	Title: YALE OFFICE OF FACILITIES PROCEDURE MANUAL Chapter: 01 - Yale Design Standard Division: HVAC Standards	Section: 23 21 16 00: Piping Components and Specialties
		Date: 06/15/16
		Author: Office of Facilities
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PART 1 - INTRODUCTION

- A. This section refers to Piping Specialty items as listed below for Building Systems, as a supplement to this section refer to the section Piping Specialty Appendix
- B. Component Name and Tag Format:
1. Air Separators: AS-x.
 2. Air Vents: AV-x.
 3. Balancing Devices
 4. Blowdown Separator
 5. Chemical Bypass Feeder: BF-x.
 6. Cooling Coils Condensate Return Units.
 7. Expansion Joint: EX-x.
 8. Expansion Tank
 9. Flexible Connector: FC-x.
 10. Gauges
 11. Pressure Indicators: PI-x.
 12. Pressure/temperature Test Ports: TP-x
 13. Pressure Regulating Valves (Water and Air): PRV-xxx-x.
 14. Suction Diffusers: SD-x.
 15. Temperature Indicators: TI-x.
 16. Thermowells: TW-x.
 17. Vacuum Breakers: VB-x.

PART 2 - DESIGN AND MINIMUM PRODUCT REQUIREMENTS

- 2.1 Air Separators (AS-X)
- A. Design and minimum product requirements
1. Provide air separator for hydronic systems
 2. Install between the expansion tank and pump
- B. Acceptable Manufacturers:
1. Bell and Gossett.
 2. Amtrol.
 3. Wheatley.
 4. Taco.
- C. Description:

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1. Type: centrifugal type with tangential inlet/outlet connections. Connection sizes as shown on the Contract Drawings.
2. Maximum Working Pressure: 125 psig.
3. Maximum Working Temperature: 350 degrees F.

D. Materials:

1. AS-1: (Services: CHW, CW, HW, Glycol, Non-Clean Process Water):
 - a. Body: cast iron or welded steel, ASME rated and stamped.
 - b. Strainer Screen: stainless steel, 3/16-inch perforations.
2. AS-2: (Services: RO, DI, Clean Process Water)
 - a. Body: 304 or 316 stainless steel, ASME rated and stamped.
 - b. Strainer Screen: stainless steel, 3/16-inch perforations.
3. Connections: NPT or flanged as indicated for piping system.
4. Connection Size: minimum pipe diameter shall be same size as up and downstream pipe connections..
5. Finish: manufacturer's standard air dry enamel finish.

2.2 Air vents (AV-X)

A. Design and minimum product requirements

1. Provide manual air vents for filling system, and at high-points
2. Provide automatic air vents for hydronic and steam systems
3. Provide manual air vents where large air quantities can accumulate.
4. Provide float type automatic air vents in ceiling spaces or other concealed locations with vent tubing extended to the nearest drain.

B. Manual Air Vent Assemblies: Construct of 3/4" diameter, 6" long, vertical pipe sections capped to form an air chamber. Provide a 12" long, 1/4" diameter annealed copper tube at the top of each chamber and terminate with an SD operated manual air vent.


C. Float Type Automatic Air Vents: Provide with isolating valve. Vent must be suitable for system operating temperature and pressure.

D. Provide in accordance with Air Vent Schedule in Section, Piping Specialties Appendix.


2.3 Balancing Valve Devices (BVD-x)

A. Design and minimum product requirements:


1. Balancing Devices: Either automatic or manual. If automatic units are used, hydronic balancing will not be required nor will any report be necessary for those components provided with automatic units. If manual units are used, complete balancing will be required and full documentation shall be prepared and included in the overall testing and balancing report.
2. Automatic or Manual Balancing Devices: Provided for each coil.

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3. Manual Balancing Devices: Provided for each cooling or heating coil installed in a central station prefabricated or built-up air handling unit, or other terminal device with cooling and or heating coil.
 4. Readout Meter Kit: Match either the automatic or manual units or both as required. Include a pressure gauge, dual hoses, shutoff and vent valves, charts or calculators, instructions, and fitted carrying case.
- B. Balancing Valves:
1. Automatic: Griswold Series 300 ductile iron flow control unit having stainless steel internal mechanism and two (2) pressure/temperature taps.
 2. Manual: Bell and Gossett Model #CB bronze calibrated circuit setter having preset balancing capabilities, memory stop, brass ball, differential pressure readout ports and calibrated nameplate.
- C. Installation Requirements:
1. Provide ball valves for isolation
 2. Provide strainers with kits or as specified in this Strainer Standard except that screens shall be stainless steel with 0.055" diameter holes. Provide rated bronze blow off ball valves.
 3. Hard pipe balancing devices.
- 2.4 Blowdown Separator (BDS-1)
- A. Design and minimum requirements
1. Provide blowdown separators as required, and for quenching.
- B. Acceptable Manufacturers:
1. Penn Separator
 2. Yale Approved Equivalent
- C. Construction: Welded steel, ASME code constructed and stamped for 150 psi working pressure, sized to suit boiler blowdown valve size and boiler pressure. Provide a stainless steel striking plate at the point of impingement. Openings shall include inlet, drain, and vent. Provide appropriate support legs for floor mounting.
- D. Temperature Control: Provide separator outlet with a full-sized aftercooler assembly consisting of a cold water inlet line strainer, temperature regulating valve with sensing bulb, bulb opening, 2-1/2" dial bimetal thermometer, and matching openings.
- E. Connect to cold water supply. Provide valve ahead of strainer. Set temperature regulator to maintain discharge at 140 deg F or less.
- F. Connect discharge to approved waste system. Assure slope of sewer is at least 1/4" per foot.
- G. Extend vent through roof full size.
- 2.5 Chemical Bypass Feeder (BF-1)

