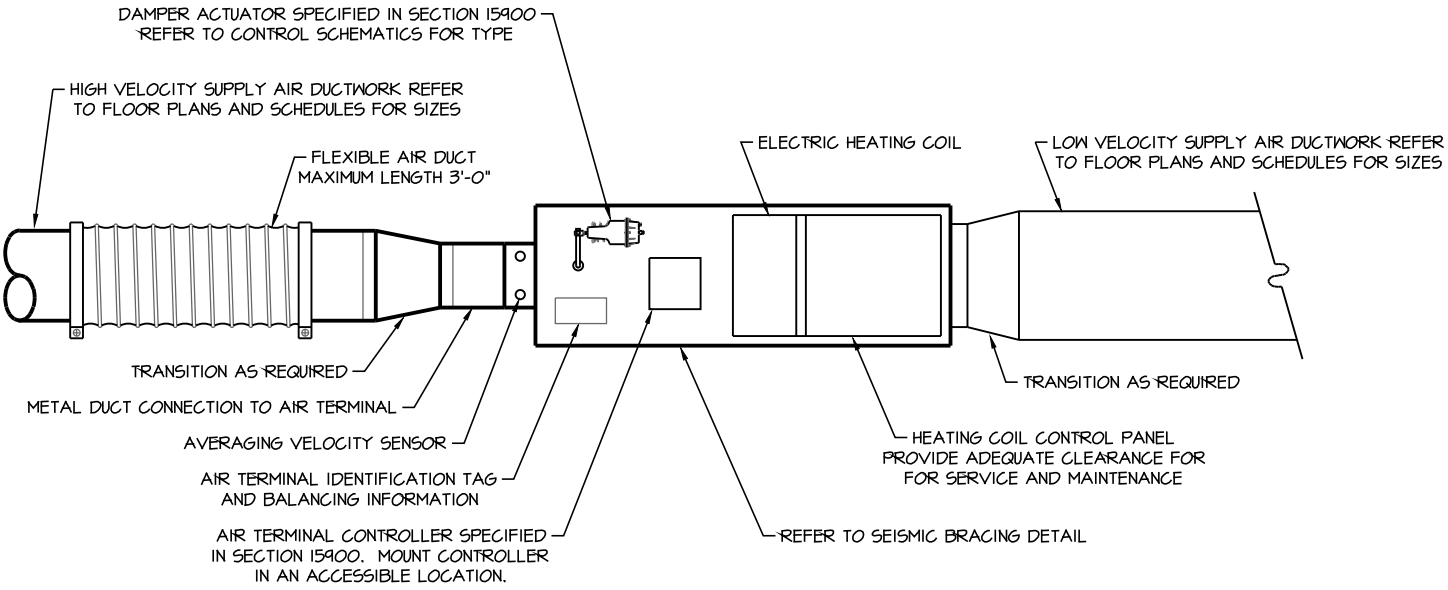
SHEET 1 OF 1



189 TYPICAL AIR TERMINAL DETAIL

NOT TO SCALE

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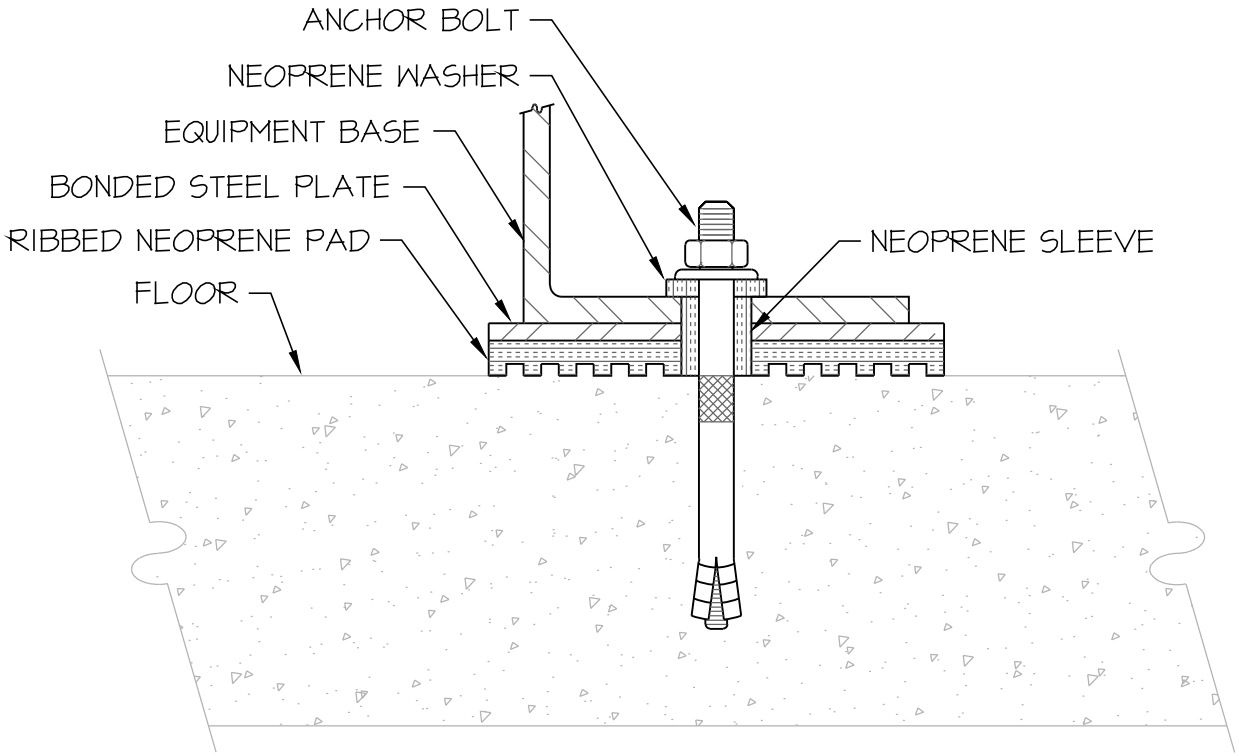
SHEET NO:

Det 189

SHEET 1 OF 1



190 ANCHOR CONNECTION DETAIL

NOT TO SCALE

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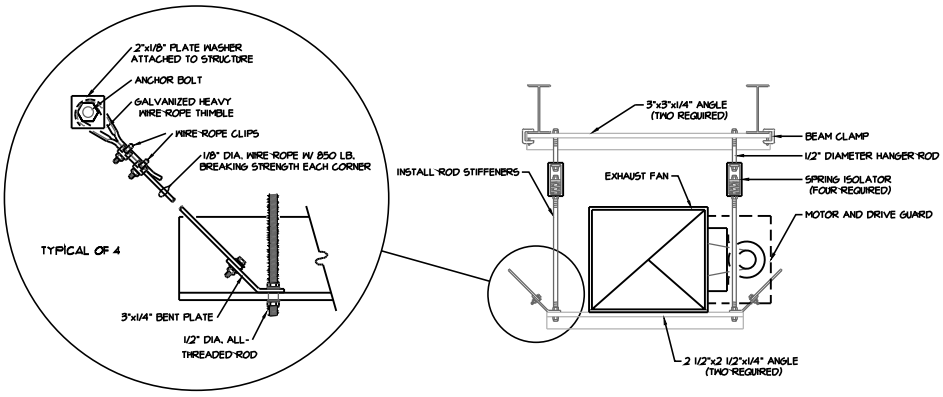
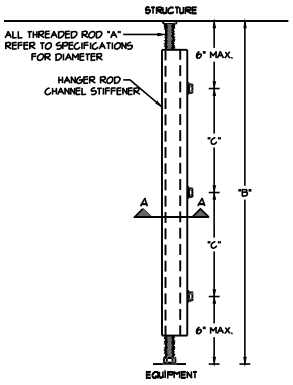
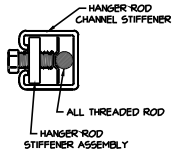
DATE: XX/XX/XX
SHEET NO: Det 190
SHEET 1 OF 1





HANGER ROD STIFFENER DETAIL



SECTION A-A

HANGER ROD DIAMETER "A"	MAXIMUM LENGTH W/O ROD STIFFENER "B"	MAX. SPACING BETWEEN HANGER ROD STIFFENER ASSEMBLY "C"
3/8" - 16	19"	13"

191 IN-LINE EXHAUST FAN DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

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DATE: XX/XX/XX

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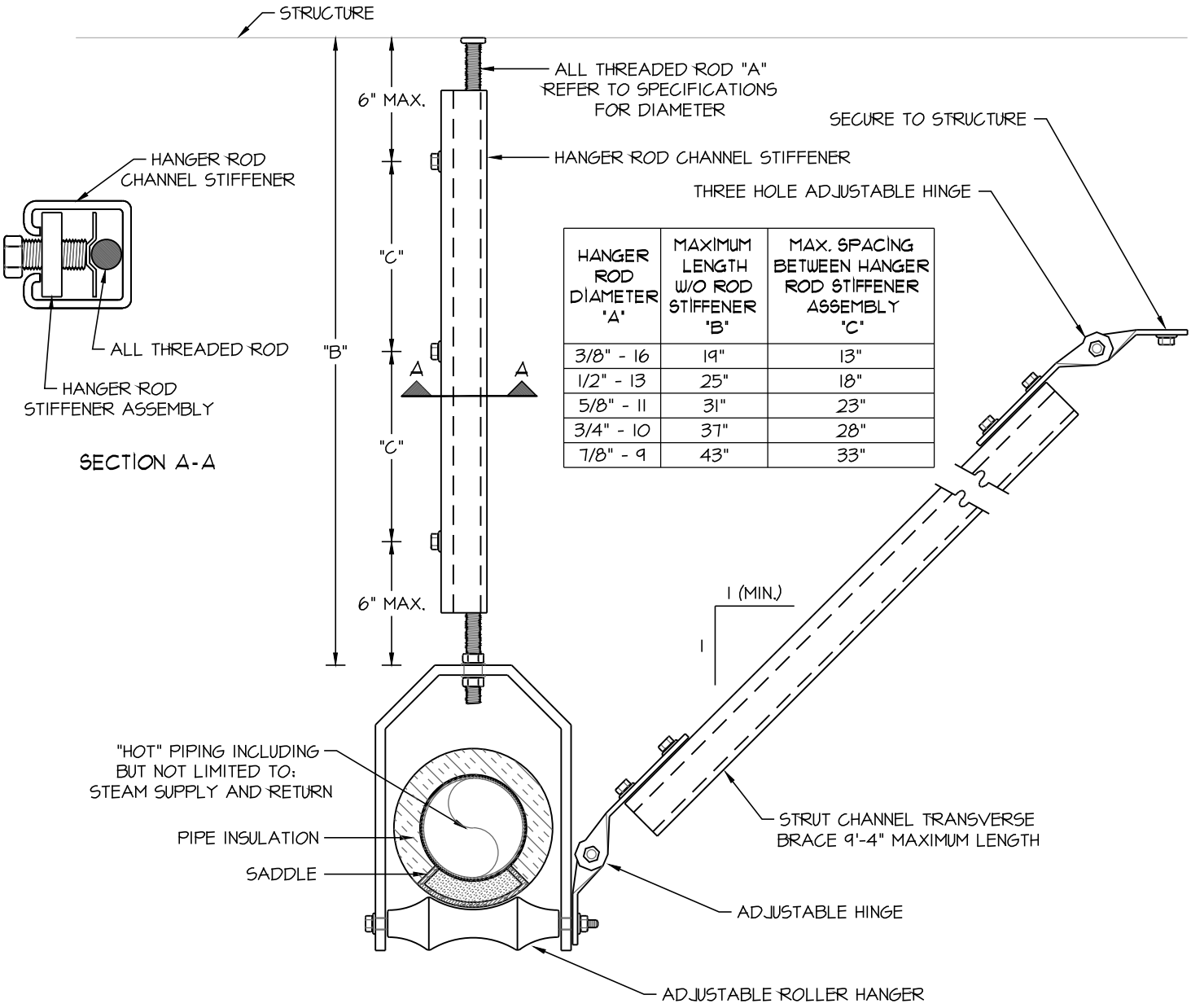
SHEET 1 OF 1



HANGER ROD DIAMETER "A"	MAXIMUM LENGTH W/O ROD STIFFENER "B"	MAX. SPACING BETWEEN HANGER ROD STIFFENER ASSEMBLY "C"
3/8" - 16	19"	13"
1/2" - 13	25"	18"
5/8" - 11	31"	23"
3/4" - 10	37"	28"
7/8" - 9	43"	33"

NOTE:
REFER TO SPECIFICATIONS FOR THE MAXIMUM TRANSVERSE SUPPORT SPACING, MAXIMUM LONGITUDINAL SUPPORT SPACING AND MINIMUM HANGER ROD DIAMETER

