

HOT WATER BOILER SCHEDULE

| MARK | MANUFACTURER | MODEL | NAT. GAS INPUT | OUTPUT | V/PH |
|-------|--------------|---------|----------------|-----------|-------|
| B-1,2 | Aeyco | BNK3000 | 3,000 MBH | 2,790 MBH | 480/3 |

NOTES:

1. Provide with modulating gas valve and burner for 15:1 turndown.
2. Provide 50 psi ASME rated relief valve.
3. Provide condensate neutralization kit.
4. Provide cascading controller for multiple boiler control.
5. Provide interface to building energy management system.
6. Provide for direct vent operation, with Cat IV vent.

PUMP SCHEDULE

| MARK | MANUFACTURER | MODEL | GPM | HEAD | MOTOR HP | V/PH |
|--------|--------------|---------|-----|------|----------|-------|
| P-1,2 | Taco | SKS3011 | 178 | 110 | 15 | 480/3 |
| BP-1,2 | Taco | KV3006 | 150 | 15 | 1 | 480/3 |

AIR DEVICE SCHEDULE

| MARK | MANUFACTURER | MODEL | APPLICATION | | | FINISH | MOUNTING | DAMPER | DESCRIPTION | NOTES |
|------|--------------|-------|-------------|--------|---------|--------|--------------------------------|--------|--|-------|
| | | | SUPPLY | RETURN | EXHAUST | | | | | |
| SD-A | KRUEGER | 1400 | • | • | • | WHITE | LAY-IN | NO | 24x24" Steel Square Cone Diffuser Neck size as follows: 6"Ø: 0-120 CFM 8"Ø: 121-250 CFM 10"Ø: 251-330 CFM 12"Ø: 331-400 CFM | |
| SD-B | KRUEGER | DPL | • | • | • | WHITE | SURFACE CEILING / LAY-IN | YES | Linear slot with plenum, (2) 2" wide slots, 48" long, 10"Ø inlet, with vertical throw pattern controllers | |
| SD-C | KRUEGER | 880 | • | • | • | WHITE | SURFACE | NO | Steel double deflection supply grille | |
| RG-A | KRUEGER | PDDR | • | • | • | WHITE | LAY-IN | NO | 24"x24" Steel perforated face return grille with neck size as indicated on drawings | 1 |
| RG-B | KRUEGER | S80 | • | • | • | WHITE | SURFACE | NO | Steel Single Deflection Grille, size as indicated | |

GENERAL NOTES:

- Provide mounting frame as required for ceiling type.
- Maximum NC shall be 30.
- Runouts to diffusers shall be same size as neck, U.N.O.
- Ceiling devices shall have adjustable blow pattern, 4-way U.N.O.

NOTES:

1. Provide device with square plenum or round neck adapter as required to transition to round run-out where indicated on plans.

**SEQUENCE OF OPERATION
for
CENTRAL HEATING PLANT****SYSTEM DESCRIPTION**

The heating hot water plant consists of (2) 3,000,000 BTU/HR gas-fired boilers (B-1 and B-2) with primary-secondary pumping. The boilers and pumps shall be provided with factory controls and BACnet gateway to allow connection to the existing building automation system.

PUMP CONTROL

The building pumps P-1 and P-2 shall operate on a lead/lag basis. The lead pump shall change on a weekly basis. The lead pump shall be energized based on a call for heating. The call for heating shall be based on any hot water valve opening. Once energized, the pump shall run for a minimum 1 hour (ADJ.)

If the lead hot water pump fails to start, the lag pump shall be energized and the lead pump shall be de-energized. An heating pump failure alarm shall be generated.

Building pumps P-1 and P-2 speed shall modulate to maintain pump differential pressure. Pump speed controls shall be provided as part of the pump factory installed/mounted variable speed drive. The building automation system shall connect to a BACnet card provided with the pump controls. The building automation system shall control only pump on/off.

