

SECTION 15100 - VALVES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. This Section includes general duty valves common to most mechanical piping systems.
- B. Valves tags and charts are specified in Division 15 Section "Mechanical Identification."

1.2 SUBMITTALS:

- A. Product Data: including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

1.3 QUALITY ASSURANCE:

- A. Single Source Responsibility: Comply with the requirements specified in Division-15 Section "Basic Mechanical Requirements," under "Product Options."
- B. MSS Standard Practices: Comply with the following standards for valves:
 - 1. MSS SP-45: Bypass and Drain Connection Standard
 - 2. MSS SP-67: Butterfly Valves
 - 3. MSS SP-71: Cast Iron Swing Check Valves, Flanged and Threaded Ends
 - 4. MSS SP-72: Ball Valves with Flanged or Butt-Welding Ends For General Service
 - 5. MSS SP-78: Cast Iron Plug Valves, Flanged and Threaded Ends
 - 6. MSS SP-84: Steel Valves - Socket Welding and Threaded Ends
 - 7. MSS SP-85: Cast Iron Globe and Angle Valves, Flanged and Threaded Ends
 - 8. MSS SP-92: MSS Valve User Guide

- C. Solenoid valves shall be UL listed, FM / AGA / ANSI and CSA approved.

1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Preparation For Transport: Prepare valves for shipping as follows:
 - 1. Ensure valves are dry and internally protected against rusting and galvanic corrosion.
 - 2. Protect valve ends against mechanical damage to threads, flange faces, and weld end preps.
 - 3. Set valves in best position for handling. Globe valves shall be closed to prevent rattling; ball and plug valves shall be open to minimize exposure of functional surfaces; butterfly valves shall be shipped closed or slightly open; and swing check valves shall be blocked in either closed or open position.
- B. Storage: Use the following precautions during storage:
 - 1. Valves shall be stored and protected against all dirt, debris and foreign material at all times.
 - 2. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.

3. Protect valves against weather. Where practical store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement and protect in watertight enclosures.
- C. Handling: Valves whose size requires handling by crane or lift shall be slung or rigged to avoid damage to exposed valve parts. Handwheels and stems, in particular, shall not be used as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

NOTE: Crane (Canada, Brazil & England), Fairbanks (Taiwan and Lukenheimer (Taiwan) Gate, Globe and Swing Check Valves are manufactured outside the United States.

- A. Manufacturer: Subject to compliance with requirements, provide products by the manufacturers listed.
1. Ball Valves:
 - a. Conbraco (Apollo)
 - b. Milwaukee
 - c. Nibco
 - d. Watts
 - e. Jomar
 2. Eccentric Plug Valves:
 - a. Keystone/Tyco
 - b. DeZurik
 - c. Milliken
 - d. Homestead
 3. Globe Valves:
 - a. Stockham
 - b. Grinnell Corp.
 - c. Hammond
 - d. Nibco
 - e. Milwaukee
 4. Butterfly Valves:
 - a. Keystone/Tyco
 - b. Centerline
 - c. Nibco
 - d. K.F. Hale
 - e. Bray
 5. Swing Check Valves
 - a. Conbraco
 - b. Grinnell Corp.

- c. Nibco
 - d. Watts (screwed)
 - e. Stockham
 - f. Grinnell (Grooved Only)
6. Non-Slam Check Valves:
- a. Centerline
 - b. Keystone
 - c. Metraflex
 - d. Techno Corporation
 - e. Nibco
 - f. Val-Matic
 - g. Milwaukee
 - h. Stockham
 - i. Golden Anderson
7. Lift Check Valves:
- a. Conbraco
 - b. Metraflex
 - c. Milwaukee
 - d. Nibco
 - e. Stockham
8. Solenoid Valves:
- a. Asco
 - b. General Controls
 - c. Skinner
 - d. Magnatrol Valve Corp.

