



# Standard Specification for Pneumatic-Operated, Globe-Style, Control Valves<sup>1</sup>

This standard is issued under the fixed designation F1985; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers the design, construction, testing, and operating requirements for pneumatic-operated, globe-style, control valves complete with actuators for various fluid systems (steam, gas, and liquid applications). The control valves with actuators may be procured under this specification complete with all associated pneumatic instrumentation necessary for the valve to function in the system application; however, complete and detailed requirements for air instrumentation are beyond the scope of this specification and thus are not included here. This specification is not intended to cover quarter-turn or multi-turn stem valves.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

## 2. Referenced Documents

2.1 The most recent edition or revision of the following standards or specifications shall, to the extent specified in this specification, form a part of this specification.

### 2.2 ASME Standards:<sup>2</sup>

- B1.1 Unified Screw Threads (UN and UNR Thread Form)
- B1.20.1 Pipe Threads, General Purpose (Inch)
- B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800
- B16.5 Pipe Flanges and Flanged Fittings
- B16.11 Forged Steel Fittings, Socket-Welding and Threaded
- B16.25 Buttwelding Ends
- B16.24 Bronze Pipe Flanges and Flanged fittings, Class 150 and 300
- B16.34 Valves - Flanged and Buttwelding End Steel, Nickel Alloy, and Other Special Allows

<sup>1</sup> This specification is under the jurisdiction of ASTM committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.11 on Machinery and Piping Systems.

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<sup>2</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

### 2.3 Manufacturers Standardization Society of the Valve and Fitting Industry:<sup>3</sup>

MSS SP-25 Standard Marking System for Valves, Fittings, Flanges and Unions

### 2.4 Fluid Controls Institute Standard:<sup>4</sup>

FCI 70-2 Control Valve Seat Leakage

### 2.5 Military Standards and Specifications:<sup>5</sup>

MIL-STD-798 Nondestructive Testing, Welding Quality Control Material Control and Identification and Hi-Shock Test Requirements for Piping System Components for Naval Ship Use

MIL-S-901 Shock Tests, H.I. (High Impact); Shipboard Machinery, Equipment and Systems, Requirements for

MIL-STD-167-1 Mechanical Vibrations of Shipboard Equipment (Type I – Environmental and Type II – Internally Excited)

MS-16142 Boss Gasket-Seal Straight Thread Tube Fitting, Standard Dimensions for

MIL-F-1183 Fittings, Pipe, Cast Bronze, Silver Brazing, General Specification for

MIL-F-20042 Flanges, Pipe and Bulkhead, Bronze (Silver Brazing)

### 2.6 Government Drawings and Publications:

Naval Sea Systems Command (NAVSEA):<sup>5</sup>

803-1385946 Unions, Bronze, Silver Brazing Alloy. For Water, Oil, and Gas

803-1385943 Unions, Silver Brazing, 3000 lb/in.<sup>2</sup>, WOG, NPS, for UT Inspection

803-1385884 Unions, Butt and Socket Welding, 6000 lb/in.<sup>2</sup> WOG, NPS, For UT Inspections

### 2.7 ISA Standard:<sup>6</sup>

ISA-S75.05 Standard for Control Valve Terminology

## 3. Terminology

### 3.1 Definitions of Terms Specific to This Standard:

<sup>3</sup> Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602, <http://www.mss-hq.com>.

<sup>4</sup> Available from Fluid Controls Institute, 1300 Sumner Ave., Cleveland, OH 44115.

<sup>5</sup> Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

<sup>6</sup> Available from International Society for Measurement and Control, 67 Alexander Dr., PO Box 12277, Research Triangle Park, NC 27709.

3.1.1 *actuator*—the unit that converts a pneumatic pressure signal into a force to position the valve plug.

3.1.2 *bonnet*—the upper portion of the valve body subassembly to which the yoke attaches. The bonnet contains the valve stem packing.

3.1.3 *dead band*—the range through which input signal can be varied, upon reversal of direction, without an observable change in the valve stem position.

3.1.4 *equal-percentage opening*—an equal-percentage flow characteristic of a control valve provides a change in flow, with the change in valve lift, that is a constant percentage of the flow before the change was made.

3.1.5 *flow coefficient* ( $C_v$ )—A basic capacity rating for valves that relates flow rate to the inlet and outlet pressure for a particular fluid in the full-open position of the valve. It is defined as the number of litres per seconds (gallons/min) of 16°C (60°F) water that will flow through the valve with a 6.9 kPa (1 psi) pressure drop ( $\Delta p$ ) across the valve.

3.1.6 *globe-style valve*—a basic control valve type that gets its name from the globular shape of its body. It normally uses a basic rising stem/plug for the closure member.

3.1.7 *hydrostatic shell test pressure*—the hydrostatic test pressure that the valve body is required to withstand without damage or leakage. Valve operation is not required during application of this test pressure, but the valve shall meet all performance requirements after the pressure has been removed.