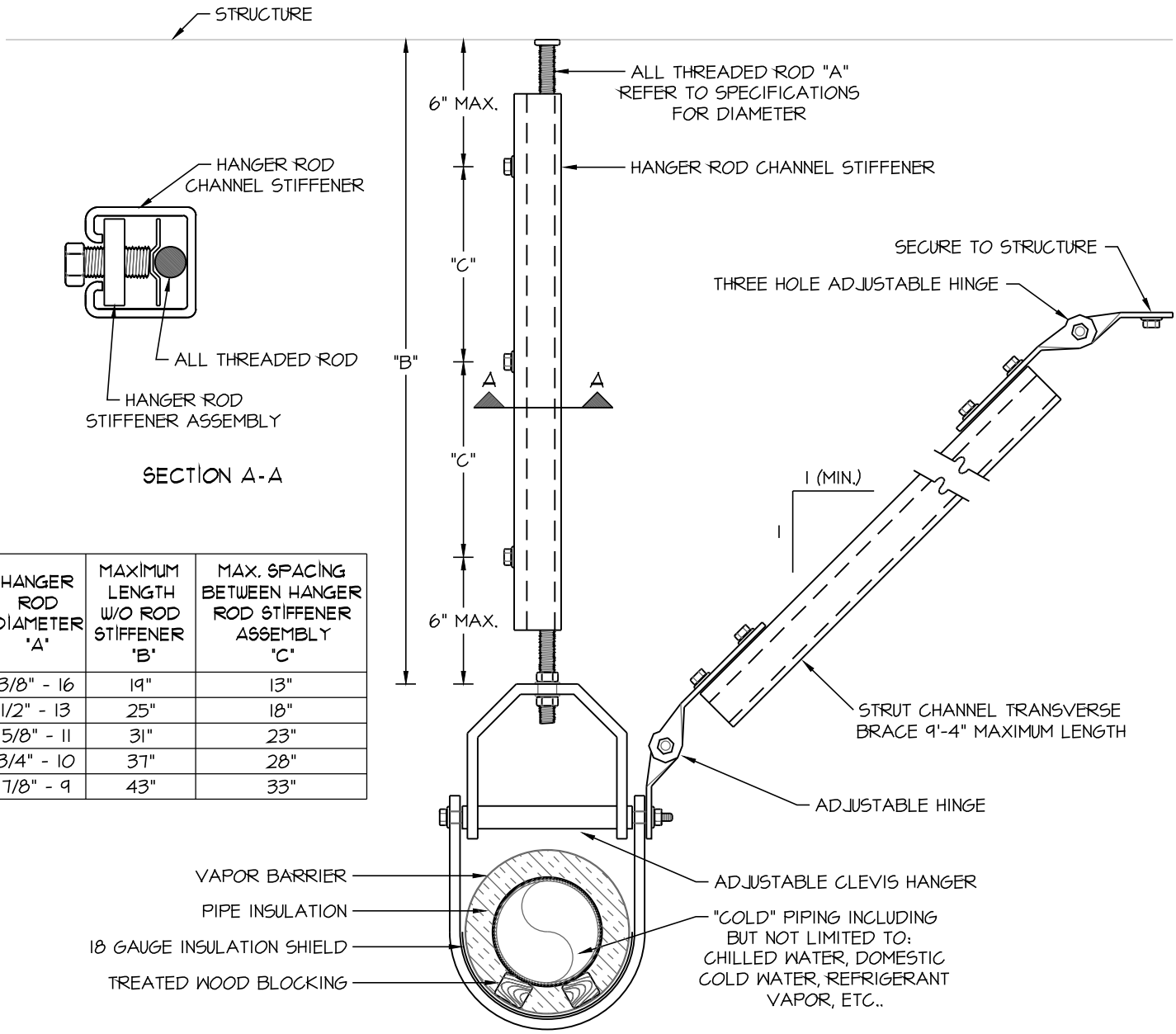
192 ROLLER PIPE TRANSVERSE BRACING DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

University of Arkansas at Fayetteville
Design Guide Details

DATE: XX/XX/XX
SHEET NO: Det 192
SHEET 1 OF 1



HANGER ROD DIAMETER "A"	MAXIMUM LENGTH W/O ROD STIFFENER "B"	MAX. SPACING BETWEEN HANGER ROD STIFFENER ASSEMBLY "C"
3/8" - 16	19"	13"
1/2" - 13	25"	18"
5/8" - 11	31"	23"
3/4" - 10	37"	28"
7/8" - 9	43"	33"

NOTE:
REFER TO SPECIFICATIONS FOR THE MAXIMUM TRANSVERSE SUPPORT SPACING, MAXIMUM LONGITUDINAL SUPPORT SPACING AND MINIMUM HANGER ROD DIAMETER

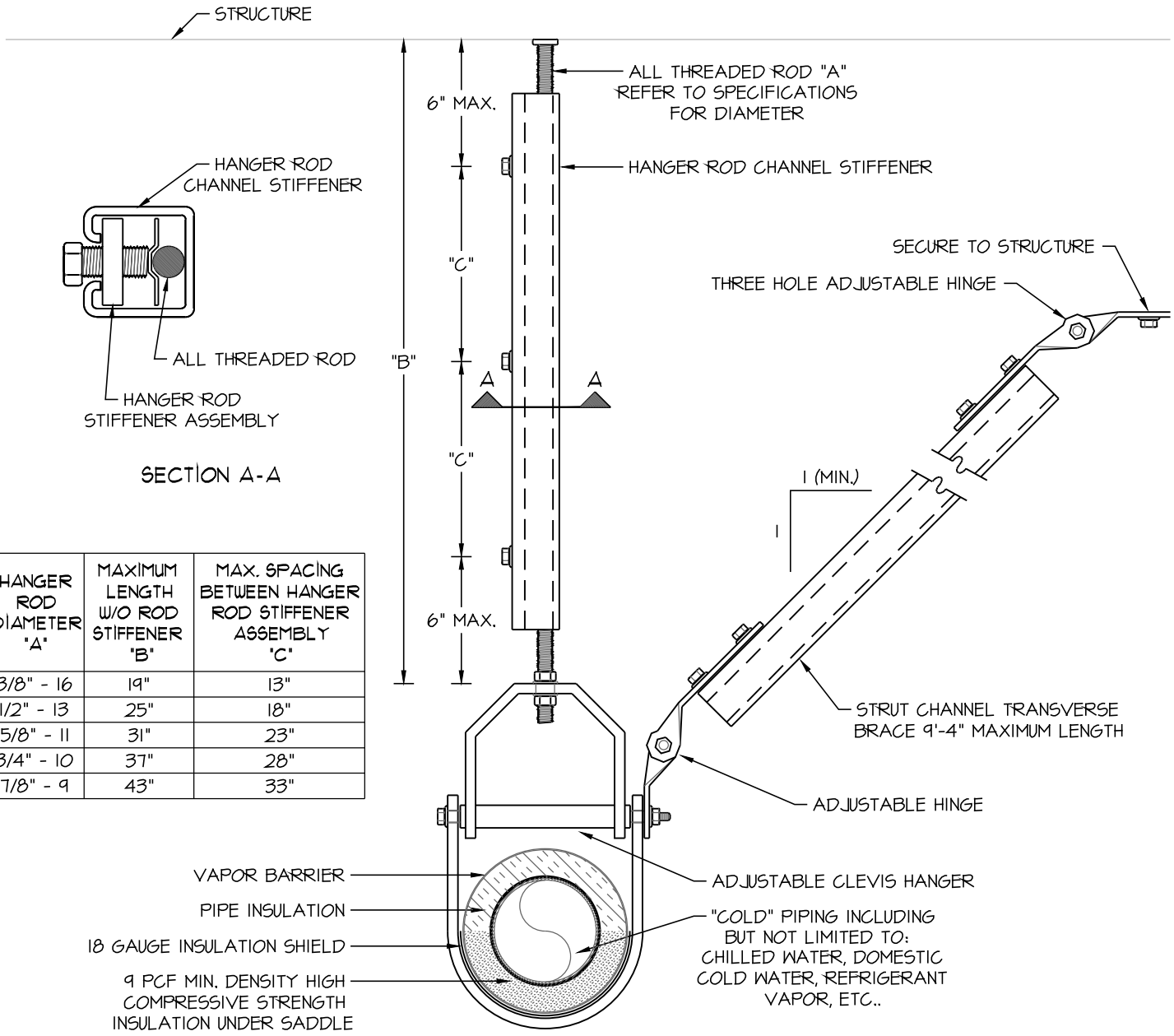
193 CLEVIS HANGER TRANSVERSE BRACING DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

University of Arkansas at Fayetteville
Design Guide Details

DATE: XX/XX/XX
SHEET NO:
Det 193
SHEET 1 OF 1



HANGER ROD DIAMETER "A"	MAXIMUM LENGTH W/O ROD STIFFENER "B"	MAX. SPACING BETWEEN HANGER ROD STIFFENER ASSEMBLY "C"
3/8" - 16	19"	13"
1/2" - 13	25"	18"
5/8" - 11	31"	23"
3/4" - 10	37"	28"
7/8" - 9	43"	33"

NOTE:
REFER TO SPECIFICATIONS FOR THE MAXIMUM TRANSVERSE SUPPORT SPACING, MAXIMUM LONGITUDINAL SUPPORT SPACING AND MINIMUM HANGER ROD DIAMETER

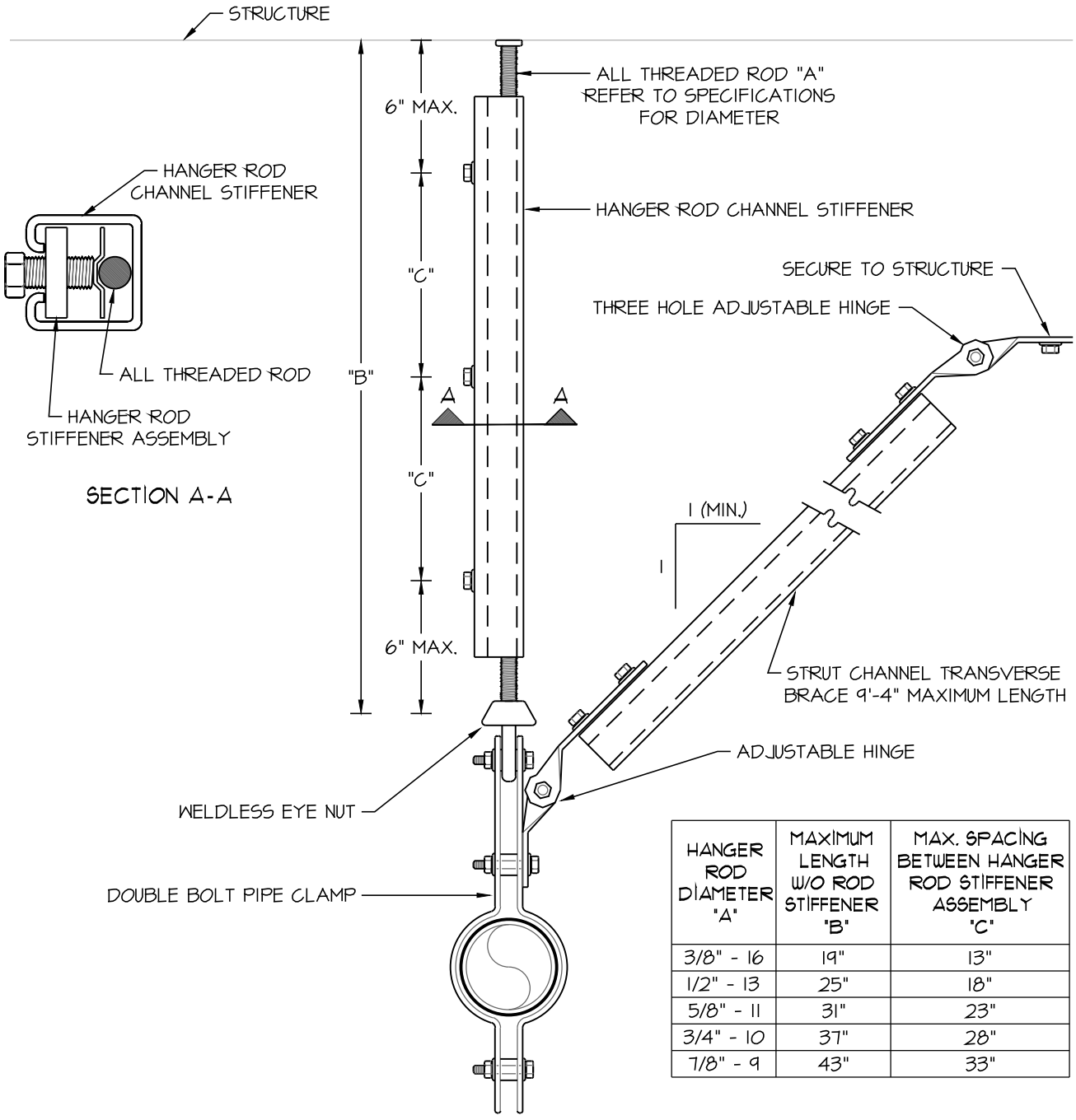
194 CLEVIS HANGER TRANSVERSE BRACING DETAI

NOT TO SCALE

UNIVERSITY OF ARKANSAS

University of Arkansas at Fayetteville
Design Guide Details

DATE: XX/XX/XX
SHEET NO:
Det 194
SHEET 1 OF 1



HANGER ROD DIAMETER "A"	MAXIMUM LENGTH W/O ROD STIFFENER "B"	MAX. SPACING BETWEEN HANGER ROD STIFFENER ASSEMBLY "C"
3/8" - 16	19"	13"
1/2" - 13	25"	18"
5/8" - 11	31"	23"
3/4" - 10	37"	28"
7/8" - 9	43"	33"

NOTE:
REFER TO SPECIFICATIONS FOR THE MAXIMUM TRANSVERSE SUPPORT SPACING, MAXIMUM LONGITUDINAL SUPPORT SPACING AND MINIMUM HANGER ROD DIAMETER

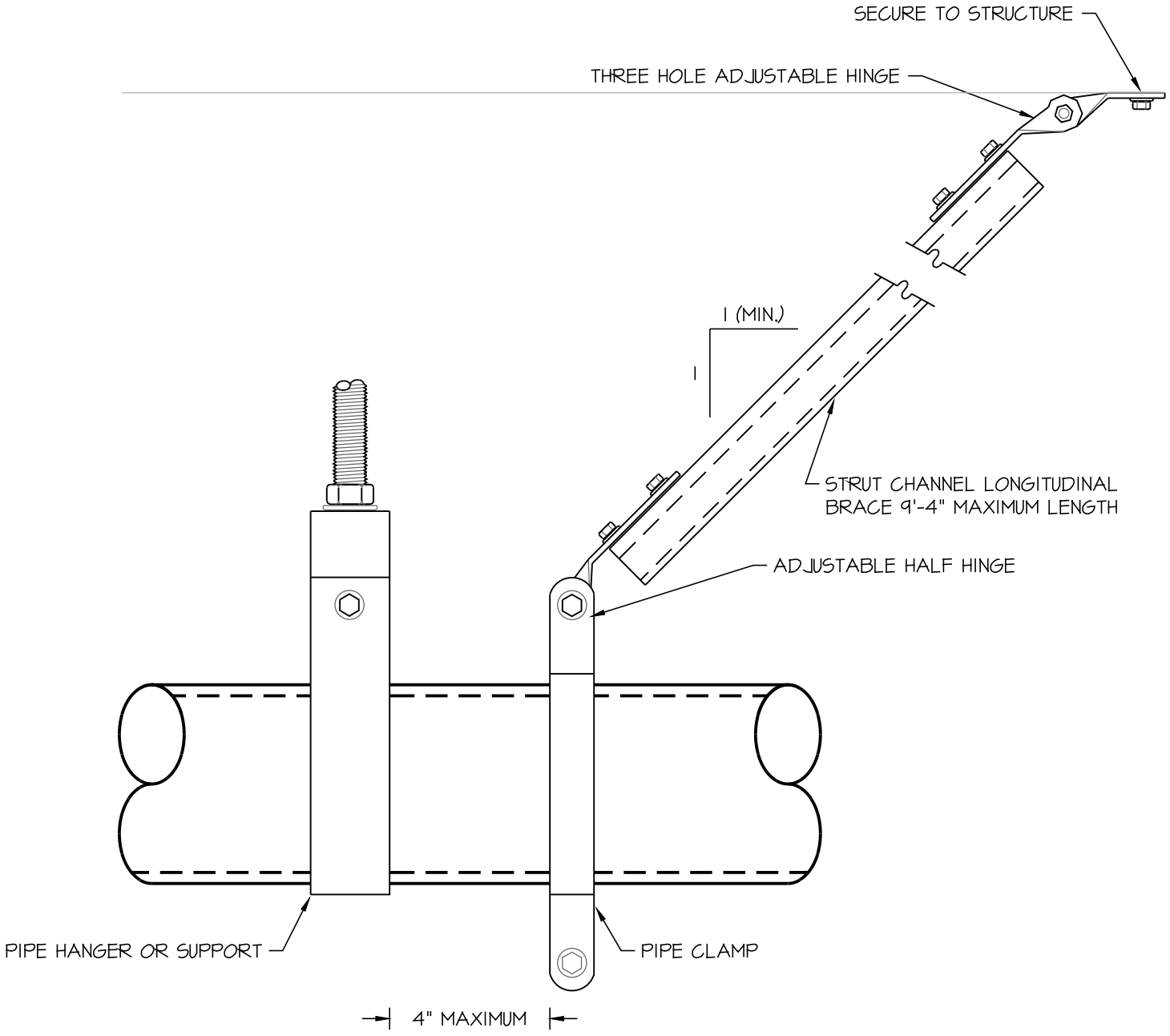
195 PIPE CLAMP TRANSVERSE BRACING DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