2.2 VALVE FEATURES:

- A. General: Comply with MSS-92 1980 "Valve Users Manual".
- B. Valve Design: Valves shall have rising stem, or rising stem outside screw and yoke design; except, non-rising stem valves may be used where headroom prevents full operation of rising stem valves.
- C. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size. (Control valves shall be sized for required flow.)
- D. Operators: Provide the following special operator features:
 - 1. Handwheels, fastened to valve stem for valves other than quarter turn.
 - 2. Lever Handle on quarter turn valves 6 inch and smaller, except plug valves. Provide a wrench for every plug valve.
 - 3. Chainwheel operators for valves 2-1/2 inch and larger that are installed 96 [] inches or higher above finished floor elevation. Provide chains to an elevation of 6'-0" [] above finished floor elevation.

4. Worm gear operators of an enclosed weather-proof design shall be provided on all quarter turn valves 8 inches and larger.
- E. Extended Stems: Where insulation is indicated or specified, provide extended stems to allow full operation of the valve without interference by the insulation.
- F. Bypass and Drain Connections: Comply with MSS SP-45.
- G. End Connections: As specified in the individual valves specifications.
 1. Threads: Comply with ANSI B2.1.
 2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze.
 3. Solder-Joint: Comply with ANSI B16.18.
 - a. Caution: Where soldered end connections are used, use solder having a melting point below 840 degrees F for gate, globe, and check valves and below 421 degrees F for ball valves.

2.3 BALL VALVES:

EDIT NOTE: Use 3-piece where desired by Owner and for brazed lines, otherwise 2-piece is acceptable

- A. Ball Valves – 1 inch and Smaller: 150 WSP, 600 WOG, rated for 150 PSI at 350 degrees F, two piece end entry body style, bronze body conforming to ASTM B584, full port chrome plated brass ball, 15 percent glass reinforced PTFE seats, PTFE packing, adjustable packing nut blow-out proof stem, vinyl covered steel handle. Provide solder ends or threaded ends to match piping system. Apollo 77-100/200
- B. Ball Valves 1-1/4 inch through 2 inches and for all silver soldered or brazed lines: ANSI B16.34, 150 WSP, 600 WOG, rated for 150 PSI at 350 degrees F. Three piece body style, bronze body conforming to ASTM B584, full port, chrome plated brass ball and stem of ASTM A276 type 316, 15 percent glass reinforced RTFE seats, RTFE packing and blow out proof stem, vinyl coated steel handle. Provide solder ends or threaded ends to match piping material system. Apollo 82-100/200.
- C. Ball valves for steam service: 250 WSP, 600 WOG rated for 250 psig saturated steam. Two piece and entry body style, bronze body conforming to ASTM B594, standard port 316 stainless steel ball and stem. Carbon and graphite reinforced PTFE blowout proof stem, vinyl covered steel handle. Threaded ends. Apollo 70-140-64.
- D. Ball valve options/accessories: Provide the following as required or as specifically indicated:
 1. Tee handle for tight fit applications (within enclosures, etc.).
 2. Locking handle.
 3. Drain.
 4. Stem extension.
 5. Mounting pads.

2.4 ECCENTRIC PLUG VALVES:

- A. 2 inches and Smaller: 125 psi, cast iron body, straightway pattern, EPDM or C11REncapsulated Eccentric plug, tight shut-off seals, square head, threaded ends. Provide memory stop feature.

Dezurik PEC

- B. 2-1/2 inches and Larger Sizes: 125 [] psi, cast iron body, straightway pattern, EPDM or C11R Encapsulated Eccentric plug, lever actuators, except handwheels where indicated, and flanged ends. Provide memory stop feature.

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NOTE: An eccentric plug valve with memory stop may be installed for combination shut-off/balancing service in lieu of a separate balancing valve plus shut-off valve installation at Contractor's option.

2.5 GLOBE VALVES:

- A. Plumbing Systems (2-1/2 inches and Smaller): MSS SP-80, Class 125 WSP body, bonnet and disc cast bronze ASTM B62, copper-silicon bronze stem, non-asbestos teflon impregnated stem packing, bronze disc ring, threaded bonnet and malleable iron handle.