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- A. Design and minimum product requirements
 - 1. Provide hydronic systems with shot feeders for introduction of water treatment chemicals as required per section, chemical treatment
 - B. Acceptable Manufacturers:
 - 1. L. Wingert Company.
 - 2. A&F Machines.
 - C. Description:
 - 1. Vertical, floor-mounted with independent support legs.
 - 2. 3/4-inch FNPT bottom drain, top feed.
 - 3. 10 gallon capacity, with 200 psi pressure rating.
 - 4. Provide isolation valves.
- 2.6 Cooling Coil Condensate Pump (CP-1)
- A. Design and minimum product requirements
 - 1. Provide unit as described where cooling coil condensate via gravity discharge is not achievable.
 - B. Materials of Construction:
 - 1. Receiver shall be carbon steel.
 - 2. Valves shall be cast iron or bronze, ANSI Class 125.
 - 3. Pumps shall be cast iron case, bronze impeller and trim.
 - 4. Control panel shall be painted NEMA 4.
 - C. Paint receiver, control panel, and skid in manufacturer's standard color.
- 2.7 Expansion Joint (EX-X)
- A. Design and minimum product requirements
 - 1. Provide in accordance with the Expansion Joint Schedule in Section, Piping Specialties Appendix.
 - 2. Provide expansion joint to accommodate contraction and expansion of mechanical systems.
 - 3. Manufacturer of expansion joints and flexible connectors shall field-inspect the installed components after installation. The manufacturer shall provide the Subcontractor a list of installation deficiencies and certification that the devices are installed appropriately after deficiencies have been corrected.
 - 4. Installation shall not cause any change of position of equipment or piping that results in stress or misalignment of the equipment or piping. Equipment and attached piping shall be supported such that expansion joints and flexible connectors do not carry piping loads.
 - 5. Components shall not be subject to torsion during or after installation.
 - 6. Pipe sections shall be adequately guided in axial directions to force movement into the expansion joint or flexible connector.
 - 7. Expansion joints and flexible connectors may be supplied with guide bars that maintain the listed overall length. These bars shall not be removed until the joint has been installed and the pipe is securely supported.

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8. Do not test expansion joints beyond 1-1/2 times their rated working pressure. Secure anchors and guides before applying test pressure to the line.
9. Expansion joints and flexible connectors are not to be used to make up for inaccuracies of pipe alignment.
10. Expansion joints and flexible connectors shall be provided with tie rods and sleeves.

2.8 Expansion Tank

A. Design and minimum product requirements

1. Provide expansion tank to accommodate for thermal expansion of chilled and heating fluid.
2. For chilled water systems assume highest temperature to be 100 F.
3. General: Welded black steel closed type ASME rated and labeled for working pressure of 125 psi, cleaned, rustproof coated inside and out, supplied with steel support saddles and appropriate tappings for the installation of accessories.
4. Gauge Glass Set: Consists of brass compression stops and guard. Glass shall extend from 2" above bottom to 2" below top. Maximum length of each glass 24".
5. Accessories: Provide Airtrol fitting and drain valve in separate tappings in bottom of tank. Provide ASME labeled pressure relief valve and automatic cold water fill assembly complete with pressure reducing valve, reduced pressure backflow preventer with test cocks, full line size valved bypass and strainer.
6. Bladder expansion tanks can be used as approved by the Engineer.

2.9 Flexible Connector (FC-X)

A. Design and minimum product requirements


1. Flexible connectors shall be provided at pump inlet and outlet connections, and other locations as required to minimize vibration.
2. Provide in accordance with the Flexible Connector Schedule in Section, Piping Specialties Appendix.

2.10 Gauges

A. Design and minimum product requirements

1. Provide pressure gauges for systems other than HVAC per requirements of other sections and standards.
2. Trerice 500X series, 4-1/2" diameter, pressure, compound, or vacuum gauge, bottom connection, 1/2% accuracy. Provide with cast aluminum case, stainless steel ring, glass face, phosphor bronze bourdon tube and friction pointer. Select operating ranges to assure nominal readings at the midpoint thereof. Provide snubber, coil syphon, T-handle cock for each gauge.

