



STANDARD PRACTICE

SP-99

1994
Edition

INSTRUMENT VALVES

Developed and Approved
by the
Manufacturers Standardization Society
of the
Valve and Fittings Industry, Inc.
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INSTRUMENT VALVES

1. SCOPE

1.1 This Standard Practice applies to small valves and manifolds developed for and predominantly used in instrument, control and sampling piping systems. It covers steel and alloy valves of 1" nominal pipe size and smaller, and pressure ratings of 10,000 psi and lower at 100°F.

1.2 This Standard Practice applies to instrument valve designs including but not limited to needle valves, packless valves, ball valves, plug valves, check valves and manifold valves. Instrument valves are generally of proprietary design; this Standard Practice is not intended to define or limit designs, construction, performance, envelope dimensions, or valve types.

1.3 The application of valve type, size, rating, materials of construction, and suitability for the service are the responsibility of the purchaser and are outside the scope of this standard.

1.4 The manufacturer shall provide pressure ratings for temperatures above 100°F. This temperature is the temperature of the pressure-containing shell of the component. In general, this temperature is the same as that of the contained fluid. Use of a pressure rating corresponding to a temperature other than that of the contained fluid is the responsibility of the user, subject to the requirements of applicable codes and regulations.

2. DEFINITIONS

2.1 General. Definitions given in MSS SP-96 apply to this Standard Practice.

2.2 Instrument valves: Valves designed for use in instrument, control and sampling piping systems, (e.g., see ASME B31.1, Article 122.3).

2.3 Instrument piping: Piping used to connect instruments to main piping or other instruments.

2.4 Control piping: Piping used to interconnect pneumatically or hydraulically operated control apparatus, or to signal transmission systems.

2.5 Sampling piping: Piping used for the collection of samples (such as steam, water, oil, gas, and chemicals) from process systems.

2.6 Manifold valve: Two or more instrument valves fabricated into a single valve body.

2.7 Cold working pressure rating: The maximum allowable working pressure of a valve at ambient conditions (-20°F to 100°F), abbreviated CWP.

2.8 Pressure boundary parts: The following items are defined to be pressure boundary parts. Each item may not apply to all valve designs.

- a) Body.
- b) Bonnet
- c) Union Nut
- d) Body to Bonnet Bolting
- e) Body Bolting

2.9 Packless Valve: A valve with a diaphragm or bellows stem seal instead of a packing or O-ring seal at the stem.

3. MATERIALS

3.1 General. The pressure boundary parts of the valve shall be made of the materials specified herein.

3.2. Non-pressure boundary parts (such as the stem, glands, packing nut) shall be made of materials compatible with the pressure boundary parts materials.

3.3 The following materials are acceptable for use as pressure boundary parts.

- a) Materials listed in ANSI/ASME B16.34
- b) Materials listed in MSS-SP-58
- c) Materials listed in Table 1

3.4 Material certifications shall be obtained for pressure boundary parts materials. Certifications shall include chemical analysis and mechanical properties.

3.4.1 The manufacturer shall specify minimum mechanical properties for materials ordered to specifications which do not include mechanical properties.

3.4.2 The manufacturer may specify minimum properties which are higher than those required by the ASTM specification or SP-58.

TABLE 1
APPLICABLE MATERIAL SPECIFICATIONS

MATERIAL	FORM	ASTM SPECIFICATION	GRADE OR TYPE
Carbon Steel Note (a)	Bars and Shapes	A 108 A 576	0.08 to 0.50 Carbon
	Forgings	A 108 Note (c)	
Austenitic Stainless Steel Note (b)	Forging Bars	A 314	303 304, 304L 316, 316L
	Bars and Shapes	A 581 A 582	303
		A 276 A 580	304, 304L 316, 316 L

Notes:

- (a) Leaded or resulfurized grades shall not be used where welding is required.
- (b) Type 303 shall not be used where welding is required.
- (c) Forgings may be produced from A 108, a recognized bar material.

3.4.3. The maximum service temperature of leaded or resulfurized steels shall be as specified in the material specification or piping code, or 500°F, whichever is less.