Boiler primary pumps BP-1 and BP-2 shall be controlled by their corresponding boiler, B-1 or B-2.

LOOP TEMPERATURE RESET CONTROL

The building automation system shall send the boiler controller, via BACnet gateway, hot water supply temperature set point. The set point shall reset from 130°F to 100°F based on an outdoor air temperature of 0°F to 60°F. The reset schedule shall be fully adjustable and confirmed with the building Owner.

BOILER PLANT CONTROL

The building automation system shall send the boiler controller, via BACnet gateway, an enable/disable signal. The enable/disable signal shall be determined based on building pump "ON/OFF" control. The boiler controller shall provide lead/lag control of two boilers, boiler fire rate and boiler pump control. A supply water temperature sensor shall be provided for the boiler control. This temperature sensor shall be connected directly to the boiler controls only, not the building automation system.

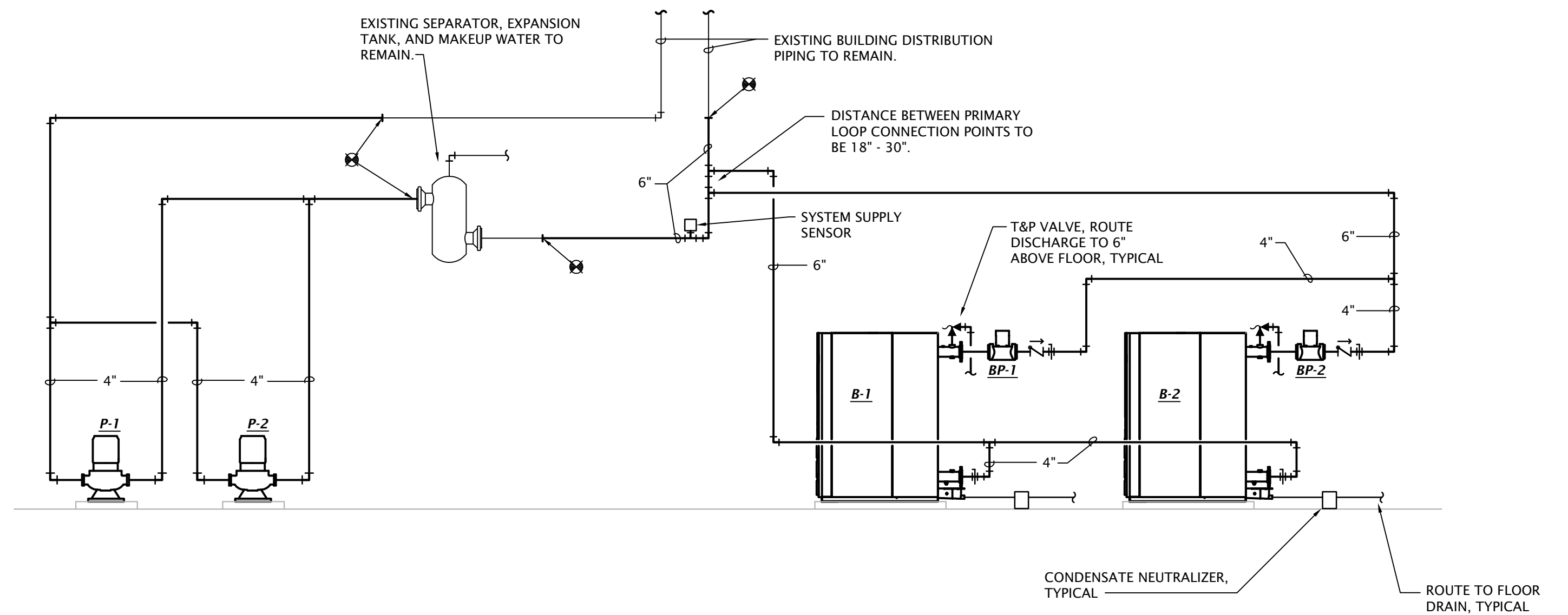
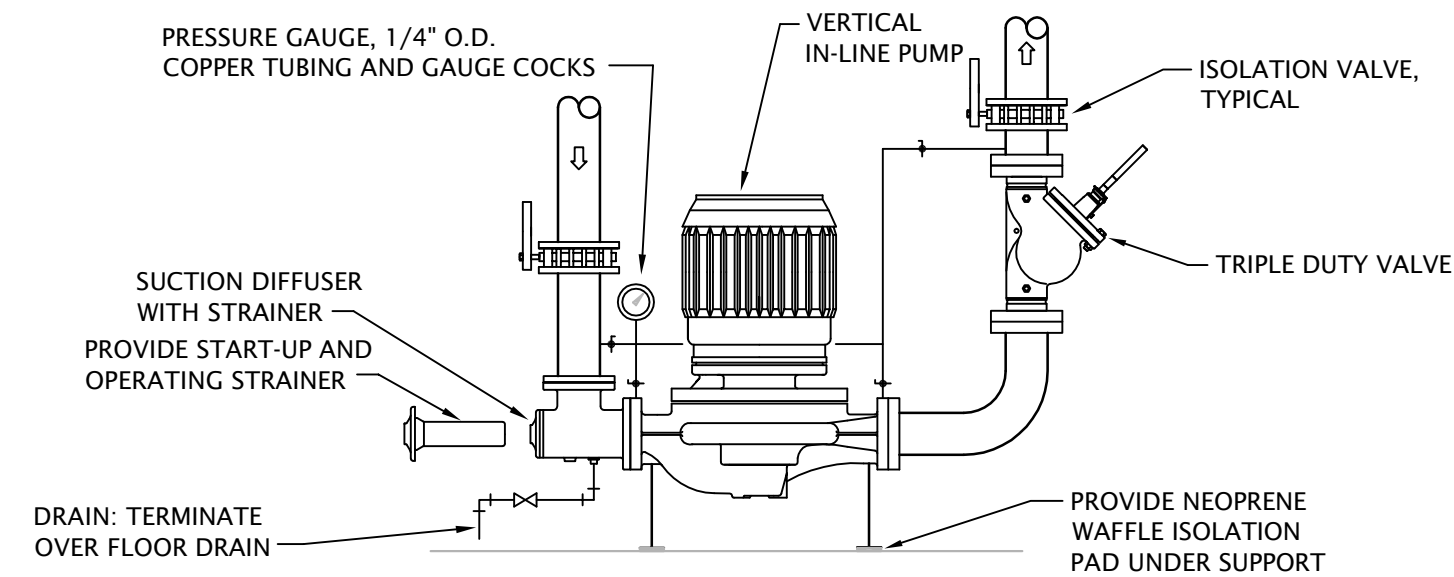
MONITORING POINTS

