SECTION 23 05 23
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The work of this Section shall include, but is not limited to the following valve types: gate, globe, check, ball, butterfly, grooved end, low- and high-pressure steam, automatic flow control valves, self-contained control valves.

1.02 RELATED DOCUMENTS

A. Section 23 05 01 – HVAC General Provisions

B. Section 23 05 29 – Hangers and Supports for HVAC

C. Section 23 07 00 – Insulation for HVAC

D. Section 23 21 13 – Hydronic Piping

E. Section 23 21 16 – Hydronic Piping Specialties

1.03 REFERENCE STANDARDS

Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this Section where cited below:

A. ASME – American Society of Mechanical Engineers

1. ASME B16.10 Face-to-Face and End-to-End Dimensions of Valves
2. ASME B16.34 Valves-Flanged, Threaded, and Welding End
3. ASME B31.9 Building Services Piping
4. ASME B31.1 Power Piping

B. ASTM – American Society for Testing and Materials ASTM A216/A216M-16 Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

C. MSS – Manufacturers Standardization Society

1. MSS-SP-67 Butterfly Valves
2. MSS-SP-70 Gray Iron Gate Valves, Flanged and Threaded Ends
3. MSS-SP-72 Ball Valves with Flanged or Butt-Welding Ends for General Service
4. MSS-SP-80 Bronze Gate, Globe, Angle, and Check Valves

1.04 QUALITY ASSURANCE

A. Valves and valve construction shall be suitable for the pressure, temperature, and fluid quality of the service in which they are to be used.

B. All valves shall be manufactured in accordance with ANSI, AWWA, ASTM, MSS-SP-70 & 80 (Manufacturers Standardization Society), standards and specifications.

C. ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.

D. ASME B16.10 and ASME B16.34 for dimension and design criteria.

E. Minimum test pressure for all valves shall be 1½ times maximum system working pressure unless noted otherwise.

F. Butterfly valves shall be suitable for dead end service and constructed of industrial design quality.

1.05 SUBMITTALS

A. Product Data: Manufacturer's latest published data for materials, capacity, performance intended service and installation.

B. For each type of valve indicated, include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; pressure differential range, shipping, installed, and operating weights; furnished specialties; and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Gate valves:

1. Bronze: NIBCO T/S-111 or equal by Grinnell, Crane, Cincinnati,
2. Cast iron: NIBCO F-617-O or equal by Crane /Jenkins, Crane/Stockham, Grinnell, Milwaukee
3. Cast steel: Velan, NIBCO or equal
4. Stainless steel: Velan, NIBCO or equal

B. Check valves:

1. Bronze: NIBCO T/S-413-B or equal by Crane, Hammond, Milwaukee
2. Gray-iron swing check: NIBCO F-918-B or equal by Crane, Hammond, Milwaukee, Victaulic
3. Spring-loaded, lift-disc check valves: NIBCO F-910-B-LF, Metraflex 900 series or equal by Milwaukee, Mueller Steam, Victaulic

C. Globe valves: NIBCO T/S-211-Y, NIBCO F-718-B or approved equal by Crane /Jenkins, Crane/Stockham, Grinnell, Milwaukee

D. Ball valves: NIBCO 585/580-70 series, Apollo 70-100/200 series, or equal by Hammond, Milwaukee, Stockham

E. Butterfly valves:

1. Single- or no-flange: NIBCO LD2000 series, Grinnell 8000, or equal by Crane QuarterMaster, Stockham, DeZurik, Keystone
2. Flanged: NIBCO N200235, Keystone Fig 222 or equal by Grinnell, Mueller, Tyco

3. Grooved-end, ductile-iron: Victaulic 300 and 709 series, NIBCO GD4765 or equal by Grinnell
4. High-pressure: NIBCO LCS-6822, Crane Flowseal, or equal by Vanessa, Tyco, DeZurik

F. Grooved end valves: Victaulic or equal by NIBCO, Grinnell

G. Automatic flow control valves: NIBCO T/S-1880 or equal by Griswold, Flow Design

H. Balancing valves: Armstrong Type CBV, NIBCO T/S-1805LF, B&G Circuit Setter Plus, Taco Accu-Flo, Tour & Andersson STAS/STAD, Victaulic series 786/787

I. Self-contained control valves: Oventrop R-Tronic or equal by Ista, Danfoss, Taco

2.02 GENERAL

A. Provide valves of same manufacturer for the same service. Valve pressure and temperature ratings shall be not less than indicated and as required for system pressures and temperatures.