3.1.8 *hysteresis*—the maximum difference in output value for any single input value during a calibration cycle, excluding errors as a result of dead band.

3.1.9 *instrumentation*—the term instrumentation, when used in this specification, refers to any instrumentation, that is, pilot controllers, transmitters, relays, selectors, positioners, instrument air reducing valves, and strainers/filters required for operation of the control valve in the system.

3.1.10 *internal trim*—internal parts of the control valve, including seat rings, plug, stem, guide bushings, cage, pistons, and so forth.

3.1.11 *linear-opening*—a linear-opening flow characteristic of a control valve provides a change in flow that is linearly proportional with valve lift.

3.1.12 *linearity*—the measure of how close a plot of the valve stem travel (in response to an increasing and a decreasing input signal) conforms to a straight line. Linearity is normally expressed as the ratio (in percentage) of the maximum deviation from a straight line connecting the end points of the full operational valve stem stroke.

3.1.13 *manual override*—the manual override allows valve operation manually. The manual override feature has the ability to oppose and overcome an opening or closing pneumatic control signal in controlling valve position.

3.1.14 *pneumatic-operated control valve*—a valve installed directly in the fluid system, which translates a pneumatic signal into a change in flow resistance for the system fluid.

3.1.15 *pressure rating*—the pressure rating of the valve shall be as defined in the documents listed in **Table 1**. The pressure

**TABLE 1 Pressure Ratings for Control Valves**

Type of End Connection	Pressure Rating	Applicable Documents for Dimensional Details of End Connections
Butt-welded	ASME B16.34	ASME B16.25
	Class 150, 300, 400, 600, 900, 1500, 2500, or 4500	
Socket-welded	ASME B16.34	ASME B16.11
	Class 150, 300, 400, 600, 900, 1500, 2500, or 4500	
Flanged	ASME B16.34	ASME B16.5
	Class 150, 300, 400, 600, 900, 1500, 2500	
Flanged (cast iron valves only)	ASME B16.1	ASME B16.1
	Class 125, 250	
Flanged (bronze)	ASME B16.24	ASME B16.24
	Class 150, and 300	
Flanged-navy (bronze)	MIL-F-20042	MIL-F-20042
	Class 150, 250, 400	
Threaded (tapered pipe thread)	ASME B16.34	ASME B1.20.1 and ASME B16.11
	Class 150, 300, 400, 600, 900, 1500, or 2500	
Union-end <sup>A</sup> , silver-brazed	MIL-F-1183 (O-ring type) 400 lb/in. <sup>2</sup>	MIL-F-1183 (O-ring type) 400 lb/in. <sup>2</sup>
Union-end, <sup>A</sup> silver-brazed	803-1385946 1500 lb/in. <sup>2</sup>	803-1385946 1500 lb/in. <sup>2</sup>
Union-end, <sup>A</sup> silver-brazed	803-1385943 3000 lb/in. <sup>2</sup>	803-1385943 3000 lb/in. <sup>2</sup>
Union-end, <sup>A</sup> butt/socket weld	803-1385884 6000 lb/in. <sup>2</sup>	803-1385884 6000 lb/in. <sup>2</sup>
Other, as specified	as specified	as specified

<sup>A</sup> For union inlet and outlet end connections, only the pertinent dimensions listed in the applicable documents (Military Specification or NAVSEA requirements) shall apply. Unless otherwise specified in the ordering data Section 5, the tailpieces and the union-nuts shall not be furnished—only the thread-pieces shall be furnished. If tailpieces and union-nuts are required, their materials of construction shall be in accordance with the applicable documents listed above and shall be specified in the ordering data Section 5.

ratings (also called pressure-temperature ratings) establish the maximum allowable working (service) pressures of a component (valve, end connections, and so forth) at various temperatures.

3.1.16 *quick change cage trim*—a gasket or an O-ring sealed seat ring held in position by a cage, which may be either separate from or integral with the seat ring. The cage is held in position by either the bonnet or bottom flange. This design shall permit the rapid replacement of all internal trim by avoiding the use of any threads located within the valve body, such as seat ring threads.

3.1.17 *quick-opening*—a quick-opening flow characteristic of a control valve provides large changes in flow for small changes in valve lift.

3.1.18 *rangeability*—a measure of the usable range of a control valve and defined as the ratio of the maximum to the minimum controllable  $C_v$ . These maximum and minimum

controllable  $C_v$ s establish the throttling range over which a given control characteristic can be maintained and within which the valve can perform a useful throttling function.

3.1.19 *travel indicator*—the moving pointer mechanically attached to the valve stem and working in conjunction with a fixed indicator scale attached to the yoke.

3.1.20 *three-way valve*—a three-way valve has three end connections configured for converging or diverging flow.

3.1.21 *valve body subassembly*—the combination of valve body, bonnet, end connections, and internal trim.