The following points shall be monitored for troubleshooting and/or maintenance purposes. These points are in addition to points and controls already in place. The points may be hard wired/physical points or software/virtual points. Program alarm values for each point shall be provided and coordinated with the Owner.

Hot water supply temperature

Hot water return temperature

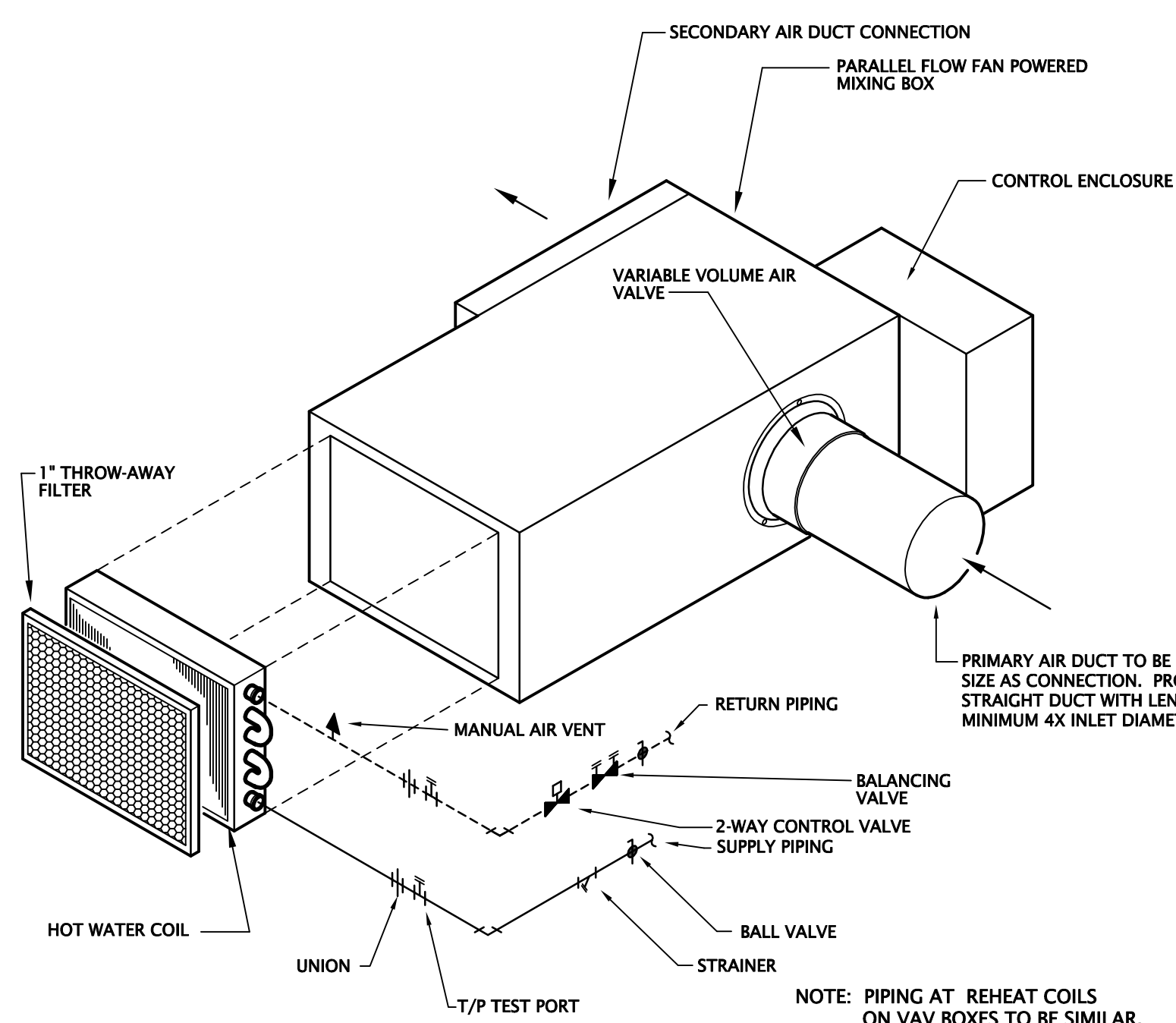
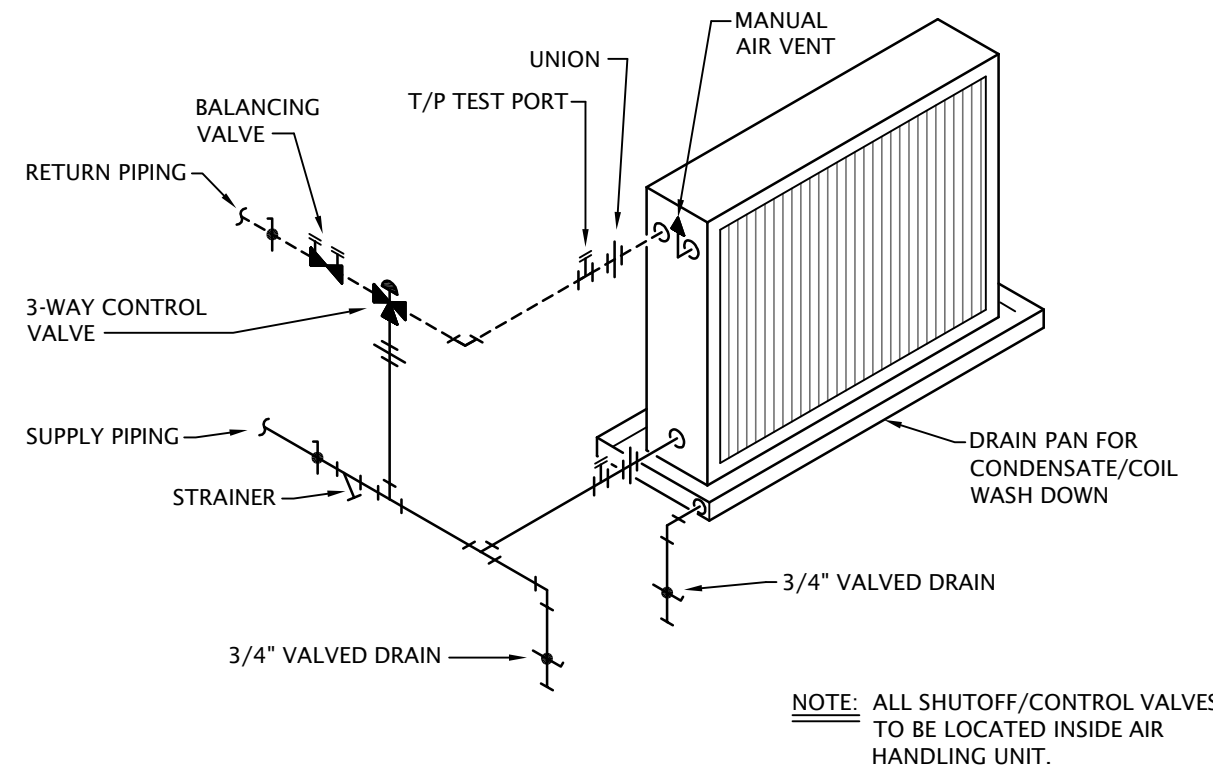
Make available to the Owner all points and control information available via boiler(s) controller BACnet gateway and pump(s) BACnet gateway. Coordinate with Owner any and all points desired along with alarm set points/values.