B. Provide valves with manufacturer's name and pressure rating clearly and permanently marked on the outside of body.

C. Provide valves suitable for connection to adjoining piping as specified for pipe joints.

D. Valves shall be full pipe size unless noted otherwise.

E. Provide valves identified for future connection with lockable handles.

F. Valve seats shall be rated to 240 degrees F minimum without deterioration.

2.03 GATE VALVES

A. Provide gate valves for isolation in steam and water systems, and as shown on the Drawings or specified for other systems.

B. Two-inch and smaller valves shall be rising stem, screwed bonnet, inside screw and wedge gate, bronze body and trim with screwed ends.

C. 2½ inch and larger valves shall be rising stem, bolted bonnet, outside screw and yoke, wedge gate, iron or steel body, bronze trim with flanged ends.

D. Gate valves shall be backseating and suitable for repacking under pressure. Packing shall be asbestos free.

2.04 GLOBE VALVES

A. Provide globe valves for throttling in steam and water systems, and as shown on the Drawings or specified for other systems.

B. Two-inch and smaller valves shall be inside rising stem, screwed bonnet with screwed ends.

C. 2½ inch and larger valves shall be rising stem, outside screw and yoke, bolted bonnet and flanged ends.

D. Globe valves shall be suitable for repacking under pressure. Packing shall be asbestos free.

E. Valve seats shall be nickel alloy or stainless steel.

2.05 CHECK VALVES

A. Swing type: Provide for water and low pressure steam services: 2-inch and smaller with screwed bonnet, screwed end; 2½-inch and larger with bolted bonnet, flanged end. Valves shall have renewable bronze seat and disc.

B. Silent type: Provide on pumps larger than 2-inch discharge. Valves shall have cast iron body with bronze or stainless steel trim, spring loaded, and to be of the center guide type, with flanged end.

2.06 BALL VALVES

A. Provide ball valves for isolation and as drain valves, in water systems up to 200 degrees F and pipe sizes up to 2-inch and as shown on the Drawings or specified for other systems.

B. Provide ball valves of the bronze top-entry body type, having a straight-through full port flow passage. Design to permit disassembly without removing body from line. Provide extended neck where used on insulated piping.

C. Provide stainless steel or chrome plated brass/bronze ball; conventional port or full port.

D. Construct seats and gland packing of glass-filled Teflon with a threaded packing gland follower; blowout-proof stem rated at 600 psig CWP.

E. Provide stem extensions when valves are installed in insulated pipe with vapor barrier so valve handles clear insulation. Lever handle shall be vinyl covered.

F. Provide lever for quarter-turn operation; lever to indicate open or closed position.

G. When used as drain valves, provide with hose thread and brass cap with chain. Cap shall be rated for full system pressure.

2.07 BUTTERFLY VALVES

A. Provide butterfly valves for isolation in water systems up to 200 degrees F and pipe sizes 2½-inch and larger and as shown on the Drawings or specified for other systems. Provide butterfly valves for isolation in steam systems for pipe sizes 4-inch and larger and as shown on the Drawings or specified for other systems.

B. Butterfly valves shall have ductile or cast iron lug body, type 416 stainless steel stem with bronze bushings which isolate stem from body and aluminum bronze disc.

C. The stem journals shall be a multiple seal design providing for completely independent seals. The stem to disc connection shall be a machined drive mated to a machined

socket in the disc. Positive stem retention shall be provided to permit removal of handle or actuator while under full operating pressure. Provide extended neck where used on insulated piping.

D. The valve seats shall be replaceable resilient elastomer bonded to a phenolic back.

E. Valves up to size 6-inch shall be supplied with multi-position handles; size 8-inch and larger shall be supplied with enclosed worm gear operator.

F. Valve body shall be full-lug pattern to comply with MSS-SP-67 and be compatible with ANSI pattern flanges of appropriate pressure rating.

G. Valve shall provide tight shut-off up to valve rating on dead-end or isolation service without the use of downstream flanges.

H. Steam service: ANSI Class 150, ASTM 216, Grade WCB suitable for continuous duty in saturated steam, cast steel body, stainless steel shaft, stainless steel or nickel plated steel disc, reinforced high temperature polymeric resilient seat with full supporting stainless steel ring. Wafer type. Manual worm gear operator with high ratio (18 to 1 minimum). Provide stem extensions where required for operator and handle to clear vapor barrier insulation.

2.08 GROOVED END VALVES

A. Valve model and series numbers listed are based on Victaulic and as shown on the Drawings or specified for other systems.

