# SECTION 232116 - HYDRONIC PIPING SPECIALTIES

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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 special-duty valves and specialties for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Dual-temperature heating and cooling water piping.
4. Condenser-water piping.
5. Glycol cooling-water piping.
6. Makeup-water piping.
7. Condensate-drain piping.

8. Blowdown-drain piping.
9. Air-vent piping.
10. Safety-valve-inlet and -outlet piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air-control devices.
3. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

Retain "Differential Pressure Meter" Paragraph below if retaining calibrated-orifice, balancing valves in Part 2.

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 016000 "Product Requirements."

2.1 PERFORMANCE REQUIREMENTS

Performance requirements in this article are for the piping system. Individual components may have higher pressure or temperature ratings.

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

Working pressure is equal to the relief pressure plus the static height of the system and pumping head. The only working pressure mandated by authorities having jurisdiction is for makeup water.

1. Hot-Water Heating Piping: <**Insert psig (kPa)**> at [**200 deg F (93 deg C)**] <**Insert temperature**>.
2. Chilled-Water Piping: <**Insert psig (kPa)**> at [**200 deg F (93 deg C)**] <**Insert temperature**>.
3. Dual-Temperature Heating and Cooling Water Piping: <**Insert psig (kPa)**> at [**200 deg F (93 deg C)**] <**Insert temperature**>.
4. Condenser-Water Piping: <**Insert psig (kPa)**> at [**150 deg F (66 deg C)**] <**Insert temperature**>.
5. Glycol Cooling-Water Piping: <**Insert psig (kPa)**> at [**150 deg F (66 deg C)**] <**Insert temperature**>.
6. Makeup-Water Piping: [**80 psig (552 kPa)**] <**Insert value**> at [**150 deg F (66 deg C)**] <**Insert temperature**>.
7. Condensate-Drain Piping: [**150 deg F (66 deg C)**] <**Insert temperature**>.
8. Blowdown-Drain Piping: [**200 deg F (93 deg C)**] <**Insert temperature**>.
9. Air-Vent Piping: [**200 deg F (93 deg C)**] <**Insert temperature**>.
10. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

## 2.2 SOURCE LIMITATIONS

A. Source Limitations: Obtain all grooved joint couplings, fittings, valves, and specialties from single source. Obtain grooving tools from same source as grooved components.

## 2.3 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230900 "Instrumentation and Control for HVAC."

MSS SP-122, "Plastic Industrial Ball Valves," is a standard for plastic ball valves. It is not comprehensive and additional data may be required for certain applications. In general, end types and pressure and temperature ratings are required. No applicable standards are available for plastic butterfly or check valves. CPVC piping in this Section is rated for up to 180 deg F (82 deg C). Verify that plastic valves are adequate for operating temperature of piping systems.

C. Plastic Ball Valves:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed. Retain option and delete insert note if manufacturer's name and model number are indicated on Drawings.

2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

   a. American Valve, Inc.
   b. Asahi/America.
   c. Charlotte Pipe and Foundry Company.
   d. Colonial Engineering.
   e. George Fischer Inc.
   f. Hayward Industrial Products, Inc.
   g. IPEX Inc.
   h. Jomar International, Ltd.
   i. KBI (King Bros. Industries).
   j. Legend Valve.
   k. NIBCO INC.
   l. Plast-O-Matic Valves, Inc.
   m. SMC The Specialty Mfg. Co.
   n. Thermoplastic Valves Inc.
   o. Watts Regulator Co.
   p. <**Insert manufacturer's name**>.

3. Body: One-, two-, or three-piece CPVC or PVC to match piping.
4. Ball: Full-port CPVC or PVC to match piping.
5. Seats: PTFE.
6. Seals: EPDM.
7. End Connections: Socket, union, or flanged.
8. Handle Style: Tee shape.
9. CWP Rating: Equal to piping service.
10. Maximum Operating Temperature: Equal to piping service.

Not all manufacturers comply with the standard in subparagraph below.

11. Comply with MSS SP-122.

Large plastic butterfly valves may have reduced pressure ratings.

D. Plastic Butterfly Valves:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed. Retain option and delete insert note if manufacturer's name and model number are indicated on Drawings.