Stockham Fig. B-16/B-17

OR

- B. Plumbing Systems (2-1/2 inches and smaller): MSS SP-80 Class 150, body, bonnet and bonnet ring, cast bronze ASTM B-62, Teflon disc, copper-silicon bronze stem, non-asbestos teflon impregnated stem packing, union bonnet and malleable iron handle.

Stockham Fig. B-22/B-24

- C. Steam Systems (2 inches and Smaller): MSS SP-80, Class 150/300 body, bonnet, bonnet ring cast bronze ASTM B-62 Type 420, stainless steel disc and seat ring, union bonnet, non-asbestos teflon impregnated stem packing, copper-silicon bronze stem, brass packing gland and malleable iron handle.

Stockham Fig. B-29/B-74

- D. Steam Systems (2-1/2 inches and larger): MSS SP-85, Class 125/250, cast iron body ASTM A-126, Class B, bolted bonnet bronze mounted, rising stem bronze disc and seat, OS&Y, non-asbestos teflon impregnated stem packing and cast iron or malleable iron hand wheel.

Stockham Fig. G-512

2.6 BUTTERFLY VALVES:

NOTE: Below is the typical HVAC valve for heating / chilled / condenser/etc. water. Extreme pressures and/or temperatures, or sized over 12 inches will require special engineering.

- A. Hydronic Service Butterfly Valves - 2-1/2 inches to 12 inches: MSS SP-67, cast iron body conforming to ASTM A126 class B, aluminum bronze ASTM B148 disc, single piece 416 stainless steel stem, EPDM seat, upper and lower bronze bearing, non-metallic bushing and stem seal, ANSI class 125 flange, rated for 200 psi pressure differential, 200 psi drop-tight shut off dead end service, with downstream flange removed. Provide extended neck for 2 inches thick insulation. All valves shall be factory tested to 110 percent of pressure rating. All butterfly valves shall be full lugged body, drilled and tapped.

Keystone Fig.222

2.7 CHECK VALVES:

- A. Swing Check Valves - 2-1/2 Inch and Smaller: MSS SP-80; Class 125/150 WSP 200/300, cast bronze body and cap conforming to ASTM B 62, ASTM B61 for 200/300 bronze, horizontal swing design, Y-pattern, with a bronze/teflon disc, stainless steel pin and having threaded or solder ends. Class 150 valves meeting the above specifications may be used where pressure requires or Class 125 are not available.
- B. Swing Check Valves - 2-1/2 to 3 Inch: MSS SP-71; Class 125 /250 (Class 175 FM approved for fire protection piping systems), cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends. Valve shall be capable of being refitted while the valve remains in the line. For sewage ejector and sump pump discharge swing check valves 2-1/2 inches and larger, provide outside lever with weight or spring to assist disc to close rapidly.
- C. Non-Slam Check Valves - 2 Inch and smaller: Bronze body, 200 psi @ 250 degrees F., threaded ends, resilient seats, center guided spring loaded disk.
- D. Non-Slam Check Valves - 2-1/2 Inch and Larger: Class 125/ 250 cast iron or stainless steel body, replaceable lapped bronze seat and balanced twin bronze flappers or bronze center guided disc and stainless steel trim. Valve shall be designed to open and close at approximately one foot differential pressure. Twin flappers or center guided disc shall be loaded with a stainless steel spring to assure even non-slam checking action. Seals shall be EPDM.
- E. Lift Check Valves 2 Inch and Smaller: Class 125 [], cast bronze body and cap conforming to ASTM B 62, horizontal or angle pattern, lift type valve, with stainless steel spring, bronze disc holder with renewable "Teflon" disc, and threaded ends. Valve shall be capable of being refitted and ground while the valve remains in the line.

