# SECTION 23 21 16 - HYDRONIC PIPING SPECIALTIES

## PART 1 - GENERAL

1.01 SUMMARY

A. Section includes special-duty valves and specialties for the following:
   1. Hydronic specialty valves.
   2. Air-control devices.
   3. Strainers.
   4. Connectors.

B. Related Requirements:
   1. Section 230523.12 "Ball Valves for HVAC Piping" for specification and installation requirements for ball valves common to most piping systems.
   2. Section 230523.13 "Butterfly Valves for HVAC Piping" for specification and installation requirements for butterfly valves common to most piping systems.
   3. Section 230523.14 "Check Valves for HVAC Piping" for specification and installation requirements for check valves common to most piping systems.
   4. Section 230923.11 "Control Valves" for automatic control valve and sensor specifications, installation requirements, and locations.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of the following:
   1. Hydronic Specialty 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. Strainers
   4. Connectors.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.04 QUALITY ASSURANCE

A. ASME Compliance: 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.

## PART 2 - PRODUCTS

2.01 HYDRONIC SPECIALTY VALVES

A. Plastic Ball Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Valve, Inc.

b. Asahi/America.
c. Charlotte Pipe and Foundry Company.
d. Colonial Engineering, Inc.
e. Georg Fischer Inc.
f. Hayward Flow Control.
g. IPEX USA LLC.
h. Jomar Valve.
i. KBI (King Bros. Industries).
j. Legend Valve & Fitting, Inc.
k. NIBCO INC.
l. Plast-O-Matic Valves, Inc.
m. SMC The Specialty Mfg. Co.
n. Thermoplastic Valves, Inc.
o. Watts; a Watts Water Technologies company.

2. Body: Two-, or three-piece CPVC or PVC to match piping.
3. Ball: Full-port CPVC or PVC to match piping.
4. Seats: PTFE.
5. Seals: EPDM.
6. End Connections: Socket, union, or flanged.
7. Handle Style: Tee shape.
8. CWP Rating: Equal to piping service.
9. Maximum Operating Temperature: Equal to piping service.
10. Comply with MSS SP-122.

B. Plastic Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. Georg Fischer Inc.
   e. Hayward Flow Control.
   f. IPEX USA LLC.
   g. Legend Valve & Fitting, Inc.
   h. NIBCO INC.
   i. Plast-O-Matic Valves, Inc.
   j. SMC The Specialty Mfg. Co.
   k. Thermoplastic Valves, Inc.
   l. Watts; a Watts Water Technologies company.
2. Body: PVC or CPVC to match piping wafer type for installation between flanges.
3. Disc: EPDM-coated steel.
4. Seats: PTFE.
5. Handle Style: Locking lever.
6. CWP Rating: Equal to piping service.
7. Maximum Operating Temperature: Equal to piping service.

C. Plastic Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. Georg Fischer Inc.
   e. Hayward Flow Control.

f. IPEX USA LLC.
g. KBI (King Bros. Industries).
h. Legend Valve & Fitting, Inc.
i. NIBCO INC.
j. Plast-O-Matic Valves, Inc.
k. SMC The Specialty Mfg. Co.
l. Thermoplastic Valves, Inc.
m. Watts; a Watts Water Technologies company.

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

D. Bronze, Calibrated-Orifice, Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Armstrong Pumps, Inc.
b. Bell & Gossett; a Xylem brand.
c. Flow Design, Inc.
d. Grinnell Mechanical Products.
e. Griswold Controls.
f. Nexus Valve, Inc.
g. NuTech Hydronic Specialty Products.
h. Taco.
i. Tour & Andersson; available through Victaulic Company.
j. Victaulic Company.
2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg. F.

E. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. AMTROL, Inc.
b. Apollo Valves; Conbraco Industries, Inc.
c. Armstrong Pumps, Inc.
d. Bell & Gossett; a Xylem brand.
e. Spence Engineering Company, Inc.
f. Watts; a Watts Water Technologies company.
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: Stainless steel removable without system shutdown.