2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering.
   d. George Fischer Inc.
   e. Hayward Industrial Products, Inc.
   f. IPEX Inc.
   g. Legend Valve.
   h. NIBCO INC.
   i. Plast-O-Matic Valves, Inc.
   j. SMC The Specialty Mfg. Co.
   k. Thermoplastic Valves Inc.
   l. Watts Regulator Co.
   m. <**Insert manufacturer's name**>.

3. Body: PVC or CPVC to match piping wafer type for installation between flanges.
4. Disc: EPDM-coated steel.
5. Seats: PTFE.
6. Handle Style: Locking lever.
7. CWP Rating: Equal to piping service.
8. Maximum Operating Temperature: Equal to piping service.

E. Plastic Check Valves:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed. Retain option and delete insert note if manufacturer's name and model number are indicated on Drawings.

2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. American Valve, Inc.
b. Asahi/America.
c. Colonial Engineering.
d. George Fischer Inc.
e. Hayward Industrial Products, Inc.
f. IPEX Inc.
g. KBI (King Bros. Industries).
h. Legend Valve.
i. NIBCO INC.
j. Plast-O-Matic Valves, Inc.
k. SMC The Specialty Mfg. Co.
l. Thermoplastic Valves Inc.
m. Watts Regulator Co.
n. <**Insert manufacturer's name**>.

3. Body: One-, two-, or three-piece PVC or CPVC to match piping.
4. Ends: Socket or flanged.
5. Seats: PTFE.
6. Check Style: Swing or ball type.
7. CWP Rating: Equal to piping service.
8. Maximum Operating Temperature: Equal to piping service.

F. Bronze, Calibrated-Orifice, Balancing Valves:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed. Retain option and delete insert note if manufacturer's name and model number are indicated on Drawings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Series 786 (soldered) and 787 (threaded) or comparable product by one of the following:

a. Tour & Andersson.
b. <**Insert engineer approved manufacturer's name**>.

2. Body: Ametal® (copper-alloy), globe type with calibrated orifice or venturi.
3. Disc: Ametal® (copper-alloy).
4. Restriction Cone: Ametal® (copper-alloy).
5. Seat: Ametal® (copper-alloy) with EPDM sealing elastomer.
6. Stem Seals: EPDM.
7. End Connections: Threaded or socket.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Handwheel with memory stop to retain set position.
10. CWP Rating: Minimum 250 psig (1725 kPa).
11. Maximum Operating Temperature: 230 deg F (110 deg C).
12. Coil Hook-up Connections:

a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Koil-Kit Series 799 and Series 79V or comparable product by one of the following:

1) <**Insert engineer approved manufacturer's name**>.

b. Kit to include:

1) Victaulic Series 786/787/78K circuit balancing valve.
2) Victaulic Series 78Y Strainer-Ball.
3) Victaulic Series 78U Union-Port fitting, with Series 78T ball valve and required hoses.

13. Differential Pressure Controller:

a. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Series 793 and Series 794 or comparable product by one of the following:

1) <**Insert engineer approved manufacturer's name**>.

14. Meter: Provided by the valve manufacturer; to remain with the building owner after commissioning.

G. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed. Retain option and delete insert note if manufacturer's name and model number are indicated on Drawings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Series 788 (flanged) and Series 789 (grooved) or comparable product by one of the following:

a. Tour & Andersson.
b. <**Insert engineer approved manufacturer's name**>.

2. Body: Ductile-iron body, globe pattern with calibrated orifice or venturi.
3. Stem Seals: EPDM O-rings.
4. Disc: Ametal® (copper-alloy) or coated ductile iron.
5. Seat: Ametal® or coated ductile iron, with EPDM seal.
6. End Connections: Flanged or grooved.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Handwheel, with memory stop to retain set position.
9. CWP Rating: Minimum 250 psig (1725 kPa).
10. Maximum Operating Temperature: 230 deg F (110 deg C).

H. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers**

**offering products that may be incorporated into the Work include, but are not limited to, the following**]:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed. Retain option and delete insert note if manufacturer's name and model number are indicated on Drawings.

2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump.
   d. Conbraco Industries, Inc.
   e. Spence Engineering Company, Inc.
   f. Watts Regulator Co.
   g. <**Insert manufacturer's name**>.

3. Body: Bronze or brass.
4. Disc: Glass and carbon-filled PTFE.
5. Seat: Brass.
6. Stem Seals: EPDM O-rings.
7. Diaphragm: EPT.
8. Low inlet-pressure check valve.
9. Inlet Strainer: <**Insert materials**>, removable without system shutdown.
10. Valve Seat and Stem: Noncorrosive.
11. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

I. Diaphragm-Operated Safety Valves: ASME labeled.

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed. Retain option and delete insert note if manufacturer's name and model number are indicated on Drawings.