2.11 Pressure Indicators (PI-X)

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- A. Design and minimum product requirements
 - 1. Pressure gauges for pumping systems shall be liquid filled.
 - 2. Where a single strainer serves multiple circuits, pressure gauges shall be supplied up and downstream of said strainer.
 - 3. Pressure gauges shall include system rated ball-type isolation valves.
 - 4. Gauge scale shall be specified for range of operation.
 - 5. Operating ranges shall be selected to assure nominal readings at the midpoint thereof. Provide snubber, coil syphon, and T-handle cock for each gauge.
 - 6. Provide in accordance with the Pressure Indicator Schedule in Section, Piping Specialties Appendix.

- 2.12 Pressure/Temperature Test Ports:
 - A. Design and minimum product requirements
 - 1. Provide P&T test ports at locations to measure system critical pressure and temperature parameters.
 - 2. Location of balancing devices.
 - 3. Provide extensions for areas where pipe is insulated.


 - B. Acceptable Manufacturers:
 - 1. Peterson Engineering.
 - 2. Sisco.

 - C. Materials:
 - 1. TP-1: brass body, neoprene valve core.
 - 2. TP-2: brass body, Nordel valve core.
 - 3. TP-3: 316 stainless steel body, Viton valve core.
 - 4. TP-4: 316 stainless steel body, neoprene valve core.

 - D. Installation: Specify one complete test kit for pressure/temperature test ports for Yale Facilities.

- 2.13 Pressure Relief Vents (PSV-XXX)
 - A. Design and minimum product requirements
 - 1. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchanger, and expansion tanks.
 - 2. Refer to applicable standard for Safety Devices associated with steam PRV stations.
 - 3. Pipe relief valve outlet to nearest floor drain.
 - 4. Install relief valves where required by code.
 - 5. Provide in accordance with the Pressure Relief Vents in Section, Piping Specialties Appendix.

- 2.14 Reduced Pressure Backflow Preventer (BP-1)
 - A. Design and minimum product requirements
 - 1. Acceptable Manufacturer: Watts Regulator Series 009, 909, 994.
 - a. Description:
 - 1) Minimum requirements, or as system parameters require.
 - 2) End Connections: threaded, sweat, 150 pound flanges.

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- 3) Materials: No-lead bronze body, Series 300 stainless steel trim with Noryl checks.
- 4) Accessories: test ports, drain line air gap fittings.

2.15 Suction Diffusers (SD-x):

A. Design and minimum product requirements

1. Provide suction diffuser at inlet of end-suction pumps, and where minimum number of pipe diameters cannot be achieved per manufacturer requirements.
2. Acceptable Manufacturers:
 - a. Bell and Gossett.
 - b. Paco.
 - c. Wheatley.
 - d. Mueller.
 - e. Taco.
3. Description: Elbow pattern, bolted cover, removable start-up screen, rated for a minimum of 175 psig at 300 degrees F. Provide with NPT drain and gauge connections and extended support foot.
 - a. Materials: Cast iron body, steel or cast iron cover, stainless steel orifice cylinder, and straightening vanes, 16-mesh bronze start-up strainer. Permanent magnet plug in drain connection.
 - b. Connections: NPT connections for pipe sizes 2-inch and smaller, ANSI Class 150 flat-faced flanged connections on inlet and outlet for larger sizes. Outlet connection same diameter as pump inlet connection size shown on Contract Drawings.
 - c. Installation: Remove suction diffuser startup strainer after system has been in operation for at least 72 hours and replace with permanent strainer.


2.16 Temperature Indicators (TI-x)

A. Design and minimum product requirements

1. Dial Thermometer: Bimetal type, 3" diameter dial, back connection, adjustable angle, 1% accuracy. Provide with hermetically sealed 304 stainless steel case and stem assembly, tempered crystal glass face, friction pointer, zero adjustment and 304 stainless steel connection nut. Install in separable socket.
2. Separable Sockets: Provide each thermometer with a 304 stainless steel separable socket of proper depth for the service intended. Provide extension necks for insulated piping.
3. Operating Ranges: Select to assure nominal temperature readings at the midpoint thereof.
4. Provide in accordance with the Temperature Indicator Schedule in Section, Piping Specialties Appendix.

2.17 Thermowells

A. Design and minimum product requirements

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1. Provide in accordance with the Thermowell Schedule in Section, Piping Specialties Appendix.
- 2.18 Vacuum breakers
- A. Design and minimum product requirements
 1. Installation:
 - a. Provide pipe nipple to space vacuum breaker clear of pipe insulation.
 - b. Provide in condensate return systems where required, steam heat exchangers, and ahead of steam trap assembly as required.
 - B. Product Guidelines:
 1. VB-1, Steam Service to 0 to 300 Psig:
 2. VB-2, PVC hydronic piping applications:
 - C. Materials:
 1. VB-1: stainless or forged steel body with stainless steel trim; NPT connection, 1/2-inch diameter, rated 300 psig at 428 degrees F.
 VB-2: PVC body and Viton elastomers, 1/2-inch through 1-inch FNPT connection, rated 100 psig at 75 degrees F.