**HEATING WATER FLOW DIAGRAM
NOT TO SCALE****INLINE PUMP CONNECTION DETAIL
NO SCALE****MECHANICAL SYMBOLS**

- TEMPERATURE SENSOR
- SQUARE SUPPLY DIFFUSER - TYPE AND AIRFLOW INDICATED
- SQUARE RETURN GRILLE - TYPE INDICATED
- GRILLE/DIFFUSER TAG
TOP: DEVICE TAG (SEE SCHEDULE)
MIDDLE: NECK SIZE
BOTTOM: AIRFLOW
- MANUAL BALANCING DAMPER
- RECTANGULAR RETURN OR RELIEF AIR DUCT UP
- RECTANGULAR RETURN OR RELIEF AIR DUCT UP
- RECTANGULAR SUPPLY AIR DUCT UP
- RECTANGULAR SUPPLY AIR DUCT DOWN
- RECTANGULAR RETURN OR EXHAUST AIR DUCT DOWN
- ROUND DUCT UP
- ROUND DUCT DOWN
- FLEXIBLE DUCTWORK - MAX 5'
- RIGID DUCT RUNOUT
- 90° ELBOW WITH TURNING VANES
- PIPE TURNING UP
- PIPE TURNING DOWN
- CONDENSATE DRAIN LINE
- HEATING WATER SUPPLY
- HEATING WATER RETURN
- UNION
- BALL VALVE
- CHECK VALVE
- BUTTERFLY VALVE
- STRAINER
- TEST PORT
- CONNECT TO EXISTING