2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump.

d. Conbraco Industries, Inc.
e. Spence Engineering Company, Inc.
f. Watts Regulator Co.
g. <**Insert manufacturer's name**>.

3. Body: Bronze or brass.
4. Disc: Glass and carbon-filled PTFE.
5. Seat: Brass.
6. Stem Seals: EPDM O-rings.
7. Diaphragm: EPT.
8. Wetted, Internal Work Parts: Brass and rubber.
9. Inlet Strainer: <**Insert materials**>, removable without system shutdown.
10. Valve Seat and Stem: Noncorrosive.
11. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

J. Automatic Flow-Control Valves:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed. Retain option and delete insert note if manufacturer's name and model number are indicated on Drawings.

2. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

a. Victaulic Company.

~~a.Flow Design Inc.~~
~~b.Griswold Controls.~~
~~c.Nexus Valve, Inc.~~
~~d.~~b. <**Insert engineer approved manufacturer's name**>.

3. Body: DZR Brass or ductile iron~~ferrous metal~~.
4. O-Ring: EPDM
~~4.~~5. ~~Piston and Spring~~ Cartridge Assembly: [**Stainless steel**] [DZR Brass~~**Corrosion resistant**~~], EPDM O-ring, and HNBR diaphragm~~tamper proof, self-cleaning, and removable~~.
~~5.~~6. Combination Assemblies: Include ~~bronze or~~ brass-alloy ball valve.
~~6.~~7. Identification Tag: Marked with zone identification, valve number, and flow rate.
~~7.~~8. Size: Same as pipe in which installed.

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~~8.~~9. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.

~~9.~~10. Minimum CWP Rating: **~~[1365~~75 psig (2500~~1207~~ kPa)~~] [300 psig (2070 kPa)]~~**.

~~10.~~11. Maximum Operating Temperature: [**~~200~~230 deg F (~~93~~110 deg C)**] [**250 deg F (121 deg C)**].

## 2.4 AIR-CONTROL DEVICES

Air vents aid in system filling. Air removal after initial startup is accomplished by air separator or boiler dip-tube.

Leakage from automatic air vents may cause damage to ceilings and other finished surfaces. Manual air vents may be preferred over automatic air vents in finished spaces.

A. Manual Air Vents:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump.
   d. Nexus Valve, Inc.
   e. Taco, Inc.
   f. <**Insert manufacturer's name**>.

2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2 (DN 15).
6. Discharge Connection: NPS 1/8 (DN 6).
7. CWP Rating: 150 psig (1035 kPa).
8. Maximum Operating Temperature: 225 deg F (107 deg C).

B. Automatic Air Vents:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

   a. AMTROL, Inc.

b. Armstrong Pumps, Inc.
c. Bell & Gossett Domestic Pump.
d. Nexus Valve, Inc.
e. Taco, Inc.
f. <**Insert manufacturer's name**>.

2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2 (DN 15).
6. Discharge Connection: NPS 1/4 (DN 8).
7. CWP Rating: 150 psig (1035 kPa).
8. Maximum Operating Temperature: 240 deg F (116 deg C).

C. Expansion Tanks:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. AMTROL, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett Domestic Pump.
d. Taco, Inc.
e. <**Insert manufacturer's name**>.

2. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested after taps are fabricated and shall be labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. (379-L) unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig (860-kPa) working pressure and 250 deg F (121 deg C) maximum operating temperature.
4. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig (860-kPa) working pressure and 240 deg F (116 deg C) maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
5. Gage Glass: Full height with dual manual shutoff valves, [**3/4-inch- (20-mm-)**] <**Insert dimension**> diameter gage glass, and slotted-metal glass guard.

D. [**Diaphragm**] [**Bladder**]-Type Expansion Tanks:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump.
   d. Taco, Inc.
   e. <**Insert manufacturer's name**>.

2. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. [**Diaphragm**] [**Bladder**]: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

E. Tangential-Type Air Separators:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump.
   d. Taco, Inc.
   e. <**Insert manufacturer's name**>.