3.1.22 *yoke*—the intermediate piece between the valve bonnet and the actuator.

3.2 Additional guidance on the control valve terminology can be found in ISA-S75.05.

#### 4. Classification

4.1 Valves shall be of the following material grades, pressure ratings, types, seat leakage classes, flow characteristics, and sizes, as specified in Section 5.

4.1.1 *Material Grades (Applicable to Pressure Containing Parts Only)*:

4.1.1.1 *Grade A—Alloy Steel*—Material Group 1.9 of ASME B16.34 (1 Cr-½ Mo, or 1-¼ Cr-½ Mo).

4.1.1.2 *Grade B—Carbon Steel*—Material Group 1.1 of ASME B16.34.

4.1.1.3 *Grade C—Corrosion-Resistance Stainless Steel*—Material Group 2.2 of ASME B16.34 (18 Cr-8 Ni alloy).

4.1.1.4 *Grade D*—As specified in the ordering information (see Section 5.)

4.2 *Pressure Ratings*—Valve shall have pressure ratings selected from those listed in Table 1 and specified in Section 5.

4.3 *Types*:

4.3.1 *Type 1*—Two-way valve, in-line (two end connections).

4.3.2 *Type 2*—Two-way valve, angle (two end connections).

4.3.3 *Type 3*—Three-way valve, converging service (three end connections—two inlet and one outlet end connections).

4.3.4 *Type 4*—Three-way valve, diverging service (three end connections—one inlet and two outlet end connections).

4.4 *Seat Leakage Classes (Maximum Allowable Seat Leakage)*—Seat leakage class shall be selected from those listed in FCI 70-2 and specified in Section 5.

4.5 *Flow Characteristics*—The inherent flow characteristics of the valve shall be specified as quick-opening, linear-opening, equal-percentage opening, or as specified in Section 5. (Additional guidance on valve flow characteristics can be found in *ISA Handbook of Control Valves*).

4.6 *End Connections*—Valve shall have end connections selected from those listed in Table 1 and specified in Section 5.

4.7 *Sizes*—Valve size shall be as specified in Section 5.

#### 5. Ordering Information

5.1 Ordering documentation for valves under this specification shall include the following information, as required, to describe the equipment adequately:

5.1.1 ASTM designation and year of issue,

5.1.2 Material grade (see 4.1 and Table 1),

5.1.3 Pressure rating (see 4.2),

5.1.4 Pressure drop ( $\Delta p$ ), kPa (psi),

5.1.5 Type (see 4.3),

5.1.6 Seat leakage class (see 4.4),

5.1.7 Flow characteristics (see 4.5),

5.1.8 End connections (see 4.6),

5.1.9 Size, inlet, and outlet (see 4.7),

5.1.10 Rangeability (see 7.2),

5.1.11 Line medium (see 6.2),

5.1.12 Operating pressures of the line media (minimum, normal, and maximum) (see 6.16),

5.1.13 Inlet temperature of the line media (minimum, normal, and maximum) (see 6.16),

5.1.14 Flow rate required (minimum, normal, and maximum) (see 7.1),

5.1.15 Replaceable seat ring requirement (see 6.13),

5.1.16 Minimum available air supply pressure to the actuator (see 6.16),

5.1.17 Minimum and maximum actuator control signal pressure, kPa (psi) (benchset of the actuator),

5.1.18 When manual override feature is required, its location—top or side-mounted (see 6.14.3),

5.1.19 Valve fail-position required upon loss of air supply to the actuator (see 6.14.4)

5.1.20 Instrumentation requirements (see 6.15),

5.1.21 Supplementary requirements, if any (see Supplementary Requirements, S1, S2, or S3).

#### 6. Valve Construction

6.1 Valves shall incorporate the design features specified below:

6.1.1 *General Requirements*:

6.1.1.1 Design shall permit adjustment without requiring removal of the valve body from the line.

6.2 *Materials of Construction*—Materials for pressure-containing parts shall be in accordance with the applicable documents listed in Table 1 (see 4.1). Materials for internal parts shall be compatible with the line media specified in Section 5.

6.3 *Pressure Envelope*—The control valve shall be designed to pass a hydrostatic shell test at pressure(s) of at least 1.5 times the 38°C (100°F) pressure rating(s) of the valve without damage.

6.4 *Joints*—The bonnet and bottom cover/flange shall be attached to the body using bolted flanges, a threaded connection, or a threaded-union connection.

6.5 *Valve Springs*—Any spring incorporated in the control valve shall not be compressed solid during operation. Spring ends shall be squared and ground.

6.6 *Threads*—Threads shall be as specified in ASME B1.1. Where necessary, provisions shall be incorporated to prevent the accidental loosening of threaded parts. The design shall be such that standard wrenches can be used on all external bolting. Lock-wire shall not be used. Any exposed threads shall be protected by plastic caps for shipping.