**SYMBOL MODIFICATION
DESIGNATORS/ABBREVIATIONS**

- OA OUTDOOR AIR
- RA RETURN AIR
- SA SUPPLY AIR
- DDC DIRECT DIGITAL CONTROL
- MC MECHANICAL CONTRACTOR
- TC TEMPERATURE CONTROL CONTRACTOR
- EC ELECTRICAL CONTRACTOR
- GC GENERAL CONTRACTOR
- AFB ABOVE FINISHED FLOOR
- AFG ABOVE FINISHED GRADE
- BLG BELOW GRADE
- FG FINISHED GRADE
- UNO UNLESS NOTED OTHERWISE

**AHU COIL CONNECTION DETAIL
NO SCALE****FAN POWERED MIXING BOX DETAIL (VAV BOXES SIMILAR)
No Scale**

| Variable Air Volume Single Duct Terminal Units Schedule | | | | | | | | | | | |
|---|-------------|--------------|--------------|---------------|----------------------------|-------------------------|------------------------------|----------------------------|----------------------------|-------------|----------------|
| Base Unit | | | | | | | | | | | |
| Tags | Area Served | Manufacturer | Model Number | Primary inlet | Design cooling airflow cfm | Min cooling airflow cfm | APD @ cooling airflow in H2O | Cooling inlet velocity fpm | Valve heating capacity cfm | Primary EDS | Hot water coil |
| VAV-1 | D107/D108 | Trane | VCWF04 | 4" | 190 | 85 | 0.04 | 2177 | 85 | 55 | 115.36 |
| VAV-2 | D110A | Trane | VCWF04 | 4" | 100 | 85 | 0.013 | 1146 | 85 | 55 | 115.36 |
| VAV-3 | F231 | Trane | VCWF06 | 6" | 385 | 260 | 0.139 | 1961 | 260 | 55 | 95 |
| VAV-4 | F234/F235 | Trane | VCWF04 | 4" | 195 | 90 | 0.042 | 2235 | 90 | 55 | 113.48 |
| VAV-5 | F236 | Trane | VCWF04 | 4" | 135 | 85 | 0.022 | 1547 | 85 | 55 | 115.36 |
| VAV-6 | F237 | Trane | VCWF04 | 4" | 200 | 85 | 0.043 | 2292 | 85 | 55 | 115.36 |
| VAV-7 | F238/F239 | Trane | VCWF06 | 6" | 375 | 100 | 0.132 | 1910 | 100 | 55 | 110.08 |
| VAV-8 | F240 | Trane | VCWF04 | 4" | 85 | 85 | 0.01 | 974 | 85 | 55 | 115.36 |
| VAV-9 | F241 | Trane | VCWF04 | 4" | 85 | 85 | 0.01 | 974 | 85 | 55 | 115.36 |
| VAV-10 | F242 | Trane | VCWF04 | 4" | 150 | 85 | 0.026 | 1719 | 85 | 55 | 115.36 |
| VAV-11 | F-Corridor | Trane | VCWF05 | 5" | 330 | 85 | 0.061 | 2420 | 85 | 55 | 115.36 |

- VAV terminal shall be double wall with insulation between panels so not to be exposed to airstream. Provide terminals with double-walled insulated manufacturer's access panel at an easily accessible area for all interior components.