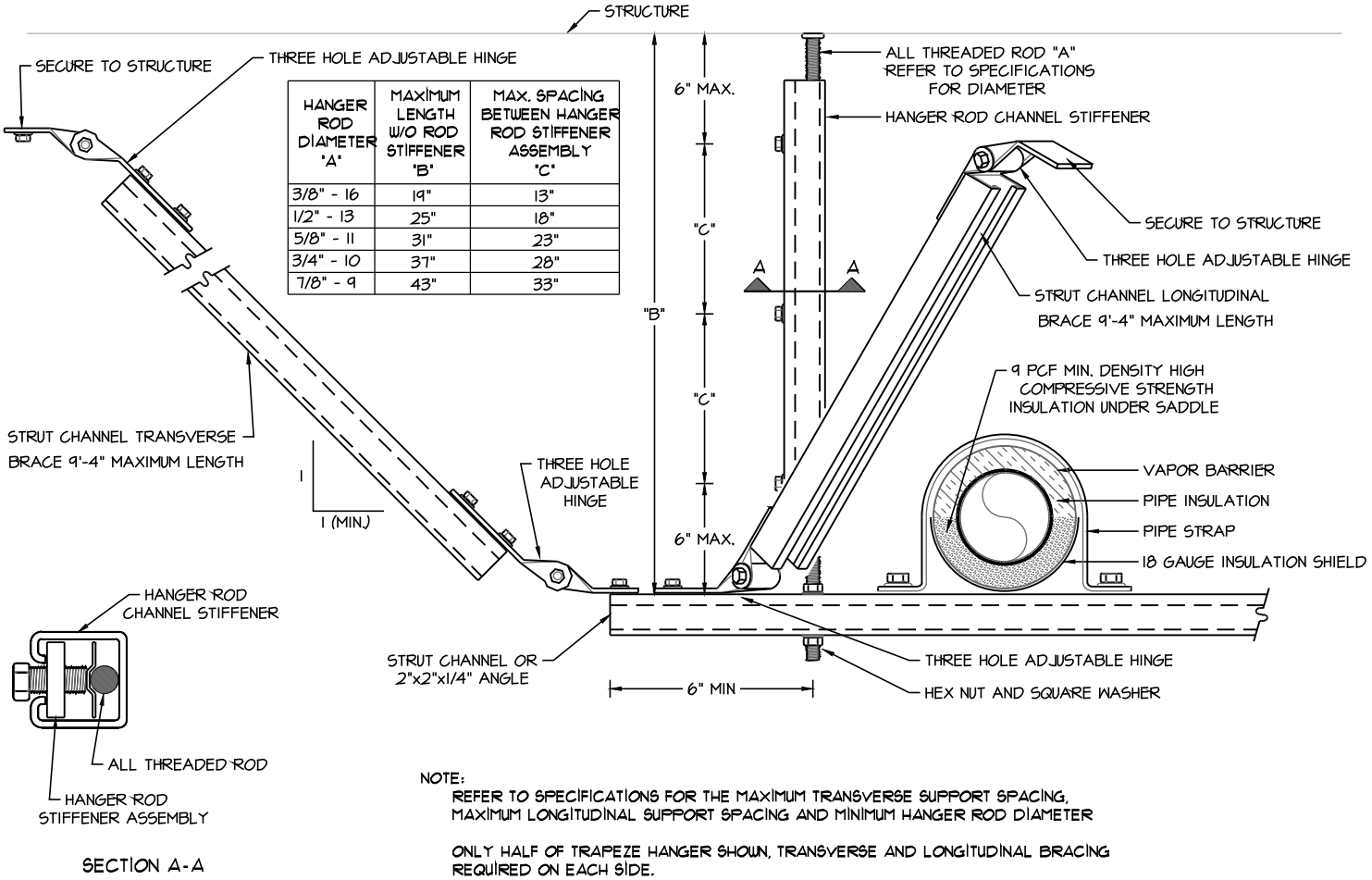
University of Arkansas at Fayetteville
Design Guide Details

DATE: XX/XX/XX
SHEET NO:
Det 195
SHEET 1 OF 1



196 PIPE LONGITUDINAL BRACING DETAIL

NOT TO SCALE



HANGER ROD DIAMETER "A"	MAXIMUM LENGTH W/O ROD STIFFENER "B"	MAX. SPACING BETWEEN HANGER ROD STIFFENER ASSEMBLY "C"
3/8" - 16	19"	13"
1/2" - 13	25"	18"
5/8" - 11	31"	23"
3/4" - 10	37"	28"
7/8" - 9	43"	33"

NOTE:
REFER TO SPECIFICATIONS FOR THE MAXIMUM TRANSVERSE SUPPORT SPACING, MAXIMUM LONGITUDINAL SUPPORT SPACING AND MINIMUM HANGER ROD DIAMETER

ONLY HALF OF TRAPEZE HANGER SHOWN, TRANSVERSE AND LONGITUDINAL BRACING REQUIRED ON EACH SIDE.

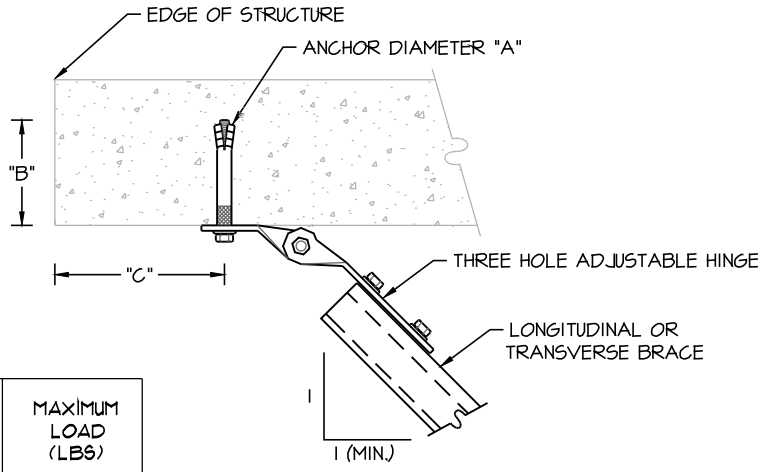
197 TRAPEZE TRANSVERSE AND LONGITUDINAL BRACING DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

University of Arkansas at Fayetteville
Design Guide Details

DATE: XX/XX/XX
SHEET NO: Det 197
SHEET 1 OF 1



ANCHOR DIAMETER "A"	MINIMUM EMBEDMENT OF ANCHOR "B"	MIN. DISTANCE FROM EDGE OF CONCRETE "C"	MAXIMUM LOAD (LBS)
3/8"	2-1/2"	4"	250
1/2"	3-1/2"	5"	425
5/8"	4"	7"	600
3/4"	4-3/4"	8"	850

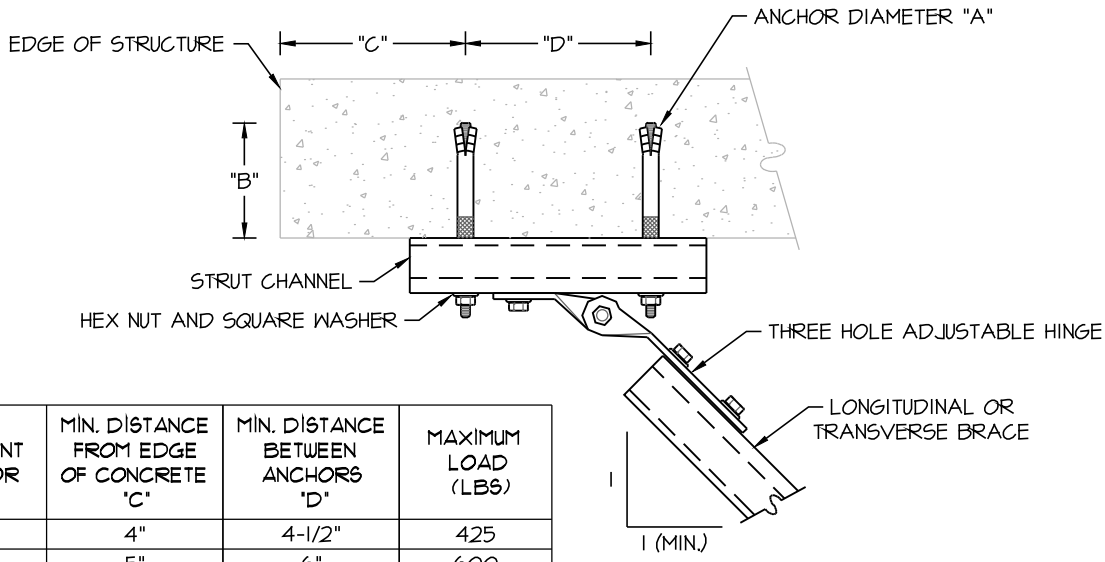
198 BRACING ATTACHMENT TO CONCRETE DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

University of Arkansas at Fayetteville
Design Guide Details

DATE: XX/XX/XX
SHEET NO:
Det 198
SHEET 1 OF 1



ANCHOR DIAMETER "A"	MINIMUM EMBEDMENT OF ANCHOR "B"	MIN. DISTANCE FROM EDGE OF CONCRETE "C"	MIN. DISTANCE BETWEEN ANCHORS "D"	MAXIMUM LOAD (LBS)
3/8"	2-1/2"	4"	4-1/2"	425
1/2"	3-1/2"	5"	6"	600
5/8"	4"	7"	7-1/2"	850
3/4"	4-3/4"	8"	9"	1200

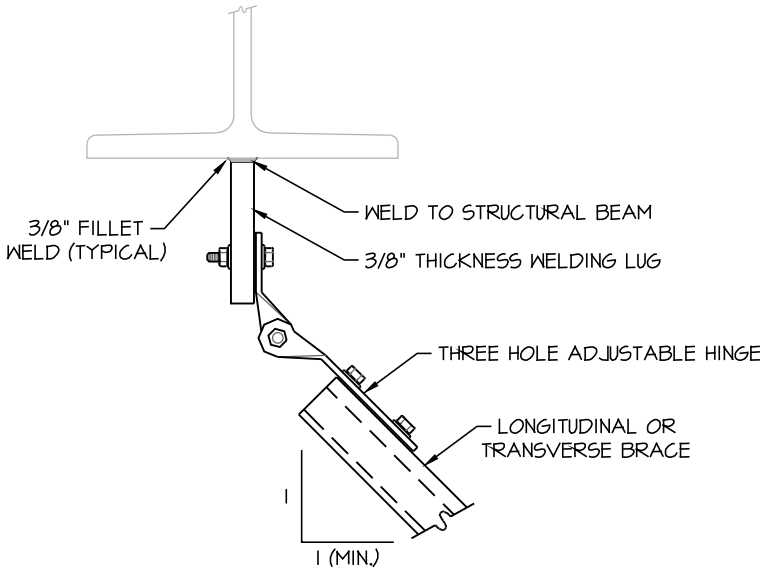
199 BRACING ATTACHMENT TO CONCRETE DETAIL

NOT TO SCALE

UNIVERSITY OF ARKANSAS

University of Arkansas at Fayetteville
Design Guide Details

DATE: XX/XX/XX
SHEET NO: Det 199
SHEET 1 OF 1



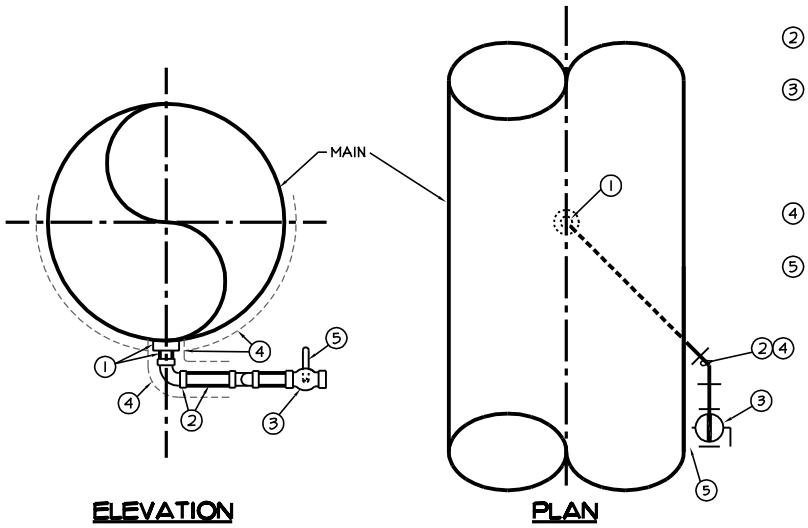
200 BRACING ATTACHMENT TO STEEL STRUCTURE