B. Butterfly valves:

1. Series 700 sizes 2-inch through 6-inch: triple seal design for bubble-tight, shutoff service up to 200 pounds per square inch and vacuum service to 29.9 inches of mercury gauge. Disc seal shall be ethylene propylene diene monomer (EPDM) or silicone, rated for service up to 215 degrees F.
2. Series 300 sizes 2-inch through 12-inch: grooved end butterfly valve for all services up to 300 pounds per square inch. Valve body of ductile iron with grooved end designed to accept grooved mechanical couplings. Valves shall be bi-directional and provide bubble-tight shutoff and dead-end service at full rated working pressure. EPDM disc seal rated for service up to 230 degrees F.
3. Series 709 sizes 14-inch through 24-inch: single piece ductile iron cast body, polyphenylene sulfide (PPS)-coated on the inside for corrosion resistance. The ductile iron disc rides on stainless steel stems with stainless steel wetted hardware. The EPDM seal, mounted on the offset disc, seals on the PPS seal for bi-directional working pressure of 175 pounds per square inch, 230 degrees F.
4. Provide extended neck where valve is used on insulated piping.

C. Ball valves:

1. Series 721 ball valves size 2-inch and under: designed for 600 pounds per square inch bubble-tight working pressure.
2. Provide extended neck where valve is used on insulated piping.

D. Check valves:

1. Series 715, 716 and 711 sizes 2½-inch through 12-inch dual disc check valves: check valves with spring activated, dual disc, non-slamming design. Valves shall be suitable for horizontal or vertical installation and rated for working pressures up to 300 pounds per square inch, 230 degrees F.
2. Series 712 swing check valves sizes 2-inch through 4-inch: full port opening and bolted coupling closure access. Valves shall be rated for 300 pounds per square inch working pressure, 230 degrees F, EPDM disc seat, ASTM D2000.

2.09 AUTOMATIC FLOW CONTROL VALVES

A. Provide automatic pressure-compensating flow control valves with extended valve body and dual temperature/pressure test ports. Wafer type body is not acceptable.

B. Automatic flow valve shall be manufactured in one piece and to consist of ground joint union, flow control and pressure/temperature test ports.

C. Valves shall be factory set to control the flow rate within 5 percent of the selected rating over an operating pressure differential of at least 10 times the minimum required for full flow conditions.

D. The control mechanism of the valve shall consist of a self-contained, open-chamber cartridge assembly with unobstructed flow passages that eliminate accumulation of particles and debris. All internal working parts shall be Type 300 stainless steel. No plated materials are acceptable.

E. The stainless steel cartridge assembly shall consist of a spring-loaded cup. The cup shall be guided at two points and shall utilize the full available differential pressure across the valve to actuate the cup and thereby reduce friction and hysteresis and eliminate binding. It shall have a thin orifice plate for self-cleaning of the variable inlet ports over the full control range. Cartridge must be removable in one piece.

F. Cast iron valve bodies shall be provided with inlet and outlet ports suitable for connection of instruments for verification of flow rates, and shall be marked to show direction of flow. Valve bodies shall be rated for use at not less than 150 percent of system designed operating pressures.

G. Provide a metal identification tag, with chain, for each installed valve. The tag shall be marked with zone identification, valve model number and rated flow in gallons per minute.

H. Correct flow shall be verified by establishing that the operating pressure differential across the valve taps is within the range indicated on the submittal data sheet for that model number.

I. The pressure measuring apparatus shall be portable and consist of a pressure gauge with a 4½-inch diameter dial, instructions, hoses, connections and a carrying case. Automatic flow control valves shall be furnished with fittings suitable for use with the measuring instruments specified.

2.10 BALANCING VALVES

A. Balancing valve for water service shall be of the calibrated balance valve type with

capped pressure/temperature ports, positive shut-off angle globe type, with adjustable memory stop and indicator.

B. Valves 2-inch and smaller: bronze or copper alloy body with calibrated ball, globe or venturi/valve arrangement, integral pointer and calibrated scale to register degree of valve opening. Provide memory stop, drain tapping, threaded or soldered ends, with or without integral unions, P/T or Shraeder type pressure taps with integral check valves and seals and adjustable memory stop. Valves shall be suitable for 200 psig water working pressure at 250 degrees F.

C. Provide a pressure differential meter, hoses and carrying case. The kit shall include a six-inch diameter gauge with 270-degree arc readout. Gauge, with accuracy of plus or minus 1percent of full scale, shall be suitable for the differential pressures of the valves supplied for this project, with over-range protection. Include color-coded hoses ten feet minimum in length with brass connectors suitable for connection to the low- and high-pressure connections on the balance valves. Provide instrument valving so meter can be vented and drained. Pressure and temperature rating shall be equal to that of the valves. Provide meter and all accessories in a durable case with carrying handle. The meter is applied directly across the pressure/temperature ports on the calibrated flow control valves. Provide a calibrated conversion calculator to convert pressure drop to flow in gallons per minute. Barton 247A, Midwest 809 or equal.