| VAV Fan Powered Terminal Units Schedule | | | | | | | | | | | |
|---|---------------|--------------|--------------|---------------|----------------------------|-------------------------|------------------------------|----------|---------|---------------|----------------|
| Base Unit | | | | | | | | | | | |
| Tags | Area Served | Manufacturer | Model Number | Primary inlet | Design cooling airflow cfm | Min cooling airflow cfm | APD @ cooling airflow in H2O | Fan size | Fan TSP | Motor voltage | Hot water coil |
| FPVAV-1 | D100 | TRANE | VPWF10 | 10" | 1205 | 450 | 0.036 | 035Q | 755 | 0.334 | 115 |
| FPVAV-2 | D101 | TRANE | VPWF12 | 12" | 2000 | 840 | 0.01 | 045Q | 1160 | 0.417 | 115 |
| FPVAV-3 | Pharm Offices | TRANE | VPWF05 | 5" | 250 | 90 | 0.062 | 025Q | 160 | 0.254 | 115 |
| FPVAV-4 | D103/105 | TRANE | VPWF08 | 8" | 515 | 205 | 0.061 | 035Q | 365 | 0.263 | 115 |
| FPVAV-5 | D106 | TRANE | VPWF05 | 5" | 195 | 40 | 0.048 | 025Q | 155 | 0.253 | 115 |
| FPVAV-6 | D109/D110 | TRANE | VPWF08 | 8" | 820 | 325 | 0.163 | 035Q | 465 | 0.271 | 115 |
| FPVAV-7 | D112 | TRANE | VPWF12 | 12" | 1500 | 450 | 0.01 | 045Q | 1050 | 0.382 | 115 |
| FPVAV-8 | D112 | TRANE | VPWF12 | 12" | 1500 | 450 | 0.01 | 045Q | 1050 | 0.382 | 115 |
| FPVAV-9 | D113 | TRANE | VPWF05 | 5" | 215 | 55 | 0.06 | 025Q | 160 | 0.254 | 115 |
| FPVAV-10 | D115 | TRANE | VPWF06 | 6" | 350 | 105 | 0.162 | 035Q | 245 | 0.257 | 115 |
| FPVAV-11 | D116 | TRANE | VPWF08 | 8" | 530 | 310 | 0.065 | 035Q | 290 | 0.259 | 115 |
| FPVAV-12 | F141A | TRANE | VPWF16 | 16" | 1850 | 425 | 0.01 | 065Q | 1425 | 0.401 | 115 |
| FPVAV-13 | F141B | TRANE | VPWF16 | 16" | 1850 | 425 | 0.01 | 065Q | 1425 | 0.401 | 115 |

- VAV terminal shall be double wall with insulation between panels so not to be exposed to airstream. Provide terminals with double-walled insulated manufacturer's access panel at an easily accessible area for all interior components.

AIR HANDLING UNIT SCHEDULE

| MARK | TYPE | Trane M-Series | MAX CFM | ESP | OA CFM | SUPPLY FAN | | | RETURN FAN | | | CHILLED WATER COIL | | | | HEATING WATER COIL | | | | | | |
|-------|------|-------------------|---------|-----|--------|------------------|-------------|---------|------------------|-------------|---------|--------------------|-------------|-------|--------|--------------------|-------|-------|------|---------|-------------|-------|
| | | | | | | SIZE AND TYPE | MOTOR HP | VOLTS/Ø | SIZE AND TYPE | MOTOR HP | VOLTS/Ø | EAT DB/WB | LAT DB/WB | GPM | WPD | MBH SENS/TOT | GPM | WPD | ROWS | FINS/FT | EAT/LAT | MBH |
| AHU-5 | VAV | SIZE 14 | 5500 | 2" | 1500 | 12" FC | 10 | 480/3 | 15" FC | 5 | 480/3 | 85.9/70.8 | 51.76/51.46 | 55.82 | 11.67 | 336/207.75 | 28.53 | 0.5' | 2 | 80 | 54.83/94.41 | 285.7 |
| AHU-6 | VAV | SIZE 21 | 9355 | 2" | 1920 | 18" FC | 15 | 480/3 | 18" FC | 10 | 480/3 | 84.1/69.9 | 55.57/55.2 | 74.19 | 10.42' | 446.61/294.94 | 29.33 | 3.42' | 1 | 80 | 57.7/86.65 | 293.7 |

NOTES:

- Provide stainless steel drain pans sloped in two directions towards drain below cooling and heating coil.
- Cooling coils (chilled water) shall be ARI listed for performance. Coils shall have no more than 12 fins per inch and serrated fins are not acceptable. The minimum design entering water temperature shall be 2 degrees F above system chilled water supply temperature as documented in latest official project plans with a water temperature differential across the coil of 12 degrees F. Provide stainless steel coil casings and intermittent supports. Aluminum coil fins shall be of 0.0075" minimum thickness. Copper coil tubing shall be of minimum tube wall thickness of .020" and 5/8" diameter. A single chilled water coil shall be no more than 8 rows. Where coil capacity requirements dictate more than 8 rows, the coil shall be split into two separate coils with minimum of 12 inches between them. Maximum cooling coil face velocity shall be no higher than 500 FPM at the AHU design capacity.
- Heating coils shall be ARI listed for performance. Coils shall have no more than 12 fins per inch and serrated fins are not acceptable Aluminum coil fins shall be of 0.0075" minimum thickness. Copper coil tubing shall be of minimum tube wall thickness of .020" and 5/8" diameter.
- Provide 200,000 hour (L10) rated bearings on shafts and motors. Provide TEFC (Totally Enclosed, Fan Cooled and NEMA premium efficiency) motors for fans.
- Provide laser alignment and belt tensioning of supply and return fans upon installation. Laser alignment and belt tensioning tool, as well as user training, shall be provided to local FM staff upon completion of project.
- Air Handlers shall have access doors in all modules except coil modules. Doors must be hinged at one side and with latches on one side that take no tool to operate. Doors shall provide full swing or have pin and sleeve hinge removal. Each module shall have a vision panel and interior lighting with switching at exterior of AHU. AHU casings shall be designed and rated for 2" water column greater pressure than the fan's total rated static pressure at maximum RPM. Provide gasketed panels and grommets on pipe and tubing penetrations of the exterior casing to eliminate air leakage.
- All air handlers shall be double wall with interior insulation but no insulation exposed to the airstream. Galvanized smooth metal interior panels are required with no perforated panels acceptable. Provide a thermal break between casing interior and exterior on all outdoor units and on those located within unconditioned interior spaces. "Sandwich" panel construction, consisting of closed cell foam that is injected between the outer and inner sheet metal panels shall be used.
- Air dampers in Air handlers or in ducts shall be airfoil type with opposed blade design, low leakage type with a neoprene seal at blade edge. All rotating shafts shall be plated steel and bushings shall be stainless steel sleeve bearings. Provide extended shafts for attachment of damper actuators at the exterior of ducts and air handlers.
- Air handlers and filter compartments shall have filter racks with spacers and gaskets necessary to prevent ANY air bypass around filters. Size the racks for max filter face velocity of 500 fpm. Design the filter racks to utilize only filter sizes that are Industry Standard and readily available as a Commercial off the Shelf product (COTS).
- Refer to latest edition of UFC 4-510-01 for proper filter selection. The default filter arrangement is a pre-filter, located upstream of all coils, velocity sensing devices or other devices requiring protection from particulate accumulation, and an intermediate filter, located downstream of the supply fan or cooling coil, whichever is last. The pre-filter shall be a 4 inch thick (minimum thickness) disposable cartridge filter with pleated media and a Minimum Efficiency Reporting Value (MERV) rating of MERV- 8. The intermediate filter, as required by UFC 4-510-01) shall be rated as MERV-14. Do NOT design or install systems which incorporate the use of bag or roll filters. Filters in outside air streams shall be metal frame type. See paragraphs 7-8.4 and 7-11.1 in UFC 4-5100 for more instruction on air filters, their location and their protection.

| DATE | DESCRIPTION | MARK | DATE | APPR |
|-------------|--------------------------|------|-------------|------|
| 10 AUG 2016 | RECORD DRAWINGS AS-BUILT | MARK | 10 DEC 2016 | APPR |

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