9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Diaphragm-Operated Safety Valves: ASME labeled.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMTROL, Inc.
   b. Apollo Valves; Conbraco Industries, Inc.
   c. Armstrong Pumps, Inc.
   d. Bell & Gossett; a Xylem brand.
   e. Spence Engineering Company, Inc.
   f. Watts; a Watts Water Technologies company.
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: Stainless steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. 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.

G. Automatic Flow-Control Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Caleffi.
   b. Flow Design, Inc.
   c. Griswold Controls.
   d. Hays Fluid Controls.
2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel tamper proof, self-cleaning, and removable.
4. Combination Assemblies: Include bonze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig 300 psig.
9. Maximum Operating Temperature: 200 deg. F 250 deg. F.

## 2.02 AIR-CONTROL DEVICES

A. Manual Air Vents:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett; a Xylem brand.
   d. Taco, Inc.
2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.

5. Inlet Connection: NPS 1/2-inch.
6. Discharge Connection: NPS 1/8-inch.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 225 deg. F.
9. Commercial buildings shall have high capacity vents.

B. Expansion Tanks:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett; a Xylem brand.
   d. Flo Fab Inc.
   e. Taco, Inc.
2. Tank: Welded steel, rated for 125-psig working pressure and 375 deg. F 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. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg. F maximum operating temperature.
4. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg. F 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- diameter gage glass, and slotted-metal glass guard.

C. In-Line Air Separators:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMTROL, Inc.
   b. Armstrong Products, Inc.
   c. Bell & Gossett; a Xylem brand.
   d. Spirotherm, Inc.
   e. Taco, Inc.
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.
4. Maximum Operating Temperature: Up to 300 deg. F.

## 2.03 STRAINERS

A. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2-inch and smaller; flanged ends for NPS 2 ½ - inch and larger.
3. Strainer Screen: Stainless-steel, 40 mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig.

## 2.04 CONNECTORS

A. 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 misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg. F.

## PART 3 - EXECUTION

### 3.01 VALVE APPLICATIONS

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

### 3.02 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
B. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.
C. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2-inch and larger.
D. 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.
E. 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

**SECTION 23 21 23 - PUMPS**

## PART 1 - GENERAL

1.01 REFERENCE

A. Refer to section 23 05 00 for requirements which are applicable to this section.

1.02 WORK INCLUDED

A. Provide all labor, material, equipment, and supervision necessary to install and place into operation pumps and piping systems as specified herein and indicated on the drawings.

1.03 SUBMITTALS

A. Submit shop drawings of pumps.
B. Submit manufacturers' data sheets for capacities.
C. Impeller diameter not more than 85% of the casing cutwater diameter.
D. Factory run and tested with written test report supplied for pumps over 500 GPM.
E. Submit only specified manufacturers or those added by addenda.

1.04 QUALITY ASSURANCE

A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.

## PART 2 - PRODUCTS

2.01 BASE MOUNTED HORIZONTAL END SUCTION FLEX CONNECTED PUMPS

A. Cast iron, 175 PSI case, bronze fitted, single stage, size and capacity indicated on the drawings, end suction, back pull-out, centrifugal.
B. Pump internals serviceable without disturbing piping or motor connections.
C. Enclosed bronze impeller, statically and dynamically balanced, keyed to shaft, locknut secured.
D. Mechanical stainless steel seal, carbon seal ring, ceramic or ni-resist seat, replaceable bronze shaft sleeve, regreaseable ball bearings, bronze replaceable case wearing rings.
E. Motor and pump on common baseplate, flexible drive coupling, coupling guard and non-overloading motor.
F. Pump factory tested, cleaned, enamel coated.
G. Manufacturers; Aurora, Model 344A or equal by Bell and Gossett, Peerless, Armstrong, provided specs are matched.
H. Factory startup.