2.11 DRAIN VALVES

A. Drain valves: ¾-inch ball valve, short ¾-inch nipple or adapter, with ASME B1.20.7, hose-thread outlet and cap.

1. Metal piping: metal or plastic valve, nipple, or adapter, and cap of material compatible with piping and system liquid.
2. Plastic piping: plastic valve, nipple, or adapter, and cap of same material as or compatible with piping, and compatible with system liquid.

2.12 SELF-CONTAINED CONTROL VALVES

A. Provide programmable thermostatic type battery-operated valves with cast bronze or forged brass body.

B. Actuator shall operate using an integral temperature sensor and an adjustment-spring-balanced bellows. A stainless-steel spindle riding against an “O”-ring within the packing gland shall provide throttling service.

C. Provide “O”-ring packing gland construction replaceable while the system is in operation with standard tools and without any need for isolation valves.

D. Valves shall be suitable for 125 psig water working pressure at 240 degrees F.

E. Valves shall return to the open position upon failure of temperature control unit.

F. Provide electronic display for temperature and to use for programming weekly schedule. Functionality shall include 4 daily programmable temperatures, weekday & weekend schedules. Display shall indicate temperature in degrees Fahrenheit.

G. Electronic display shall be integral to the valve operator/actuator, or may be in the form of

a wireless wall-mount thermostat.

2.13 VALVE ACTUATORS

A. Provide chainwheel for attachment to valves, of size and mounting height, as specified. Construct of cast or ductile iron, with adjustable sprocket rims and chain guides. Use galvanized or brass chain and chain closure links to form a continuous loop of chain at each operator.

B. Provide gear drive for quarter-turn valves 8-inch and larger or valves where torque requirements to operate the valve exceed lever and handwheel operators.

C. Provide handwheel for valves other than quarter-turn types.

D. Provide lever handle for quarter-turn valves-6-inch and smaller, except plug valves.

E. For plug valves with square heads, furnish Owner with one wrench for every 10 plug valves, for each size square plug head.

PART 3 – EXECUTION

3.01 PRE-INSTALLATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling. Protect internal parts against rust and corrosion. Protect threads, flange faces, grooves, and weld ends.

B. Set angle, gate, and globe valves closed to prevent rattling. Set ball and plug valves open to minimize exposure of functional surfaces. Set butterfly valves closed or slightly open. Block check valves in either closed or open position. Maintain valve end protection.

C. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

D. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

E. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations. Examine threads on valve and mating pipe for form and cleanliness. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage. Do not attempt to repair defective valves; replace with new valves.

F. Properly align piping before installation of valves in an upright position.

3.02 INSTALLATION

A. Install valves so that they are accessible for repacking. Locate valves for easy access and provide separate support where necessary.

B. Install valves with stem vertical and handle up wherever possible, never with stem below horizontal position. Do not install check valves in vertical line with downward flow.

C. Install valves with operating clearance for handle and stem in position to allow full stem movement.

D. Check valves:

1. Install swing check valves in horizontal position with hinge pin level.
2. Install check valves a minimum of 5 pipe diameters downstream from pump discharge or changes in direction to avoid flow turbulence.
3. Install dual-plate check valves in horizontal or vertical position, between flanges. Install lift check valves with stem upright and plumb.
4. Provide swing check valves where specified, detailed, and at steam condensate lines where they rise at outlet of traps.
5. In such cases, provide isolation valves to allow repair or replacement of check valve.

E. Install isolation valves on equipment so that valve and piping do not interfere with equipment removal or maintenance. Install unions or flanges on equipment side of valves arranged to allow service, maintenance, and equipment removal without system shutdown.

F. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.03 VALVE ACCESSORIES

A. Provide valves of a design permitting packing while open and under pressure.

B. Provide 1-inch drain valves with threaded ends for hose connections at drain points, at main shut-off valves, low points of piping systems, bases of vertical risers, and at equipment.

C. Provide required manual or automatic vent valves at high points of piping systems to facilitate venting of air and to ensure quiet operation. Provide piping from air vents to a drain.

D. Provide renewable bronze seat rings and bronze spindles for cast iron body valves.

E. Provide chain operated sheaves and chains for all valves, 2½-inch and larger, which are more than 10 feet above the floor in mechanical equipment rooms. Extend chains to within 84 inches above finished floor.

F. Provide an isolation valve in the common supply line and an individual balance valve in the return line from each hydronic coil, heat exchanger, and all heat transfer elements.

G. Provide an isolation valve in each supply riser near main and a balancing valve in each return riser near main.

H. Provide pressure/temperature test port fittings at each side of globe valves.

I. Use plastic and plastic-lined valves with wetted surfaces made of same material as or compatible with piping and compatible with system liquid.

END OF SECTION 23 05 23