NOT TO SCALE

UNIVERSITY OF ARKANSAS

University of Arkansas at Fayetteville
Design Guide Details

DATE: XX/XX/XX
SHEET NO:
Det 200
SHEET 1 OF 1



KEYED NOTES:

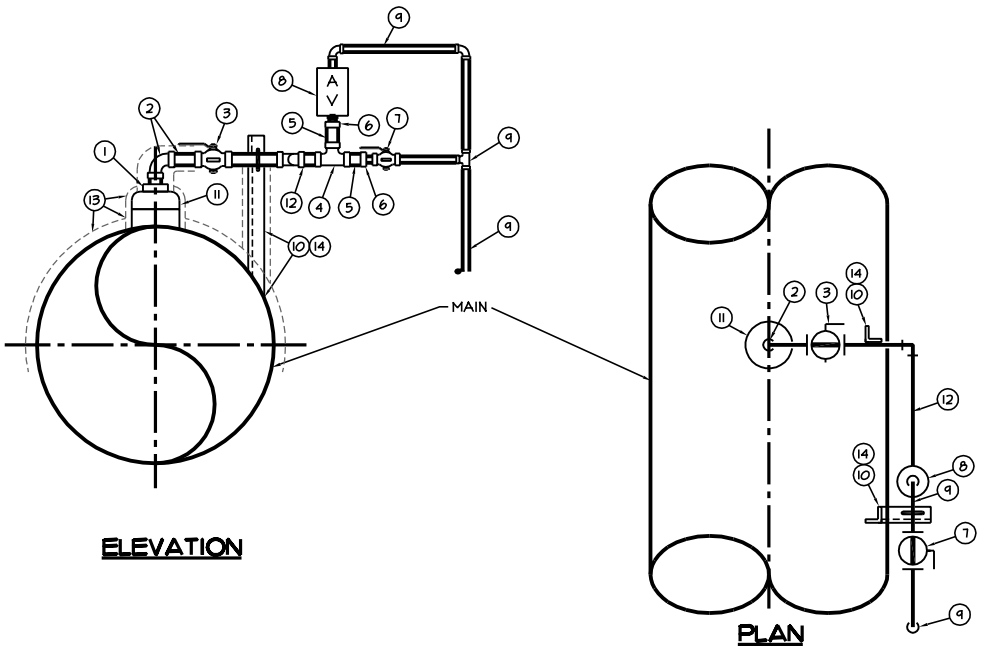
1. THREAD-O-LET, CLASS 3000 FORGED STEEL WITH 2" +/- NIPPLE. (HOLD DRAIN LINE CLOSE TO MAIN ALLOWING FOR BOTH MAIN AND DRAIN LINE INSULATION AND A SLIGHT GAP BETWEEN THE TWO).
2. ALL PIPING TO BE SCH 80. THREADED FITTINGS TO BE CLASS 300 MALLEABLE IRON.
3. STAINLESS STEEL BALL VALVE EQUAL TO APOLLO SERIES 76F-100 WITH LOCKING LEVER HANDLE.

VALVE SIZE	PIPE SIZE
1-1/2"	6" AND SMALLER
2"	8" AND LARGER

4. INSULATE DRAIN LINE WITH FLEXIBLE CLOSED CELL ELASTOMERIC FROM VALVE BACK TO MAIN PIPE. SEAL TO MAIN PIPE INSULATION.
5. ORIENT VALVE HANDLE IN VERTICAL PLANE, WITH CLOSED BEING IN THE UP POSITION, SO GRAVITY HOLDS HANDLE LOCK IN "LOCKED" POSITION. HANDLE TO FACE AISLE.

201 MAIN LINE / LARGE SERVICE DRAINS - CHILLED AND HEATING HOT WATER

NOT TO SCALE



KEYED NOTES

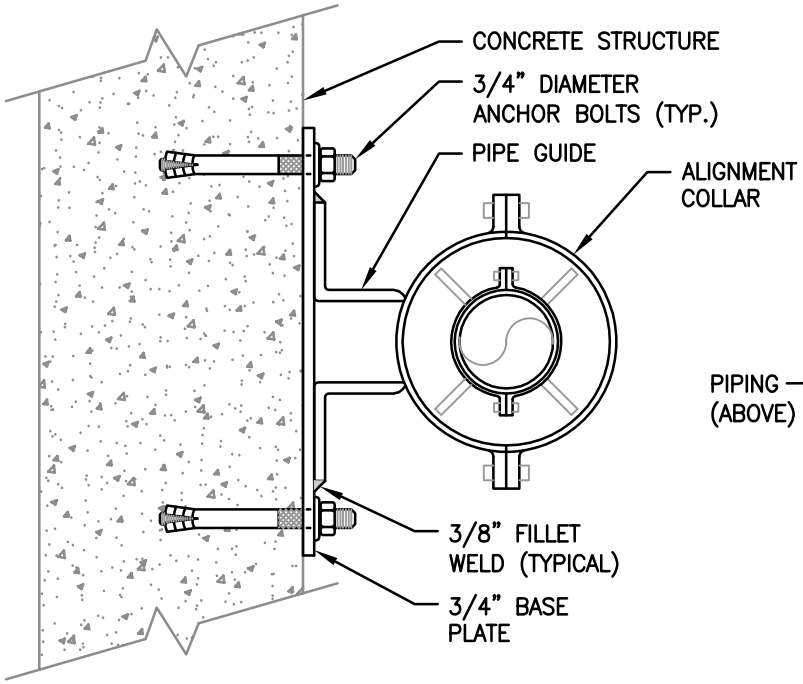
1. 1" THREAD-O-LET CLASS 3000, FORGED STEEL.
2. ALL LINE SIDE PIPE TO BE SCH 80. THREADED FITTINGS TO BE CLASS 300 MALLEABLE IRON.
3. 1" STAINLESS STEEL BALL VALVE EQUAL TO APOLLO SERIES 76F-100.
4. 1" THREADED TEE, CLASS 300 MALLEABLE IRON.
5. SCH 80 NIPPLE.
6. 1" X 1/2" FORGED STEEL BUSHING.
7. 1/2" STAINLESS STEEL BALL VALVE EQUAL TO APOLLO SERIES 76F-100. HANDLE TO FACE AISLE.
8. 1/2" AUTOMATIC AIR VENT.
9. PIPE TO FLOOR DRAIN WITH 1/2" SCH. 40 PIPE. THREADED FITTINGS TO BE CLASS 150, MALLEABLE IRON.
10. PROVIDE PIPE SUPPORT FOR ASSEMBLY. WELD TO MAIN.
11. AIR POCKET.

AIR POCKET SIZE	PIPE SIZE
FULL PIPE SIZE	4" AND SMALLER
4"	6" AND 8"
6"	10" AND LARGER

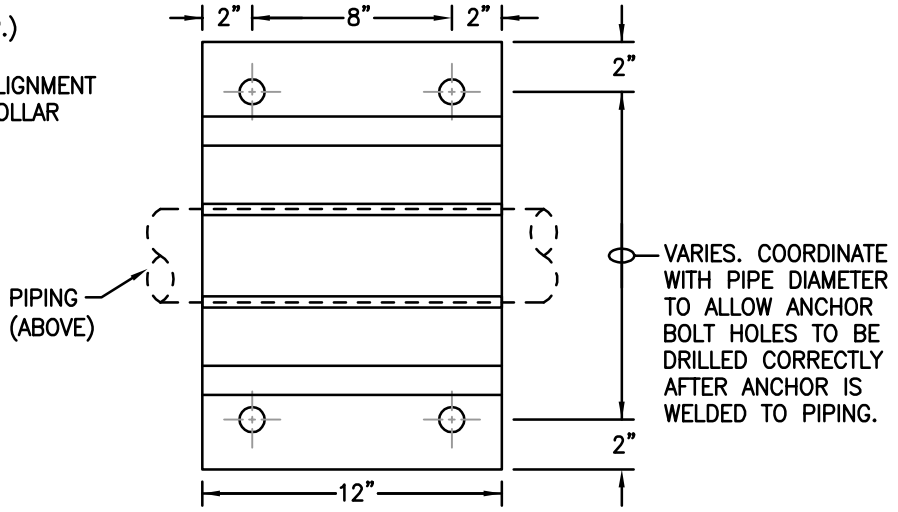
12. IN PLAN VIEW, ROTATE VENT ASSEMBLY PARALLEL WITH MAIN PIPE RUN TO MINIMIZE CONFLICT WITH AISLE.
13. INSULATE AIR VENT LINE WITH FLEXIBLE CLOSED CELL ELASTOMERIC INSULATION FROM VALVE BACK TO MAIN PIPE. SEAL TO MAIN PIPE INSULATION.
14. INSULATE PIPE SUPPORTS WITH FLEXIBLE CLOSED CELL ELASTOMERIC INSULATION UP TO PIPING TO PREVENT CONDENSATION FORMING AT THE SUPPORTS.

202 MAIN LINE/ LARGE SERVICE AIR VENTS - CHILLED AND HEATING HOT WATER

NOT TO SCALE



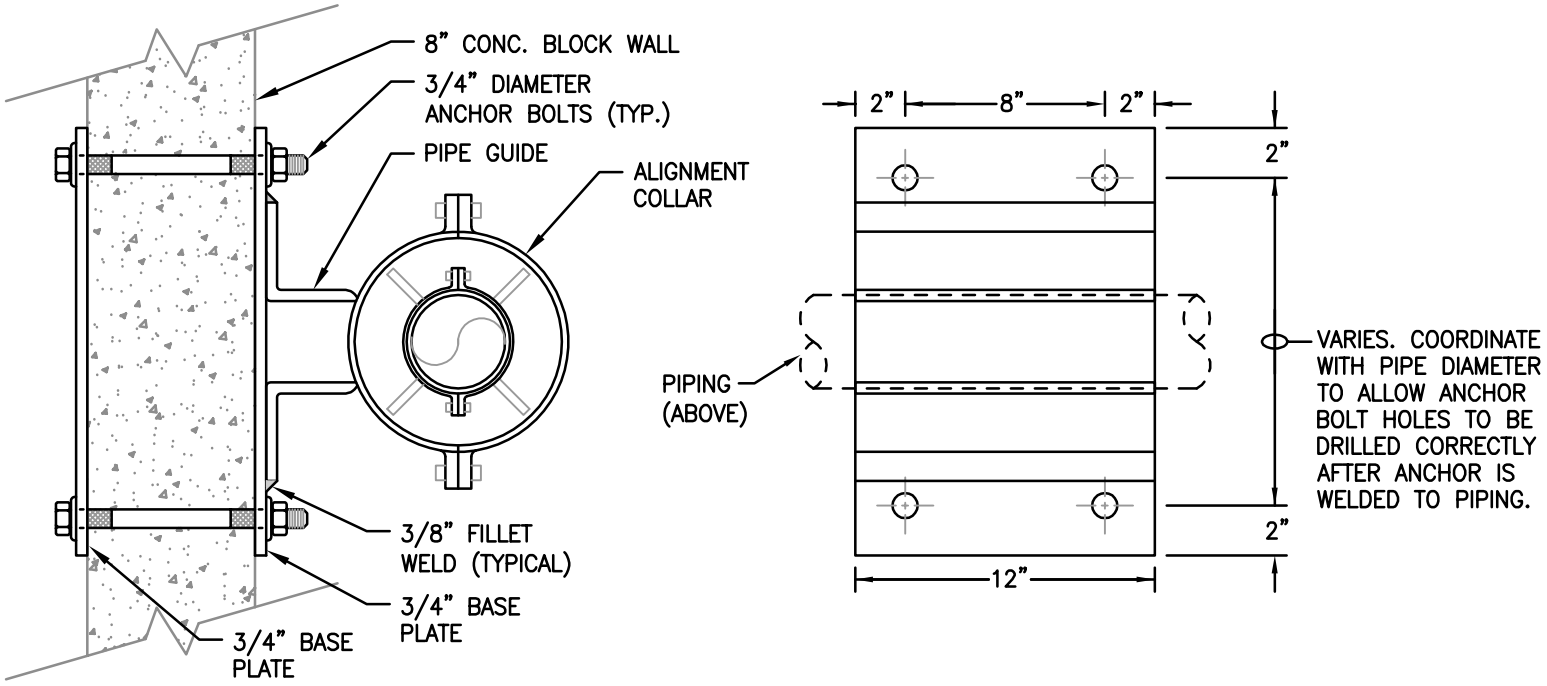
ELEVATION



BASE PLATE (PLAN VIEW)

203 PIPE GUIDE DETAIL

N.T.S.

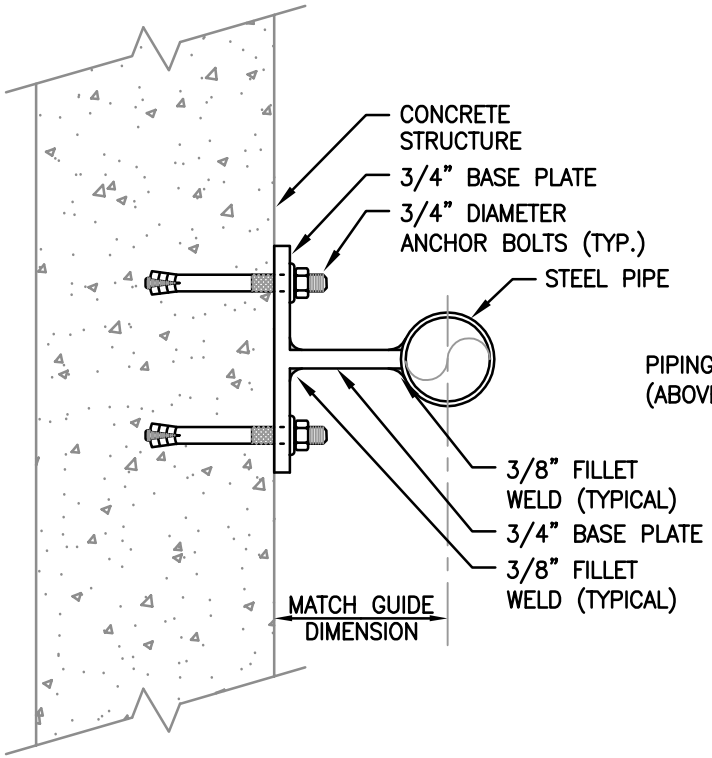


ELEVATION

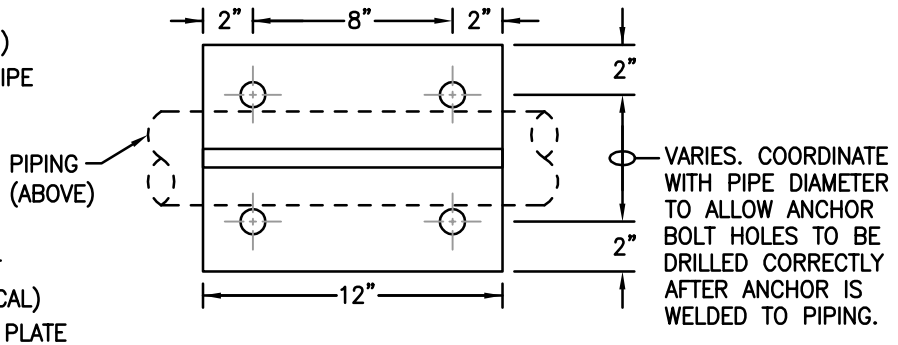
BASE PLATE (PLAN VIEW)

204 PIPE GUIDE DETAIL

N.T.S.



