Designation: F 1985 – 99

An American National Standard

Standard Specification for Pneumatic-Operated, Globe-Style, Control Valves[1]

This standard is issued under the fixed designation F 1985; 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 (ϵ) 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 metric units (SI) are to be regarded as standard. The values given in parenthesis (inch/pound) are provided for information purposes.

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:*

B1.1 Unified Screw Threads (UN and UNR Thread Form)[2]

B1.20.1 Pipe Threads, General Purpose (Inch)[2]

B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800[2]

B16.5 Pipe Flanges and Flanged Fittings[2]

B16.11 Forged Steel Fittings, Socket-Welding and Threaded[2]

B16.25 Buttwelding Ends[2]

B16.24 Bronze Pipe Flanges and Flanged fittings, Class 150 and 300[2]

B16.34 Valves - Flanged and Buttwelding End Steel, Nickel Alloy, and Other Special Allows[2]

2.3 *Manufacturers Standardization Society of the Valve and Fitting Industry:*

MSS SP-25 Standard Marking System for Valves, Fittings, Flanges and Unions[3]

2.4 *Fluid Controls Institute Standard:*

FCI 70-2 Control Valve Seat Leakage[4]

2.5 *Military Standards and Specifications:*

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[5]

MIL-S-901 Shock Tests, H.I. (High Impact); Shipboard Machinery, Equipment and Systems, Requirements for[5]

MIL-STD-167-1 Mechanical Vibrations of Shipboard Equipment (Type I– Environmental and Type II – Internally Excited)[5]

MS-16142 Boss Gasket-Seal Straight Thread Tube Fitting, Standard Dimensions for[5]

MIL-F-1183 Fittings, Pipe, Cast Bronze, Silver Brazing, General Specification for[5]

MIL-F-20042 Flanges, Pipe and Bulkhead, Bronze (Silver Brazing)[5]

2.6 *Government Drawings and Publications:*

Naval Sea Systems Command (NAVSEA):

803-1385946 Unions, Bronze, Silver Brazing Alloy. For Water, Oil, and Gas[5]

803-1385943 Unions, Silver Brazing, 3000 lb/in.^{2}, WOG, NPS, for UT Inspection

803-1385884 Unions, Butt and Socket Welding, 6000 lb/in.^{2} WOG, NPS, For UT Inspections[5]

2.7 *ISA Standard:*

ISA-S75.05 Standard for Control Valve Terminology[6]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

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[1] 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.

Current edition approved July 10, 1999. Published September 1999.

[2] Available from American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

[3] Available from Manufacturers' Standardization Society of the Valve and Fitting Industry, 1815 N. Fort Myer Dr., Arlington, Va 22209.

[4] Available from Fluid Controls Institute, 1300 Sumner Ave., Cleveland, OH 44115.

[5] Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20036.

[6] 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 value 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 (Δp) 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 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_Vs establish the throttling range over which a given control characteristic can be maintained and within which the valve can perform a useful throttling function.

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 Class 150, 300, 400, 600, 900, 1500, 2500, or 4500	ASME B16.25
Socket-welded	ASME B16.34 Class 150, 300, 400, 600, 900, 1500, 2500, or 4500	ASME B16.11
Flanged	ASME B16.34 Class 150, 300, 400, 600, 900, 1500, 2500	ASME B16.5
Flanged (cast iron valves only)	ASME B16.1 Class 125, 250	ASME B16.1
Flanged (bronze)	ASME B16.24 Class 150, and 300	ASME B16.24
Flanged-navy (bronze)	MIL-F-20042 Class 150, 250, 400	MIL-F-20042
Threaded (tapered pipe thread)	ASME B16.34 Class 150, 300, 400, 600, 900, 1500, or 2500	ASME B1.20.1 and ASME B16.11
Union-end[A], silver-brazed	MIL-F-1183 (O-ring type) 400 lb/in.^{2}	MIL-F-1183 (O-ring type) 400 lb/in.^{2}
Union-end,[A] silver-brazed	803-1385946 1500 lb/in.^{2}	803-1385946 1500 lb/in.^{2}
Union-end,[A] silver-brazed	803-1385943 3000 lb/in.^{2}	803-1385943 3000 lb/in.^{2}
Union-end,[A] butt/socket weld	803-1385884 6000 lb/in.^{2}	803-1385884 6000 lb/in.^{2}
Other, as specified	as specified	as specified

[A]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.