4. DESIGN REQUIREMENTS

4.1 Valves designed in accordance with this practice shall have cold working pressure ratings established by hydrostatic proof and burst qualification tests, as specified in Section 5.

4.1.1. Hydrostatic qualification tests shall be conducted on each design and size of valve to establish the CWP rating.

4.1.2. The CWP rating of valves of identical design and size but made of different materials shall be proportional to the allowable stress of each material or may be determined by hydrostatic qualification tests on valves made of each material, at the manufacturer's option.

4.1.3 The CWP rating of valves of identical design and size but with different end connections shall be determined by the rating of the valve or the end connection, whichever is less.

4.1.4 The CWP rating of a valve design may be established by the manufacturer at a value lower than the rating allowed by the qualification tests of Section 5. In that case the lower pressure rating may be established for a valve design and size, regardless of materials or end connections. Such reduced ratings are usually dictated by performance limitations such as operating torque, cycle life, or non-metallic component limitations.

4.1.5 Packing nut adjustment may be necessary to compensate for temperature change.

4.2 End connections

4.2.1 Pipe threads: Tapered pipe threads shall be in accordance with one of the following:

- a) ANSI/ASME B1.20.1 Pipe Threads, General Purpose
- b) ANSI B1.20.3 Pipe Threads, Dryseal
- c) ANSI/CGA V-1-1987 Compressed Gas Cylinder Valve Outlet and Inlet Connections

4.2.2 Pipe Socket Weld Connections: The socket bore diameter and depth of socket shall be in accordance with the dimensions and tolerances of ANSI/ASME B16.11.

4.2.3 Tube socket weld dimensions shall be in accordance with the manufacturer's standard.

4.2.4 Butt weld connections for pipe shall have an end preparation in accordance with ASME B16.25.

4.2.5 Butt weld connections for tube shall be in accordance with the manufacturer's standard.

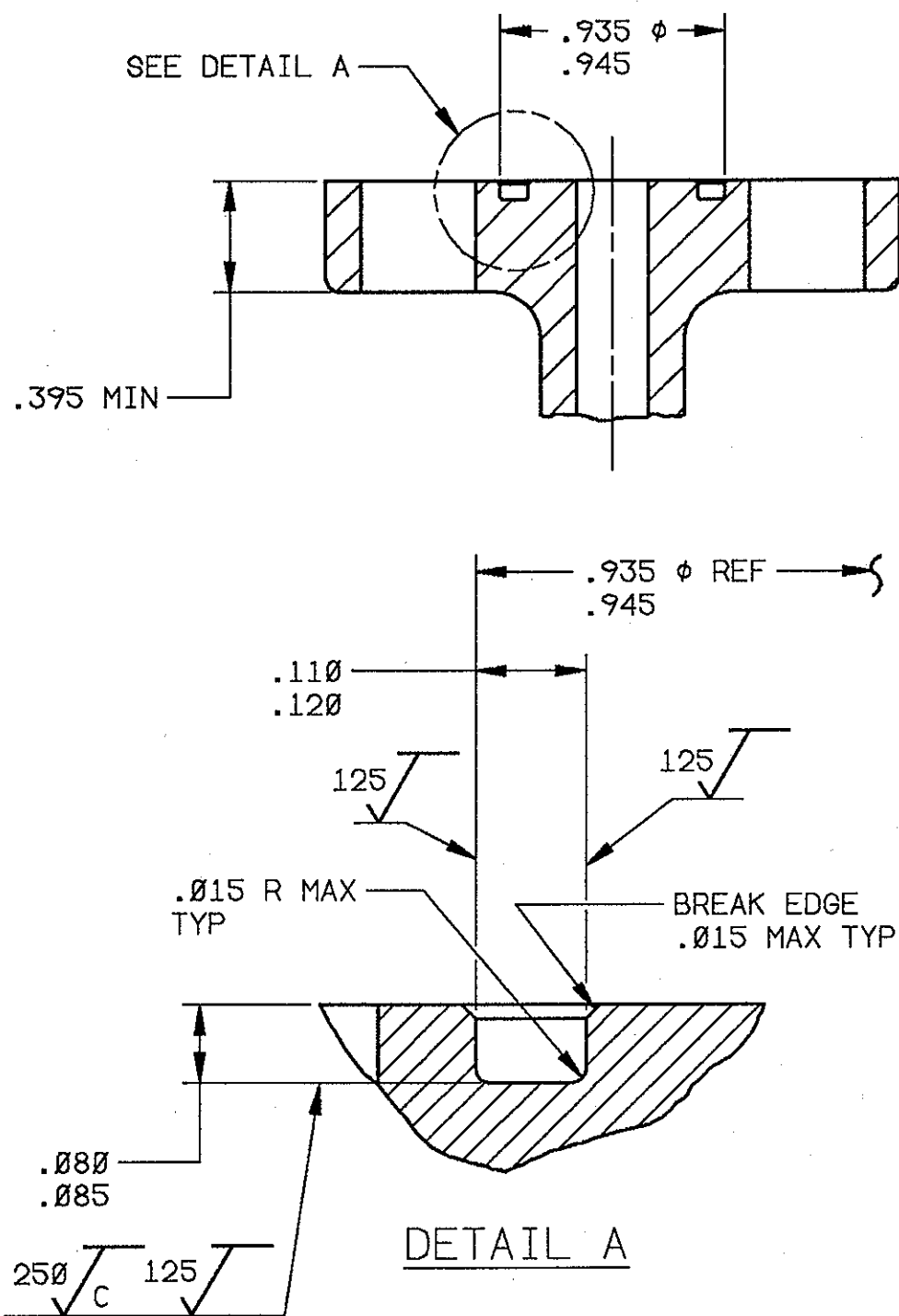
4.2.6 Pipe or tube stub extension end connections may be socket welded or butt welded to the valve. The diameter and wall thickness shall be the manufacturer's standard. The standard stub extension lengths are 3" or 6", measured from the end of the valve.