2.02 Split-Coupled Vertical Inline Pumps with Integrated Controls

A. Furnish and install Armstrong Series 4300 Design Envelope IVS pumps. The pumps shall be single stage, single or double suction type, vertical inline design with integrated controls. The seal shall be

serviceable without disturbing the motor or the piping connections. The capacities and characteristics shall be as outlined in the plans and specifications. The complete pump unit shall be labeled with ETL listing certification that the product conforms to UL Std 778 and is certified to CSA Std C22.2 No.108. Refer to drawings for additional information.

B. Pump casing shall be constructed of ASTM A48 class 30 cast iron with ANSI 125 / PN16 flanges for working pressure below 175 psig (12 bar) at 150°F (66°C) and ASTM A536 ductile iron with ANSI 250 / PN25 flanges for working pressures to 375 psig (25 bar) at 150°F (66°C). The casing shall be hydrostatically tested to 150% maximum working pressure. The casing shall be radially split to allow removal of the rotating element without disturbing the pipe connections. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line.

C. The pump shall have a factory installed vent/flush line to insure removal of trapped air from the casing and mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge.

D. The impeller shall be bronze, fully enclosed type. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. Two-plane balancing is required where installed impeller diameter is less than 6 times the impeller width.

E. The pump shaft shall be stainless steel.

F. The coupling is to be rigid spacer type constructed of high tensile aluminum alloy. The coupling is to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.

G. The pump shall be fitted with an outside balanced type mechanical seal, with Viton elastomers and antimony carbon (or resin bonded carbon for potable water applications) vs. silicon carbide faces rated up to 250°F (121°C). A 316 stainless steel gland plate shall be provided with a factory installed flush line with manual vent.

H. All split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positively cooling and lubrication.

I. To improve seal chamber cleanliness, supply in the flush line to the mechanical seal a 50 micron cartridge filter and sight flow indicator, to suit the working pressure encountered.

J. Alternately, supply in the flush line to the mechanical seal a maintenance-free sediment separator, with sight flow indicator for pump differential pressures exceeding 30 psig (or 200 kPa).

K. The motor frame shall be NEMA TC type. Motor enclosure is to be ODP or TEFC with NEMA Premium Efficiency rating. Acceptable motor insulation for variable speed operation is NEMA MG-1 Part 31.

L. The variable frequency drive & controls shall be rated UL Type 12 or UL Type 4X and be an integral component of the pumping unit.

M. The integrated VFD shall be of the VVC-PWM type providing near unity displacement power factor (cos Ø) without the need for external power factor correction capacitors at all loads and speeds. The VFD shall incorporate DC link chokes for the reduction of mains borne harmonic currents and to reduce the DC link ripple current thereby increasing the DC link capacitors lifetime. RFI filters will be fitted as standard to ensure the VFD meets low emission and immunity requirements.

N. VFD and motor protection shall include: motor phase to phase fault, motor phase to ground fault, loss of supply phase, over voltage, under-voltage, motor over-temperature, inverter overload, and over-current.

O. Where selected, VFD shall have Sensorless control software to provide automatic speed control in variable volume systems without the need for pump mounted (internal/external) or remotely mounted differential pressure sensor. The default operating mode under Sensorless control shall be Quadratic Pressure Control (QPC) whereby head reduction with reducing flow will be according to a quadratic control curve, the head at minimum flow being 40% of the design duty head. Control mode setting and minimum/maximum head setpoints shall be user adjustable via a built-in programming interface.

P. If the quantity of pumps in a system is 2 to 4-maximum, including any standby, a Sensorless controller shall be added to a pumping unit and set up at the factory to operate in parallel Sensorless mode. The pump controls, which will be linked on site by the control contractor, will automatically stage the units, as appropriate, to maintain the best efficiency pumping and minimum operating cost. The standby unit will be brought into the rotation to exercise and equalize wear. The sequence of controls and staging points will be submitted to the engineer for approval at the time of order.