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 *Grace 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 (Δp), 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.

6.7 *Interchangeability*—The control valve, including all associated piece parts, shall have part number identity and shall be replaceable from stock by the manufacturer on a nonselective and random basis. Parts having the same manufacturer's part number shall be directly interchangeable with each other with respect to installation (physical) and performance (function). Physically interchangeable assemblies, components, and parts are those that are capable of being readily installed, removed, or replaced without alternation, misalignment, or damage to parts being installed or to adjoining parts. Fabrication operations such as cutting, filing, drilling, reaming, hammering, bending, prying, or forcing shall not be required.

6.8 *Nonmetallic Element Interchangeability*—Nonmetallic elements, including but not limited to, soft-seating inserts, cushions, and O-rings, shall be treated as separately identified and readily replaceable parts.

6.9 *Maintainability*—Maintenance shall require standard tools to the maximum extent possible. Any special tools required for maintenance shall be identified and shall be supplied with the valve when specified.

6.10 *Reversibility*—Seating inserts shall not be physically reversible unless they are also functionally reversible to preclude incorrect assembly.

6.11 *Pressure-Temperature Ratings*—Valve pressure-temperature ratings shall be in accordance with the documents listed in Table 1.

6.12 *Stem Seal Assembly*—A stem seal assembly shall be provided to seal against leakage along the stem. The stem seal design shall allow the removal of the actuator assembly without disturbing the stem seal assembly.

6.13 *Seat Ring*—Where required by the service, a seat ring shall be incorporated in the valve and shall be of a material different from the valve body to provide increased resistance to wear, erosion, and leakage. The method of installation of the seat ring shall ensure against dislodgment of the seat ring or leakage between the seat ring and the valve body. Where a replaceable seat ring is required, it shall be specified in Section 5. Unless the method of seat ring retention (for example, quick change cage trim, threaded, brazed, threaded and seal welded, and so forth) is specified in Section 5, it shall be per manufacturer's standard.

6.14 *Actuator Assembly*:

6.14.1 *Yoke*—Yoke construction shall allow easy access to the stuffing box, stem connection, and spring adjuster from either side of the valve. Mounting pads shall be provided on the opposite sides of the yoke for mounting valve positioners or other accessories or both.

6.14.2 *Travel Indicator*—A travel indicator shall be provided to indicate the valve closure member position.

6.14.3 *Manual Override*—When specified (see Section 5), manual override shall be furnished. Location (top- or side-mounted handwheel) shall be as specified (see Section 5). A clockwise rotation of the handwheel shall close the valve. The maximum rim force required on handwheel shall not exceed manufacturer's standards.

6.14.4 *Fail-Position Requirement*—In the event of loss of actuator air supply, the valve shall proceed to and remain in fail-open, fail-close, or fail-in-position as specified in Section 5.

6.15 *Instrumentation*—When specified (see Section 5), the valve manufacturer shall furnish with the valve the instrumentation necessary to accomplish the required control functions. The process and pneumatic connection(s) to controller's pilots or transmitters shall be specified in the ordering data. Intermittent bleed instrumentation shall be used wherever it is compatible with performance, sensitivity, and response speed requirements. Instrumentation interface requirements shall be specified in Section 5.

6.16 *Valve Operation*—The valve shall operate properly at the operating conditions specified in Section 5. Operating conditions such as operating pressure of line medium. Δp, inlet temperature, and air-supply pressure to actuator shall be supplied in Section 5.