4.2.7 Mechanical tube fittings shall be in accordance with the manufacturer's design. Fittings may be machined integral with, welded, or threaded to the valve body.

4.2.8 Weld qualifications for end connections welded to the valve body shall be in accordance with ASME Boiler and Pressure Vessel Code, Section IX.

4.2.9 Other end connections not listed herein may be provided as agreed upon by the manufacturer and purchaser.

4.3. Direct Mounted Instrument Manifold Gasket Groove and Flange Details: The standard groove for gaskets and minimum flange or plate thickness shall be per Figure 1. Other groove dimensions shall be considered special.



**FIGURE 1 — DIRECT MOUNTED INSTRUMENT MANIFOLD GASKET GROOVE
AND FLANGE DETAILS**

5. QUALIFICATION TESTS

5.1 General: Valve designs shall be qualified by hydrostatic proof and burst tests.

5.2 Documentation: Hydrostatic tests shall be conducted in accordance with the manufacturer's written procedure. Copies of the test procedure and test reports shall be kept on file by the manufacturer.

5.3. Test Valves: Hydrostatic tests conducted on pre-production prototypes shall be confirmed by tests on at least three production valves. The CWP shall be based on the lowest test pressure result of the three valves tested.

5.4. Material Properties: The actual tensile and yield strength of the pressure boundary parts of the test specimens shall be obtained from heat traceable material certifications or by submitting sample material from the same lot to testing in accordance with the procedures of ASME Boiler and Pressure Vessel Code, Section VIII, Article UG-101 (J).

5.5. Proof Test Procedure

5.5.1 Each test valve shall pass a hydrostatic shell proof test in accordance with the following minimum requirements:

- a) Fluid: Water or hydraulic oil
- b) Temperature: 50°F to 125°F
- c) Pressure: Two times the CWP rating
- d) Time: One minute, minimum, at proof pressure
- e) Position: Placed in all positions capable of subjecting pressure boundary components to internal pressure.

5.5.2 There shall be no visible leakage during the proof test at any pressure containing part, joint, or seal.

5.5.3 The stem packing may be adjusted during the proof test to stop leakage. No other adjustments are permitted on any other pressure boundary joints or seals.

5.6. Burst Test Procedure

5.6.1 Each test valve shall be hydrostatically shell tested to failure by rupture. The hydrostatic pressure at which rupture occurs shall be recorded. The same valves used for the proof test shall be used for the burst test.