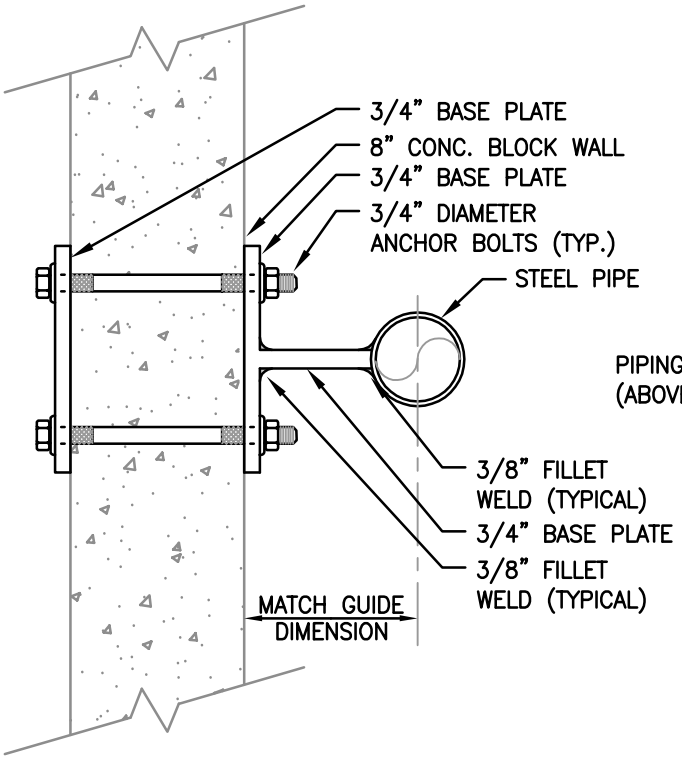
ELEVATION



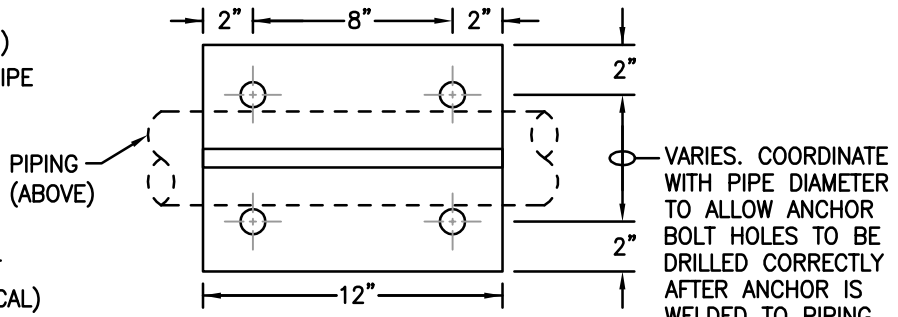
BASE PLATE (PLAN VIEW)

205 PIPE ANCHOR DETAIL

N.T.S.



ELEVATION



BASE PLATE (PLAN VIEW)

206 PIPE ANCHOR DETAIL

N.T.S.

Coil Selection / Rating 2004.500

Job Name: C189-05 Center for Academic Excellence Date: 12-19-05
Tag: ERAHU-1 Entered by: User Name Serial #: 0

Steam Heating AL		5SS – 2 – 48 X 70 X 1 – 8
Individual Coil Construction	Entering Conditions	Leaving Conditions
(Qty) FH x FL: (2) 48.00 X 70.00	ACFM: 25 000	Total Heat: 1 187 635 Btu/Hr
Rows – FPI: 1 – 8	SCFM: 25 000	Sensible Heat: 1 187 635 Btu/Hr
	Altd: 0 ft.	
Total Face Area: 46.67 sq.ft	EDB: 7.5°F	LDB: 51.3°F
Fin Thick / Mat.: 0.008" / AL		
Tube O.D. / Wall: 5/8" / 0.025"		
Tube Material: CU		FV: 535.7 ft/min
Case Material : Galvanized		APD: 0.08 in. WG
Conn Location: RH Same	Steam Press: 2.0 psig	Condensate: 1229 lbs/hr
Sup.Conn – Qty / Size: (1) 1-1/2"		
Ret.Conn – Qty / Size: (1) 1-1/2"		
ARI CERTIFIED 'Rated in Accordance with ARI Standard 410'		

1. Air Temperature Correction for CFM not active.
2. If EDB is less than or equal to 32°F, Ventrol recommends 5 psig minimum and NO modulating steam valve.

Guide Specifications

PART 1: GENERAL

1.01 WORK INCLUDED

A. Indoor and outdoor air-handling units and components as shown, scheduled, and indicated on the drawings.

1.02 RELATED SECTIONS

A. The requirements of the General Conditions, Supplementary Conditions, Division 1, and Drawings apply to all work herein.

B. Requirements of the following sections apply.

a. Section 01513 - Temporary Heating, Cooling, and Ventilating.

b. Section 15121 - Expansion Compensation.

c. Section 15170 - Motors.

d. Section 15242 - Vibration Isolation.

e. Section 15290 - Ductwork Insulation.

f. Section 15410 - Plumbing Piping: Equipment Drains.

g. Section 15790 - Air Coils.

h. Section 15811 - Evaporative Humidifier.

i. Section 15812 - Evaporative Pan Humidifier.

j. Section 15813 - Steam Grid Humidifier.

k. Section 15821 - Spray Coil Humidifier.

l. Section 15860 - Centrifugal Fans.

m. Section 15865 - Axial Fans.

n. Section 15885 - Air Cleaning.

o. Section 15890 - Ductwork.

p. Section 15910 - Ductwork Accessories: Flexible Duct Connections.

q. Section 16180 - Equipment Wiring Systems: Electrical Characteristics and Wiring Connections.

1.03 QUALITY ASSURANCE

A. Manufacturers: The design shown on the drawing is based upon products of the manufacturer scheduled. Alternate equipment manufacturers will be acceptable if equipment meets the scheduled performance and complies with these specifications. The intent of this specification requirement is to assure that the products are delivered through a quality system and framework that will assure consistent quality. If equipment manufactured by manufacturer other than that scheduled is utilized, then the Mechanical Contractor shall be responsible for coordinating with the General Contractor and all affected Subcontractors to ensure proper provisions for installation of the furnished unit. This coordination shall include, but not be limited to, the following:

a. Structural supports for units.

b. Piping size and connection/header locations.

c. Electrical power requirements and wire/conduit and overcurrent protection sizes.

d. The Mechanical Contractor shall be responsible for all costs incurred by the General Contractor, Subcontractors, and Consultants to modify the building provisions to accept the furnished units.

1.04 REFERENCES

A. AMCA 99 – Standard Handbook.

B. AMCA 210 – Laboratory Methods of Testing Fans for Rating Purposes.

C. AMCA 300 – Test Code for Sound Rating Air Moving Devices.

D. AMCA 301 – Method of Publishing Sound Ratings for Air Moving Devices.

E. AMCA 500 – Test Methods for Louvers, Dampers, and Shutters.

F. ANSI/AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.

G. ANSI/UL 900 – Test Performance of Air Filter Units.

H. ARI 410 – Forced-Circulation Air Cooling and Air Heating Coils.

I. ARI 430 – Standard for Application of Central-Station Air Handling Units.

J. ARI 260 – Sound Rating of Ducted Air Moving and Conditioning Equipment.

K. NFPA 90A – Installation of Air Conditioning and Ventilation Systems.

L. SMACNA – Low Pressure Duct Construction Standards.

M. AMCA 611-95 – Methods of Testing Airflow Measurement Stations for Rating.

N. ASHRAE 52.1/52.2 – Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size.

O. ASHRAE 62 – Ventilation for Acceptable Indoor Air Quality.

P. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section_____.

B. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.

C. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, gages, and finishes of materials.

D. Provide fan curves with specified operating point clearly plotted.

E. Submit product data of filter media, filter performance data, filter assembly, and filter frames.

F. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

G. Submit manufacturer's installation instructions under provisions of Section_____.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section_____.

B. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.07 RATINGS AND CERTIFICATIONS

A. Conform to AMCA 210 for fan performance ratings.

B. Conform to E.T.L. or U.L. standards.

C. Conform to ARI 410 for capacities, pressure drops, and selection procedures of air coils.

D. Conform to ARI 430 for all fabrication procedures of air handling units.

E. Utilize only ANSI/UL 900 listed Class I or Class II filter media, approved by local authorities.

F. Utilize only ISO9001, 9000, or 9002 certified facilities in the manufacturing of the air- handling unit.

G. Electric control wiring shall be in accordance NEC codes & ETL requirements

H. Motors shall satisfy the Federally mandated Energy Policy Act (EPACT).

I. Test Airflow Monitoring Stations in accordance with AMCA 611-95. Provide Certified Ratings Seal for Airflow Measurement Performance.

1.08 DELIVERY, STORAGE AND HANDLING

A. All handling and storage procedures shall be per manufacturer's recommendations.

B. Unpainted units shall be shrink-wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Alternatively, units may be completely covered by tarps while in transit or shipped in an enclosed truck. Units not factory shrink-wrapped shall be re-covered by the contractor at the job- site while awaiting installation. Protection of the complete unit for avoidance of general rusting must be handled as best suits the circumstances. Store in a place protected from construction traffic and handle carefully to avoid damage to components, enclosures, and finish.

C. All openings shall be protected against damage from shipping

D. Safety warning labels shall be clearly marked in 3-language format

E. Filters will [ship loose from factory with unit] or [require call for delivery] as scheduled.

F. All loose-shipped items need to be packed, protected and secured with the air units.

G. Pipe chases will ship attached to the unit as indicated on the drawings unless the total unit width including the pipe chase exceeds 102", in which case the pipe chase will ship loose.

H. Rain hoods will [ship loose] [ship attached to the unit] as indicated on the drawings.

I. Factory Packaged Controls (FPC) will be factory mounted or shipped loose as selected. Motor control devices will be factory mounted or shipped loose as selected and indicated on the drawings. Electronic equipment cannot be stored in wet or damp areas even though they are sealed and secured.

J. Motors should be protected and inspected in accordance with the manufacturers specific instructions regarding periods of long storage.

1.09 WARRANTY

A. The manufacturer's standard warranty shall be for a period of eighteen months from the date of shipment.

Warranty is limited to manufacturers defect only.

The warranty shall include parts (18 mo.) and labor (12 mo.) during this period.

A factory trained and factory employed technician shall be available within 50 miles of the job site to respond to a service call.

Guide Specifications

The warranty shall not include parts associated with routine maintenance, such as belts, air filters, etc.

Warranty is not extended to any alteration, modifications or external component attached to “original” equipment “as-built” and shipped from manufacturing facilities.

All factory provided controls will carry the “Limited Warranty” as described above.

1.10 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.

B. Manufacturers “start-up” requirements must be complied-with to ensure safe and correct operation.

1.11 EXTRA STOCK

A. Provide one spare set(s) of filters per unit.

B. Provide one set of spare fan belts for each unit.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. York Solution (Basis of design).

B. _____

C. _____

2.02 GENERAL DESCRIPTION

A. Factory manufactured air-handling units designed to the performance levels specified with a combination of air-handling components in unitized housings to form complete, integrated machines as indicated on the drawings.

B. Fabricate air-handling units suitable for the scheduled capacities.

C. Factory test and balance fan design and drives to limit vibration (displacement in mils) at operating speeds.

D. Base performance on sea level conditions or [altitude].

E. All internal components specified in the air handling unit schedule shall be factory furnished and installed. Unit(s) shall be completely factory assembled.

G. Unit(s) shall ship in one (1) piece whenever possible. Unit splits will be provided only where necessary for shipping [or where indicated by customer]. Lifting lugs will be supplied on each side of a shipping split and at all unit corners to facilitate rigging and aid in joining shipping sections. Lifting lugs to be suitable for rigging without requiring additional support frames.

2.03 UNIT CASING

A. The air-handling unit shall be specifically designed for use in an indoor or outdoor application, as specified.

B. The construction of the air handling unit shall consist of a complete structural frame with removable panels. Casing shall be supported in such a manner so that maximum allowable air leakage shall not exceed 1% and panel deflection shall not exceed a L/240 ratio when subjected to +/- 8-in. w.g. static pressure. All panels shall be completely gasketed prior to shipment and shall be completely removable for unit access and removal of components. Removal of any or all panels shall not affect the structural integrity of the unit.

C. The air-handling unit shall be provided with a full perimeter base rail channel.

   a. The base rail channel shall be formed of 16-gage minimum galvanized steel.

   b. The base rail channel shall have a minimum height of [8] " to insure adequate clearance for drain pipe trapping.

   c. The base rail channel shall support all major components.

   d. Perimeter structural steel lifting lugs shall be provided to accommodate overhead lifting.

D. The air-handling unit shall be supplied with double wall panels for walls, roof, and floor constructed of G90 mill galvanized sheet steel.