2. Tank: Welded steel; ASME constructed and labeled for 125-psig (860-kPa) minimum working pressure and 375 deg F (191 deg C) maximum operating temperature.
3. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
4. Tangential Inlet and Outlet Connections: Threaded for NPS 2 (DN 50) and smaller; flanged connections for NPS 2-1/2 (DN 65) and larger.
5. Blowdown Connection: Threaded.
6. Size: Match system flow capacity.

F. In-Line Air Separators:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers**

**offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. AMTROL, Inc.
b. Armstrong Products, Inc.
c. Bell & Gossett Domestic Pump.
d. Taco, Inc.
e. <**Insert manufacturer's name**>.

2. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
3. Maximum Working Pressure: Up to 175 psig (1207 kPa).
4. Maximum Operating Temperature: Up to 300 deg F (149 deg C).

G. Air Purgers:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. AMTROL, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett Domestic Pump.
d. Taco, Inc.
e. <**Insert manufacturer's name**>.

2. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
3. Maximum Working Pressure: 150 psig (1035 kPa).
4. Maximum Operating Temperature: 250 deg F (121 deg C).

## 2.5 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Style 732 and W732, or comparable product by one of the following:

a. <**Insert engineer approved manufacturer's name**>.

2. Body:

a. ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
b. ASTM A 536, Grade 65-45-12, ductile iron with coupled cover and drain connection in cap.

3. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; grooved ends for NPS 2-1/2 (DN 65) and larger.

In "Strainer Screen" Subparagraph below, larger mesh numbers have larger passages, thus allowing larger objects to pass.

4. Strainer Screen: Stainless-steel, frame and mesh strainer, or perforated stainless-steel basket.
5. CWP Rating: 300 psig (2065 kPa).

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: [**40**] [**60**]-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (860 kPa).

C. T-Pattern Strainers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Style 730 and W730, or comparable product by one of the following:

   a. <**Insert engineer approved manufacturer's name**>.

2. Body:

   a. Ductile iron with removable access coupling and end cap for strainer maintenance.
   b. Factory-fabricated carbon steel with T-bolt hinged closure for strainer maintenance.

3. End Connections: Grooved ends.
4. Strainer Screen: Perforated stainless-steel basket with 2:1 total free area.
5. CWP Rating: 300 psig (2065 kPa).

Retain "Stainless-Steel Bellow, Flexible Connectors" Paragraph below for small pipe sizes. Allow sufficient length for installation. Where space is limited and for larger piping applications, consider using flexible joints and spherical connectors.

Three Victaulic grooved joint couplings may be used in lieu of a flexible connector at equipment connections to accommodate vibration attenuation and stress relief. Place couplings in close proximity to source of the vibration.

D. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch (20-mm) misalignment.

4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

Three Victaulic grooved joint couplings may be used in lieu of a flexible connector at equipment connections to accommodate vibration attenuation and stress relief. Place couplings in close proximity to source of the vibration.

E. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

Retain one of two "Triple Duty Valve Assembly" paragraphs below. Retain second for 14 through 24 inch sizes.

F. Triple Duty Valve Assembly:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; MasterSeal butterfly valve with memory stop and a Victaulic Series 779 Venturi-Check, or comparable product by one the following:

a. <**Insert engineer approved manufacturer name**>.

2. Water Service: Rated to 230 deg F (110 deg C).
3. Pressure Rating: 300 psi (2065 kPa) maximum.

G. Triple Duty Valve Assembly: For 14 inch (356 mm) through 24 inch (610 mm) sizes.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; AGS-Vic300 butterfly valve with Series W715 AGS check valve, or comparable product by one of the following:

a. <**Insert engineer approved manufacturer's name**>.

2. Pressure Rating: 230 psi (1575 kPa) maximum.

For water systems, Victaulic flexible couplings may be used on header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. Where loops are required, use flexible-type couplings on the loops.

H. Expansion Fittings: Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping."

## PART 3 - EXECUTION

### 3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install [**throttling-duty**] [**calibrated-orifice, balancing**] valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

## 3.2 HYDRONIC SPECIALTIES INSTALLATION

Retain one of first two paragraphs below. Leakage from automatic air vents may cause damage to ceilings and other finished surfaces. Air vents aid in system filling. Air removal after initial startup is accomplished by air separator or boiler dip-tube. Manual air vents may be a better solution.

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

Retain one of first two paragraphs below according to air separator specified in Part 2.

D. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 (DN 50) and larger.

E. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

Retain one of two paragraphs below.

F. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

G. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 232116