5.6.2 Leakage is permitted at the valve packing, gaskets, and pressure retaining joints during the burst test, at pressures above the proof pressure.

5.6.3 If the hydrostatic test is stopped before rupture occurs, the highest sustained pressure attained shall be considered the burst pressure for that valve.

5.7 Pressure Rating Determination: The CWP rating shall be less than or equal to the pressure determined from the burst pressure as follows:

$$P \leq 0.25 B T_m / T_a$$

WHERE

P = CWP Rating

B = The lowest burst test pressure recorded for three specimens tested

T_a = Actual tensile strength of the test specimen

T_m = Specified minimum tensile strength of the material

6. ACCEPTANCE TESTING

Each production valve shall pass a seat leakage test and a shell test.

6.1 The standard test methods shall be the liquid or gas test methods described herein. Either method may be used.

6.1.1 Liquid tests shall meet the following minimum requirements:

- a) Fluid: Water or other liquid of similar or lower viscosity
- b) Pressure:
1.1 times the CWP Rating, minimum, for seat tests
1.5 times the CWP Rating, minimum, for shell tests
- c) Temperature: 50°F to 125°F
- d) Time: 15 seconds
- e) Acceptance criteria: No visible leakage

6.1.2 Gas tests shall meet the following minimum requirements:

- a) Air, nitrogen, or other gas of similar or lower viscosity
- b) Pressure: 80 psi, minimum, for both shell and seat tests
- c) Time: 15 seconds
- d) Acceptance criteria: No visible leakage when immersed in water or coated with a leak detection solution

6.2 Alternative test methods: Other leakage test methods may be used provided that the manufacturer demonstrates they are equal in sensitivity to the standard liquid or gas tests specified herein.

7. MARKING

7.1 Each valve shall be marked in accordance with MSS SP-25 with at least the following:

- a) Manufacturer's identification
- b) Flow direction (if applicable)
- c) Manufacturer's model number
- d) Material grade (unless coded in model number)

7.2 Additional markings may be applied in accordance with MSS SP-25.

ANNEX A REFERENCED STANDARDS

This Annex is an integral part of this Standard Practice which is placed after the main text for convenience.

List of standards and specifications referenced in this Standard Practice show the year of approval.

ANSI B1.20.3-1976 (R 91)	Dryseal Pipe Threads (Inch)
ANSI/ ASME B1.20.1-1983 (R 92)	Pipe Threads, General Purpose (Inch)
ANSI/ ASME B16.11-1991	Forged Steel Fittings, Socket-Welding and Threaded
ANSI/ ASME B16.34-1988	Valves-Flanged, Threaded and Welding End
ANSI/ CGA V-1-1987	Compressed Gas Cylinder Valve Outlet and Inlet Connections
ASME B16.25-1992	Buttwelding Ends
ASME B31.1-1992	Power Piping
ASME Boiler and Pressure Vessel Code, Section VIII, Division 1	
ASME Boiler and Pressure Vessel Code, Section IX	
ASTM A108-1990A	Steel Bars, Carbon, Cold-Finished, Standard Quality
ASTM A276-1992	Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A314-1992	Stainless and Heat-Resisting Steel Billets and Bars for Forging
ASTM A576-1990B	Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM A580-1991B	Stainless and Heat-Resisting Steel Wire
ASTM A581-1992	Free-Machining, Stainless and Heat-Resisting Steel Wire and Wire Rods
ASTM A582-1992	Free-Machining, Stainless and Heat-Resisting Steel Bars, Hot-Rolled or Cold-Finished
MSS SP-25-1993	Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58-1993	Pipe Hangers and Supports — Materials, Design and Manufacture
MSS SP-96-1991	Guidelines on Terminology for Valves and Fittings

Dates preceded by R indicate date reaffirmed.

Publications of the following organizations appear on the above list:

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| ANSI | American National Standards Institute, Inc.
11 West 42nd Street
New York, NY 10036 |
| ASME | The American Society of Mechanical Engineers
345 East 47th Street
New York, NY 10017 |
| ASTM | American Society for Testing and Material
1916 Race Street
Philadelphia, PA 19103 |
| CGA | Compressed Gas Association
1235 Jefferson Davis Highway
Arlington, VA 22202 |
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