E. Outdoor air handling unit(s) shall be provided with a full-perimeter, gasketed [insulated] roof curb. Roof curb shall ship loose for field installation prior to unit placement.

   a. Roof curb shall be a prefabricated galvanized steel-mounting curb.

   b. Roof curb application shall provide for continuous insulation between unit panels and roof curb.

   c. The roof curb shall have 1.5-inch, 3 pound per cubic foot density fiberglass insulation**.**

   d. Roof curb shall be a perimeter type providing complete perimeter support of the air-handling unit.

   e. Roof curb shall be flat or sloped to accommodate

the roof pitch, as indicated on the curb drawings.

f. The curb shall be a minimum 18 gage and a minimum of 14 inches high.

g. Gasketing shall be provided for field mounting between the unit base and the roof curb.

h. The curb shall include a 1" x 4" wood nailer.

F.

G. The air handling unit casing shall be constructed of 2" thick double wall roof panels, floor panels, and wall panels having exterior construction of [16] gage G90 galvanized steel. The interior lining shall be a solid lining of minimum 18 gage exterior casing screws shall be zinc chromate coated.

H. Floor panels shall be double wall construction, designed to provide at most L/240 deflection based on 300 lb. concentrated load at mid-span. The interior liner of the floor panels shall be a solid lining of minimum 18 gage galvanized.

An additional 0.125" aluminum diamond tread plate liner shall be provided as a walk-on surface in unit access areas.

I.

J. The air-handling unit shall be completely insulated throughout all panels and structural frame members with spray injected foam to thoroughly insulate and seal the air unit structure. Openings in structural channels shall be covered. If structural channels are not internally insulated, then structural channels must be wrapped with an armaflex type insulation to maintain unit thermal performance and prevent sweating. Any portion of the unit that is not insulated (gaps) or has less than 2" of insulation shall be the responsibility of the contractor to modify.

a. Insulation shall be a full 2" throughout the entire unit.

b. Units with less than 2" of insulation in any part of the walls, floor, or roof shall not be acceptable.

c. Insulation application shall conform to NFPA 90A requirements.

d. Panels shall have a minimum thermal conductivity R of 12.5 (Hr-Ft2-°F/BTU).

e. For outdoor units all pipe chases, coil header panels and return bend panels shall be fully insulated.

f. Panels with perforated panel liner shall utilize a triple-wall construction, joining a matte-faced fiberglass insulated panel with a foam insulated panel to achieve both superior thermal performance and sound attenuation.

g. All drain pans shall have double-wall construction and be insulated with spray injected foam. Fiberglass insulation is not acceptable.

K. Double wall access doors shall be provided on sections as scheduled. Doors shall be of the same material type as the wall panels. A bulb-type gasket shall be provided around the entire door perimeter. Industrial style stainless steel hinges shall permit a complete 180 degree door swing. All doors shall open against positive pressure. Alternatively, if doors opening against positive pressure are not available, a safety chain mechanism and warning labels shall be provided to prevent injury to maintenance personnel.

a. Access door must be of the same material type as exterior/interior casing.

b. Access door latches shall utilize a roller cam latching mechanism to insure maximum sealing. Latches featuring a rotating “paw” are not acceptable.

c. Access doors shall be provided with a single door handle linked to multiple latching points. Stacked indoor units shall insure door handles are positioned at the lowest possible point of the top tier segments for convenient access.

d. Doors serving access areas shall be provided with inside operable door latches.

Guide Specifications

e. Unit access doors shall be provided with a locking hasp to accommodate a combination/pad lock.

f. Unit access doors shall be provided with a keylock. All access doors shall be operated by the same key.

L. Viewing windows shall be provided as shown on the schedule. All windows shall be double-pane tempered glass.

M. Provide auxiliary drain pans in segments as indicated on the schedule.

a. The auxiliary pans shall be double sloped, positive draining with galvanized [stainless] steel liner and double wall construction with drain connection of like material, draining to one side of the unit.

b. Coat auxiliary drain pans with a [mastic] [antimicrobial] coating.

c. Drain connection shall be welded to the drain pan. If threaded screw-type joint is used, all joints must be easily accessible for inspection and service.

2.04 FANS

A. Fans shall be Class I, II, and III, as scheduled, selected to provide the airflow and pressure specified.

B. Fan segments shall be equipped with [single width single inlet (SWSI) plenum fans as scheduled.]. All single width single inlet fans (SWSI) fans shall have airfoil (AF) blades. Flat plate blades shall not be acceptable.

C. All airfoil fans shall bear the AMCA Seal. Airfoil fan performance shall be based on tests made in accordance with AMCA standards 210 and comply with the requirements of the AMCA certified ratings program for air and sound. In addition, all airfoil wheels shall comply with AMCA standard 99-2408-69 and 99-2401-82.

D. SWSI fans shall be provided with [inlet screens, fan screens and belt guards.].

E.

F. Fans shall have polished steel shafts sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class. Close tolerances shall be maintained where the shaft makes contact with the bearing. Shaft shall be factory coated after assembly with an anti-corrosion coating.

G. After the pre-balanced fan is installed on the fan skid and isolator rails, the entire fan skid shall be run-balanced at the specified speed to insure smooth and trouble-free operation. The run balance shall include filter-in and filter-out balancing in all three (3) planes, on both sides of the fan assembly at the bearings.

a. Filter-in measurements shall be taken in the horizontal and vertical planes on the drive and opposite-drive sides of the fan shaft.

b. Filter-out measurements shall be taken in the horizontal, vertical and axial planes on the drive and opposite-drive side of the fan shaft.

H. The fan motor and fan-assembly shall be internally mounted. The fan motor and fan-assembly shall be mounted on a common base to allow consistent belt tension with no relative motion between the fan and motor shafts. The common base shall be isolated on a full width isolator support channel using 2" springs [with seismic restraints].

a. Fan motor and drive shall be contained within an OSHA-compliant belt guard.

b. The fan motor shall be on an adjustable base.

c. The fan discharge shall be connected to the cabinet through a canvas flexible connection to insure vibration-free operation.

d. Thrust restraints shall be provided as specified to mitigate fan assembly vibration in the horizontal plane.

e. Fan segments shall be equipped with an access door located on [drive side, opposite drive side, both sides] of the segment.

f. Fan sections shall be equipped with safety screens covering bottom inlets and discharge openings, sufficient to hold 300 lb. service person with minimal deflection.

g. Fan assemblies shall be balanced for inverter duty operation.

h. The fan will be balanced over the entire range of fan operation (30% to 100% of RPM).

2.05 BEARINGS AND DRIVES

A. Fan bearings shall be designed for an average life (L50) of at least 200,000 hours [an L10 life of at least 200,000 hours].

B. Plenum fans shall be [belt-driven].

C. All re-greaseable bearings shall be factory

lubricated

and equipped with standard hydraulic grease fittings and lube lines extended [to the motor side of the fan]. Re-greasable bearings provided without factory installed lubrication lines are unacceptable.

D. Fan drives shall be selected for a 1.5 service factor and anti-static belts shall be furnished.

a. [All drives 15 hp or smaller on constant volume units shall be adjustable pitch. Drives 20 hp or larger or any drives on units equipped with VFDs shall be fixed pitch].

b. [All fans with motors 10 HP or larger shall be equipped with multiple belt drives].

c. Sheaves shall be machined from a close grain cast iron and statically balanced by the manufacturer. A fixed pitch sheave shall be provided on the motor.

d. Drive belts shall be a V type. All drive belts shall be precision molded raw edge construction. Belts shall be oil and heat resistant.

2.06 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Fan motors shall be furnished in sizes, electrical power and starting characteristics as shown in the schedule.

a. All fan motors will be built in accordance with the latest standards of the National Electrical Manufacturer's Association (NEMA) and IEEE and shall be rated for continuous duty at full load at 40°C ambient temperature rise and a service factor of 1.15.

b. Fan motors shall be NEMA design ball bearing type.

c. Fan motors shall be 1750 RPM [1500 RPM], [open drip proof], [type] [as indicated on the schedule].

1. Direct drive plenum fans shall be coupled with appropriately sized motors to nearly match synchronous motor speed, as detailed in the schedule.

d. All fan motors shall be premium efficiency.

e. Motors shall be [suitable for use in variable frequency application, per NEMA MG-1 Part 30] or ["inverter ready", complying with *NEMA STD MG1 PART 31.4.4.2*].

B.

2.07 HEATING/COOLING COMPONENTS

A. Coil segment length shall be optimized to contain selected coil(s), spacer(s), and optional access doors. Coils shall be selected to maximize unit tunnel area using [single] or [stacked] coil arrangements as needed to satisfy required coil face areas.

   a. Coil segment design and coil selection shall not require a drain pan in any downstream section to contain the coil condensate.

   b. All cooling and/or heating coils shall be furnished to meet the performance requirements set forth in the schedule.

   c. All water and steam coils shall have performance certified in accordance with ARI Standard 410 for coil capacity and pressure drop.

   d. Coils used with glycol are outside the scope of ARI-410, but shall be selected to meet scheduled performance.

   e. All coils must be circuited to operate at design load with water velocity within the ARI range of certified rating conditions.

   f. Multiple coils in a single coil segment shall be separated by [galvanized steel] [stainless steel] coil spacers. Coil spacers should accommodate side-access via a removal side-plate.

   g. [Coil segment side and top panels (indoor units)] shall be removable to allow for removal and replacement of coils, without affecting the structural integrity of the unit.

   h. Upstream and downstream segment door clearances shall accommodate a minimum 2-inches of field installed external piping insulation.

   i. Coil segment shall accommodate full-face height or reduced face height coils, as specified.

B. Cooling Coil Segment shall be provided with a full-width, multi-sloped (IAQ) drain pan that extends downstream a minimum 6” beyond the last coil in the section to provide drain pan access for cleaning and inspection.

C. Drain pan design and application shall comply fully with the stated intent of ASHRAE 62-2001.

D. Drain pans shall be sloped in a minimum of 2 planes; cross break interior pans and pitch toward drain

connections to ensure complete condensate drainage. Units with cooling coils shall have drain pans under complete cooling coil section. A minimum of 1" clearance shall be provided from the bottom of the coil casing to the drain pan so that the drain pan can be visually inspected and physically cleaned, including underneath coil, without removal of the coil. All drain pan connections will be to one side of the unit to enable proper trapping. Drain pans that do not comply with these maintenance requirements will be the responsibility of the contractor to field modify.

E. The drain pan shall be of double wall construction with a minimum 20 gage stainless steel liner and shall be insulated with spray-injected foam to completely seal the drain pan assembly. Fiberglass insulation is not acceptable.

F. The drain pan liner shall have a coating.

G. Drain pan shall be provided with a minimum 1-1/4" MPT condensate connection positioned beneath the lowest point of the drain pan. Drain connection shall be welded to the drain pan and shall match the drain pan liner material type. If threaded screw-type joint is used, all joints must be easily accessible for inspection and service.

H. All coils shall be slide out, “shipping” type, mounted on tracks, and easily removable from the air handling unit by removing only one exterior panel. Coils that require additional disassembly of the unit or replacement of the entire coil section (e.g. “unit” type coils) for coil removal are unacceptable.

I. Coils shall be supported by galvanized [stainless steel] coil support members, constructed of channeled members, allowing uninhibited access for inspection and safe cleaning.

J. All vertical coil supporting members (bulkheads) and blockoffs shall be constructed of galvanized steel [stainless steel] and shall entirely seal off the coil, preventing air bypass.

K. Coil grommets shall be provided on all coils to completely seal the area between the coil connection and the unit casing.

L. Drainable Water coils shall be designed to operate at 250 psig design working pressure and up to 300° F and shall be tested with 325 psig compressed air under water. Circuiting shall provide free and complete draining and venting when installed in the unit. All vent and drain connections shall be extended to the outside of the unit casing.

M. Direct expansion coils shall be designed to conform to the ANSI B9.1 (Safety Code for Mechanical Refrigeration) when operating with a refrigerant pressure not exceeding 250 psig and shall be tested with 325 psig compressed air under water. The completed coil shall be dehydrated, including headers, return bends and distributors and sealed for shipment. Each coil shall be furnished with a brass distributor with solder-type connections. Suction and discharge connections shall be on the same end regardless of rows deep. Direct expansion liquid lines should be extended to outside of unit. All refrigerant specialties should be mounted outside of unit.

N.

O. The primary surface shall be 5/8" O.D. copper tube, staggered in direction of airflow. Tubes shall be mandrel expanded to form fin bond and provide burnished, work-hardened interior surface. The tubes shall have a minimum tube wall thickness of 0.020" for 5/8" O.D coils. Specified thickness shall be maintained throughout the tube including brazed U-bends.

P. Extended surface shall consist of die-formed, continuous, [aluminum] [copper] [corrugated] enhanced performance fins. The fins shall have fully drawn collars to accurately space fins, and to form a protective sheath for the primary surface. The fin thickness shall be 0.008”.

Q. Coils with finned height greater than 48 inches shall have an intermediate drain pan extending the entire finned length of the coil. Cooling coils in excess of 48 inches in height shall not be acceptable unless provided with an intermediate drain pan. The intermediate pans shall have PVC [copper] down spouts to guide condensate to the main drain pan.

R. Coil casing shall be constructed of 16-gauge galvanized steel [stainless steel]. Tube sheets on each end shall have drawn collars to support tubes. A single intermediate coil support shall be provided on coils with a finned length of more than 62 inches, two (2) intermediate supports above 100 inches in length, and three (3) intermediate supports on coils with a finned length of more than 141 inches. Cas-

ing channels shall be free-draining, without depressions to collect moisture and contaminants. Casing channels shall not block fin area.

S. Headers shall be of heavy seamless copper] [red brass] tubing, silver-brazed to tubes. Connections shall be of steel [red brass], with male pipe threads, silver-brazed to the headers. A 1/4" FPT, plugged vent or drain tap shall be provided on each connection. All vent and drain connections shall be extended to the outside of the unit casing.

T. Coil shall be protected with a coating.

U. Circuiting shall be to provide free draining and venting, through one vent and one drain on each coil, when installed with casing level. Coils shall be circuited, and have connections arranged, for counterflow of air and water with supply on bottom and return on top of coil headers. Coil circuiting shall provide for design water velocity in tubes without exceeding total water pressure drops in schedule.

V. Coils using turbulators are unacceptable.

2.08 FILTERS

A. Filters and filter segments shall be provided as scheduled. Filter tracks shall be constructed of galvanized steel and be built as an integral part of the unit. Filter media shall be listed Class 2 or Class 1 under U.L. Standard 900 as required by local codes.