7. Performance

7.1 All valves shall meet the requirements of 7.1.1-7.7.

7.1.1 *Capacity*—The valve shall be capable of passing the maximum flow rate specified or any intermediate flow rate within the rangeability specified (see Section 5).

7.2 *Rangeability*—The valve shall exhibit the rangeability specified in the ordering data (see Section 5).

7.3 *External Leakage*.

7.3.1 *Valve*—There shall be no visible external leakage from the pressure boundary.

7.3.2 *Actuator*—There shall be no leakage in the actuator assembly.

7.3.3 *Stem*—There shall be no visible leakage past the stem.

7.4 *Internal Seat Leakage*—The seat leakage shall not exceed the leakage specified in FCI 70-2 for its seat leakage class specified in Section 5 (see 4.4).

7.5 *Hysteresis*—Hysteresis shall not exceed 2 % of valve stroke for valves supplied with or without instrumentation installed.

7.6 *Dead Band*—Under operating conditions, the dead band shall not exceed 2.4 kPa (0.35 psi) within the full stroke of the stem.

7.7 *Linearity*—The linearity shall not exceed ±3 % with the instrumentation installed, if the instrumentation is specified in Section 5.

8. Tests Required

8.1 Each control valve shall pass the tests outlined in 8.1.1-8.5.

8.1.1 *Visual Examination*—The control valve shall be examined visually to determine conformance with the ordering data, interface dimensions, and workmanship without disassembly.

8.2 *Hydrostatic Shell Test*—Each control valve shall be hydrostatically tested in the partially open position, by applying a test pressure of not less than 1.5 times the 38°C (100°F) pressure rating to the inlet and outlet ports to check structural integrity. Test pressure(s) shall be applied for 3 min. Air or nitrogen may be used in lieu of water, providing appropriate safety precautions are taken to minimize the risk associated with the use of a compressible fluid. There shall be no external leakage (excluding stem-packing leakage), permanent distortion, or structural failure.

8.3 *Nondestructive Examination (NDE)*—When specified in Section 5, NDE requirements shall be met by performing tests in accordance with the commercial practices listed in ASME B16.34. This shall include radiography testing, magnetic particle testing, dye penetrant, or ultrasonic testing and visual testing as delineated in the above specification.

8.4 *Seat Leakage Test*—A seat leakage test shall be conducted to verify conformance with the internal seat leakage allowed in 7.4.

8.5 *Functional Test*—With air pressure applied to the valve actuator, the valve shall be stroked through its entire range of stem travel. Stem travel shall be smooth without sticking or binding. Thereafter, with no air pressure applied to the valve inlet port, the valve shall be tested to verify the minimum air pressure required to initiate stem travel and the maximum air pressure required to complete its full stroke. Air pressure requirements to stroke the valve shall be based upon the operating conditions specified in the ordering information (see Section 5).

9. Marking

9.1 *Markings*—Valves shall be marked in accordance with MSS SP-25.

10. Quality Assurance System

10.1 The valve manufacturer shall establish and maintain a quality control program following the principles of an appropriate standard from the ISO 9000 series. The need for registration or certification by an independent organization for the valves manufactured under the quality control program shall be determined by the manufacturer. Documentation demonstrating quality control program compliance shall be available to the purchaser at the facility at which the valves are manufactured. A written summary shall be available to the purchaser upon request. The valve manufacturer is the corporate entity whose name or trademark appears on the valve.

10.2 The purchaser reserves the right to witness the production tests and inspect the valves in the manufacturer's plant to the extent specified on the purchase order.

11. Technical Data Requirements

11.1 *Drawings*—Assembly drawings, information sheets, or catalog sheets shall be provided to indicate the design and materials used in the valve for approval by the purchaser.