Q. The VFD shall have the following additional features:
   1. Sensorless override for BAS/BMS control signal.
   2. Manual pump control or closed loop PID control
   3. Programmable skip frequencies and adjustable switching frequency for noise and vibration control
   4. Auto alarm reset.
   5. Four programmable digital inputs, two analog inputs, one programmable analog / digital output
   6. One volt-free contact
   7. One RS485 port for serial communications to building management systems.
   8. Standard serial communication protocols Modbus RTU (default), Johnson Controls Metasys N2, or Siemens FLN Environmental

2.03 IN-LINE PUMPS

A. Furnish and install in-line circulating pumps of the size and capacity indicated on the drawings.
B. Pumps shall be cast iron with stainless shaft and iron impellers.
C. Motors shall be 1750 RPM with internal overload protection.
D. Manufacturers; B&G, Aurora, Armstrong, Peerless.

2.04 FLEXIBLE CONNECTORS

A. Neoprene flanged connectors for 150 lb. ASA drilling, galvanized flanges, neoprene and nylon bellows.
B. Type MFNC or MFNEC as manufactured by Mason Industries Inc, or equal by Amber/Booth.

2.05 VIBRATION ISOLATING BASES

A. Steel frame, reinforced for concrete fill, spring mounted.
B. 6" deep for 1 inch static deflection.
C. Springs recessed into frame corners.
D. Manufacturers; Mason Industries Inc, Amber/Booth.

2.06 HORIZONTAL SPLIT-CASE DOUBLE-SUCTION PUMPS

A. Aurora Model 411 bronze-fitted, horizontal, split-case, double-suction, centrifugal pumps to operate with the capacities, pressures, and RPM as indicated on pump schedule.
B. Each pump shall be equipped with a heavy cast iron casing having a 250 lb. case working pressure, bronze double-suction impeller, statically and dynamically balanced, bronze case wear rings, (bronze shaft sleeves with mechanical seals) (hardened stainless steel shaft sleeves with packed boxes), grease-lubricated ball bearings with double row thrust bearing housed in integrally-cast bearing support arms, field interchangeability between packing and mechanical seals, and mounted on heavy steel baseplates.
C. Pumps with packing shall have drilled and tapped connection for piping gland leakage to floor drains. If not available as part of pump design, drain connections must be from drip-rim feature of baseplate.
D. Pumps shall be driven through flexible coupling with guard by open drip-proof motors having

electrical characteristics as indicated on pump schedule.

E. The pump manufacturer or his representative shall provide start-up service and maintenance manuals for the building operating maintenance personnel.

2.07 END-SUCTION PUMPS - CLOSE COUPLED

A. Aurora Model 341A bronze-fitted, end-suction, centrifugal pumps.
B. Pumps shall be designed for back pull-out for ease of field servicing.
C. Unit shall be equipped with heavy cast iron casing having a 175 lb. case working pressure, bronze statically and dynamically balanced impeller, bronze case wear ring, mechanical seal with carbon against Ni-resist stationary seat, and 303 stainless steel metallic parts.
D. Hot water pumps shall be equipped with mechanical seal flush line.
E. Pumps shall be equipped with bronze shaft sleeves and be driven by open drip-proof motors having horsepower and electrical characteristics as indicated on pump schedule.
F. The pump manufacturer or his representative shall provide start-up service and maintenance manuals for the building operating maintenance personnel.

## PART 3 - EXECUTION

3.01 PUMPS - GENERAL.

A. Install pump in accordance with pump manufacturer's instructions and the Hydraulic Institute.
B. Piping shall not generate any load on pump casing.
C. Pumps shall be mounted on a 6 inch high housekeeping pad and vibration isolation as specified or indicated elsewhere.
D. Install flexible connectors on suction and discharge.
E. Provide pressure gauges on suction and discharge.
F. Provide a strainer at pump suction and check valve at pump discharge.
G. Suction reducers shall be eccentric, discharge increases concentric.
H. Long radius elbows installed only in vertical position and adequately supported to prevent load on pump casing.
I. Verify alignment prior to grouting.
J. Provide factory authorized startup of pumps over 200 GPM.
K. Provide balancing valve on pump discharge.

END OF SECTION