B. **Flat Filter (FF) segment** shall be provided with throwaway (2")], or 30% pleated **2"** as scheduled.

C.

D. **High Efficiency Filter (RF) segment** shall accommodate 4" media.

   a. Media shall be 4" mini-pleated (60-65% efficiency-MERV 11.

   b. Media shall be 12" rigid (60-65% efficiency-MERV 11 (80-85% efficiency-MERV 13 (90-95% efficiency-MERV 14 or as scheduled.

   c.

   d. Prefilter media shall be throwaway or permanent cleanable or 30% efficient. Spare sets of media shall be provided as scheduled.

2.09 DAMPERS

A. Dampers will be of ultra-low leak design having airfoil blades. The damper blades shall be provided with extruded vinyl edge seals and flexible metal compressible jamb seals. Outside air and Exhaust Air dampers shall have leakage not exceeding 4 CFM/square foot at 1" w.g., complying fully with the requirements of ASHRAE 90.1. Damper blades shall be parallel acting [opposed acting].

2.10 APPURTENANCES

A. **Mixing box (MB) segment** shall be supplied as indicated on the drawings. Mixing Box segment(s) shall be supplied with air inlets optimized to achieve mixing of outside air and return air.

   a. The inlet segment shall have outside and return airstreams directed into each other by damper assemblies to facilitate mixing of the airstreams, or return air connection only, or outside air opening only as indicated on the schedule.

   b. Outside air rain-hood with “bird screen” will be provided for outdoor applications. Rain hood shall be outfitted with a moisture eliminator to channel moisture away from the air being drawn into the unit. Return air opening shall be sized for 100% of unit airflow.

   c. The return air inlet shall [be left open, having no damper] [have Airflow Monitoring Station] [be blanked off, having no damper option] [have standard control damper], constructed of [aluminum] [galvanized steel] with parallel [opposed] blades. Damper configuration shall be full faced [25% min/max] [25%/75% split].

   d.

   e. A factory installed safety screen shall be provided over all bottom inlet openings, sufficient to hold 300 lb. service person with minimal deflection.

   f.

B. **Filter/Mixing box (FM) segment** shall be provided with combination Filter/Mixing Box combining the filtering and mixing functions in one segment.

a. Segments shall be designed to accommodate 2" angled filter media. The filter media shall be side-loading.

b.

c. The return air inlet shall [be left open, having no damper] [have Airflow Monitoring Station] [be blanked off, having no damper option] [have standard control damper], constructed of [aluminum] [galvanized steel] with parallel [opposed] blades. Damper configuration shall be full faced [25% min/max [25%/75% split].

d.

e.

C. **Flat Filter (FF) segment** shall be designed to accommodate 4" media. The filter shall be side loading.

a.

D. **Angle Filter (AF) segment** shall be designed to accommodate (2") media. The filter shall be side loading.

a.

E.

a.

b.

F.

a.

G. **Cooling Coil (CC) segment** shall be supplied as indicated on the drawings.

a. The outdoor unit shall have a pipe chase with a nominal depth of [24] [36] [48] inches.

H.

I.

J.

Guide Specifications

f. A factory installed safety screen shall be provided over all bottom inlet openings, sufficient to hold 300 lb. service person with minimal deflection.

g. [Provide associated return or exhaust fan as scheduled].

K.

L. **Access (XA) segment** shall be supplied as indicated on the drawings. Access segments shall be of length specified in schedule.

M. **Discharge plenum (DP) segment** shall be supplied as indicated on the drawings [horizontal] or [vertical] application. Discharge plenum segment(s) shall be supplied with factory discharge opening(s) in locations shown on the drawings.

a. Discharge plenum segment shall be supplied with a factory installed safety screen over all air bot tom openings.

N.

O. **Supply fan (FS) segment** shall be supplied as indicated on the drawings. Supply fan segments shall be equipped with [single width single inlet (SWSI) plenum fans as scheduled].

a. Supply fan segments shall be equipped with [a single belt-drive fan], as scheduled.

b. Supply fan segment shall include a factory installed safety screen on all air opening.

c.

d.

P.

Q.

tional electric damper motor(s) and air stream thermostat.

3. Dampers to be arranged so as to completely enclose and isolate the heating coil passes when no temperature rise is required.
4. Each coil shall be capable of maintaining a constant discharge air temperature regardless of variations in entering air temperatures with full steam pressure or water flow at all times.
5. Proportioning of the air shall be such that the temperature at any point in a plane parallel to the face of the coil three feet downstream from the leaving side will not vary more than ±5°F from the average discharge air stream temperature.
6. Finned heating elements shall be fabricated of seamless 5/8 inch O.D. copper tubes with 0.035 inch wall thickness and rectangular embossed aluminum fins of 0.010 inch thickness.
7. Fins shall not be spaced closer than 12 fins per inch.
8. Each tube shall be individually secured to the supply and return headers by a brazed joint with provision for individual tube expansion and contraction.
9. Headers shall be 3 inch SCH 40 pipe.
10. Volume of air passing through the coil shall not vary more than ±5°F, regardless of the position of the internal dampers.

R. Vertical discharge plenum (VP) segment shall be supplied as indicated on the drawings for vertical airflow application.

S. Indirect Fired Gas Heater

1. Interior and exterior frame structure, and casing, shall be of G-90 galvanized steel. The cabinet construction shall be double-wall G-90 galvanized steel construction, with 18 gauge exterior panels and 20 gauge interior liner panels.
2. Front casing double-wall construction shall be internally insulated comprising three-inch thick, 3PCF density fiberglass insulation, providing R-13 thermal resistance.
3. Double-wall construction shall be internally insulated comprising one-inch thick, 2PCF density fiberglass insulation, providing R-4 thermal resistance.
4. Base Channels shall be of 10 gauge steel 'C' channels, minimum 3" height, spanning width of unit, perpendicular to air flow, secured by weld procedure, forming a rigid structural support base.
5. At heat exchanger, airflow outlet 1" duct flanges, of 18 ga. galvanized formed steel, shall be provided to accommodate connection of heat exchanger module to downstream ductwork, or other system components.
6. The Heat Exchanger shall be a multi-pass design featuring a gasketed flue gas tight positive seal suitable for internally pressurized forced draft natural gas firing.
7. Primary heating surface shall be of fully welded construction type 430 stainless steel comprising cylindrical combustion chamber, and reversing chamber, with 2nd pass 16 gauge type 304, 409 or 430 stainless steel firetubes, secured to reversing chamber and flue gas exit assembly by attachment weld. 4" OD Firetubes shall incorporate 20 gauge type 304 or 430 stainless steel multi-plane turbulators to assure turbulent flue gas flow.
8. Full access to flue gas exit assembly shall be accommodated through cabinet exterior casing access panel at ID Fan mounting flange. Internally, a removable gasketed flue gas tight positive sealed flue gas exit assembly access panel permits direct access to firetubes and turbulators to accommodate Heat Exchanger internal inspection, cleaning and turbulator replacement.
9. A condensate drain connection shall be provided internally within cabinet, from heat exchanger reversing chamber to the flue gas exit assembly and piped externally to same connection of ID Fan housing.
10. Condensate drain piping shall be Schedule 40 type 304 stainless steel pipe and fittings.
11. A factory mounted and wired Induced Draft Fan (ID Fan) shall be of direct drive centrifugal type, self-ventilating motor with ball bearings capable of withstanding Flue Gas Outlet temperatures.
12. The fan shall incorporate a split double-inlet wheel applied such that 80% of the capacity is used for flue gas induction, while 20% draws cooling air over the inboard motor bearing and shaft.
13. An adjustable diaphragm actuated air proving switch shall sense negative pressure at the fan inlet and shall be interlocked with the control circuit.

Guide Specifications

14. A rectangular to cylindrical 16 gauge type 430 stainless steel flue gas outlet breeching transition fitting to accommodate cylindrical breeching system.
15. The housing of the induced fan shall have a condensate drain connection that shall be pre-piped to main heat exchanger condensate drain piping manifold.
16. The modular duct furnace shall be provided with a NEMA–1 control station which shall accommodate a single point electrical connection, suitable for 460v-3ph-60hz main supply voltage, incorporating a 120v-1ph-60hz step down transformer to further accommodate control circuit and applicable fractional motor horsepower loads.
17. Applicable 3ph line starters, fractional motor and control circuits shall be properly fused.
18. Mounted and pre-wired operating controls including an automatic operating/recycling and manual reset temperature limit, and airflow proving device, shall be provided.
19. The modular duct furnace shall operate automatically at the command of a 'Heat On' signal, provided by BMS. A set of dry contacts shall be provided for 'Heat On' firing sequence verification.

T. ELECTRIC HEAT SEGMENT

Electric heat of capacity, voltage and steps of control specified will be provided as an integral part of the unit. The electric heater and control panel will be a UL recognized electric duct heater.

All electric heater elements will be of 80% nickel and 20% chrome. Coil elements will float freely in ceramic bushings, which are stacked in support brackets, not exceeding 4.5 inches apart. Coils will be machine crimped into stainless steel terminals, which are insulated with high temperature ceramic insulators. Heater casing and support brackets will be of galvanized steel.

All heaters will be supplied with internal wiring of controls, contactors, etc. including 120 volt, 60 hertz control circuit transformer, automatic reset thermal cutout and fuses per NEC and UL (on heaters exceeding 48 amps).

U. IP SEGMENT

Inlet plenum (IP) segment(s) shall be supplied as indicated on the drawings for horizontal airflow application. Inlet plenum segment(s) shall be supplied with factory discharge opening(s) in locations shown on the drawings

2.11 FINISHES

A. Air-handling units shall be painted prior to shipment, as specified.
   a. The exterior of the unit shall be completely cleaned prior to application of finished coats.
   b. A prime coat shall be applied to the unit.
   c. A finish coat of desert sand (or other owner approved color) acrylic polyurethane shall be applied.
   d. The finished unit shall exceed 500-hour salt spray solution (5%) without any sign of red rust when tested in accordance with ASTM B-117**.**

B. G90 galvanized exceed 250-hr
   a. Shrink-wrap for indoor units.

PART 3: EXECUTION

3.01 INSTALLATION

A. General: Installing contractor shall install air handling unit(s), including components and controls required for operation, in accordance with air handling unit manufacturer's written instructions and recommendations.
   a. Air handling unit(s) shall be stored only in a clean, dry place, protected from weather and construction traffic.
   b. Air handling unit(s) shall be handled such that damage to components, enclosure, and finish is avoided.
   c. Isolate fan segments with flexible duct connections.

Factory Packaged Controls Guide Specifications

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Guide specification to be used as a basis for design when using optional factory- supplied factory package end devices and controls.

   a. Factory mounted end devices will imply a package of devices that would be able to tie into any control manufacturers building automation system & would be mounted and commissioned at the HVAC manufacturer's factory.

B. These specifications should be reviewed to match the specific system control requirements and available control packages.

1.02 GENERAL REQUIREMENTS

A. The controls shall be an integral part of the air handler, with start-up an available option and warranty supported provided by the air handler manufacturer.

B. The air handler shall carry the ETL approval.

C. The factory package control (automatic temperature control) system shall utilize electric/electronic control. Valve and damper actuation shall be electric/electronic control, except where specific devices to be required to be pneumatically actuated.

D. Factory supplied control panel shall include power supplies for main control panel, actuators (including valve actuators) and transducers provided as part of the air handling unit assembly. **(if mount and wire)**

E. The manufacturer and provider of the air handler and controls shall be regularly engaged in the engineering, programming, installation and service of control systems of similar size and complexity. Bids from franchised dealers, wholesalers, contractors, manufacturers representatives, or any firm whose principal business is not manufacturing and installing Building Automation System's shall not be acceptable.

F. The manufacturer and provider of the air handler and controls shall be in compliance with ISO 9001. The intent of this specification requirement is to assure that the products from the provider are delivered through a quality system and framework that will assure consistent quality in products delivered.

1.03 DELIVERY, STORAGE AND HANDLING

A. Please be advised that the following information does not imply that York International is condoning the storage of indoor units outdoors. Nor does the information imply that York International is assuming responsibility for the storage of the units and or the condition of the units during and after the storage period.

*B. Helpful Hints for long term storage***:**

C. Control panels, electronic or pneumatic devices and/or air modulators must be removed and specially enclosed and protected from moisture and humidity with desiccant bags. Replace the desiccants every 30-60 days depending on the Relative humidity during the storage period. RH greater than 60% requires changing bags every 30 days. Electronic equipment cannot be stored in wet or damp areas even though they are sealed and secured.

D. Motors should be protected and inspected in accordance with the manufacturers specific instructions regarding periods of long storage. Periodic rotation of the shaft is required during long storage periods. Provisions should be made to ensure no water is allowed to collect and remain in the motor terminal box or any electrical junction box.

E. Follow responsibilities and guidelines listed on Form 50.20-NM3.

F. Protection of the complete unit for avoidance of general rusting must be handled as best suits the circumstances. Alternatives would be to provide a special paint to meet anticipated climatic conditions during storage and/or building a special frame to shelter the units from environmental conditions (venting the space accordingly).

G. All loose-shipped items need to be packed, protected and secured with the air units. All the above precautions apply to all loose-shipped items.

1.04 WARRANTY

1.04.1 Warranty is limited to manufacturers defect only.

1.04.2 Warranty will be as per the standard airside products warranty. Warranty is not extended to any alteration, modifications or external component attached to "original" equipment "as-built" and shipped from YORK manufacturing facilities. All factory provided controls will carry the "Limited Warranty" as described in FORM 50.05-NM2.

PART 2 PRODUCTS

2.01 SYSTEM CONTROL DEVICES & SPECIFICATIONS

A. The FACTORY MOUNTED END DEVICE option shall provide the capability to perform any of the following functions per the specific devices provided.

Factory Packaged Controls Guide Specifications

2.02 DEVICE SPECIFICATIONS (INCLUDE SECTION AS DEVICE IS SELECTED IN YW)

AIR FLOW MONITORING (25-OAF, 75/100 OAF)

The YORK AMS-60 airflow monitoring station combines the functions of control damper and airflow measurement station in one assembly. Shall be factory installed in Solution air handling units. The AMS-60 shall be tested to AMCA Standard 611-95 and shall bear the AMCA Ratings Seal for Airflow Measurement Performance.

Temperature Sensors (SAT/RAT)

The Temperature Sensor line offers an economical solution for a wide variety of temperature sensing needs. Each sensor provides precision remote temperature sensing for building automation systems.