2.8 DRAIN VALVES: FOR HVAC AND PLUMBING HYDRONIC SYSTEMS PROVIDE BALL VALVE WITH THREADED HOSE END, AND CAP WITH CHAIN.

Apollo Fig. 78-100/78-200 Series

2.9 SOLENOID VALVES:

- A. Solenoid valves shall consist of a solenoid (electro-magnet) with its core and a valve body containing one or more orifices. The solenoid shall be mounted directly on the valve body.
- B. Response time from fully open or closed to fully closed or open shall be slow acting.
- C. Solenoid valves shall be 2 / 3 / 4 way type valves.
- D. Solenoid valves shall be normally open or normally closed operation as required for proper operation of the system for protection against freeze, fire and safety.
- E. Solenoid enclosures shall meet the ICS-6 ANSI/NEMA standard and UL standard 429, 508 and/or 1002 as follows:
 - 1. Type 1: General Purpose.
 - 2. Type 2: Drip proof.
 - 3. Type 3 and 3S: Raintight, Dust tight and sleet (ice) resistant.
 - 4. Type 3R: Rainproof, sleet (ice) resistant
 - 5. Type 4: Watertight and dust tight.
 - 6. Type 4X: Watertight, Dust tight and Corrosion resistant.
 - 7. Type 6: Submersible.
 - 8. Type 6P: Submersible, prolonged submersion at a limited depth.
 - 9. Type 7: Explosion proof, Class I, Division 1, Group A (acetylene); B (hydrogen); C (ethyl-ether vapors, ethylene or cyclopropane); D (gasoline, hexane, naphtha, benzene, butane, propane, alcohol, acetone, benzol, lacquer, solvent vapors or natural gas).
 - 10. Type 9: Dust-ignition proof, Class II, Group E (metal dust); F (carbon black coal or coke dust); G (flour starch or grain dust).
 - 11. Operating temperatures shall range from 185 degrees F to 842 degrees F for T1 through T6 code numbers.
- F. Minimum ambient temperature limitation of 32 degrees F (0 degrees C) for any valve which contains water or water vapor and 0 degrees F (-18 degrees C) where freezing water is not a factor. (Special construction for ambient temperature down to -40 degrees F (-40 degrees C). Maximum ambient temperature limitation of 180 degrees F (82 degrees C).
- G. Parts in contact with fluid shall be brass, bronze, or stainless steel; core tube, 305 stainless steel; core and plug nut, 430 F stainless steel; Seal-BUNA "N"; shading coil-copper; disc-BUNA "N" and Nylon; Spring, 302 stainless steel (General Service).
- H. Manual reset safety shut-off valve shall open manually and close upon interruption of current.
- I. Electric current shall be AC of voltage shown on Division 16 drawings.

2.10 MOTORIZED VALVE ACTUATORS:

See appendix 15100a if actuators are required.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Install valves in accordance with manufacturers instructions.

- B. Examine valve interior through the end ports, for cleanliness, freedom from foreign matter and corrosion. Remove special packing materials, such as blocks used which prevents disc movement during shipping and handling.
- C. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the position in which it was shipped.
- D. Examine threads on both the valve and the mating pipe for form (out-of-round or local indentation) and cleanliness.
- E. Examine mating flange faces for conditions which might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size and material, and for freedom from defects and damage.
- F. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.

3.2 VALVE SELECTION:

- A. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select valves with the following ends or types of pipe/tube connections:
 - 1. Copper Tube Size 2 Inch and Smaller: Solder ends, except in heating hot water and low pressure steam service which shall have threaded ends.
 - 2. Steel Pipe Sizes 2 Inch and Smaller: Threaded or grooved-end.
 - 3. Steel Pipe Sizes 2-1/2 Inch and Larger: Flanged or grooved end.
 - 4. At all piping hot taps provide a gate valve with the hot tap and a butterfly valve for shut-off service. Hot taps shall be provided only where approved by the Engineer.
 - 5. Contractor shall provide and install hi-performance steam butterfly valves on sizes 6" and larger (or) [where limited space does allow adequate access to maintain gate valves].