SUPPLEMENTARY REQUIREMENTS

One or more of the following supplementary requirements, S1, S2, or S3 shall be applied only when specified by the purchaser in the inquiry, contract, or order. Details of those supplementary requirements shall be agreed upon in writing by the manufacturer and purchaser. Supplementary requirements shall in no way negate any requirement of the specification itself.

S1. Supplemental Tests

S1.1 Supplemental tests shall be conducted at a facility satisfactory to the customer and shall consist of the examinations and tests selected from those specified in S1.1 through S1.5 and delineated in the ordering data. The supplemental tests may be conducted only on representative valve sizes and pressure classes to qualify all sizes and pressure classes of valves, provided the valves are of the same type and design. Evidence of prior approval of these tests may be acceptable.

S1.1.1 *Flow Tests*—A flow test shall be conducted to determine the valve C_V and the flow characteristic of the control valve.

S1.2 *Operational Tests:*

S1.2.1 The valve shall be operationally tested as follows:

S1.2.1.1 The valve shall be assembled. Stuffing box nuts shall be finger tight with packing installed or with the packing removed; the valve body shall be at atmospheric pressure. Tapping the valve to remove friction is not permitted.

S1.2.1.2 Hysteresis shall be tested at 25 and 75 % of stroke. At any stroke position, a change of air pressure of 1.7 kPa (0.25 psig) (excluding dead band) in either direction shall cause the valve stem to move. If an automatic hysteresis loop record is obtained, the maximum difference in valve position between increasing and decreasing pressures shall not exceed 2 % of stroke (see 7.5).

S1.2.1.3 Linearity of travel shall be tested at 0, 25, 50, 75, and 100 % of stroke. The relationship between air pressure and stem travel shall be linear to within ±3 % (see 7.7).

S1.3 *Shock Test*—The control valve shall be subjected to the high-impact shock tests as specified in MIL-S-901 and MIL-STD-798 while pressurized with water, air, or nitrogen to determine its resistance to high-impact mechanical shock. The detail requirements of MIL-S-901 and MIL-STD-798 shall be delineated in the ordering information. There shall be no visible structural damage to the control valve or any of its components. There shall be no degradation to the performance capability of the control valve. During impact, an instantaneous, reversible pressure excursion is allowable.

S1.4 *Vibration Test*—Control valve shall be vibration tested in accordance with Type I of MIL-STD-167-1 while pressurized with water, air, or nitrogen gas. The detail requirements of MIL-STD-167-1 shall be delineated in the ordering information. There shall be no visible structural damage or degradation to the performance capability of the control valve.

S1.5 *Posttest Examination*—After completion of the shock and vibration testing, the control valve shall be disassembled and material conditions noted. If shock and vibration tests are done successively in sequence, it is not necessary to disassemble and inspect the valves in between the tests.

S2. Technical Data Requirements

S2.1 *Drawings*—Assembly drawings or catalog sheets of the control valve that clearly depict design and material of each part shall be provided.

S2.2 *Technical Manuals*—A technical manual or instruction booklet shall be provided which provides a description of the valve, operation and maintenance instructions, calibration valves, and illustrated parts breakdown. It shall include wrench sizes and assembly torque (or equivalent) for all bolting and threaded assemblies and step-by-step disassembly and reassembly procedures.

S3. Special Material, Design, and Performance Requirements

S3.1 Pipe threads shall not be used in control valve construction.

S3.2 Control valve performance shall not be adversely affected by the following line and ambient conditions:

S3.2.1 *Quality of Inlet Air/Gas*—Air or nitrogen moisture content between the limits of −7°C (20°F) to −51°C (60°F) saturated at maximum rated pressure.

S3.2.2 *Ambient Atmospheric Conditions:*

S3.2.2.1 *Temperature*—4°C (40°F) to 49°C (120°F).

S3.2.2.2 *Moisture Content*—Exposure to atmosphere containing salt-laden moisture.

S3.3 *Air Connections*—Air connections between the pilot controller, actuator, and other accessories shall be in accordance with MS 16142, straight-thread and O-ring seal.