The duct temperature sensor is designed for direct mounting on sheet metal duct systems. The sensor is point sensitive and comes with 2" & 9" insertion depths.

Sensors are available in the following types:

1k RTD 8" Duct Immersion
1k RTD 3" Duct Immersion
10k Type III thermistor 9" Duct Immersion
10k Type III thermistor 2" Duct Immersion
10k thermistor 9" Duct Immersion
10k thermistor 2" Duct Immersion
100k thermistor 9" Duct Immersion
100k thermistor 2" Duct Immersion
20k thermistor 9" Duct Immersion
20k thermistor 2" Duct Immersion

Averaging Sensor (HCDT, CCDT, MAT)

The duct-averaging sensor is designed for direct mounting to sheet metal for average duct temperature sensing. The sensor is multi-point sensitive through the length of the temperature conductive tubing

Sensors are available in the following types:

1k RTD 17' Averaging Sensor
1k RTD 8' Averaging Sensor
10k Type III thermistor 25' Averaging Sensor
10k Type III thermistor 8' Averaging Sensor
10k thermistor 25' Averaging Sensor
10k thermistor 8' Averaging Sensor
100k thermistor 25' Averaging Sensor
100k thermistor 8' Averaging Sensor
20k thermistor 25' Averaging Sensor
20k thermistor 8' Averaging Sensor

Outside Air Sensor (OAT)

The temperature sensor provides precision remote temperature sensing in multiple applications such as Duct, OSA, and immersion installations for building automation systems.
Sensors are available in the following types:
1k RTD Outside Air Sensor
10k Type III thermistor Outside Air Sensor
10k thermistor Outside Air Sensor
100k thermistor Outside Air Sensor
20k Thermistor Outside Air Sensor

Static Pressure Transducer (SAP, FDP1, 2, 3, REFSP, DXFC, ZP)

The choice of pressure probe, which is designed to pick up static pressure in a duct, plenum, air handler or other HVAC equipment are 100% solid state, micro- machined, glass on silicone ultra stable capacitance sensor.

Sensors are available in the following types:

Static Pressure Transducer
Probe for S.P. Trans. above (Use on high side)
Static Pressure Transducer FlexSys
Probe for S.P. Trans. above (Use on high side)
Building Static Pressure

Damper & Valve Actuator on/off 2-10v

The Electric Spring Return Actuator shall allow direct-mount, spring return line of electric actuators that operates on 24 VAC or VDC power and is available for use with on/off, proportional controllers. These bi-directional actuators shall be factory mounted and sized to operate the devices they are connected to.

Differential Pressure Switch (SFP, FDP1, 2,3, REFP, HAFC)

The differential pressure switch is for use in applications where a proof of airflow is needed for proper system operation. All switches are designed for use only as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls), or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Duct-mount Humidity/Temperature Sensor (OARH, RARH, SAH)

The sensor combines humidity and temperature sensing in a single surface-mounted unit for use inside economizers. The humidity sensor is capable of measuring humidity over the range of 0 to 100% RH, and its construction increases resistance to corrosion in HVAC environments. The sensor (a thin-film nickel sensor) can be powered with 14 to 30 VDC or 20 to 30 VAC and features a user-selectable output of 0 to 5 VDC.

Freeze stat/Low Limit Temperature Cutout Control (FS)

Low temperature cutout controls shall have DPST contact action or be supplied with a powered relay that has DPDT contacts.

The low temperature cut out shall be factory installed so that the top and bottom 1 ½" is protected and the remaining sensing element is spaced evenly across the face of the coil. The controls shall have an adjustable temperature set point range with a fixed differential. The range adjustment screw is accessible at the bottom of the control, and at the top of the control when the cover is removed. The setting shall be set at the factory for 35° F.

High Temperature Manual Reset Control (HTC)

The single-pole control is supplied in a wide selection of ranges to meet most application needs. Models may be supplied to open a circuit on temperature increase. A single-pole control may optionally include a separate reverse-acting auxiliary contact.

Static Pressure Limit Manual Reset (SPC, RELPC)

The sensing switch is designed to sense static pressure or differential pressure and break an electrical circuit when the set point is exceeded. The electrical circuit will remain open until the reset button on the switch is pressed.

IAQ Sensor (ZIAQ, IAQ, OAQ)

The sensor to be used for demand control ventilation – specifically for CO2 sensing. Controls the ventilation system to ensure the right amount of fresh air when and where you need it. Applications extend to control ventilation in a building where occupancy varies frequently; control ventilation to ensure excess outside air is not causing energy waste; ensure good air distribution throughout zones.

Duct Humidity Limit (Auto Reset) (HHLR-6, HHLR-3)

The control will limit duct humidity by comparing a controller's request for humidification with the humidity present in a duct. It will proportionately reduce its output signal to the humidification equipment as duct RH% approaches a user-defined, high-limit set point.

Current Operated Switch for fan status (SFP, REFP)

The control will provide an On/Off status for direct drive fans, pumps and motors. 100% solid state, no moving parts to fail. (Not intended to detect belts breaking)

Zone Temperature & Zone Humidity Sensor

The zone space temperature sensor allows separate heating and cooling settings. Single or dual set point adjustment with choice of warmer or cooler graduation scales in C° or F° .

The humidity sensor shall be capable of measuring humidity over the range of 0 to 100% RH, and it shall be of a construction which is resistant to corrosion in harsh environments. (Optional: shall also include an additional thin-film nickel, thin-film platinum or thermistor temperature sensor for use in enthalpy control and other strategies requiring both humidity and temperature information.)

VoluProbe Air Flow Monitoring

The control is an airflow measuring element assembly specifically designed for installation in the inlet cone of centrifugal fans or inlet bell of vane axial fans. Each assembly is complete with two (2) airflow-measuring elements, pivot mounting hardware and signal connection fittings.

2.03 SYSTEM CONTROL OPERATION CAPABILITIES:

- Control of the chilled water valve to maintain supply-air temperature (SAT)
- Control of stages of direct expansion cooling to maintain SAT
- Control of the hot water valve to maintain return-air temperature to an occupied or un-occupied set point.
- Control of stages of electric heat to maintain return-air temperature or room temperature to an occupied or unoccupied low set point. Fail-safe control mode shall be provided to turn the stages off should the PSIO fail.
- Control fan inlet guide vanes (or field-supplied and installed variable-frequency drive) to maintain static pressure set point (VAV units only).
- Control of mixed-air dampers to provide a constant outside airflow (cfm) during VAV operation.
- Indoor air quality control during occupied times using a single gas, single gas with indoor/outdoor differential control, or using two gases. When a single sensor reaches the field-adjustable setting, it shall modulate outside air control of dampers to reduce sensor (CO2 or volatile organic compound [VOC]) levels. When 2 sensors are used for differential monitoring, they shall accomplish a comparative analyses of VOC gas levels and modulate supply, mixed, or return dampers to provide the best air to the space.
- Nightly purge of stagnant indoor air for a configured duration prior to occupancy.
- Control of mixed-air damper (economizer) to provide integrated use of out-side air to provide free

Factory Packaged Controls Guide Specifications

cooling when controlling supply air, room temperature, or minimum outdoor air.

- Control of two-position dampers to meet minimum outdoor air requirements during occupied periods.
- Control of the supply fan based on the occupancy schedule.
- Control of supply fan to cause adaptable start/morning warm-up of the system.
- Control of the mixed-air damper to maintain a minimum position when the enthalpy switch or differential enthalpy calculation indicates the outside air is un-suitable for cooling.
- Provide alarms based on freeze stat, duct high humidity, pressurization, and evacuation, smoke purge, and fire shutdown input states being true.
- Allow manual and system override of selected output channels and internal values.
- Return fan capacity control.
- Filter maintenance option.
- Smoke evacuation.
- Smoke purge.
- Building pressurization.
- Fire shutdown.
- Humidifier control; proportional analog or two-stage discrete.

PART 3 EXECUTION

3.01 SCOPE OF WORK

1. Factory mounted end devices, less controller, will imply a package of devices that would be able to tie into any control manufacturers building automation system.
   a. It shall be the responsibility of the factory mounted end device provider to properly locate and install the control panels, sensors and all control devices required to implement a fully wired system.
   b. All factory control wiring shall be internal to the unit. Internal wiring shall consist of plenum-rated wire ETL approved. The electrical components shall be listed under UL. The unit shall be in compliance with the NFPA 90A standard and ETL approved.
   c. The mounted and wired end device option shall furnish and install all control and interlock wiring between motor control method and control devices such as start-stop switches, pilot lights, electric relays, low limit thermostats, high limit thermostats, smoke detectors, differential pressure switches, DDC devices and sensors, and associated safety and limit devices.
   d. It shall be the responsibility of the end device provider to properly locate and install the control panels, sensors and all control devices required to implement a fully functional system.

3.02 WIRING WORK

a. The wiring definition within this section applies to either of the optional factory- supplied controls:
b. Factory mounted end devices will imply a package of devices that would be able to tie into any control manufacturers building automation system
c. Electric control wiring shall be in accordance NEC codes & ETL requirements. Specific state and local codes should be referenced to ensure compliance.
d. All factory control wiring shall be internal to the unit. Internal wiring shall consist of plenum-rated wire ETL approved. The electrical components shall be listed under UL. The unit shall be in compliance with the NFPA 90A standard and ETL approved.
e. All plenum rated wiring shall be installed in a neat and workmanlike manner.
f. Line voltage and sensor wire shall not be installed in same wiring harness.
g. Low voltage and communication wiring (less than 30 volts) may be installed in the same harness.
h. The provider shall issue a schematic drawing of the entire control system for the air handler.

3.03 FINAL TESTING PROCEDURE

a. This procedure defining the requirements of material to be furnished and performed is not subject to interpretation.
b. After final assembly of each device, the device shall be tested per the manufacturers standard.
c. The manufacturer final test procedure will assure that the products from the provider are delivered through a quality system and framework that will assure consistent quality in products delivered.
d. Necessary deviations must be approved, in writing, for each case and be applicable only to specific production sales order number.
e. After successful testing, inspector shall apply the marking “TESTED” and date of test (or a serial number

providing the manufacture, the lot and date information).

Red Brass*MPT connections		
	Supply	Return
ERAHU-1	1 x 1.5	1 x 1.5
b		
c		
d		
e		
	*Copper when smaller than 1.25"	

	Fins	5/8" Tubes
ERAHU-1	0.008 AL	0.025 CU
b		
c		
d		
e		

	Qty	Rows	fpi	A	B	CT	CB	D	E	F	G	H	I	J	L	R	S
ERAHU-1	2	1	8	48.0	70.0	1.0	1.0	1.5	1.5	50.0	73.0	6.5	77.4	7.5	4.9	1.7	25.4
b																	
c																	
d																	
e																	

	Coil Model	Casing Material	Customer	
ERAHU-1	5SS - 2 - 48 x 70 x 1 - 8AL8 - CU25 - G - 1R	Galvanized Steel	Rep.	Airetech
b			Project	Center for Academic Excellence
c				
d			Date	20-Dec-05
e			Ventrol Standard Steam Coil Drawing 1.01	

	62.5	125	250	500	1000	2000	4000	8000	LwA
Supply Air - Typical of two									
65' x 65" Lw (ea.):	94	95	105	99	94	90	84	78	
Return Air - Typical of two									
79" x 40" Lw (ea.):	92	94	97	91	85	79	72	66	
Entering Exhaust Air -									
74" x 24" Lw:	90	91	91	85	79	71	64	58	
Exhaust Air w/ Damper -									
66" x 66" Lw:	92	93	93	87	83	74	68	61	
Outside Air w/ Damper·									
66" x 66" Lw:	87	94	88	81	79	75	69	68	
Venlilation Air w/ Damper									
110" x 24" Lw:	89	97	96	90	85	80	74	70	
Total Cabinet Radiated Sound (through panels)·									
Cabinet Radiated - Lw:	88	91	87	66	58	49	41	39	
Transmitled/Floor - Lw:	88	91	87	66	58	49	41	39	

Fan data accuracy as per AMCA 311 (63Hz ± 6dB, remaining bands ± 3dB)
Model predic1ive accuracy ± 6 dB.
Based on preliminary designs and selections. Subject to change.

VENMAR SOUND ANALYSIS
U of A for Academic Excellence

ERAHU - 2

Air Tunnel

	62.5	125	250	500	1000	2000	4000	8000	LwA
Supply Fan - Mechanovent MVP333/17,500 CFM @ 6.75" TSP at sea level (2 Req.)									
Discharge Lw:	93	96	104	100	96	93	89	85	102
Inlet Lw:	92	93	100	92	90	87	85	83	96
Ventila1ion Fan - Mechanovent MVP303/10,800 CFM @ 2.50" TSP at sea level									
Discharge Lw:	85	94	91	88	84	80	74	67	90
Inlet Lw:	82	91	84	80	78	75	70	65	84
Exhaust Fan - Mechanovent MVP273/9,800 CFM @ 4.00" TSP at sea level									
Discharge Lw:	89	89	99	92	89	85	81	74	95
Inlet Lw:	86	86	95	84	82	80	76	71	89

Panel Construction:

Walls and Roof, 4" thick with 3# insulation
All Sections - 18ga exterior, 22ga solid liner.

Rigid Filters:	62.5	125	250	500	1000	2000	4000	8000
est. Insertion Loss-dB	5	6	5	5	5	5	5	5

	62.5	125	250	500	1000	2000	4000	8000	LwA
Supply Air - Typical of two									
50" x 50" Lw (ea.):	88	90	99	95	91	88	84	102	
Return Air - Typical of two									
69' x 25" Lw (ea.):	83	86	90	84	81	74	69	64	
Entering Exhaust Air -									
60" x 22" Lw :	81	79	87	77	73	66	60	53	
Exhaust Air w/ Damper -									
44' x44" Lw:	84	82	89	79	75	69	64	57	
Outside Air w/ Damper·									
44" x 44" Lw:	76	85	79	75	72	70	54	47	
Total Cabinet Radiated Sound (through panels)·									
Cabinet Radiated - Lw:	82	86	83	62	57	47	41	41	
Transmitled/Floor - Lw:	82	86	83	62	57	47	41	41	

Fan data accuracy as per AMCA 311 (63Hz ± 6dB, remaining bands ± 3dB)
Model predic1ive accuracy ± 6 dB.
Based on preliminary designs and selections. Subject to change.