3.3 VALVE INSTALLATIONS:

Valve Application Table

(Where sizes overlap, contractor has choice of either type)

SERVICE	VALVE TYPE
Plumbing Water Services; 3" or smaller	Ball Valve
Plumbing Water Services; 2-1/2" and larger	Butterfly Valves
Plumbing Pressure Reducing Bypass; all sizes	Globe Valve
Plumbing Balancing Service; 2" and smaller	Calibrated Balancing Valve See Section 15135
Plumbing Balancing Service; 2-1/2" and larger	Eccentric Plug Valve

HVAC Hydronic Piping; 3" and smaller	Ball Valve
HVAC Hydronic Piping; 2-1/2" and larger	Butterfly Valve
HVAC Hydronic Pressure Reducing Valve Bypass; all sizes	Globe Valve
HVAC Hydronic Balancing valve; 2" and smaller	Calibrated Balancing Valve See Section 15135
HVAC Hydronic Balancing Valve; 2-1/2" and larger	Eccentric Plug Valve.
HVAC & Plumbing Check Valves; 2" and smaller	Swing Check
HVAC & Plumbing Pump Discharge Check Valve;	Non-Slam Spring Loaded
Sewage Ejector and/or Sump Pump	Swing Check, (Provide outside weighted lever or spring for 2-1/2" and larger)

- A. Locate valves for easy access and provide separate support where necessary.
- B. Install valves and unions for each fixture and item of equipment in a manner to allow equipment removal without system shut-down. Unions are not required on flanged devices.
- C. Install 3-valve bypass around each pressure reducing valve using throttling type valves.
- D. Gate and globe valves shall be installed with the stem in the upright position. In overhead horizontal piping, ball valves shall be installed with the handle in the side or bottom of the piping. Butterfly valves shall be installed with the stem within 45 degrees of the horizontal position. The handle of quarter turn valves shall open in the direction of flow. Quarter turn valves with hand wheels or chain wheels shall be located so that the position indicator is visible from the floor without the use of a ladder or climbing on equipment or piping.
- E. Installation of Check Valves: Install for proper direction of flow as follows:
 - 1. Swing Check Valves: Install in horizontal position with hinge pin level.
 - 2. Wafer Check Valves: Install between 2 flanges in horizontal or vertical upward flow position.
 - 3. Lift Check Valve: Install in piping line with stem upright and plumb.

3.4 SOLDER CONNECTIONS:

- A. Cut tube square and to exact lengths.
- B. Clean end of tube to depth of valve socket, using steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket in same manner.
- C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.
- D. Open gate and globe valves to fully open position.
- E. Remove the cap and disc holder of swing check valves with composition discs.
- F. Insert tube into valve socket making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to insure even distribution of the flux.
- G. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating the valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

3.5 BRAZED CONNECTIONS:

- A. Protect valves from temperatures which exceed the valve material temperature limitations as recommended by the valve manufacturer.

- B. Disassemble 3 piece ball valves prior to brazing.
- 3.6 THREADED CONNECTIONS:
- A. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
 - B. Align threads at point of assembly.
 - C. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
 - D. Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.
- 3.7 FLANGED CONNECTIONS:
- A. Align flanges surfaces parallel.
 - B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using a torque wrench.
- 3.8 GROOVED CONNECTIONS:
- A. Assemble valves with grooved end in accordance with manufacturers published instructions.
 - B. Clean pipe ends from indentations, projections, burrs and roll marks from pipe to groove.
 - C. Provide gasket, flanges, fittings, bolts, nuts, lubrication applied per manufacturers instructions for intended service.

EDIT NOTE: Include if 15100a was included.
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- 3.9 BUTTERFLY VALVE MOTORIZED ACTUATORS:
- A. Coordinate with the control system installer to set up all end switches, pilot valves, and control panels.
 - B. Provide min 80 psig main air piping to pneumatic actuators.
 - C. Provide electric valve actuator power in accordance with Division 16.
 - D. Set travel stops as recommended by the valve manufacturer or as indicated.
 - 1. Valves _____ shall stop just short of seating to allow a minimal amount of bleed.
 - 2. Valves _____ shall be set to shut off but not fully seat.
 - E. Locate pilot positioners and valve position indicators so that they will be visible from the floor or roof surface, without the need of a ladder or climbing over equipment and piping.

3.10 FIELD QUALITY CONTROL:

- A. Testing: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks; replace valve if leak persists.

3.11 ADJUSTING AND CLEANING:

- A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare to receive finish painting or insulation.

END OF SECTION 15100